Phone: 613 584-2000
Fax: 613 584-3237
Email: info@deepriver.ca

deepriver.ca |

The Corporation of the Town of Deep River

REQUEST FOR TENDER
for
Deep River Water Treatment Plant Upgrades
2025-RFT-001

Tenders shall be submitted ***via email by 1330 hours Eastern Standard Time (EST) on Wednesday, November 19, 2025. Submissions*** received after that date and time will not be considered further. All submissions must be in accordance with the requirements stated in this Request for Tender (RFT).

All Submissions shall be directed to the Contact Persons for this RFT:

CONTACTS:	David McCarthy, Director of Operations, and Jessy Pace, Executive Assistant / Deputy Clerk
ADDRESSED TO:	dmccarthy@deepriver.ca and jpace@deepriver.ca
SUBJECT:	Deep River Water Treatment Plant Upgrades (2025-RFT-001)

Any questions or clarification regarding this RFT must be communicated via email to the Contact Persons listed above by **Thursday, November 13, 2025.**

SUBMISSIONS WILL NOT BE OPENED IN PUBLIC (NEITHER IN PERSON NOR ELECTRONICALLY). PROPONENT NAMES WILL BE POSTED ON THE TOWN'S WEBSITE. DETAILS INCLUDING COSTS WILL NOT BE POSTED.

NOTE: Should any potential bidders download this Request for Tender, tis the Proponent's responsibility to check for Addenda which will be posted on the Town website: http://www.deepriver.ca/

The Corporation of the Town of Deep River
Contract No.: 2025-RFT-001

DEEP RIVER WATER TREATMENT PLANT UPGRADES
in the Town of Deep River, Ontario.

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THE CORPORATION OF THE TOWN OF DEEP RIVER

CONTRACT 2025-RFT-001

DEEP RIVER WATER TREATMENT PLANT

UPGRADES

CIMA PROJECT A001332

1. SUBMISSION OF TENDERS

The Tenderer must submit their tender to dmccarthy@deepriver.ca and jpace@deepriver.ca on or before **1330 hours** (local time) on **Wednesday, November 19, 2025**. Late tenders will not be accepted by the Town. Each Tenderer must electronically submit the following .pdf files:

File Label	Contents of File
Tender	Completed Form of Tender (Pages FT1 – FT16) – signed and sealed
WSIB	Current WSIB Certificate or Proof of Independent Operator Status
Insurance	Current Insurance Certificate, as per Information for Tenderers, Section 20
Bond	Scanned copy of bid bond or certified cheque or bank draft **OR**
eBond	eBond

NOTES: Bidder is only required to submit either a bond or eBond – but not both.

Tender documents are not assignable. The Town of Deep River may refuse to accept any documents which are being submitted by a party that did not receive the original Tender from the Corporation, directly. It is the responsibility of the Bidder to ensure they receive the package from the Corporation and to inform the Purchasing Officer if they have obtained the package through other means.

Tenders shall be submitted on the Form of Tender supplied herewith and shall be complete with Schedule of Items and Prices, Agreement to Bond, List of proposed major sub-contractors. All blank spaces shall be filled in and the total tendered amount shall be stated in both words and figures.

2. DEPOSIT TO BE SUBMITTED WITH TENDER

Tender Security can be provided in the form of Bid Bonds, Letters of Credit, Cash or Certified Cheque:

- Bid Bonds are to be provided at 10% of the Total Contract Price, rounding up to the nearest cent.
- Letters of Credit or Cash or Certified Cheque or Bank Draft are to be provided at a minimum of 10% of the Total Contract Price or the specified amount, whichever is greater, rounding up to the nearest cent.

The deposit of the successful Bidder and the second Bidder will be retained until the Agreement has been signed and sealed, with appropriate ancillary documentation.

3. EVALUATION CRITERIA

The following criteria form the basis upon which the evaluation of Tenders will be made:

Cost	100%

4. TENDER DOCUMENTS

The Tenderer shall verify that these Tender Documents are complete and assume responsibility for documents as received. Any discrepancies noted in the Tender set should be reported to the Engineer.

5. ADDENDA

Where a request results in a change or a clarification to the tender, the Town of Deep River will prepare and issue an Addendum to this tender. The Town of Deep River will make every effort to not issue an addendum within the forty-eight (48) hours prior to closing - not including Saturdays, Sundays and Statutory Holidays observed by the Town of Deep River for regular business hours.

All Tenderers are solely responsible to monitor the Town's website for all Addenda and are therefore also solely responsible for submitting complete new bids acknowledging any said Addendum prior to the closing date and time of the bid solicitation.

FAILURE TO ACKNOWLEDGE ALL ISSUED ADDENDA SHALL RESULT IN THE TENDER BEING REJECTED.

6. CONTACTS AND QUESTIONS

If a Bidder needs to address any discrepancies, errors and/or omissions in the Bid Document, or if they are in doubt as to any part thereof they shall submit questions in writing by email to dmccarthy@deepriver.ca and jpace@deepriver.ca.

7. TIME OF THE ESSENCE OF THE CONTRACT

Time shall be deemed to be the essence of the contract due to funding deadlines.

The Tenderer, having carefully examined the site of the proposed works, and having read, understood and accepted the provisions, plans, specifications and conditions attached hereto, each and all of which forms part of this tender, agrees to have the works under the contract "Substantially Performed" on or before **Wednesday, September 16, 2026** or the extended time allowed in writing by the Engineer. All works shall be completed, on or before **Friday, October 16, 2026.**

Failure by the Contractor to complete any of the above works to the satisfaction of the Engineer by the respective specified completion dates shall render the Contractor liable for Liquidated Damages.

8. LIQUIDATED DAMAGES

Should the Contractor fail to complete works to the satisfaction of the Engineer and in accordance with the Contract within the time for completion specified in the contract or the extended time allowed in writing by the Engineer, the Contractor shall pay to the Owner:

- The sum of $800 for each calendar day which has been derived from the cost to the Owner for delay in completion of the works, and includes interest on the capital cost of the Contract and other relevant costs where applicable; and,
- The Consulting Engineer's Head Office and site supervision and contract administration costs of $1200 for each calendar day that the Work or works remain uncompleted after the time so specified or allowed.

9. INFORMAL OR UNBALANCED TENDERS (PART A)

All entries in the Form of Tender shall be made in ink or shall be typewritten. Entries or changes made in pencil shall, unless otherwise decided by the Owner, be considered invalid.

Tenders which are incomplete, conditional, illegible or obscure, or that contain additions not called for, reservations, erasures, alterations or irregularities of any kind, may be rejected as informal. Only alterations that are clearly made and initialled by the Tenderer's signing officer and no other person shall relieve the tenderer from this consideration.

Tenders that contain prices in Part A of the tender, which appear to be so unbalanced as likely to affect adversely the interests of the Owner may be rejected.

Wherever in Part A of the tender, the amount tendered for an item does not agree with the extension of the estimated quantity and the tendered unit price, the unit price shall govern and the amount and the Total Lump Sum Tender Price shall be corrected accordingly, unless otherwise decided by the Owner.

A discrepancy in addition or subtraction in Part A of the tender shall be corrected by the Owner by adding or subtracting the items correctly and correcting the Total Lump Sum Tender Price accordingly, unless otherwise decided by the Owner. Within Part A of the tender, where an error has been made in transferring an amount from that part of the Form of Tender to another, the amount shown before transfer shall, subject to any corrections as provided for above, be taken to be correct and the amount shown after transfer and the Total Lump Sum Tender Price shall be corrected accordingly.

If a Tenderer omits to enter a price for an item of work set out in Part A of the Form of Tender and does not specifically state that it is otherwise included in the tender, then the tender may be rejected unless otherwise decided by the Owner.

The Owner reserves the right to waive formalities at its discretion.

Tenderers who have submitted tenders that have been rejected by the Owner because of informalities will normally be notified of the reasons for the rejection within ten (10) days after the closing date for tenders.

10. EXAMINATION OF SITE

Tenderers shall satisfy themselves as to the existing conditions which may be encountered in constructing the proposed works. Tenderers shall examine the site and location of the proposed works.

A **mandatory** site meeting has been scheduled for **Wednesday, November 12, 2025** beginning at 11 AM. All interested parties will meet at 177 River Road in Deep River Ontario. All Tenderers, major sub-trades and suppliers are invited. Bidders / Contractors are required to wear all appropriate protective equipment during visit.

Tenderers shall not claim at any time after submission of their tender that there was any misunderstanding of the terms and conditions of the Contract relating to site conditions.

11. QUANTITIES

This is a lump sum contract. Where noted in the Form of Tender, some contingency and other items will be paid by measured final quantity. The quantities shown for the items in the Form of Tender are approximate only and, subject to the stipulation of the General Conditions, are for the purpose of indicating to Tenderers the general magnitude of the Work and for the comparison of tenders received.

12. TENDER

Each tender shall include a completed Form of Tender, Statements, and an Agreement to Bond, all as bound herein and a tender deposit as required herein, together with any further forms or sheets which the Tenderer is instructed elsewhere herein, or in any addendum hereto, to submit with the tender. The Tenderer may retain the rest of the tender documents.

The Tenderer shall give the Total Lump Sum Tender Price both in words and in figures and, except as is otherwise specifically permitted in the Form of Tender, shall fill in all blank spaces for unit prices, item prices, lump sums and other information in the Form of Tender. All prices tendered and all amounts to be paid will be in Canadian dollars.

13. OMISSIONS, DISCREPANCIES AND INTERPRETATIONS

Should a Tenderer find omissions from or discrepancies in any of the tender documents or should the Tenderer be in doubt as to the meaning of any part of such documents, then the Tenderer should notify the Engineer in writing and not later than five (5) working days before the closing date for tenders. If the Engineer considers that a correction, explanation or interpretation is necessary or desirable, then an addendum will be issued to all who have taken out tender documents.

No oral explanation or interpretation shall modify any of the requirements or provisions of the tender documents.

14. ACCEPTANCE OR REJECTION OF TENDERS

Subject to the General Conditions, except as provided hereunder, neither the Engineer nor any officer or employee of the Owner has authority to make or accept an offer or to enter into a contract on behalf of the Owner or to create any rights against or to impose any obligations on the Owner. The recommendation of a tender to the Owner for acceptance does not constitute acceptance of the tender by the Owner.

A tender is accepted by the Owner when an agreement in the form bound herein is executed by the Owner and by the Tenderer or when the Engineer, with the written authorization of the Owner and within the period referred to in Section 12 hereof, has issued a written order to commence work to the Tenderer and the Owner or anyone acting on its behalf has requested the Tenderer to execute the Agreement and to return it to the Owner and the acceptance of the tender and the execution of the Agreement by the Owner are subject to the express condition that the owner receive a Performance Bond and a Payment Bond in the forms bound herein and in accordance with the requirements hereof, within seven (7) days after notification of the execution of the Agreement by the Owner has been mailed to the Tenderer whose tender has been accepted as aforesaid.

The Owner shall not be responsible for any liabilities, costs, expenses, loss or damage incurred, sustained or suffered by any Tenderer prior or subsequent to or by reason of the acceptance or

the non-acceptance by the Owner of any tender or by reason of any delay in the acceptance of a tender save as provided in the Contract. Tenders are subject to a formal contract being prepared and executed.

The Tenderer agrees that the Owner has the right, at the Owner's own discretion, to accept or reject any non-compliant tenders without stating the reasons therefore and that the lowest or any tender will not necessarily be accepted.

The Tenderer understands that fundamental to this competition is the selection of a tender that, in the Owner's opinion, is in the best interest of the Owner. To this end, the Tenderer agrees that the Owner reserves the right to evaluate the tenders in any manner it deems fit; such evaluation is to include the right to give preference to local bidders upon determination of the price, quality, and services being equal, and to base the award of tender on such evaluation.

15. PERIOD OF VALIDITY OF TENDER

The Tenderer's attention is drawn to the Form of Tender, "Standard Tender Requirements", for the tender validity period.

The prices entered by the Tenderer in the Form of Tender shall be based on the assumption that the Engineer's written order to commence work will be issued to the Tenderer within a 30-day period after the opening date for tenders.

16. AGREEMENT

The Tenderer agrees that, if requested so to do by the Owner or anyone acting on its behalf within 30 days after the date of opening tenders, the Tenderer will execute in triplicate and return to the Owner the Agreement in the form bound herein within seven (7) days after being so requested. If the Tenderer has not been so requested within the said 30 days or if the Engineer's written order to commence work has not been mailed or delivered to the Tenderer or to their office or to their postal address within the said 30 days, the Tenderer may, unless they have otherwise agreed or offered and except as otherwise provided herein, withdraw their tender.

17. PERFORMANCE AND PAYMENT BONDS

The Contractor, together with a surety company approved by the Owner and authorized by law to carry on business in the Province of Ontario, shall, unless otherwise directed, furnish to the Owner a Performance Bond and a separate Labour and Material Payment Bond in the forms attached hereto, each in the amount of 100% of the total lump sum tender price and such additional amount, if any, as may be required by the Owner. The Tenderer shall tender for the cost of the bonds in the item provided for that purpose in the Form of Tender on the assumption that each bond will be in the amount of 100% for the Performance Bond and 100% for the Labour and Material Bond of the total lump sum tender price. In the event that either of the bonds is required to be in an amount in excess of 100% for the Performance Bond and 100% for the Labour and Material Bond of the total lump sum tender price, the Owner will reimburse the Contractor in the amount of the premium for such excess amount after submission by the Contractor to the Owner of the surety company's relevant receipted invoice.

The Tenderer shall include with their tender the Agreement to Bond in the form enclosed herewith executed under its corporation seal by the surety company from which they propose to obtain the required bonds.

The Owner may in its discretion decide to obtain the bonds from a surety company of its choice and may pay the premium for such bonds directly to the surety company so chosen. In that event, the Owner will notify the selected Tenderer accordingly before the tender has been accepted and the Tenderer shall execute and furnish to the Owner the required bonds as

provided for herein but the item relating to the cost of the bonds in the Form of Tender shall be deleted from the Contract and no payment shall be made to the Contractor therefore.

The Tenderer will be required to furnish the Performance Bond and the Labour and Material Payment Bond in triplicate as required herein and in the forms bound herein within seven (7) days after notification of the execution of the Agreement by the Owner has been mailed to him. One (1) copy of the said bonds shall be bound into each of the three (3) executed sets of the Contract.

18. SUBCONTRACTORS

The Tenderer shall provide on Statement “C” of the tender documents the name and address of each proposed subcontractor used in preparing the tender and shall state the portion and value of the work allotted to each. Only one (1) subcontractor shall be named for each part of the work to be sublet.

If the Tenderer is one of the two apparent low bidders for this Contract, they shall comply with the requirements set out in Statement “C1". This is in addition to complying with the requirements relating to Statement “C” as set out above.

If the successful Tenderer wishes to substitute a subcontractor other than the one named in Schedule “C” of the Form of Tender for a specific item of work, then they shall submit documentation to the Engineer pertaining to the proposed subcontractor’s experience and competence to carry out the work. Employment of the proposed subcontractor on the works is subject to the written approval of the Engineer.

The term “sub-contractor” as referred to in this Clause shall not include suppliers of pre-selected equipment unless otherwise specifically stated in these documents or directed.

The Contractor shall arrange that each of their Owner-approved subcontractors whose subcontracts have a value of $250,000.00 or greater, together with surety companies approved by the Owner, shall furnish to the Contractor a Performance Bond and a separate Labour and Material Payment Bond each in the amount of fifty percent (50%) of the total value of the respective subcontract. The Tenderer shall provide, in the total lump sum tender price, for the cost of the bonds required for the subcontractors whose subcontracts have a value of $250,000 or greater.

The Owner will not require completed Agreement to Bond forms, for the subcontractors bonds mentioned above, to be submitted by the Tenderer at the time of tendering. The Tenderer may, at their own discretion, decide to obtain Agreements to Bond from their subcontractors at the time of tendering.

19. WORKPLACE SAFETY AND INSURANCE BOARD

The Contractor shall at the time of entering into any contract with the Owner, make a statutory declaration or furnish a satisfactory clearance letter from the Workplace Safety and Insurance Board stating that all assessments or compensation payable to the Workplace Safety and Insurance Board have been paid.

The selected Tenderer shall submit such statutory declaration or clearance letter to the Owner in triplicate together with the Agreement executed by the said Tenderer. One (1) copy of the statutory declaration or clearance letter shall be bound into each of the three (3) executed sets of the Contract.

20. OCCUPATIONAL HEALTH AND SAFETY

In order to avoid any misunderstanding as to the nature of the work to be performed herein, the Contractor by executing this Contract, unequivocally acknowledges that it is the constructor within

the meaning of the Occupational Health and Safety Act, and the Contractor undertakes to carry out the duties and responsibilities of a constructor with respect to the work.

It is specifically drawn to the attention of the Tenderer that the Occupational Health and Safety Act provides in addition to other matters that,

"A constructor shall ensure, on a project undertaken by the constructor that,

a) the measures and procedures prescribed by this Act and the regulations are carried out on the project;

b) every employer and every worker performing work on the project complies with this Act and the regulations; and,

c) the health and safety of workers on the project is protected."

21. COST OF POWER AND FACILITIES AT THE SITE

The Contractor shall provide and shall bear the costs of all electricity, fuel, water and sanitary facilities required for, or at the site of, the works up to the date of substantial performance as established by the Certificate of Substantial Performance. Such costs incurred after the said date shall be borne by the Owner except that any such costs incurred in completing unfinished work or rectifying deficiencies may, at the discretion of the Engineer, be charged against the Contractor.

22. HARMONIZED SALES TAX (HST)

The tendered unit and lump sum prices under the contract shall not include any amount for Harmonized Sales Tax (HST)

The successful Contractor shall bill the Owner directly, upon the preparation of each progress payment certificate, for the appropriate amount of HST the Owner is legally obliged to pay. This amount will be paid to the Contractor in addition to the amount calculated for payment by the extension of quantities and unit and lump sum prices under the tender schedule. It will appear as a separate item on the progress payment certificate.

The Contractor must have a HST registration number and must quote this number on all invoices where HST is being billed.

23. INSURANCE

The Contractor shall procure and maintain All Risk and Liability Insurance in accordance with the General Conditions and the requirements set out below except that, unless otherwise specifically stated in the Contact, All Risk Insurance is not required in respect of sewer, forcemain or watermain construction.

The Tenderer whose tender has been recommended to the Owner for acceptance shall, on receipt from the Owner of the Agreement for execution, procure and maintain All Risk and Liability Insurance and shall file with the Owner, together with the Agreement executed by him, a Cover Note of such All Risk Insurance and a Certificate of Liability Insurance in the forms attached hereto. The Contractor shall file with the Owner prior to the first progress payment the original policy of such All Risk Insurance or a Certificate of Insurance clearly stating that the policy of All Risk Insurance provided as aforesaid with the requirements hereof. Insurance shall be obtained from a company satisfactory to the Owner.

The All Risk Insurance shall:

- comply with the requirements of the "Specification for All Risk Insurance" as attached hereto, which specification shall form part of the said policy of All Risk Insurance.
- include Flood and Earthquake coverage in respect of the construction or alteration of treatment plants, pumping stations, buildings, storage tanks, reservoirs and other structures and equipment.
- be maintained until the date of completion of the works has been established by the Certificate of Completion or such time as the Owner has notified the Contractor in writing that the Owner has arranged its own All Risk Insurance coverage of the permanent works of the General Conditions.

The Liability Insurance shall:

- have a limit of liability of not less than $10,000,000 inclusive for any one (1) occurrence.
- be Comprehensive Liability Insurance covering all operations and liability assumed under the Contract with the Owner.
- not contain any exclusions or limitations in respect of shoring, underpinning, raising or demolition of any building or structure, pile driving, caisson work, collapse of any structure or land from any cause.
- cover the use of explosives. The Contractor shall be solely responsible for all damage, loss or costs resulting directly or indirectly from such use. The Contractor shall indemnify and save harmless the Owner, the Project Manager, the Engineer, up to three (3) subconsultants, the Operator, the Ministry of the Environment and government funding agencies from and against all claims, demands, loss, damage and costs resulting directly or indirectly from such use.
- include insurance against liability for bodily injury and property damage caused by vehicles owned by the Contractor and used on the work, and in addition, shall include insurance against liability for bodily injury and property damage caused by vehicles <u>not</u> owned by the Contractor and used on the work. Each such insurance shall have a limit of liability of not less than $5,000,000 inclusive for any one occurrence. A "vehicle" shall be as defined in the Highway Traffic Act.
- be endorsed to provide that the policy or policies will not be altered, cancelled or allowed to lapse without thirty (30) days written notice to the Owner.
- be endorsed to include the Owner and the Engineer, up to three (3) subconsultants and any government funding agencies as additional named insured's.

The Contractor shall take careful note that Section 31 of the General Conditions is in full force and effect except as amended herein:

a) A Certificate of Insurance shall be completely filled in with the required information.

b) A deductible clause is acceptable if the Contractor submits a signed and sealed letter stating the following:

"We (insert the Contractor's name) authorize the Owner to appoint an independent adjuster to settle any claims arising from this Contract which are for amounts less than our insurance deductible figure. Furthermore, the Owner can deduct any amounts of justifiable claims from monies owing to the Contractor."

24. ACCESS TO EXISTING OPERATING FACILITIES DURING CONSTRUCTION

The Contractor is reminded that it is essential that continuous access be provided to existing operating facilities within the vicinity of the working areas during the entire construction period. Therefore, the Contractor will be required to schedule work and construct necessary temporary works as necessary to ensure this requirement is met. All costs anticipated for compliance with this clause shall be included in the Lump Sum Tender Price.

25. DOCUMENTS, PLANS AND SPECIFICATIONS

The following is a list of plans and specifications which constitute the Contract:

i. Information to Tenderers
ii. Form of Tender
iii. General Conditions of Contract
iv. Form of Agreement
v. Performance and Maintenance Bond
vi. Labour and Material Payment Bond
vii. Certificate of Insurance
viii. Specification for All Risk Insurance
ix. Technical Specifications
x. Contract Drawings
xvii. Appendices

26. APPROVAL

The award of this contract is subject to the approval of the Corporation of the Town of Deep River.

27. LOCAL RESOURCES

Whenever possible, Contractors shall make use of local resources.

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FORM OF TENDER

THE CORPORATION OF THE TOWN OF DEEP RIVER

CONTRACT 2025-RFT-001

DEEP RIVER WATER TREATMENT PLANT

UPGRADES

CIMA PROJECT A001332

TO: ***THE CORPORATION OF THE TOWN OF DEEP RIVER***

This Tender is submitted by: _____
Firm Name

_____
Address

_____

_____
Telephone

Total Tender Price
(H.S.T. excluded) _____

The works shall be "Substantially Performed" on or before Wednesday, September 16, 2026. The works shall be Completed on or before Friday, October 16, 2026.

1. I/We _____

of _____

DECLARE that no person, firm or corporation other than the one whose signature or the signature of whose proper officers and the seal is or are attached below, has any interest in this tender or in the contract to be entered into with the Town of Deep River.

2. I/WE FURTHER DECLARE that this tender is made without connection, knowledge, comparison of figures or arrangements with any other company, firm or person submitting a tender for the same work and is in all respects fair and without collusion or fraud.

3. I/WE FURTHER DECLARE that no member of the Municipal Council, or any officer of the Town of Deep River, is or will become interested directly or indirectly as a contracting party or otherwise in or in the performance of the contract, or in the supplies, work or business to which it relates or in any portion of the profits thereof, or of any such supplies to be used therein or in any of the monies to be derived therefrom.

4. We recognize that this is a Lump Sum Contract and that the Total Lump Sum Tender Price also includes provisional items and allowances that will not be paid unless the works are specifically ordered by the Engineer.

5. I/WE FURTHER DECLARE that the matters stated in the said tender are in all respects true.

6. I/WE FURTHER DECLARE that I/we have carefully examined the locality and site of the proposed works, as well as the plans, drawings, Information for Tenderers, Form of Tender, Specifications, Addendum/Addenda No.____ to No._____ ,* General Conditions, Form of Agreement and Agreement to Bond relating to the said Contract, and hereby acknowledge the same to be part and parcel of any contract to be let for the work therein described or defined.

7. I/WE AGREE THAT this offer is to continue open for acceptance until the formal contract is executed by the successful tenderer for the said work or until sixty (60) days after the tender closing date, whichever event first occurs, and that the Owner may at any time within that period, without notice, accept this tender whether any other tender has been previously accepted or not.

8. I/WE DO AGREE THAT if I/we withdraw this tender before the Owner shall have considered the tenders and awarded the Contract in respect thereof, at any time not later than sixty (60) days after the tender closing date, the amount of the deposit accompanying this tender shall be forfeited to the Town of Deep River.

9. I/WE DO AGREE THAT the awarding of the Contract on this tender by the Municipal Council of the said Owner shall be an acceptance of this tender.

10. IF THIS TENDER is accepted, I/We agree to furnish a bona fide Performance Bond for the proper fulfilment of the Contract as required and to execute four (4) copies of the Contract Documents, within ten (10) days after being so notified so to do. In the event of default or failure on our part so to do, I/We agree that the Town of Deep River shall be at liberty to retain the money deposited by us to the use of the Owner and to accept the next lowest or any tender or to advertise for new tenders, or to carry out the works in any other way they deem best.

11. I PROPOSE THE Bonding Company named hereunder

_____

Name of Bonding Company

A Company which is willing to become bound with

_____

the amount designated for the performance and fulfilment of the Contract for which this is a tender.

12. I/WE DO HEREBY tender and offer to enter into a contract, to do all of the work, and to furnish all necessary expertise, labour, machinery, tools, apparatus and other means of construction, and to provide, furnish, deliver, place and erect all materials mentioned and described or implied therein, except as otherwise specified, to complete the work, herein described in strict accordance with the schedule of plans, specifications and documents and to accept in full payment therefore, the sums entered in the Form of Tender or calculated in accordance with the actual measured quantities at the unit prices set forth in the tender herein. The Schedule of Items and Prices is attached and is comprised of pages FT-4 to FT-8.

* The Tenderer will insert here the numbers of the Addenda received by him during the tendering period and taken into account by him in preparing his tender.

By my/our signature, hereunder, I/we hereby agree to complete this Contract in accordance with the terms contained herein.

Dated this_____day of_____2025.

_____
Name of Firm

_____
Signature of Authorized Person Signing
for Firm (Company Seal)

_____
Position

_____
Witness

PART A
SCHEDULE OF ITEMS AND PRICES
TO BE COMPLETED AT THE TIME OF TENDER

Item No.	Spec. Section	Description	Unit	Amount ($)
PART A - GENERAL REQUIREMENTS				
A.1	01000	General Requirements	L.S.	$
A.2	01120	Coordination and Sequence of Construction	L.S.	$
A.3	01140	Special Project Procedures	L.S.	$
A.4	01300	Administrative Requirements	L.S.	$
A.5	01320	Construction Schedule	L.S.	$
A.6	01330	Submittal Procedures	L.S.	$
A.7	01355	Project Waste Management	L.S.	$
A.8	01351	Health and Safety	L.S.	$
A.9	01400	Environmental Protection	L.S.	$
A.10	01450	Quality Control	L.S.	$
A.11	01510	Temporary Utilities	L.S.	$
A.12	01520	Construction Facilities	L.S.	$
A.13	01610	Basic Product Requirements	L.S.	$
A.14	01740	Cleaning	L.S.	$
A.15	01750	Disinfection of Water Infrastructure	L.S.	$
A.16	01760	Warranty Work	L.S.	$
A.17	01770	Closeout Procedures	L.S.	$
A.18	01780	Closeout Submittals	L.S.	$
A.19	01810	Testing and Commissioning	L.S.	$
A.20	01820	Demonstration and Training	L.S.	$
		Subtotal Part A – General Requirements (Excluding HST)		**$**
PART B - SITE WORKS				
B.1	02061	Tank Draining and Cleaning	L.S.	$
		Subtotal Part B – Site Works (Excluding HST)		**$**

PART C - FINISHES				
C.1	09967	Fluid Applied Insulative Coating	L.S.	$
		Subtotal Part C – Finishes (Excluding HST)		**$**
PART D - EQUIPMENT				
D.1	11010	Equipment General Requirements	L.S.	$
D.2	11015	Installation of Pre-Purchased Equipment	L.S.	$
D.3	11100	Miscellaneous Piping and Accessories Installation	L.S.	$
D.4	11101	Piping, Valves and Fittings	L.S.	$
D.5	11170	Pipeline Pressure and Leakage Testing	L.S.	$
D.6	11190	Pipe and Valve Supports	L.S.	$
D.7	11530	Chemical Metering System and Storage	L.S.	$
D.8	11540	Chemical Pipes, Valves and Fittings	L.S.	$
		Subtotal Part D – Equipment (Excluding HST)		**$**
PART E – INSTRUMENTATION, CONTROL & SCADA				
E.1	13100	Control and Instrumentation Systems	L.S.	$
E.2	13110	SCADA Integration Services	L.S.	$
E.3	13200	SCADA Hardware and Software	L.S.	$
E.4	13560	Instrumentation General Requirements	L.S.	$
E.5	13563	Pressure and Level Instruments	L.S.	$
E.6	13565	Turbidity Analyzers	L.S.	$
E.7	13566	Magnetic Flow Meter	L.S.	$
E.8	13567	Chlorine Residual Analyzer	L.S.	$
		Subtotal Part E – Instrumentation, Control & SCADA (Excluding HST)		**$**

PART F – CONVEYING AND HOISTING SYSTEM				
F.1	14310	Hoists and Trolleys	L.S.	$
F.2	14660	Gantry Crane	L.S.	$
		Subtotal Part F – Conveying and Hoisting System (Excluding HST)		**$**
PART G - ELECTRICAL				
G.1	16010	Electrical General Requirements	L.S.	$
G.2	16021	Demolition of Electrical Systems	L.S.	$
G.3	16062	Grounding Secondary	L.S.	$
G.4	16090	Equipment Identification	L.S.	$
G.5	16122	Wires and Cables 0-1000V	L.S.	$
G.6	16131	Splitters, Junction and Pull Boxes	L.S.	$
G.7	16132	Outlet, Conduit Boxes and Fittings	L.S.	$
G.8	16133	Conduits, Fastening and Fittings	L.S.	$
G.9	16222	AC Induction Motors	L.S.	$
G.10	16223	Motor Starters to 600V	L.S.	$
G.11	16400	Basic Electrical Equip and Materials	L.S.	$
G.12	16412	Moulded Case Circuit Breakers	L.S.	$
G.13	16423	Control Devices	L.S.	$
G.14	16441	Panel Boards Breaker Type	L.S.	$
		Subtotal Part G – Electrical (Excluding HST)		**$**

Item No.	DESCRIPTION	Unit	Qty.	Unit Price	Amount ($)
Part H - Provisional Items					
H.1	Additional labour (labour rates to include payroll burden, overhead and profit)				
H.1a	Project/Office Manager	hrs	20	$	$
H.1b	Site Supervisor/Coordinator	hrs	10	$	$
H.1c	Skilled labourer	hrs	10	$	$
H.1d	Certified electrician	hrs	15	$	$
H.1e	Certified welder	hrs	30	$	$
H.1f	Coatings applicator/painter	hrs	50	$	$
H.2	Crack injection in existing concrete using polyurethane injection material per Division 3, including access requirement for repair inside the Actiflo tank(s).	m	10	$	$
H.3	Repair of localized concrete spall (300mm*300mm*75mm) per Division 3, including access requirement for repair inside the Actiflo tank(s).	Ea	5	$	$
H.4	Clean of efflorescence and refer to G.2, if cracks are found, including access requirement inside the Actiflo tank(s).	Ea	3	$	$
H.5	Repair of minor rust spots, including access requirement for repair inside the Actiflo tank(s), surface preparation, patch and protective coating per Division 3.	m^2	2	$	$
H.6	24 hours of hydrostatic testing of Actiflo tank(s) following concrete repairs.	Ea	3	$	$
Subtotal Part H – Provisional Items (Excluding HST)					**$**

The Tenderer acknowledges that the Total Amount for the Provisional Items shall be included in the Total Tender Price and that all unused portions shall be deducted from the final cost of the Work and any quantities exceeding those shown will be added.

The Tenderer acknowledges that whenever extra work or deletions involve items listed above, the unit prices entered will be used in determining the amount of the extra or deductions regardless of the quantity involved.

The Tenderer agrees that they are not entitled to payment of the Provisional Items except for extra work carried out by them in accordance with the contract and as directed by the Engineer and only to the extent of such extra work.

TENDER SUMMARY

Item	Description	Amount ($)
Part A	General Requirements	$
Part B	Site Works	$
Part C	Finishes	$
Part D	Equipment	$
Part E	Instrumentation, Control & SCADA	$
Part F	Conveying and Hoisting System	$
Part G	Electrical	$
Part H	Provisional Items	$
TOTAL TENDER PRICE (Excluding HST) **Enter this Amount on Page FT-1**		**$**

STANDARD TENDER REQUIREMENTS

PERIOD OF VALIDITY

The prices entered by the Tenderer in the Form of Tender Page FT-8 shall be based on the assumption that the Engineer's written order to commence work will be issued to the Tenderer within 30 days after the opening date of tenders.

AGREEMENT TO BOND

We, the undersigned, hereby to agree to become bound as Surety for

_____

_____

in a Bond totalling One Hundred Percent (100%) of the contract amount, and conforming to the Instruments of Contract attached hereto, for the full and due performance of the works shown as described herein, as well as a Labour and Material Payment Bond in the amount of 100% of the contract amount if the Tender for

Deep River Water Treatment Plant Upgrades, Contract 2025-RFT-001

is accepted by the Owner.

It is a condition of the Agreement that if the above-mentioned Tender is accepted, applications for a Performance Bond and Labour and Material Payment Bond must be completed with the undersigned within ten (10) days of acceptance of Tender related thereto, otherwise this Agreement shall be null and void.

Dated this_____day of_____2025.

_____
Name of Bonding Company

_____
Signature of Authorized Person Signing
for Bonding Company (Company Seal)

_____
Position

STATEMENT "A"

Qualifications of Tenderer's senior supervisory staff to be employed on this Contract.

NAME	APPOINTMENT	QUALIFICATIONS AND EXPERIENCE

STATEMENT "B"

Proposed construction equipment to be utilized on this Contract.

Equipment Available:

Equipment To Be Rented:

Equipment To Be Purchased:

STATEMENT "C"

LIST OF SUBCONTRACTORS AND SUPPLIERS

The Tenderer also agrees that the following is a complete list of Subcontractor(s) and Supplier(s) that will be required in the performance of the work and that no additions, deletions or changes to this list will be permitted after closing of Tenders without the approval of the Engineer.

State OWN FORCES if a Sub-Contractor is not required for any of the trades listed. If additional trades are required, insert in blank spaces.

Failure to complete this list of Sub-Contractors may render the Tender informal.

SUBCONTRACTOR OR SUPPLIER	NAME & ADDRESS	TRADE
Electrical		
Process Mechanical / Plumbing		
HVAC Mechanical		
Piping Coating		

STATEMENT "C1"

LIST OF PROPOSED MAJOR SUBCONTRACTORS

The Tenderer is required to complete this statement listing the names of each proposed subcontractor where their work is valued at or above $250,000.00. The Tenderer must also list the part of the work each subcontractor is to carry out and the value of each part of the work of which 50% Performance and 50% Labour and Material Payment Bonds are required. No blank spaces are to be left.

Failure by the tenderer to comply with the foregoing may result in the disqualification of the tender.

PARTS OF WORKS OR SUBTRADE	PROPOSED SUBCONTRACTOR	VALUE OF WORK
		$
		$
		$
		$
		$
		$

Signed:_____

Name:_____

For:_____
(Name of Tenderer)

Date:_____

SCHEDULE OF PLANS, SPECIFICATIONS AND DOCUMENTS

The contract plans and documents for this contract are:

Contract Documents

- Information for Tenderers
- Form of Tender
- General Conditions of Contract
- Standard and Contract Forms
  - Form of Agreement
  - Performance and Maintenance Bond
  - Labour and Material Payment Bond
  - Certificate of Insurance
  - Specifications for All Risk Insurance
- Technical Specifications
- Contract Drawings
- Appendix A – Design Modifications Drawings – Deep River Water Treatment Plant Upgrades (Jp2g, 2005)
- Appendix B – PLC's I/O Loop Drawings – Deep River Water Treatment Plant Upgrades (Stroma, 2007)
- Appendix C – Process Control Narrative

In addition to the Contract Documents and Drawings contained herein, the following plans, specifications and documents shall be considered to form part of the contract and shall be in full force and effect. It is the contractor's responsibility to obtain these documents, and to ensure that up to date copies of these plans, specifications and documents are available in his on-site field office.

1. Ontario Provincial Standard Drawings
2. Ontario Provincial Standard Specifications
3. Ontario Provincial Supplemental Specifications

In the event of any inconsistency or conflict in the provisions of the plans or specifications, such provisions shall take precedence and govern in accordance with the General Conditions of Contract.

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GC1 DEFINITIONS

Wherever used in these General Conditions, Agreement, Plans, Drawings, Form of Tender, Information for Tenderers, Specifications, Statutory Declarations or other documents forming part of this Contract:

1.01 "Approved", "permitted", "instructed", "required", “Submit" or similar words or phrases are used in the contract documents, it shall be understood that they mean, unless the context prescribes otherwise, "approved by the Engineer", "selected by the Engineer", "directed by the Engineer", "permitted by the Engineer, "instructed by the Engineer" and "submitted to the Engineer".

1.02 "Authorized", "Directed", "required", "requested", "approved", "ordered", "sanctioned", "considered" and "satisfactory" shall, unless some other meaning is obvious from the context, mean respectively authorized, directed, required, requested, approved, ordered, sanctioned or considered by or satisfactory to the Engineer.

1.03 "Contract" includes the Agreement to do the Work entered into with the Owner, the Specifications, the General Conditions, Information for Tenderers, the Plans, the Tender, and all other documents referred to in or bound with the said Agreement and identified as being part of the Contract documents.

1.04 “Contract Administrator” refers to the authorized employee(s) of the Owner, or his/her designate, to whom carriage and administration of this Contract has been granted. For the purposes of this Contract the Contract Administrator is CIMA Canada Inc.

1.05 "Contract Documents" consist of the executed Agreement between the Owner and the Contractor, the General Conditions of the Contract, Information for Tenderers, Form of Tender, Contract Drawings and Specifications including amendments thereto incorporated before the execution of the contract and subsequent amendments thereto made pursuant to the provisions of the Contract and agreed upon between the parties.

1.06 "Contractor" or a pronoun in place thereof, means the person or persons that executes the contract document with the Owner who have undertaken to carry out the Contract.

1.07 "Engineer" means the Manager of Operations of the Town of Deep River, his designate or such other person, partnership or company as may be authorized by the said Manager of Operations, to act on his behalf.

1.08 "Inspector" means any person, partnership, or company that the Engineer may appoint for the purpose of assisting in the supervision and inspection of the Work and the materials to be used in the Work.

1.09 "Plans" means all plans, profiles, drawings, sketches, or copies thereof exhibited, used or prepared for or in connection with the work embraced under the Contract.

1.10 "Plant" (unless the context requires a different meaning) means every temporary or accessory means necessary or required to carry on or complete the Work and extra work, in the time and manner herein provided.

1.11 "Provide" shall mean the inclusion of all labour, materials and services necessary to supply and install complete, the item of work referred to, unless the context prescribes otherwise.

1.12 "Owner" means the Corporation of the Town of Deep River.

1.13 "Shall", "may", "herein", "person", "writing" or "written", "surety" and "security" and words used in the singular number or the masculine gender, shall have the meaning and effect as given in the Interpretation Act of the Revised Statutes of Ontario.

1.14 "Solicitor" means the person acting on behalf of the Owner.

1.15 "Sub-Contractor" includes only a person, firm or corporation having a contract for the execution of a part or parts of the work included in the Contract, or a person, firm or corporation furnishing material called for in the Contract and worked to a special design according to the plans or specifications, but does not include one who merely furnishes material not so worked.

1.16 "Work" or "works" (unless the context requires a different meaning), means the total construction and related services; to include but not limited to, the supply of all materials, products, labour, supervision, services, permits and licenses required to complete the Contractor's obligations under the terms and conditions of the contract documents, including all extra or additional work or material, matters or things which may be ordered by the Engineer, as herein provided.

GC2 TENDERS

2.01 All tenders for the execution of the work herein set forth or referred to must be made on the printed forms supplied for that purpose. No others will be considered. Such tenders must be made without any knowledge, comparisons of figures or arrangements with any other person making any tender or estimate for the same purpose, and the Tenderers shall declare that such tenders are in all respects fair and without collusion or fraud, and that no officer of the Corporation or Owner, is, shall be, or shall become interested, directly or indirectly, as contracting party, partner, surety or otherwise in, or in the performance of, the Contract, or in the supplies, work or business to which it relates, or in any portion of the profits to be used therein or thereof, or in any of the monies to be derived therefrom. Tenders must cover the cost of completion of the Contract in every respect, in accordance with the Contract, including all labour, plant, tools, etc.

The Contractor agrees that he is fully informed regarding all of the conditions, local or otherwise, affecting the work to be performed and that his information was secured by personal investigation and that he will make no claim against the Owner based on any estimate or representation of the Owner or of any representative of same.

GC3 SCOPE OF CONTRACT

3.01 Stated in general terms, and without in any way limiting the requirements and intent of the Contract, the Work required to be done by the Contractor under the Contract comprises all excavations required for the proper carrying out of the Work, the formation, construction, completion and maintenance of the Work referred to in the Plans, Drawings, Specifications, General Conditions or other contract documents relating thereto and includes the provision, except where otherwise specifically stated in the Contract, of all labour, plant, materials and equipment required for the complete and proper execution of the Work.

3.02 The Contract Documents are complementary and what is required by any part thereof should be considered as being required by the whole.

3.03 Materials and work which are not specifically described or shown in the Contract Documents but the necessity of which can reasonably be considered as inferable from the contract documents, as determined at the sole discretion of the Engineer, shall be supplied and performed by the Contractor at no additional cost to the Owner and the Contractor shall not claim extra payment thereof or an extension of the time for completion on account thereof.

GC4 EXAMINATION OF CONTRACT DOCUMENTS

4.01 The Contractor shall examine the Contract Documents carefully and shall promptly report to the Engineer any error, inconsistency or omission or departures from good construction or from the requirements of the authorities having jurisdiction, he may discover.

4.02 The examination by the Contractor shall be to the best of his knowledge as reasonably expected and shall include co-ordination and communication with sub-contractors so as to ensure the completeness of the entire Work to its useful intent.

4.03 If the Contractor does discover any error, inconsistency or omission in the Contract Documents he shall immediately notify the Engineer and shall not proceed with the work affected until he has received corrected or missing information from the Engineer.

4.04 The Owner does not accept any additional costs or damages, inconsistencies, or omissions which could have been reasonably determined, of which the Engineer shall be the judge, by such examination prior to tender close.

GC5 CONFLICTS AND OMISSIONS

5.01 The Contractor shall do all work and furnish all materials in accordance with the best practice, and in the event of any inconsistency or conflict in the provisions of the plans or specifications, the Contract document shall take precedence and govern as set out in the Agreement:

(1) Agreement
(2) Addenda
(3) Information for Tenderers
(4) General Conditions
(5) Contract Drawings
(6) Specifications
(7) Tender
(8) Shop Drawings

5.02 Should reference standards and specifications conflict with the specifications pertaining to the Work, the specifications pertaining to the Work shall govern. Should reference standards and specifications conflict with each other, the more stringent shall apply.

5.03 Figured dimensions shall govern over scaled dimensions.

5.04 Later dates will govern within each of the categories of documents.

5.05 Neither party to the Contract shall take advantage of any apparent error or omission in the plans or specifications, but the Engineer shall be permitted to make such corrections and interpretations as may be necessary for fulfilment of the intent of the plans and specifications.

5.06 Any work or material not herein specified but which may be fairly implied as included in the Contract, of which the Engineer shall be the judge, shall be done or furnished by the Contractor as if such work or material had been specified.

5.07 The location of fixtures, outlets, conduit, piping, etc. shown or specified but not dimensioned, shall be considered approximate. The actual location shall be as approved and as required to suit the job conditions.

5.08 The organization of the specifications into divisions, sections, articles and arrangement of drawings, all pertaining to the Work, shall not be construed so as to require the Contractor to sub-contract or allocate the Work in any particular manner or to any particular trade. The division of specifications pertaining to the Work are for convenience only; the specifications shall be read as a whole. This division places no responsibility on the Engineer to settle any disputes between the Sub-Contractors or between the Contractor and Sub-Contractors.

GC6 PROVISION OF CONTRACT DOCUMENTS

6.01 The Contractor will be provided, without cost, 2 copies of the Contract Documents in addition to those that are part of the executed contract. In addition all other Sub-Contractors, listed by the Contractor in the tender document, will be provided with 1 copy of the Contract Documents.

6.02 Additional copies will be furnished for the cost of reproduction and applicable taxes plus 10%.

GC7 LOCATION OF EXISTING INFRASTRUCTURE

7.01 No responsibility will be assumed by the Owner for the correctness or completeness of the plans with respect to existing utilities, pipes, catchbasins, chambers, or other objects, either underground or on the surface, and should the plots of such be found incorrect or incomplete, the Contractor shall have no claim on that account.

7.02 The Owner does not insure the accuracy of such information, and the Contractor shall not make any claim against the Owner for damages or extra work caused or occasioned by his relying upon such services, reports or information either as a whole or in part. The Contractor shall obtain the locations of the utilities and the connections therefrom from the owner(s) of the utility prior to construction.

7.03 The Owner shall not be liable for any loss, damage, delay or claim whatsoever resulting or arising from the disruption or absence in whole or in part, of any municipal or other services. Without limiting the generality of the foregoing, this includes roads, water, storm and sanitary services, electricity, gas, telephone and conditions of drainage from or to the site.

GC8 GEOTECHNICAL INVESTIGATION

8.01 If the Owner has retained the services of a Geotechnical Engineer to perform test boring of soil, the boring was made to determine the character of the soil for design purposes.

8.02 The Owner does not guarantee or warrant the accuracy or warrant any extrapolation of any interpretation of the borehole log or any opinions or any conclusions expressed in the geotechnical report(s) and disclaim any liability arising from such report(s). The Contractor is assumed to have made such additional investigation or examination of the soil as he may consider necessary to satisfy himself of the conditions that may be encountered during construction.

8.03 In addition to the geotechnical investigation, the Owner has taken all reasonable steps to determine whether any toxic or hazardous substances and material are present at the site and if found, has taken all reasonable steps to cleanup the site. However, if additional toxic or hazardous substances and material are subsequently found during construction, the Owner will cleanup the site at no cost to the Contractor and the Contract time may be extended for such reasonable time where it can be demonstrated by the Contractor that his work has been delayed by the cleanup. The Owner shall not be liable for any other costs, such as delay or impact, as a result of having to cleanup the additional toxic or hazardous substances and material from the site.

GC9 SCHEDULE OF CONSTRUCTION

9.01 The Contractor shall, within two weeks after the receipt by him of (a) the Contract executed by the Owner and the Contractor or (b) the Engineer's written order to commence work, whichever is the earlier, submit his construction schedule, **based on his tender**, to the Engineer. The construction schedule shall show clearly in weekly stages the proposed progress on the main items, structures and sub-trades of the Contract and shall indicate where applicable the labour, construction crews, plant and equipment to be employed. The schedule shall be designed in conformance with the required contract time.

9.02 The Contractor shall monitor the progress of the Work relative to the schedule and shall maintain the construction schedule. Any deviation from this schedule due to weather conditions, labour disputes or any other causes whatsoever, are to be made up by extra forces, overtime work, or any other measures that may be required to bring progress of the Work back onto the construction schedule. The Contractor shall not be entitled to additional payment for such remedies.

9.03 The Contractor shall revise and update the construction schedule every month to ensure that he meets his contractual obligations and commitments. He shall submit to the Engineer such updated schedule as required hereto no later than 5 working days prior to the scheduled site meeting.

GC10 PLANT, LABOUR AND MATERIAL

10.01 The Contractor shall provide all necessary storage ground and storage sheds and shall furnish all required skilled and unskilled labour, and materials, fuel, machinery, tools and all plant, so that the Contract, and all work required to be done, can and will be carried on continuously and expeditiously to completion, in all respects to the satisfaction of the Engineer.

10.02 All material, plant, machinery, tools and equipment acquired, possessed or provided by the Contractor for incorporation into the Work shall be the property of the Owner, whether or not such material, plant, machinery, tools and equipment are brought to or upon the Work or upon lands of the Owner and the Contractor is prohibited from removing or disposing of the same, or any part thereof, without the consent or instruction of the Engineer in writing.

10.03 No materials, plant, machinery or equipment reasonably required for the performance of the Contract and not for incorporation into the Work, brought to or upon the Work or upon lands of the Owner, shall be removed or disposed of during the progress of the Work without the written consent or instruction of the Engineer or his authorized representative. In case of a difference of opinion between the Contractor and the Engineer or his authorized representative as to whether any of the aforesaid items is reasonably required on the Work for the satisfactory progress of the Work, the Contractor shall abide by the decision of the Engineer.

10.04 The Contractor shall use, install and handle all manufactured materials, equipment and appliances in strict accordance with the manufacturer's directions and instructions.

GC11 SAMPLES

11.01 Before any material of any kind is used on the Work, the Contractor shall submit such standard manufacturer's samples thereof for the approval of the Engineer and must obtain such approval. Samples shall be labelled as to the requirements of the Contract Documents. No material shall be used on the Work which is in any way inferior to the approved samples.

11.02 The giving of such approval shall not obligate the Owner to pay for any material other than in accordance with the Contract, shall not prevent the rejection of any material which may be found, in the opinion of the Engineer, to be unsound or unfit for use on the Work or not in accordance with the approved samples or the requirements of the Contract and shall not be deemed to be a waiver of any claims based on the Work or any part thereof at any time on account of the materials used not being satisfactory or on any other account.

11.03 The Contractor shall provide samples of special products, assemblies or components, when so requested by the Engineer, and at no additional cost to the Contract.

11.04 The decision of the Engineer with respect to the approval or rejection of the samples shall be final.

GC12 TESTS ON MATERIALS

12.01 The Contractor shall supply at his own expense certified copies of all tests upon all materials entering into the Contract. Such tests shall be made as and when directed by the Engineer, and by a testing laboratory approved by the Engineer. Any costs in connection with the design of any works required to be used in the Work under this Contract shall be borne by the Contractor.

12.02 If at any subsequent time any portion or portions of the material or works previously passed by the Engineer or Inspector as being satisfactory, is shown to be unsatisfactory, the Contractor shall remedy this defect at his own expense.

GC13 CONDEMNED AND SURPLUS MATERIALS

13.01 If the Engineer deems that any materials are unfit for use in or on the Work, the materials shall be wholly removed therefrom within twenty-four (24) hours after notification to that effect from the Engineer. In the case of failure or neglect on the part of the Contractor to remove the same, the Engineer may cause the same to be taken away at the Contractor's expense and deposited, wasted, or otherwise disposed of, in any locality, place or way he considers convenient or proper, and the Contractor shall forthwith pay to the Owner on demand, all expenses incurred, including storage, if any, or the same may be deducted or collected by the Owner, as provided in GC61 - MONEY DUE OWNER.

13.02 No surplus or other material of any kind, arising from any portion of the Work, shall be sold, thrown away, dumped, wasted, or otherwise disposed of without the written sanction of the Engineer, and if so disposed of the Engineer may ascertain as nearly as he conveniently can the quantities of value, and deduct the same from the Contractor's next progress payment certificate.

13.03 All excavated or surplus material shall be disposed of in the manner set forth in the Plans and Specifications for the Work or as required by the Ontario 3Rs Regulations as provided in GC 32.9 or as directed by the Engineer.

13.04 All excavated material of value to, or required by the Owner including materials from existing structures, such as old lumber, stone flagging, scoria, granite or cedar blocks, cobble stones, paving brick, stone, sewer or other pipe, sewer brick, manhole or gully tops, valves, hydrants, and earth or any other materials, must be neatly piled, deposited or evenly spread by the Contractor in such place as may be directed by the Engineer, the whole expense, including that of hauling, unloading and spreading to be borne by the Contractor. The above mentioned materials must be removed and deposited, as required, as soon as excavated, or as soon thereafter as the Engineer may direct.

13.05 Surplus excavated material not required by the Owner shall be disposed of by the Contractor off the line of the works, in such a manner as not to cause a nuisance, injury or inconvenience to the Owner or to public or private parties, otherwise the Contractor will in all cases be held liable for, and must indemnify the Owner, all claims in respect thereof.

GC14 EQUIVALENT

14.01 Where pursuant to the Specifications the Contractor is required to supply an article or group of related articles designated by a trade or other name or an "approved equal", the tender shall be based only upon supplying the article or group of articles so designated, which shall be regarded as the standard of quality required by the Specifications.

14.02 Where more than one trade or supplier's name is given, the Contractor shall note that the design as shown on the drawings and/or described in the specifications has been based on the first name listed but that the Contractor may base his tender on any one of the other suppliers named. In that event, the material and equipment supplied must be equal in quality, material, and performance (including maximum and minimum criteria specified or implied) to the material/equipment first named in the specifications. Any design and/or construction changes necessitated by the use of other trade or supplier's names given shall be at the expenses of the Contractor. The Contractor shall be responsible for assuring the proper fit and matching of all equipment or materials to surrounding pipe, equipment or materials.

14.03 No ruling on a proposed substitution as an "approved equal" will be made prior to acceptance of a tender. No substitution shall be made without the prior approval of the Engineer. No tender price shall be based on a presumed acceptance by the Engineer of a substitute item of supply.

14.04 After the acceptance of a tender, the Contractor may apply to the Engineer to substitute as an approved equal, another article or group of related articles identified by a different trade or other name for an article or group of related articles designated as aforesaid. In all cases the proposed substitution must be justified by the Contractor in his written application to the Engineer indicating reasons why he wishes to substitute (significant delay in delivery, strikes, unavailability, improved quality or field service, amount of contract cost reduction, etc.) and be accompanied by sufficient descriptive and technical information for the Engineer to thoroughly compare articles or group of articles with that specified. Failure to comply with this requirement to the Engineer's satisfaction, may result in rejection of the request due to insufficient information or time to evaluate same. All applications and submissions related to substitution shall only be made by the Contractor and not by any Sub-Contractors or suppliers.

14.05 The approval or rejection of a proposed substitution shall be at the discretion of the Engineer and his decision shall be final.

14.06 The Contractor shall assume all responsibilities for liabilities and additional costs that may subsequently arise as a result of his proposed substitution being accepted by the Engineer.

GC15 MATERIALS AND EQUIPMENT SUPPLIED BY THE OWNER

15.01 All materials and equipment shall be supplied by the Contractor with the exception of such material or equipment as is specifically stated to be supplied by the Owner. In all cases where materials or equipment are supplied by the Owner, every effort will be made to have a sufficient supply of such material or equipment tested, examined and approved and ready for use at such times as may be required, but in case the Owner fails to furnish sufficient supply at any time, the Contractor will not be entitled to any compensation for delay on that account (except as may be allowed in accordance with GC18 - DELAYS) other than an extension of the time for completion, the extent of which shall be determined by the Engineer and shall be as nearly as possible equivalent to the time delayed.

15.02 When the Contractor is required to make provision for and convey Owner supplied materials or equipment as above from warehouses, storage facilities or any third party transport, he shall do so as soon as the materials or equipment are delivered to their destination. Any charges on account of his inattention will be borne by him.

15.03 Unless otherwise specified, all materials and equipment supplied by the Owner shall be transported to the Work by the Contractor from the point designated for their supply, at the expense of the Contractor.

15.04 The Contractor shall assist the Owner, whenever necessary at the request of the Owner, to receive any equipment belonging to the Owner and install the same in the appropriate place within the contract. Costs incurred for providing any manpower, special handling equipment, shoring, protection to existing work, openings and making good shall be deemed to be included in the price of the contract.

15.05 Once material or equipment has been supplied to the Contractor by the Owner its storage prior to use is his responsibility. Any loss, theft, or damages occurring after the material is in the Contractor's custody shall be at his expense.

15.06 Before taking delivery of Owner supplied materials or equipment, whether they are being delivered by truck or by rail, the Contractor shall examine such materials or equipment and satisfy himself as to possible damages which they may have suffered in transit. Where damage has occurred, the Contractor shall immediately notify the Engineer so that a claim may be made against the carrier. Should the Contractor fail to notify the Engineer of damage to materials or equipment, the Contractor will be liable for the cost of making good any damage subsequently found.

15.07 The Contractor shall afford other Contractors reasonable co-operation and opportunity to receive and store materials at the place of Work.

GC16 APPROVALS AND PERMITS

16.01 The construction of the Work and all operations connected therewith are subject to the approval, inspection, bylaws and regulations of all municipal, provincial and federal and other authorities having jurisdiction in respect to any matter embraced in this Contract. The Contractor's compliance with statutes or regulations made thereunder or by-laws shall not relieve the Contractor of obligations set out in this Contract which may be more extensive than the requirements of those statutes, regulations or by-laws.

16.02 The Owner will obtain and pay the fees, if any, for approvals and permits relating to the design and location of the permanent works required from the Ministries of Environment and Climate Change, Transportation, Labour, from utility companies and local authorities.

16.03 Unless otherwise specifically stated in the tender documents, the Contractor shall obtain the permits, licenses and certificates and pay the fees required for the performance for the Work which are in force at the date of tender closing, except the Building Permit which will be applied and paid for by the Owner. The Contractor shall co-operate and do all things necessary to expedite such municipal building permits.

16.04 The Contractor shall notify the Ministry of Labour of the commencement of construction by mailing a "Notice of Project", in accordance with the latest version of the Occupational Health and Safety Act.

16.05 The Contractor shall prepare drawings additional to the Contract Drawings which may be required by authorities having jurisdiction to supplement or clarify specific details and items in order to obtain all applicable and necessary approvals.

GC17 ERRORS AND OMISSIONS BY CONTRACTOR

17.01 Errors, mistakes, omissions or unauthorized changes made by the Contractor or his agents, workers or employees and all damage that may result therefrom shall be rectified by the Contractor at his own expense.

GC18 DELAYS

18.01 If the Contractor is delayed in the performance of the Work by any act or neglect of the Owner or Engineer, then the contract time shall be extended for such reasonable time as the Engineer may decide. The Owner will not make any additional payment as a result of any delays caused by the Owner or its Engineer.

18.02 If the Contractor is delayed in the performance of the Work by a "Stop Work Order" issued by any court or other public authority and by providing that order was not issued as a result of any act or fault of the Contractor or of anyone employed by him directly or indirectly, then the Contract time shall be extended for such reasonable time as the Engineer may agree that the Work was delayed.

18.03 If the Contractor is delayed in the performance of the Work by labour disputes, strikes, lock-outs (including lock-outs decreed or recommended for its members in a recognized Contractor's association, of which the Contractor is a member or to which the Contractor is otherwise bound), fire, unusual delay by common carriers or unavoidable casualties or, without limit to any of the foregoing, by a cause beyond the Contractor's control, the contract time shall be extended for such reasonable time as the Engineer may decide, but in no case shall the extension of time be less than the time lost as the result of the event causing the delay, unless such shorter extension be agreed to by the Contractor.

18.04 No claim for delay shall be allowed on account of failure to furnish instructions until ten (10) days after the date of receipt of a written demand for such instructions and not then unless such a claim is reasonable.

18.05 The Contractor shall take all steps to reduce or eliminate all damage or loss by reason of delay with respect to construction of the Work arising from any cause whatsoever.

GC19 ORAL ARRANGEMENTS

19.01 In all cases of misunderstandings or disputes, oral arrangements will not be considered, but the Contractor must produce written authority found within the Contract Document that support his contentions, and shall advance no claim in the absence of such written authority, and shall not use, or attempt to use, against the Owner any conversation with any parties.

GC20 DECISIONS BY THE ENGINEER

20.01 Should any discrepancies appear or differences of opinion or misunderstanding arise as to the meaning of the Contract or as to any omissions therefrom or statements therein in any respect, or as to the quality or dimensions or sufficiency of the materials, plant or work or any part thereof, or as to the due and proper execution of the Work, or as to the measurement or quantity or valuation of any works executed or to be executed under this Contract, the same shall, subject to the terms of the Contract, be determined by the Engineer.

20.02 The Engineer shall have the right at all reasonable times to visit, enter and carry out inspection at any buildings, factories, workshops, works or sites of the Contractor or others wherever any materials are being prepared, manufactured or treated, or other work is being done in connection with this Contract and the right also to take such samples therefrom as he may deem necessary.

20.03 The Contractor shall immediately when ordered by the Engineer, proceed with and execute the Work or works, or any part thereof, forthwith in accordance with such order and with such additions to or deductions from the contract price as are provided under the terms of the Contract, without making any claim for any extension of time in completing the Work, unless arranged in writing with the Engineer as herein provided.

20.04 Throughout this Contract any decision of the Engineer shall be deemed to be binding and final.

GC21 INSPECTOR AND INSPECTION

21.01 All works to be done under the Contract shall be done to the satisfaction of the Engineer or of an Agent or Inspector authorized to act for him. The Inspector is required by the Engineer to see that the provisions of the Contract are faithfully adhered to, especially with regard to the quality of workmanship and materials, and may stop the Work entirely if there is not a sufficient quantity of suitable and approved material on the site to carry on the Work properly or for any good and sufficient reason. The Engineer will not be responsible for the acts or omissions of the Contractor, any Sub-Contractors, or any of their agents or employees, or any other persons performing any of the Work in accordance with the Contract document.

21.02 In particular, but without limiting the powers of the Inspector, orders given by the Inspector relating to the quality of material or workmanship or in respect of safety or public convenience must at once be obeyed by the Contractor.

21.03 The Inspector shall have the power to suspend any worker for wilful negligence or disregard of orders and the Contractor shall ensure that any worker so suspended is forthwith removed from the site.

21.04 Materials and equipment and the process of preparation or manufacture of materials or equipment shall at all times be subject to inspection, testing and rejection at any stage by the Engineer or his representatives. The Engineer will give the Contractor reasonable notice of the materials and equipment in respect of which the Engineer proposes to have inspection or testing carried out during the process of preparation of manufacture, save that in the case of materials or equipment specifically stated in the Contract as required to be tested or inspected by or in the presence of the Engineer or his representative, the Engineer shall not be obliged to give such notice.

21.05 The Contractor shall notify the Engineer in writing at least seven days prior to the commencement of preparation or manufacture of each item of such materials or equipment of the time and place at which such preparation or manufacture is to commence in order that the Engineer may be present.

21.06 Notwithstanding compliance by the Contractor with the foregoing paragraph hereof, if any materials or equipment prepared or manufactured away from the site of the Work and required by the Contract or by the Engineer to be inspected or tested by or in the presence of the Engineer or his representative at the place of preparation or manufacture become ready for delivery to the site of the Work but have not been inspected or tested as required, the Contractor shall so notify the Engineer in writing and shall not have such materials or equipment delivered to the site of the Work until authorized so to do in writing by the Engineer.

21.07 In any event, no materials or equipment required by the Contract or by the Engineer to be inspected or tested by or in the presence of the Engineer or his agent shall be incorporated into the Work until the required inspection or testing has been carried out to the satisfaction of the Engineer.

21.08 The Contractor shall provide, and shall ensure that all Sub-Contractors and those carrying out the process of preparation or manufacture shall provide, every reasonable facility and cooperation to assist the Engineer or Inspector or others designated by the Contract or by the Engineer in carrying out inspection and testing.

21.09 The Contractor shall not backfill or otherwise cover up any work without either having it inspected and passed by the Inspector or first notifying the Inspector in a manner approved or as directed by the Engineer that the work is ready to be covered up and allowing the Inspector reasonable notice and opportunity for carrying out an inspection.

21.10 Any work covered up other than in accordance with the foregoing shall, if ordered by the Inspector or the Engineer, be uncovered or opened up for inspection and the Contractor shall, as directed by and to the satisfaction of the Inspector or the Engineer, make good again all openings, excavations and disturbances of any property, real or personal, resulting therefrom, all at the Contractor's expense, but if the Contractor has backfilled or otherwise covered up any work in accordance with GC21.09, the cost of any uncovering or opening up and making good shall be borne by the Owner.

21.11 No approval by an Inspector or by the Engineer or failure of an Inspector or the Engineer to carry out an inspection shall relieve the Contractor or any of his obligations under the Contract or shall be interpreted as being an acceptance of defective or improper work or material which must in every case be removed and replaced properly or otherwise rectified in a satisfactory manner whenever discovered at any time as provided for in GC52 - WARRANTY AND GUARANTEE PERIOD AND GC64 - NON FULFILMENT OF THE CONTRACT.

21.12 If, in addition to the inspection provided for above, the Contractor is required by the Contract, by law, by local by-law or by the Engineer to have any part of the works inspected by others, the Contractor shall give the Engineer and the others concerned reasonable notice of the time and date proposed for the additional inspection.

GC22 OCCUPANCY AND ACCESS OF THE WORKS

22.01 The use or occupancy of the Work or any part thereof by the Owner shall not be taken in any manner as an acceptance by the Owner of any work or material not in accordance with the Contract or to relieve the Contractors or his surety from liability, whether heretofore or hereafter incurred or arising, in respect of the observance or performance of any covenant or condition in the Contract not then performed, whether such covenant or condition be by way of indemnity to the Owner or otherwise, save to the extent that loss or damage is caused during such use or occupancy by the Owner or by employees of the Owner for whom the Owner is responsible.

22.02 Entry by the Owner's own forces and by other Contractors does not mean acceptance of the Work and does not relieve the Contractor of his responsibility to complete the Contract. In particular, without limiting the generality of the foregoing, the use or occupancy of the Work or any part thereof by the Owner shall not release the Contractor from liability to pay to the Owner, or waive or impair the right of the Owner to deduct and retain, liquidated damages and engineers' and inspectors' fees, in accordance with the Contract.

22.03 The Owner shall have the right to enter upon and take possession of the Work, in whole or in part, for the purpose of placing fittings and equipment or other use before completion, if in the opinion of the Engineer such action does not prevent or interfere with the Contractor in the performance of total completion of the Contract within the time specified. Such entry and possession shall not be considered as acceptance of the Work nor in any way relieve the Contractor of responsibility to complete the Contract.

22.04 The Contractor shall co-operate in all respects to provide accommodation and safe access to the building or portion thereof which the Owner may require, prior to completion of the Contract, at no cost to the Owner.

22.05 The Contractor will only be allowed access to the site for the duration of the contract from the fence gate indicated on the contract drawings. The Contractor shall provide good vehicular and pedestrian access at all times to the site and the neighbouring areas. Where there is no alternative but to shut off access temporarily to the property, the Contractor shall work so as to keep the period of inconvenience to a minimum. The Contractor will also be provided with a lay down area inside the fenced site. Notwithstanding, any closure of access must be approved by the Engineer in writing prior to closing.

GC23 ABSENCE OF ENGINEER AND HIS AGENT

23.01 The Owner may appoint an Engineer or firm of consulting engineers as agents of the Engineer for the purpose of inspecting the work performed under this Contract. In the absence of the Engineer or his duly appointed agent, any inspector who has been designated by the Engineer or his agent to inspect the Work shall have full power to decide as to the manner of conducting and executing the Work in every part and the Contractor shall follow the instructions or orders of the person so designated.

GC24 CONTRACTOR'S ABSENCE

24.01 In the absence of the Contractor from the Work (whether permanent or temporary) he must provide and leave a competent and reliable superintendent in charge of the Work for him, and such person shall be considered as acting in his place, and all notices, communications, orders or instructions given or sent to or served upon such person shall be taken as served upon and received by the Contractor.

GC25 CONVENIENCES

25.01 The Contractor must provide, and properly maintain in clean condition, suitable and convenient privy or water closet accommodation for his men.

25.02 From the first day of November to the thirtieth day of April, the Contractor shall provide at his own expense, an adequate, warm, comfortable shelter, accessible during the noon hour and inclement weather to all the men employed on the Work, and its location shall be approved by the Engineer.

GC26 PUBLIC CONVENIENCE AND SAFETY

26.01 All work shall conform to the **Occupational Health and Safety Act, R.S.O. 1980, c. 321**, as amended, the Owner's Health and Safety Policy and the Contractor's Health and Safety Policy whichever is more stringent. The Contractor, by executing this Contract unequivocally acknowledges that he is the "**Constructor**" as defined in the **Occupational Health and Safety Act, R.S.O. 1980, c. 321** and regulations passed thereunder with respect to the Work and is bound thereunder.

26.02 The Engineer will provide a copy of the Owner's Health and Safety Policy to the Contractor and the Contractor is also required to submit to the Engineer a copy of its own Health and Safety Policy.

26.03 The Contractor shall provide to the Engineer the data sheets for each chemical substance he proposes to bring and use on site. Upon Final Completion of the Contract, he shall remove all chemical and hazardous products from the Work site to the satisfaction of the Engineer.

26.04 If at any time the Engineer, or his representative considers the works to be unsafe he may order the Contractor to take measures forthwith to ensure adequate safety. Should the Contractor fail to take adequate measures, the Engineer or his representative may order the Work to cease until such measures have been taken. The Contractor shall not be entitled to additional payment for, or an extension of time for the performance of the Contract by reason of, such safety measures. The fact that the Engineer or his representative has ordered or has failed to order additional safety measures shall not relieve the Contractor of responsibility for the adequacy of the safety measures taken.

26.05 The Contractor, during the progress of the Work, shall keep the site and the Work in as tidy a condition as practicable. He shall not deposit any material in any portion of street, sidewalk, boulevard, grass plot, or Crown or public property, without permission of the Engineer, and shall remove same without delay when and as directed by the Engineer. Upon completion of the Work and subject to GC13 - CONDEMNED AND SURPLUS MATERIALS, he shall remove all false work, plant and surplus materials, as well as any rubbish accumulated on account of his operations and shall leave the site in a condition

satisfactory to the Engineer. In addition, the Contractor shall carry out the final clean-up of all areas within the building, equipment, fixtures, piping, conduits, electrical panels etc as directed by the Engineer and ensure that these are properly cleaned to the satisfaction of the Engineer. Clean, brush, vacuum, flush with water as required, to provide clean work area.

26.06 Unless all surplus material, plant, rubbish, false work, etc. are removed from time to time, when and as directed, the Engineer will proceed to do whatever is necessary to restore the site, street, sidewalk, boulevard, grass plot, or Crown or public property to a tidy condition and will charge the cost thereof against the Contractor.

26.07 Whenever and wherever any work is closed, suspended or stopped for the winter, all material of every description must be gathered up from the street, sidewalks, boulevards and grass plots and removed therefrom and the site shall be left in a safe and tidy condition and shall be maintained in a safe condition until work is resumed.

26.08 Without limiting the generality of this section, the Contractor shall prevent excessive amounts of dust and noise resulting from the Work. The amount of dust and noise which is excessive shall be at the sole discretion of the Owner. The Contractor shall use wet type blades and grinders with sufficient water to control dust when work requires the Contractor to saw or grind asphalt or concrete. The Contractor shall pay for all measures taken to control dust and noise except as otherwise provided in the Contract.

26.09 The method of use and the charter of all explosives shall be subject to the approval of the Engineer. The Contractor shall ensure that the charges of explosives used by the Contractor and the time at which they are exploded shall be such as not to cause damage to person(s) or property or to cause unreasonable inconvenience.

26.10 Explosives shall be properly housed and protected as provided by law, and no explosives known to have deteriorated shall be used. Approved methods of handling and thawing of frozen explosives shall be followed, and the greatest care shall be exercised at all times by the Contractor in blasting operations.

GC27 RESTORATION

27.01 Where the Contractor enters into the lands or buildings of the Owner, the Province or any Owner or of any person or enters onto any highway or road under the jurisdiction and control of any public authority for the purpose of making any survey, examination, investigation, inspection or other arrangement or lays any pipes or appurtenances in, upon, through, over or under any highway or road under the jurisdiction and control of any public authority and in so doing disturbs any such lands, buildings, highways or roads, such lands, buildings, highways or roads shall be restored to their original conditions without unnecessary delay.

GC28 DRAINAGE

28.01 The Contractor shall keep all portions of his work properly and efficiently drained during construction and until completion, and he will be held responsible for all damage which may be caused or result from water backing up or flowing over, through, from or along any part of the Work, or which any of his operations may cause to flow elsewhere.

28.02 The Contractor shall dewater all work sites and excavations as necessary or as directed to enable the Work to be constructed in a satisfactory manner.

28.03 The Contractor shall not be entitled to any additional payment for compliance with the requirements hereof beyond the prices tendered for the construction of the Work.

GC29 BARRIERS, LIGHTS AND DETOURS

29.01 The Contractor must, at his own expense, and without further or other order, provide, erect and maintain all requisite barriers, fences or other proper protection; and must provide, keep and maintain watchmen and lights with red globes, as may be necessary or as may be ordered by the Engineer, in order to ensure safety to the public as well as to those engaged about the premises or works. Should the Contractor neglect to carry out the above requirement, the Engineer is hereby authorized to place such watchmen, lights, barriers, etc., as are required, and to charge the cost to the Contractor, without relieving the Contractor of any claims for damages or accident.

29.02 The Contractor must (where it is practicable in the opinion of the Engineer) keep the roadway open for travel for the use of the public, for such width as the Engineer may direct. Where, in the opinion of the Engineer, it is not practicable to keep a roadway open for the full flow of traffic, he may permit the Contractor to close or partially close such roadway and to provide for a detour of the traffic or a part thereof. In each such case and before putting into effect the closure or detour, the Contractor shall present his proposal for closure or detour to the municipal or other authority or authorities having jurisdiction over any of the roadways which will be affected by the proposed closure or detour and shall obtain the written authorization tosuch proposal of the said authority or authorities. The Contractor must provide a sufficient number of "NO THOROUGHFARE", "DETOUR" or other proper notices, which he must cause to be placed and maintained in good order in conspicuous places wherever any roadway, sidewalk, or thoroughfare is torn up or dangerous, and so long as it remains unsafe or unfinished.

29.03 When any work is carried on in the evening, the Contractor must supply, at his own expense, a sufficient number of electric or other approved and efficient lights, to enable the same to be done in an efficient and satisfactory manner, and the Engineer shall have the power to order additional lights to be put on at the Contractor's expense if in the opinion of the Engineer, they are, or may be required at no additional cost to the Owner.

GC30 LOSS OR DAMAGE

30.01 The Owner shall not in any manner be answerable or accountable for any loss or damage by fire or otherwise that shall or may happen to the Work or any part or parts thereof; or for any of the materials or other things used and employed in finishing and completing the Work, or for any injury to any person or persons, including workmen and the public, or for damage to adjoining property, against all of which injuries and damages to persons or property, the Contractor shall properly guard, and shall make good all damage of whatsoever nature or origin which may arise out of, or be occasioned by any cause connected with the Contract, or the work done by the Contractor, and shall indemnify and keep indemnified the Owner against same until the completion of the Work hereunder and the termination in accordance with the Contract of the insurance which the Contractor is required by the Contract to provide.

GC31 INSURANCE

31.01 Without restricting the generality of GC32 - CONTRACTOR'S LIABILITY, the Contractor shall provide, maintain and pay for the insurance coverage listed herein unless otherwise stipulated and shall commence from the start of the Work until the date of the issuance of the Substantial Completion Certificate by the Engineer. Prior to the commencement of the Work and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the Contractor shall provide the Owner with confirmation of coverage and a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements.

31.02 **Comprehensive General Liability Insurance** shall be in the joint names of the Contractor, the Owner and the Engineer, with limits as specified in the *Information to Bidders* per occurrence for bodily injury, death, and damage to property with a deductible not exceeding five thousand dollars ($5,000) and shall provide for full cross-liability thereunder. Liability coverage shall be maintained for completed operations

hazards from the date of Substantial Performance of the Work on an ongoing basis for a period of two years and substantiated by individual certificates. The policy shall not be cancelled or changed without giving the Owner not less than 30 days notice in advance in writing.

31.03 **Automobile Liability Insurance** in respect of licensed vehicles shall have limits of not less than five million dollars ($5,000,000) inclusive per occurrence for bodily injury, death, and damages to property, covering all licensed vehicles owned or leased by the Contractor. The policy shall be endorsed to provide the Owner with not less than thirty days written notice in advance of cancellation, change or amendment restricting coverage.

31.04 **"All Risks" Property Insurance** shall be in the joint names of the Contractor, the Owner, and the Engineer, ensuring not less than the sum of the amount of the Contract Price and the full value of materials and equipment supplied by the Owner as provided in GC15 - MATERIALS AND EQUIPMENT SUPPLIED BY THE OWNER, with a deductible not exceeding five thousand dollars ($5,000). The insurance coverage shall not be less than the insurance required by Form IAO 507 or its equivalent replacement. The coverage shall be maintained continuously until ten days after the date of the issuance of the Substantial Completion Certificate by the Engineer.

31.05 **Boiler and Machinery Insurance** shall be in the joint names of the Contractor, the Owner, and the Engineer for not less the replacement value of the boilers, pressure vessels, and other insurable objects forming part of the Work. The insurance coverage shall not be less than the insurance provided by the "Comprehensive Boiler and Machinery Form" and shall be maintained continuously until ten days after the date of the issuance of the Substantial Completion Certificate by the Engineer.

31.06 **"All Risks" Contractor's Equipment Insurance** covering construction machinery and equipment used by the Contractor for the performance of the Work, including boiler insurance on temporary boilers pressure vessels, shall be in the form acceptable to the Owner and shall not allow subrogation claims by the insurer against the Owner. The policies shall be endorsed to provide the Owner with not less than thirty days notice in writing in advance of cancellation, change, or amendment restricting coverage.

31.07 The above policies shall allow for partial or full use or occupancy of the Work as provided for in GC22 - OCCUPANCY OF THE WORKS.

31.08 The policies shall provide that, in the event of a loss or damage, payment shall be made to the Owner and the Contractor as their respective interest may appear. The Contractor shall act on behalf of both the Owner and the Contractor for the purpose of adjusting the amount of such loss or damage payment with the Insurers. When the extent of the loss or damage is determined, the Contractor shall proceed to restore the Work. Loss or damage shall not affect the rights and obligations of either party under the Contract except that the Contractor shall only be entitled to such reasonable extension of Contract time relative to the extent of the loss or damage as the Engineer may decide and whose decision shall be final and binding.

31.09 If the Engineer does not extend the time for completion, then the Work shall be completed within the time fixed for the Contract. Monies paid to the Contractor under such insurance shall be used for the purpose of replacing, rebuilding, repairing and completing the Work, and all such material, plant, fuel, machinery, tools and equipment which have been damaged or destroyed. Such replacing, rebuilding, repairing and completion shall be carried out in every way subject to the terms and conditions of the Contract.

31.10 The Contractor shall be responsible for deductible amounts under the policies.

31.11 The Contractor shall maintain and pay for such insurance and shall pay such assessments as will protect him from claims under the **Workers' Compensation Act** and from any other claims for damages arising from bodily injury, including death, and from claims for property damage which may arise from his operations under this Contract. The Contractor shall deposit with the Owner a Certificate of such insurance, in a form acceptable to the Owner, clearly stating that the policy of insurance so provided complies with these provisions.

31.12 Where a policy is renewed, the Contractor shall provide the Owner, on a form acceptable to the Owner, renewal proof of insurance immediately following completion of renewal.

31.13 If the Contractor fails to provide or maintain insurance as required herein or elsewhere in the Contract Document, then the Owner will have the right to provide and maintain such insurance and give evidence thereof to the Contractor. The Owner's cost thereof shall be payable by the Contractor to the Owner on demand.

31.14 If the Contractor fails to pay the cost of the insurance placed by the Owner within 30 days of the date on which the Owner made a formal demand for reimbursement of such costs, the Owner may deduct such costs thereof from monies which are due or may become due to the Contractor as provided in GC61 - MONIES DUE OWNER.

GC32 CONTRACTOR'S LIABILITY

32.01 The Contractor shall assume the defence of and indemnify and save harmless the Owner and its officers and agents and all those named as additional insured on the Certificate of Insurance from all claims relating to the Contract including but not limited to labour and materials furnished for the Work, and to inventions, copyrights, trademarks, royalties or patents, and rights thereto, relating to or used in doing the Work, or the subsequent use and operation of the Work or any part thereof upon completion.

32.02 In carrying out the Work from its inception, and until the final acceptance of the same, the Contractor must be careful not to cause any settlement of the ground, injury or damage as to any adjacent property, public or private, utilities, or to any sidewalks, roadways, curbs, gutters, drains, hydrants, manholes, frames, covers or street gullies, boulevards, grass plots, sodding, trees, shrubs, or structures, works or things on or near the line or in the vicinity of the Work or elsewhere. Except as provided for in this Contract, if injury or damage is done, he must make good the same at his own expense in the manner directed by and to the satisfaction of the Engineer.

32.03 The Contractor shall be responsible for any and all damages, or claims for damages for injury or accidents done or caused by him or his employees or agents, or resulting from the prosecution of the Work, or any of his operations, or caused by reason of the existence or location or condition of the Work, or of any materials, plant or machinery used thereon or therein, or which may happen by reason thereof, or arising from any act or commission or omission on his part, or on the part of any of his agents or employees, in connection with the Contract, and covenants and agrees to hold the Owner and its agents and employees harmless and indemnified from all damages and claims for damage, demands, losses, costs, suits, actions or proceedings.

32.04 In case of the Contractor's failure, neglect or omission to observe and perform faithfully and strictly, all the provisions of the Contract, the Engineer may, either with or without notice (except where in this Contract, notice is specially provided for, and then upon giving the notice therein provided for), take such steps, procure such material, plant, trucks and men, and do such work or things as he may deem advisable toward carrying out and enforcing the same, and any and all expenses so incurred may be deducted or collected by the Owner under the provisions of GC61 - MONIES DUE OWNER and any such action by the Engineer as he is herein empowered to take, shall not in any way relieve the Contractor or his surety from any liability under the Contract.

32.05 Without limiting the generality of the foregoing provisions of this section and notwithstanding any consent or order which the Engineer may give to the Contractor to prosecute the works under this Contract for a longer period than eight hours a day or forty-eight hours a week, the Contractor may, by order of the Engineer be prohibited from carrying on operations during any hour or hours of the day in which the Engineer in his judgment deems such operations to be a disturbance and nuisance to the residents of the Owner or municipalities wherein the work is being executed in whole or in part. Irrespective of any permission or order which the Engineer may have given to the Contractor, the Contractor shall indemnify and save harmless the Owner or such Owner or municipalities as aforesaid, from any claim, action, loss or damage whatsoever which may be made, brought or recovered against it or them as a result of any of his operations.

32.06 In the event of the Contractor being enjoined by court process in connection with any of his operations, he shall not have recourse against the Owner or Owner or municipalities as aforesaid on account thereof.

32.07 The Contractor shall make such alterations in his method, equipment and working forces if at any time the method or equipment or working forces are found by the Engineer to be inadequate to ensure a rate of progress sufficient in the opinion of the Engineer to complete the Work within the time limited therefore under the Contract but, not withstanding the foregoing, the onus is on the Contractor to ensure that such required progress of the Work is maintained.

32.08 The Contractor will be required to change his method of operation, sequence of operation or type of equipment when the Contractor's method of operation causes erosion or other adverse environmental effects contrary to the **Environmental Protection Act, R.S.O. 1980, Chapter 141** and amendments thereto, at no additional cost to the Owner.

32.09 The Contractor is required to comply with the **Ontario 3Rs Regulations** with respect to materials to be source separated, irrespective of total floor area's criteria imposed by the Regulations for recyclable materials which are generated in the execution of the Work. Collected recyclables must be transported to a municipal waste recycling site, to an end-user, to a distributor who sends the materials to end-users, or to a waste disposal site, as required and the cost shall be deemed to be included in the price of the Contract.

32.10 The Contractor shall attend meetings with respect to the Work as may be directed by the Engineer. The Contractor shall not claim any extra compensation for attendance at these meetings. The Contractor shall provide a representative, to attend such meetings, who is able to make undertakings on behalf of the Contractor.

32.11 The Contractor shall at all times pay, or cause to be paid, any assessment or compensation required to be paid pursuant to the **Workers' Compensation Act**, and the Owner may pay the same and deduct or collect such expenses under the provision of GC61 - MONIES DUE OWNER.

32.12 The Contractor shall, at the time of entering into any contract with the Owner, make a statutory declaration or furnish a satisfactory clearance letter from the **Workers' Compensation Board** stating that all assessments or compensation payable to the Workers' Compensation Board have been paid. Thereafter, the Contractor shall submit a satisfactory clearance letter from the Workers' Compensation Board on a monthly basis during the performance or upon the completion of such contract, further proof that such assessments or compensation have been paid.

32.13 The Contractor shall at all times be subject to and will be required to observe all rules and regulations which are or may from time to time be imposed by law, as related to all branches of the Work under contract. The Contractor shall from time to time adopt such approved construction or operating methods in carrying out the Work as may be called for or needed due to changing conditions which may be encountered during the progress thereof at no additional cost to the Owner.

32.14 Should construction be closed for any cause, the Contractor shall assume all responsibility for protecting the Work and provide security to the building and site during such periods.

GC33 EVENING, SUNDAYS AND HOLIDAY WORK

33.01 The Engineer may order the Contractor to proceed on a two or three eight-hour shift basis if he deems this necessary to speed up the Work, or he may order any work to be carried out in whole or in part in the evening, and the Contractor shall have no claim for extra compensation in respect thereof. No work, however, shall be undertaken at night without the consent in writing of the Engineer.

33.02 Whenever, in the judgment of the Engineer, it may be necessary or expedient, in order to preserve and maintain traffic over or on any street or road, to do work in the evening or after or before the regular time of ending or beginning labour, such night or overtime work shall be performed by the Contractor without additional or extra cost to the Owner beyond the price bid for the Work. Work shall be performed by the Contractor on working day, except in the case of emergency, and then only with the written permission of the Engineer and to such extent as he may judge to be necessary.

33.03 A working day is defined as any day except:

i) Saturdays, Sundays and Designated Holidays;

ii) A day on which the Contractor is prevented by inclement weather or conditions resulting immediately therefrom adverse to controlling operation or operations, as determined by the Engineer, from proceeding with at least 60% of the normal labour and equipment force engaged on such operation or operations for at least five (5) hours toward completion of such operation or operations. A controlling operation or operations is to be construed to include any feature of the work considered at the time by the Engineer and the Contractor which if delayed, will delay the time of completion of the Contract.

33.04 The Contractor shall, as far as possible, refrain from working on days which are designated holidays in Ontario. In case he desires to work on any such holiday he shall notify the Engineer in writing to that effect at least four (4) days in advance of such holiday, stating those places where the said work will be conducted. If approval is granted, it will be on condition that the Contractor pays any and all expenses incurred by the Owner for layout, supervision and inspection. If the Contractor fails to give such notice in advance of any holiday, such failure shall be considered as an indication that no work requiring the presence of an engineer or inspector is to be done by the Contractor on such a holiday.

33.05 Designated holiday is to be defined as the following days:

New Year's Day	Civic Holiday (August)
Family Day (February)	Labour Day
Good Friday	Thanksgiving Day
Victoria Day	Christmas Day
Canada Day	Boxing Day

GC34 NOTICE TO CONTRACTOR

34.01 Any notice or communication to the Contractor shall be deemed to be well and sufficiently given and served if handed to the Contractor or any of his clerks or agents, or if posted or sent to the address given in the Agreement, or to his domicile or usual place of business, or to the place where the Work is to be or is being carried on, or if posted to or left at his last known address, and any papers so left, sent or addressed shall be considered to be, and to have been legally served upon the Contractor.

34.02 In any written or printed notice to the Contractor in respect of general, special, or other repairs, or of any work of any nature required to be done under any of the provisions of the Contract, or of any other matter, it shall not be obligatory upon the Engineer to specify minutely or in detail everything required, nor to specify by measurement the exact extent thereof, or the precise spot or spots where the work or material may be defective or faulty or where any of the requirements of the Specifications have not been observed; but a reference in such notice to the clause or clauses bearing upon the matter, and a description of the locality in general terms, and sufficiently clear, in the opinion of the Engineer, to indicate where the defect or trouble exists, shall be deemed to be, and shall be, ample notice.

34.03 Where standard of performance are specified or implied and the Work does not comply with the performance standard specified or implied, such deficiency shall be corrected by the Contractor as directed by the Engineer. Any subsequent testing (including retesting by the Owner) to verify performance shall be done at the Contractor's expense and not out of cash allowance.

34.04 Additional instructions issued by the Engineer will not be considered as a change in the contract price or change in the contract time, if, in the Engineer's opinion the additional instructions are necessary to carry out the useful intent of the design and could reasonably have been understood by the Contractor to have been implied as required.

GC35 CONTRACTOR'S DISCHARGE OF LIABILITIES

35.01 The Contractor shall discharge all liability incurred by him for labour, materials or services, used or reasonably required for use in the performance of this Contract on the date upon which each becomes due.

35.02 The **Construction Lien Act**, **R.S.O. 1990**, and any amendments thereto and any regulations made thereunder apply to the performance of this Contract, but do not limit the provisions of this Contract, and the Owner has all the rights and powers set out therein and in the Contract. The Contractor shall display and keep displayed in a conspicuous place on the site of the works a notice or notices relating to the **Construction Lien Act** when supplied by the Owner.

35.03 The Contractor shall cause every Sub-Contractor engaged in the performance of this Contract to discharge all liabilities incurred by such Sub-Contractor for labour, materials or services used or reasonably required for use in the performance of this Contract. Workmen employed by a Sub-Contractor shall be paid in full at intervals not less frequently than semi-monthly and other liabilities of the Sub-Contractor, as aforesaid, shall be discharged on the date upon which each becomes due. At the request of the Owner, the Contractor shall furnish the Owner with evidence satisfactory to it that his liabilities and those of the Sub-Contractors, as aforesaid, have been discharged.

35.04 The Owner may, in writing, require the Contractor to send to it, by registered mail, within fifteen days from the date of the mailing of the demand, a list of the names and addresses of and the amounts owing to his creditors in a form satisfactory to the Engineer.

35.05 No payment to which the Contractor is otherwise entitled under this Contract shall in the discretion of the Owner be due and payable to him so long as he or any of such Sub-Contractors are in default under this Section, and upon such default occurring, the Engineer may notify the Contractor to discontinue all work under the Contract and the Owner shall have the same rights and privileges as are provided in GC64 - NON FULFILMENT OF THE CONTRACT. The Owner may, after notice in writing to the Contractor and his Surety, if any,

(1) pay any such liability of the Contractor and of the Sub-Contractors, as aforesaid or

(2) make a direct payment at any time, with or without default,

to a creditor of the Contractor or of a Sub-Contractor arising out of these works, and in each such case deduct the amount so paid from any monies due or that may become due to the Contractor on any account, and, if there are insufficient monies due or to become due to the Contractor to permit of such deduction, the Contractor shall pay to the Owner upon demand an amount sufficient to make up the deficiency. In making payments under this Section the Owner may act upon any evidence that it deems sufficient and may compromise any disputed liability.

35.06 The Contractor shall submit to the Engineer in duplicate, together with each monthly statement, except the first one a "Statutory Declaration re Payment of Accounts" in such form as may be required by the Owner signed by an authorized signing officer of the Contractor stating that all workmen employed by the Contractor in the performance of the Contract have been paid in full and in accordance with the requirements of the Contract not less frequently than semi- monthly and up to and including the pay-day immediately preceding the date of the declaration and that all other liabilities incurred by the Contractor arising out of work performed or materials supplied as set forth in the Monthly Estimate relating to the last monthly statement previously submitted have been discharged. The Owner may withhold approval of a Monthly Payment Certificate if the Contractor fails to submit such a declaration or if the Contractor submits an improperly completed declaration.

35.07 Before any holdback will be released to the Contractor the statutory declaration required by the General Conditions must have been submitted by the Contractor.

35.08 The Owner may in its discretion require the Contractor to submit such additional statutory declaration relating to discharge of liabilities as the Owner may require before the Owner will release to the Contractor any remaining holdback.

GC36 COMMENCEMENT AND COMPLETION

36.01 The Work shall not commence nor shall any materials for incorporation into the Work be delivered to the work site until the Owner has requested the Contractor to execute the Contract agreement and the Engineer has issued to the Contractor a written order to commence work. Following such request and order, the Work shall be commenced within seven days after the date of the said order and shall be continuously carried on to completion, (subject as herein provided) and shall be completed and full possession thereof given the Owner within the period provided in the Contract, unless an extension of time, in writing, shall be allowed by the Engineer in which case, it shall be carried on to completion, and possession given to the Owner within the additional period so allowed.

36.02 If ordered by the Engineer, the Contractor and his agents and employees shall be required to work continuously throughout the twenty-four (24) hours of the day for six days per week in the performance of the Work under the Contract at no additional cost to the Owner.

36.03 In the event of delay caused by strikes or combinations on the part of the workmen employed, or by any act of the Owner, or from such other cause as, in the opinion of the Engineer, the Contractor cannot reasonably be held responsible for, or, in the event of extra or additional work being ordered by the Engineer, the Engineer may allow such additional time for completion as he may deem fair and reasonable, provided the Contractor applies in writing for an extension of time at the time such delay occurs or such extra or additional work is ordered and satisfies the Engineer that he is justly entitled to a further time allowance.

36.04 Notwithstanding the time allowed for completion of the Work, if in the opinion of the Engineer the rate of progress of any part or parts of the Work or during any period or periods during which work is being carried on or is required to be carried on is unsatisfactory and if amounts are payable by the Owner in respect of site supervision of the Work, traffic control, compensation or damages by reason, in the opinion

of the Engineer, of such unsatisfactory rate of progress, the Contractor shall be liable to the Owner for the payment of such amounts and such amounts may be deducted by the Owner from any money due to the Contractor under the Contract.

36.05 No progress or interim estimate or certificate shall release the Contractor or his surety from any responsibility, or be taken as evidence of any such release, or as acceptance of any work or material, or as a waiver of any condition herein.

36.06 The Work and every portion and detail thereof shall, during construction, be protected by the Contractor from damage from any cause whatsoever, and shall at the date of issuance of the Completion Certificate, be put and left by the Contractor in good and satisfactory condition, finished in all respects, and, at that time, must be fully up to the requirements of the Contract in every part, all surplus and refuse material and rubbish removed from the vicinity of the Work; the premises left in a neat and tidy condition, all damage to adjacent property, pavements, foot-walks, beaches, boulevards and sodding, or other things, injured or interfered with by the Contractor or his agents or employees, made good, and, every other requirement of the Contract complied with.

36.07 In case of the Contractor's failure to finish the Work properly and fully, and as required, or in case of the Work, or any part thereof, being taken out of his hands, as provided in these General Conditions, the Engineer may proceed to finish the Work for him, as his agent in this respect, and at his expense, or proceed, as provided in GC64 - NON FULFILMENT OF THE CONTRACT.

GC37 LIQUIDATED DAMAGES

37.01 In case the Contractor shall fail to complete the Work in accordance with the Contract and to the satisfaction of the Engineer, within the time or times specified, the Contractor shall pay the amounts specified in the Information for Tenderers, for each calendar day that the Work or works shall remain unfinished after the time so specified; which said sum or sums in view of the difficulty of ascertaining the losses which the Owner may suffer by reason of delay in the performance of the said Work, is hereby agreed upon, fixed and determined by the parties hereto as the liquidated damages that the Owner will suffer by reason of said delay and default and not as a penalty; and the Owner may deduct and retain the amounts of such liquidated damages out of the monies which may be due or become due to the Contractor under the Contract, as provided in GC61 - MONIES DUE OWNER.

GC38 COMPLETION SECURITY ACCOUNT

38.01 The contract price includes the Completion Security Account as stated herein.

38.02 The Completion Security Account consists of a fixed percentage of the contractor's approved monthly (or any other) invoices, after construction lien holdback and maintenance holdback amount has been deducted.

38.03 The total accumulated amount in the Completion Security Account shall be released to the Contractor upon issuance of the Completion Certificate by the Engineer. No partial release from the Completion Security Account will be considered.

38.04 Following the issuance of the Certificate of Substantial Performance of the Work, and if within twenty-one (21) days of written notice from the Engineer, the Contractor either fails to complete the Work to 100% completion or fails to provide any acceptable schedule for the completion of the outstanding work and fails to maintain such schedule, the Owner shall in writing terminate the Contractor's right to continue with the outstanding work and hire other forces to complete the work to 100% completion.

38.05 An administration cost will be assigned by the Owner, and deducted from the Completion Security Account as it sees fit, to compensate for its co-ordination of the additional work.

38.06 Upon issuance of the Completion Certificate of the Work, the balance of the monies in the Completion Security Account shall become due and payable, subject to the provision of the **Workers' Compensation Insurance, Section 18.1.**

38.07 The Completion Security Account shall consist of one-half percent (0.5%) of the Contract price.

38.08 The Completion Security Account, which is at no time part of the statutory holdback, shall be retained by the Owner in increments from monies that would otherwise be payable to the Contractor, commencing at seventy percent (70%) completion of the Contract, or thereabouts, as determine by the Engineer, so that by the date of Substantial Performance of the Contract, the full value of the required Completion Security Account has been retained.

38.09 None of the provisions of this General Condition shall take precedence over the Owner's right to Perform Work or Stop the Work, or Terminate Contract unless the Certificate of Substantial Performance of the Work has been issued, in which case, the provisions of this contract condition shall govern.

GC39 SUBSTANTIAL PERFORMANCE OF CONTRACT

39.01 The Contract shall be considered as substantially performed when the Work has satisfactorily passed the required inspection and performance testing, when all operational training and documentation have been completed and can be used for the purposes intended, and the Work is capable of being completed or, where there is a known defect, corrected at a cost of not more than,

(1) 3 percent of the first $1,000,000 of the contract price plus

(2) 2 percent of the next $1,000,000 of the contract price plus

(3) 1 percent of the balance of the contract price.

39.02 The words "can be used for the purposes intended" are defined as compliance of the Work where:

- Each item of mechanical, electrical, instrumentation, piping and HVAC equipment installed under this contract have been tested to demonstrate compliance with the performance requirements of this contract **AND**

- Each mechanical, electrical, instrumentation, piping and HVAC system installed or modified under this Contract have been tested in accordance with the specified requirements **AND**

- All draft operating manuals, maintenance manuals, "As-Built" red line drawings **AND**

- All training **AND**

- All spare parts and materials **AND**

- All warranty certificates **AND**

- All test results have been submitted to the Engineer and instructions provided to Owner’s staff to enable the Owner to operate the facility have been provided. **No deviation to this requirement will be permitted**.

39.03 Where the Work or a substantial part thereof are ready for use or are being used for the purposes intended but part of the Work cannot be completed expeditiously for reasons beyond the control of the Contractor or where the Owner and the Contractor agree to delay completion of the Work, the cost, as determined by the Engineer, of completing the outstanding work shall be deducted from the contract price in determining substantial performance and the value of the Work completed.

39.04 When the Contract has been substantially performed by the Contractor in accordance with the foregoing and GC48 - SUBSTANTIAL PERFORMANCE CERTIFICATE and upon the Contractor's application for the Substantial Performance Certificate, the Engineer will issue the certificate on submission by the Contractor of the following documents:

(1) A written undertaking by the Contractor to complete expeditiously any outstanding work and to discharge all unfulfilled obligations under the Contract.

(2) The Contractor's final claim (except in respect of outstanding work).

(3) A release by the Contractor in a form satisfactory to the Engineer releasing the Owner from all further claims relating to the Contract (except in respect of outstanding work).

(4) A statutory declaration in a form satisfactory to the Engineer that all liabilities incurred by the Contractor and his Sub-Contractors in carrying out the Contract have been discharged and that all liens in respect of the Contract and sub-contracts thereunder have expired or have been satisfied, discharged or provided for by payment into Court.

(5) A satisfactory Clearance Certificate from the Workers' Compensation Board.

39.05 The Engineer shall set out in the Certificate of Substantial Performance the date on which the Contract was substantially performed and within seven days after signing the said certificate he shall provide a copy to the Contractor.

39.06 Upon receipt of a copy of the Certificate of Substantial Performance, the Contractor shall forthwith, as required by **Section 32(1) Paragraph 5 of the Construction Lien Act**, publish a copy of the said certificate in a construction trade newspaper. Such publication shall include placement in the Daily Commercial News.

39.07 Alternatively, in order to expedite payment to the Contractor and to creditors under the Contractor, the Engineer may, if so requested by the Contractor, arrange on behalf of the Contractor to publish the said certificate in the Daily Commercial News within seven days after signing the certificate. Such arrangement shall not relieve the Contractor of any responsibility under the said Act. The cost of publication shall be borne by the Contractor.

39.08 Where the Contractor fails to publish a copy of the Certificate of Substantial Performance as required above within seven days after receiving a copy of the said Certificate signed by the Engineer, the Owner may publish a copy of the certificate at the Contractor's expense.

39.09 Except as otherwise provided in **Section 31 of the Construction Lien Act**, the 45-day period prior to the release of holdback as referred to in GC47.03 hereof, shall commence from the date of publication of the Certificate of Substantial Performance as provided for in GC39.06.

GC40 COMPLETION OF CONTRACT

40.01 The work shall be deemed to be completed when:

(1) the work has satisfactorily passed the required inspection and testing, and

(2) the cost of completion of all outstanding work and known defects is not more than the lesser of:

(i) one percent of the contract price, and
(ii) $1,000.00

40.02 When the Contract has been completed in accordance with GC40.01 and upon the Contractor application for the Completion Certificate, the Engineer will issue a certificate on submission by the Contractor of the following documents:

(1) The Contractor's final claim (including the value of work completed since the date of the claim referred to in GC39.04 (2) above).

(2) An up-to-date release by the Contractor in a form satisfactory to the Engineer releasing the Owner from all further claims relating to the Contract.

(3) An up-to-date statutory declaration in a form satisfactory to the Engineer that all liabilities incurred by the Contractor and his sub-contractors in carrying out the Contract have been discharged and that all liens in respect of the Contract and sub-contracts thereunder have expired or have been satisfied, discharged or provided for by payment into Court.

40.03 The Engineer shall set out in the Completion Certificate the date on which the Work was completed and within seven days of signing the said certificate he shall provide a copy to the Contractor.

40.04 Payment due to the Contractor following issuance of the Certificate of Completion shall be as provided for in GC49 - COMPLETION CERTIFICATE.

40.05 The Engineer may in his discretion direct or approve that the Work covered by the Contract be divided into two or more parts for the purpose of issuing Completion Certificate. In that event, the Contractor shall submit documentation as set out above in respect of each such part.

GC41 FINAL COMPLETION OF CONTRACT

41.01 On the expiration of the requirements of GC52 - WARRANTY AND GUARANTEE PERIOD, 24 months from the date of issuance of the Completion Certificate by the Engineer, as set out in the Completion Certificate, and after **all known imperfect work has been rectified in accordance with the Contract** to the satisfaction of the Engineer and the Engineer is satisfied to the best of his knowledge that the Contractor has discharged all his obligations under the Contract and has met the requirements of GC50 - FINAL COMPLETION CERTIFICATE and upon the Contractor application for the Final Completion Certificate, the Engineer will issue the Final Completion Certificate approving the release to the Contractor of the maintenance security, less any deduction as provided for in the Contract.

41.02 On the expiration of the Warranty and Guarantee Period of twenty-four (24) months from the date of issuance of the Completion Certificate by the Engineer, as set out in the Completion Certificate, the Engineer may approve the release to the Contractor a part of the Maintenance Security on such terms and conditions as the Engineer deems advisable notwithstanding that the Final Completion Certificate has not been issued and that all imperfect work has not been rectified in accordance with the Contract.

GC42 RELEASE OF HOLDBACK TO SUB-CONTRACTORS

42.01 Notwithstanding that the Contract as a whole has not yet been substantially performed, the Engineer may, if requested in writing by the Contractor, approve the completion of a sub-contract and the release to the Sub-Contractor through the Contractor of the 10% holdback retained by the Owner in respect of the Work covered by the said sub-contract provided that

(a) the Contractor certifies

(1) that the said sub-contract has been completed satisfactorily, or

(2) that the said sub-contract has been completed satisfactorily except for work not exceeding in value the lesser of

(i) one percent of the sub-contract price, or

(ii) $1,000.00

and gives reasons why the uncompleted work is still outstanding.

AND

(b) the Engineer is satisfied

(1) that the said sub-contract has been completed satisfactorily, or

(2) that the said sub-contract has been completed satisfactorily to the fullest extent reasonably possible at that date and that the work remaining to be completed does not exceed in value the sum derived from (a) (2) above.

(3) that all required or necessary inspection and testing of the works covered by the said sub-contract have been carried out and that the results are satisfactory.

AND

(c) the Contractor has furnished to the Engineer

(1) a release by the Contractor in a form satisfactory to the Engineer releasing the Owner from all further claims (excepting holdback monies) relating to the said sub-contract.

(2) evidence satisfactory to the Engineer that the said sub-contractor has discharged all liabilities incurred by him in carrying out the said sub-contract and that all liens in respect of the completed sub-contract have expired or have been satisfied, discharged or provided for by payment into Court.

(3) a satisfactory clearance certificate or letter from the Workers' Compensation Board relating to the said sub-contractor.

(4) the required Warranty and Guarantee Security in respect of the said sub-contract as provided for in GC53 - WARRANTY AND GUARANTEE SECURITY.

AND

(d) The Engineer retains sufficient money to cover the cost of completing any work which remains uncompleted under the said sub-contract.

AND

(e) if he so requests, the Engineer is furnished with a photostat copy of the contract between the Contractor and the said Sub-Contractor and with a satisfactory statement showing the total amount due from the Contractor to the said Sub-Contractor.

42.02 The Engineer shall, within seven days after he approves a certificate wherein it is certified that the Sub-Contract has been completed, give a copy of the said certificate to the Contractor and to the sub-contractor concerned.

42.03 On receipt of the holdback monies from the Owner, the Contractor shall forthwith pass to the Sub-Contractor concerned the payment due under the said sub-contract and shall pass to the Engineer a copy of the transmittal letter showing the amount of the said payment.

42.04 The requirements of GC52 - WARRANTY AND GUARANTEE PERIOD for the Work carried out under the said sub-contract shall continue until the issuance of the Final Completion Certificate for the Contract.

42.05 Release of holdback monies by the Owner in respect of a sub-contract in accordance with the foregoing shall not relieve the Contractor or his surety of any of their responsibilities pursuant to the **Construction Lien Act, 2018**, as amended, and shall not be made until a period of 60 days has elapsed from the date of approval of the certificate certifying the said sub-contract to be completed.

GC43 MEASUREMENTS

43.01 The Contractor shall submit to the Engineer at the end of each calendar month a fully itemized statement showing the estimated value of the permanent work executed up to the end of the month based on the unit prices shown in the Contract, together with a fully itemized statement of the value of major items of material and equipment on site for incorporation into the permanent works.

43.02 The said monthly statement shall not bind the Engineer in any manner in the preparation of his final measurement of the Work constructed by the Contractor under this Contract.

43.03 The final measurement shall be prepared in detail as soon as the whole of the Work have been completed, and this final measurement shall be approved and accepted in writing by the Engineer. Thereafter the Completion Payment Certificate shall be issued and payment shall be made in accordance with GC49 - COMPLETION CERTIFICATE.

GC44 ALTERATIONS, EXTRAS, DEDUCTIONS AND CLAIMS

44.01 The Engineer shall have the right to

(1) make or order any alterations and changes as he may deem advisable at any time before or during the prosecution of the Work, in any line, grade, plan or detail thereof, or
(2) to suspend or omit any portion of the work, or

(3) to increase or decrease the dimensions of any part of the Work or works, or

(4) to vary in any way the Work herein contracted for, or

(5) to order any additional or extra work to be done, or additional or extra materials to be furnished;

and the Contractor shall, in pursuance of written orders of the Engineer to that effect, proceed with, carry out and execute the works as directed, and shall supply such additional materials, and do such additional or extra work as the Engineer requires in pursuance of such orders, without being entitled to any extension of time for completion or any additional payment on account thereof, except only as herein provided.

44.02 In each and every case where additional or extra work or materials of any kind is ordered to be done or supplied, or where the Contractor does or supplies, or contemplates doing or supplying any work or material which he considers extra or beyond the requirements of the Contract, or upon which he intends

claiming any extra or additional payment, he is required, before commencing any such work, or procuring any such material, to obtain from the Engineer a written order therefor, stating (a) that the same is an extra and will be paid for as such, and also clearly defining the nature of such extra work or material, and the amount the Contractor is to receive therefore, or the terms under which the same is to be paid for; or (b) that the same is considered to be a part of the Contract and not an extra and that no additional payment shall be made therefore; and the Contractor shall also, before beginning any such work or commencing to deliver any such material, notify the Engineer in writing of his intention to commence work thereon or delivery thereof, so that a proper account or record of the same may be kept by the Engineer. If the Contractor proposes to claim additional payment for work or materials which the Engineer considers to be a part of the Contract and not an extra, the Contractor shall so notify the Engineer in writing before commencing such work or delivering such materials and must submit his claim for additional payment within 15 working days of completing such work.

44.03 In case of the Contractor's neglect or failure to observe fully and faithfully the above conditions in this section contained, he shall forfeit all right to payment therefor which he otherwise might have had, and shall not make any claim in respect thereof, and if made, the Engineer may reject the same as invalid.

GC45 VALUATION OF VARIATIONS

45.01 The Engineer shall determine the amount, if any, to be added to, or deducted from, the sum named in the Tender, in respect of any extra or additional work done, or work omitted by his Change Order. All such work, either by quotation or time and material shall be valued at the price as set out in the Schedule of Items and Prices or the Schedule of Additional Unit Prices if, in the opinion of the Engineer, the same shall be applicable.

45.02 If the Contract does not contain any prices applicable to the extra, additional, or omitted work, then the Contractor and Engineer may agree on a price for such work, in which case the price shall be comparable to prices quoted on work of a similar nature and shall be limited to such amounts as can be directly substantiated by current market value charged for labour burden and materials.

45.03 If the methods of evaluating extras described herein are clearly inapplicable, then the Engineer may direct that extra work shall be done by the Contractor on a cost plus basis providing for payment as follows:

(1) The actual cost of all labour, including allowance for holiday pay, unemployment insurance, levy by Workers' Compensation Board, and other contributions made by the employer to an employee as required by law or a contract, required directly for the performance of extra work plus 15% of the same, for the first $10,000 and 5% over and above $10,000.

(2) The actual cost of all materials including transportation charges required directly in the extra work, plus 15% of the same, for the first $10,000 and 5% over and above $10,000.

(3) A reasonable rental to be agreed upon before the work is begun for machinery and heavy equipment, such as tractors, bulldozers, ditching machines, air compressors, concrete mixers and graders, for the actual time required in operation for the performance of the extra work, to which no percentage shall be added.

45.04 If the Contractor is directed to carry out extra or additional work on a cost-plus basis and he proposes to have such work or a part thereof carried out by a Sub-Contractor, he shall notify the Engineer to that effect before commencing the said work. Provided that the Contractor's proposal and all Sub-Contractors involved have first been approved by the Engineer, the Contractor may claim payment from the Owner for such work as follows:

(i) In respect of work carried out by the Contractor's own forces, an amount equal to the sum of the amounts provided for under (1), (2), and (3) above.

(ii) In respect of work carried out by a Sub-Contractor's forces, an amount equal to the sum of the amounts provided for under (1), (2), and (3) above plus 5% of such sum.

45.05 Allowances for overhead and profit shall cover all the Contractor's administrative and incidental costs relating to a change, including, without limitation, costs relating to superintendence and supervision, shop drawing production, Site Office and Home Office expenses, workers tools, temporary facilities and controls. No further claim for change in the contract time, delay, prolongation charges, impact costs, loss of anticipated profit or other such claims will be accepted as having resulted from a Change Order, after it has been accepted by the Owner.

45.06 In the valuation of labour costs in connection with changes and the amount to be charged for labour burden and materials, they shall be limited to such amounts as can be directly substantiated by current market value.

45.07 The Contractor will not be entitled to charge a fee or charge for overhead and profit on credits to the Contract. Where a change involves extra and credits, the Contractor will only be entitled to allowances for overhead and profit on the total net extra for the change.

45.08 No compensation for extra work or material shall be allowed unless such work or material is ordered in writing by the Engineer. Whenever any extra work is being performed in accordance with GC45.03 herein the Contractor shall, each working day, report to the Engineer, in writing, in full detail, the amount and cost of the labour and materials supplied and used in carrying out each order for extra work on the preceding working day, and no claim for compensation for extra work or materials will be considered or allowed unless such report shall have been made.

The Engineer will not allow any compensation for the cost of repairs to equipment of any kind or for damage to anything used in performing any such extra work or making any such alterations. No change in contract time resulting from a change in the Work will be accepted, if in the Engineer's opinion , such change in the Work can reasonably be accommodated within the approved schedule.

GC46 BOOKS AND RECORDS OF THE CONTRACTOR

46.01 The Contractor shall keep proper books and records showing names, trades, and addresses of all workmen in his employ and wages paid to, and the time worked by, such workmen; also records, books, and invoices showing all costs, expenditures, payments, settlements, receipts, and balances in connection with the construction of the works.

46.02 All records of the Contractor relevant to the valuation of the works including payrolls, time books of account, invoices, and statements, shall be maintained on the site or at some other place approved by the Engineer and shall be open at all reasonable times for inspection by the Engineer. The Contractor shall in every way assist such inspection for the purpose of establishing and determining labour costs, the cost of extra work, and progress payments to be made.

GC47 MONTHLY PAYMENT CERTIFICATES

47.01 The Contractor shall submit to the Engineer at the end of each calendar month a fully itemized statement showing the estimated value of the permanent work executed up to the end of the month based on the prices shown in the Contract and the section covering Valuation of Variations, together with a fully itemized statement of the value of major items of material and equipment on site for incorporation into the permanent works. The Engineer assumes no responsibility to determine the payment due to a Sub-Contractor, or a Sub-Contractor's percentage of completion. It remains the Contractor's duty to make appropriate payment to his sub-contractors and to ensure that failure to do so will not result in reduced progress of the Work and remedy deficiencies of completed work of that Sub-Contractor.

47.02 From each monthly statement including the statement based on the final measurement, the Engineer will prepare a Monthly Payment Certificate and will include therein so much as he considers fair and reasonable in respect of the value of the work executed and of the major items of material and equipment on site.

47.03 Ten percent (10%) of all monies due the Contractor in accordance with the Monthly Payment Certificate up to a limit of 10% of the contract price, shall be retained by the Owner (except as may otherwise be provided for in the Contract) and shall be termed the statutory holdback.

47.04 The Monthly Payment Certificate will show the Engineer's gross valuation of the work performed and materials supplied, the deduction of the appropriate amount of holdback, the previous payments to the Contractor and the amount due him.

No progress estimate or payment shall be held to bind the Engineer in his valuation of the work on its completion and the Engineer may on any Monthly Payment Certificate make correction or modification to any previous certificate he has made.

At the time of issuance by the Engineer of the Certificate of Substantial Performance in accordance with Section 60 of the General Conditions, the Engineer shall:

(1) Notify the Contractor of the value of the maintenance security required by Section 11 hereof.

(2) Prepare a Substantial Performance Payment Certificate showing:

(i) The value of work completed to-date.

(ii) The value of outstanding or uncompleted work.

(iii) The value of the required maintenance security.

(iv) The amount of the 10% holdback (allowing for any previous release of deliveries of pre-selected equipment).

(v) The amount due to the Contractor.

(3) Prepare a Payment Certificate releasing the Contractor the 10% holdback due in respect of work performed up to the date of substantial performance. Subject to the provisions of the Construction Lien Act and the submission by the Contractor of the following documents, such holdback shall become payable after 60 days from the date of publication of the Certificate of Substantial Performance:

(i) A written undertaking by the Contractor to complete expeditiously any outstanding work and to discharge all unfulfilled obligations under the Contract.

(ii) The Contractor's final claim (except in respect of outstanding work).

(iii) A release by the Contractor in a form satisfactory to the Engineer releasing the Owner from all further claims relating to the Contract (except in respect of outstanding work).

(iv) A Statutory Declaration in a form satisfactory to the Engineer that all liabilities incurred by the Contractor and his Subcontractors in carrying out the Contract have been discharged and that all liens in respect of the Contract and Subcontracts thereunder have expired or have been satisfied, discharged or provided for by payment into Court.

(v) A satisfactory Clearance Certificate from the Worker's Compensation Board.

At the time of issuance by the Engineer of the Certificate of Completion in accordance with Section 62 of the General Conditions, the Engineer shall:

(1) Prepare a Completion Payment Certificate showing:

(i) The Final Contract Price

(ii) The amount of the further 10% holdback (based on the value of further work completed over and above the value of work completed shown in the Substantial Performance Payment Certificate).

(iii) The value of the required maintenance security.

(iv) The amount due the Contractor.

(2) Prepare a Payment Certificate releasing to the Contractor the further 10% holdback. Subject to the provisions of the Construction Lien Act and the submission by the Contractor of the documents required by Section 62 of the General Conditions, such further 10% holdback shall become payable after 45 days from the date of completion of the works as established by the Certificate of Completion.

If, when the Engineer issues the Final Certificate at the end of the period of maintenance, any monies are still being retained by the Owner as maintenance security or for other reasons, the Engineer will issue a Final Payment Certificate releasing the monies due the Contractor and will arrange for the payment of any interest due on the maintenance security.

47.05 Requests for payment for products prior to their incorporation into the actual construction when accompanied by an invoice identified as "Paid in Full" from the manufacturer and/or supplier of said product, will be considered on an individual basis where the prior payment for such products will, in the opinion of the Engineer:

(1) ensure maintenance of the construction schedule,

(2) ensure materials in short supply will be available when required, and/or

(3) ensure that the Contractor will not be burdened with increasing costs.

47.06 Request for payment for such products, shall be supported by such evidence as the Engineer may reasonably require to establish the value and delivery of the products.

47.07 Products receiving "prior payment" shall be stored at the risk of the Contractor, in such a place and manner as approved by the Engineer, so as to be immediately available on site as required. The Contractor shall be responsible for storage, security and timely delivery of product to job site, as well as any and all such additional costs resulting therefrom.

47.08 No progress estimate or payment shall be held to bind the Engineer in his valuation of the work on its completion and the Engineer may on any Monthly Payment Certificate make correction or modification to any previous certificate he has made.

47.09 The Contractor shall submit with each application for payment, after the first, a standard Statutory Declaration, which may be in the form of CCDC 9B, verifying that all payments due to Sub-Contractors, for wages and salaries for work done and products furnished in connection with the Work to the end of the month immediately preceding that covered by the current application have been made, and that all

assessments and levies under the **Unemployment Insurance Act**, the **Workers' Compensation Act** and other social and labour legislation with respect to this Contract have been paid.

47.10 The Contractor must comply with GC10.1, the submission of his construction schedule, **based on his tender**, prior to his application for the first progress payment. No deviation to this requirement will be permitted.

47.11 The Owner shall make payment to the Contractor on account no later than twenty (20) working days after receipt from the Engineer of a Certificate for payment by the Engineer.

47.12 Delay by the Owner in making any payment to the Contractor shall be deemed not to be a breach of contract by the Owner.

GC48 SUBSTANTIAL PERFORMANCE CERTIFICATES

48.01 When the Contractor considers the Contract to be substantially complete in accordance with GC39 - SUBSTANTIAL PERFORMANCE OF CONTRACT, the Contractor shall request an inspection. The inspection team shall consist of the Engineer and the Contractor. A list of deficiencies will be prepared. These deficiencies shall be corrected as soon as possible and the Engineer notified in writing by the Contractor when all items are to be completed. The Contractor may then make application for Substantial Performance Certificate.

48.02 The Contractor's application for Substantial Performance Certificate shall include the following:

(1) A statement to the Owner through the Engineer to the effect that:

i) the Contract is substantially performed, and

ii) the performance of the balance of the contract is in progress and a detailed schedule for the rectification of all deficiencies or outstanding work and the date of total performance. Where the balance of the contract, or a part or parts thereof cannot be performed forthwith, but must be deferred for reasons beyond the control of the Contractor, the Contractor's statement shall contain a complete date for each phase of the balance of the contract.

(2) A statement showing the amount of holdback monies due for release and payment following the issue of the Substantial Performance Certificate.

(3) A statement of completion with the cost value of:

i) work to be completed including unsatisfactory work,

ii) work which cannot be performed for reasons beyond the control of the Contractor.

(4) The submission of all data, operating instructions, maintenance manuals, record drawings, spare parts and materials, evidence of all tests, instructions to the Owner staff etc. to enable the Owner to operate the facility.

(5) Notification by the Engineer of any imperfection due materials or products used in the construction of the work or workmanship thereof prior to the date of issuance of the Completion Certificate shall be deemed to be a deficiency in the Work and shall be made good prior to the commencement of the warranty and guarantee period by the Contractor. The decision of the Engineer as to the nature, extent and cause of such imperfections and the necessity for remedying the same shall be final. If the Engineer notifies the Contractor in writing of imperfections prior to the termination of the warranty and guarantee period, the Contractor shall

make good the imperfections as specified above notwithstanding that the work of making good may commence after or extend beyond the end of the twenty-four (24) months as required by GC52 - WARRANTY AND GUARANTEE PERIOD.

48.03 At the time of issuance by the Engineer of the Substantial Performance Certificate in accordance with GC39.04, the Engineer shall

(1) Notify the Contractor of the value of the Warranty and Guarantee Security required by GC53 - WARRANTY AND GUARANTEE SECURITY.

(2) Prepare a Substantial Performance Payment Certificate showing:

(i) the value of work completed to date;

(ii) the value of outstanding or uncompleted work;

(iii) the value of the required Warranty and Guarantee Security;

(iv) the value of the Completion Security Account;

(v) the amount of the 10% holdback (allowing for any previous releases of holdback to the Contractor in respect of completed sub-contracts and deliveries of pre-selected equipment;

(vi) the amount due the Contractor

(3) Prepare a payment certificate releasing to the Contractor the 10% Lien Holdback due in respect of work performed up to the date of substantial performance. Subject to the provisions of the **Construction Lien Act** and the submission by the Contractor of the documents required by GC39.4 hereof, such holdback shall become payable after 45 days from the date of publication of the Substantial Performance Certificate.

GC49 COMPLETION CERTIFICATE

49.01 At the time of issuance by the Engineer of the Completion Certificate in accordance with GC40.01 above, the Engineer will, no later than ten (10) working days after the receipt of an application from the Contractor for payment upon Completion of the Contract, make an inspection and assessment of the Work to verify the validity of the application. The Engineer will, no later than seven (7) working days after his inspection, notify the Contractor of his approval or the reasons for his disapproval of the application.

49.02 When the Engineer finds that Completion of the Contract has been achieved, he will issue a Completion Certificate and certify for payment the remaining monies due to the Contractor under the contract less holdback monies which are required to be retained and the guaranteed period of maintenance and rectification shall commence as of the date stated in the Completion Certificate.

49.03 The date of Completion of the Contract shall be as stated in the Certificate. Subject to the provision of **Workers' Compensation Insurance, Section 18.1**, the Owner shall, no later than twenty (20) working days after the issuance of such Certificate, make payment to the Contractor.

49.04 Monies for Completion of the Work shall not be released until certified by the Engineer, as provided for hereto and under GC38 - COMPLETION SECURITY ACCOUNT.

49.05 The Owner reserves the right to contract out uncompleted deficiencies as provided for in GC38 - COMPLETION SECURITY ACCOUNT, without prejudice, to any other right or remedy and without affecting GC52 - WARRANTY AND GUARANTEE PERIOD, and without limiting the generality of the foregoing, including costs of engineering and investigation and all cost of administration, or sustains damage or loss of any kind, the Contractor and his surety or sureties shall be liable to the Owner for such costs, damage and loss.

49.06 When the Engineer is fully satisfied that all work has been completed, the Contractor shall issue a written statement to the Owner to the effect that "the Work in respect to the Contract has been completed as of the date of the statement and no further work is required, except for the requirements of GC52 - WARRANTY AND GUARANTEE PERIOD.

GC50 FINAL COMPLETION CERTIFICATE

50.01 Prior to final release of warranty holdback monies, the Contractor shall submit to the Engineer:

(1) An acceptable Statutory Declaration signed by the Contractor stating that all materials, work and services, in connection with the contract, have been paid in full and there exists no preserved or unpreserved liens.

(2) A statement from the Workers' Compensation Board to the effect that all assessments from the Workers' Compensation Board to the end of the execution of the contract have paid in full.

(3) The Final Deficiency List issued by the Engineer, completed with the date for each and every deficiency on the Deficiency List when each of the deficiency was corrected.

50.02 If, when the Engineer issues the Final Completion Certificate at the end of the guaranteed period of maintenance and rectification, any monies are still being retained by the Owner as maintenance security or for other reasons, the Engineer will issue a Final Payment Certificate releasing the monies due the Contractor.

GC51 STATUTORY DECLARATION REQUIREMENTS

51.01 When making application for Substantial Completion, Completion and Final Completion of the Contract, the Contractor shall submit to the Engineer, all specified written guarantees, bonds, maintenance manuals, records, certificates and a statutory Declaration acceptable to the Engineer, signed by the Contractor stating that all material, work and services in connection with the Contract have paid in full, up to the holdback, and that no liens do or can exist, including a receipt from each Sub-Contractors, stating that he has been paid in full up to the holdback for all materials, work and service in connection with this Contract.

GC52 WARRANTY AND GUARANTEE PERIOD

52.01 The “Warranty and Guarantee Period” is also referred to as the “Maintenance Period”.

52.02 The "Warranty and Guarantee Period" means the period from the date of completion of the Contract, as set out in the Completion Certificate to the date of issuance of the Final Completion Certificate and shall not be less than twenty-four (24) months. However, the Contractor may apply for early release of holdback after the first 24 months of the maintenance period. If there are no deficiencies then the Contractor’s holdback will be released after the first 24 months. Otherwise, the holdback will be retained for the full 24 month maintenance period.

52.03 The Contractor warrants and guarantees that with ordinary wear and tear the Work shall, until the end of the warranty and guarantee period, remain in such conditions as will meet with the approval of the

Engineer, and that he will be responsible for rectification in a manner satisfactory to the Engineer, and for the cost thereof, of any imperfect work due to or arising from materials, equipment or plant incorporated into or used in the construction thereof or due to or arising from workmanship or methods of construction, that is discovered by any means at any time prior to the issuance of the Final Completion Certificate. The Engineer shall decide as to the nature, extend, cause of a responsibility for imperfect work and the necessity for rectification thereof.

52.04 Prior to the expiration of the warranty and guarantee period of 24 months from the date of the Completion Certificate, the Engineer shall carry out an inspection of the Work and shall notify the Contractor of any imperfections therein disclosed by such inspection, provided that the failure of the Engineer or their agent to carry out such an inspection or to give notification shall not relieve the Contractor or his surety from any responsibility or obligations under, or any term or provision of, the contract.

52.05 If, as a result of imperfect work, for which the Contractor is responsible, the Owner incurs any cost, and without limiting the generality of the foregoing, including cost of engineering and investigation and all cost of administration, or sustains damage or loss of any kind, the Contractor and his surety or sureties shall be liable to the Owner for such costs, damage and loss. The amount of such costs, damage or loss shall be determined or estimated by the Engineer and, upon such determination or estimation, shall be deemed to be "MONIES DUE OWNER".

52.06 The Contractor shall, at any time or times prior to the issuance of the Final Completion Certificate and when required to do so by the Engineer, make such openings, tests, inspections, excavations, examinations, or other investigations in, through, of or in the vicinity of the Work as the Engineer may direct and shall, if required, make good again, to the satisfaction of the Engineer, any openings, excavations or disturbances of any property, real or personal, resulting therefrom.

If, in the opinion of the Engineer, any imperfect work for which the Contractor is responsible is found in the Work by such investigations, the cost of such investigations and such making good shall be borne by the Contractor, but if, in the opinion of the Engineer, no such imperfect work is found by such investigations, the said cost shall be borne by the Owner.

52.07 No payment certificate, document, act, failure to act, statement or representation of, by or on behalf of the Owner or its employees or agents, no dealing, transaction, forbearance or forgiveness which may take place between the Contractor or his surety or sureties and the Contractor or its employees or agents and no exercise or forbearance to exercise any of the rights or powers of the Owner, shall release the Contractor or his surety or sureties from any term of provision or of any responsibility, obligation or liability under the Contract, or otherwise, shall waive or impair any of the rights and powers of the Owner or of the Engineer.

52.08 Notwithstanding expiration of the 24 month warranty and guarantee period, the Contractor shall not be relieved by correcting any defects or faults of which notice has been given to the Contractor prior to the expiration of the said period. The Contractor immediately prior to the expiration of the warranty and guaranteed period or upon correction of the defects if these defects or faults have not been corrected during the said period, shall request a joint inspection of the Work and the Engineer will, on being satisfied that all rectification work has been completed, issue a Final Completion Certificate.

52.09 Notwithstanding the provision of this Article, if any statue or by-law of the Province, Owner or Company where the Work is being performed creates a more extended liability for faulty materials or workmanship, then the provisions of such statue or by-law shall apply.

GC53 MAINTENANCE PERIOD AND MAINTENANCE SECURITY

53.01 The “Maintenance Period and Maintenance Security” is also referred to as Warranty and Guarantee Security.

53.02 **Maintenance Period:** The Contractor shall maintain the works and every part thereof in perfect order and in complete repair for a period of 24 months from the date of substantial performance, as herein provided, and make good in a permanent manner, satisfactory to the Engineer, any and all damage or injury to the works, both during their construction and during period of maintenance, as aforesaid, and, should the Contractor, from any cause, fail to do so when ordered, then the Engineer, at his option, after giving the contractor twenty-four hours notice, may do so and the whole cost, charges and expenses so incurred may be deducted or collected by the Owner as provided in Section 43 of the General Conditions. The decision of the Engineer is to be final as to the necessity of repair of any work done or required to be done under the provision of this or any other clauses in the Contract, and for the amounts expended thereunder.

53.03 **Maintenance Security:** The Contractor shall provide to the Owner for the duration of the period of maintenance, a maintenance security the value of which shall be derived from the following table:

CONTRACT PRICE		**VALUE OF MAINTENANCE** (in dollars) (M = million)		
FROM $	TO $			
LESS THAN 0.1 M		4% OF FINAL CONTRACT PRICE		
0.1 M	0.5 M	4,000 ON 1ST	0.1M + 3.0% ON NEXT	0.4M
0.5 M	1.0 M	16,000 " "	0.5M + 2.4% " "	0.5M
1.0 M	2.0 M	28,000 " "	1.0M + 2.2% " "	1.0M
2.0 M	4.0 M	50,000 " "	2.0M + 2.0% " "	2.0M
4.0 M	6.0 M	90,000 " "	4.0M + 1.8% " "	2.0M
6.0 M	10.0 M	126,000 " "	6.0M + 1.5% " "	4.0M
Over 10.0 M		186,000 " "	10.0M + 1.0% on balance.	

53.02 The Maintenance Security, which is at no time a part of the statutory holdback, shall be retained by the Owner in increments from monies that would otherwise be payable to the Contractor, commencing during the latter part of the period of construction, so that by the date of substantial performance of the contract the full value of the required maintenance security has been retained.

53.03 One month prior to the expiry of the Warranty and Guarantee Period, the Contractor shall request an inspection. The inspection team shall consist of the Engineer and the Contractor. A final list of deficiencies will be prepared. These deficiencies shall be corrected as soon as possible and the Engineer notified in writing by the Contractor when all items are to be completed.

53.04 Except as otherwise provided hereunder, the Maintenance Security, less any deductions made therefrom as provided for in the Contract, plus interest thereon over the period of maintenance and compounded annually at the applicable rate(s) of interest set from time-to-time by the Minister of Finance shall be paid to the Contractor following the issuance by the Engineer of the Final Certificate at the end of the period of maintenance.

53.05 The Contractor may apply in writing to the Engineer at the time of substantial performance to substitute for the monies retained as the Maintenance Security an alternative security of equivalent or greater value comprising:

(a) one or more irrevocable letters of credit or

(b) another readily negotiable security.

Acceptance of any such alternative shall be at the discretion of the Engineer and the Owner.

53.06 Following receipt and acceptance of any such alternative, the Engineer shall release to the Contractor the monies previously retained for Maintenance Security purposes.

53.07 The Engineer may, at his/her discretion, allow the total Maintenance Security to be made up in part of monies retained under the Contract and in part of an alternative Maintenance Security as indicated in (a) and (b) above provided that the total value of such parts, as determined by the Engineer, shall be not less than the required value as derived from the table set out above.

53.08 Such alternative Maintenance Security or the monies derived therefrom, less any deductions made as provided for in the Contract, shall be released to the Contractor following the issuance by the Engineer of the Final Certificate at the end of the period of maintenance. Interest shall only be paid on monies, if any, derived from the said security and which remain unexpended in the maintenance security fund.

53.09 Where the Engineer proposes to release the statutory holdback to a Sub-Contractor through the Contractor as provided for in Section 59 of the General Conditions, the Engineer shall arrange for "the required maintenance security in respect of the said sub-contract", as referred to in the General Conditions, to be provided by a retention from monies that would otherwise be payable to the Contractor. The value of the required Maintenance Security shall be determined by applying to the value of the sub-contract work the same effective percentage retention, derived from the foregoing table, as applies to the Contract as a whole.

53.10 The Contractor may apply in writing to the Engineer to substitute for the Maintenance Security referred to in the preceding paragraph an Irrevocable Letter of Credit in the name of the Contractor.

53.11 Following the substantial performance of the Contract, the Engineer may require the Contractor to consolidate all Letters of Credit provided pursuant to the foregoing into one or two Letters of Credit covering the Contract as a whole.

53.12 The Contractor may allow his sub-contractors to provide Letters of Credit to the Contractor in conformity with the foregoing procedures. The Contractor shall provide the Engineer with copies of any or all such letters of credit on request.

GC54 PAYMENT OF INTEREST

54.01 The Owner shall not be liable for any interest on overdue accounts nor will interest be paid by the Owner for any payment delayed due to a dispute regarding a claim by the Contractor.

GC55 SUSPENSION OF WORK

55.01 The Engineer may, by an order in writing, at any time stop or suspend any part of the Work, or direct any portion to be commenced or completed in priority to any other part or portion, or may cancel the order to proceed with the Work, or with any part thereof, and the Contractor shall not thereby be entitled to any additional payment, or to claim for loss of profit or anticipated profit, or for damages or otherwise howsoever, by reason of such order except as may be allowed in accordance with GC19 - DELAY.

55.02 When in the opinion of the Engineer, it is deemed advisable for any reason to discontinue the Work, or any part thereof, for the winter, the Contractor must, on notice from the Engineer of the required discontinuation, forthwith place the Work in proper and satisfactory condition for the accommodation and safety of the public and for the effectual protection of the work against damage from rain, snow, frost, ice or other causes, and must so maintain the work.

55.03 When work is ordered or permitted by the Engineer to be done during freezing weather, the Contractor shall provide the necessary means for heating and all the materials required in the Work shall be heated. Unless otherwise directed in writing by the Engineer, all masonry, concrete, painting, roadway and other work liable to be injuriously affected by frost, or which cannot, in the opinion of the Engineer, be satisfactorily proceeded with because of the condition of the weather, must be put in proper and satisfactory condition and be carefully and well protected from damage by frost at all times - all at the cost and expense of the Contractor.

GC56 SUB-LETTING

56.01 The Contractor shall keep the Work under his personal control, and shall not assign, transfer, or sub-let any portion without first obtaining the written consent of the Engineer. The consent of the Engineer to any such assignment, transfer, or sub-letting, shall not, however, relieve the Contractor of any responsibility for the proper commencement, execution, and completion of the Work according to the terms of the Contract.

56.02 If the Engineer consents to any such assignment, transfer or sub-letting the Contractor shall, either in person or through an accredited agent, receive all agent, receive all notices, communications, orders, instructions, or legal service, as if he were performing the Work with his own plant and his own men.

GC57 USE OF HYDRANTS AND WATER

57.01 The Contractor shall make arrangements for a supply of water to be used in carrying out the Contract, and shall bear all costs for water and temporary connections unless otherwise specifically provided for in the Contract.

57.02 The Contractor shall comply with the regulations of the Owner shall not attempt to use it without approval of Operations Manager regarding the use and care of hydrants. Any damage to hydrants caused by the Contractor's operations shall be his responsibility. In the event the Contractor fails to make good such damage the Engineer will have the necessary repairs made and will retain the cost from monies due the Contractor.

57.03 The Contractor shall bear the cost of all water used in testing and chlorinating of all installations. The Contractor to provide water for testing.

GC58 SETTING OUT

58.01 The Engineer will provide the Contractor in writing with bench marks and points of reference to be used by him in setting out the works.

58.02 The Owner will be responsible only for the correctness of the information so supplied. From these bench marks and points of reference the Contractor will do his own setting out. The setting out by the Contractor shall include but shall not be limited to the preparation of grade sheets, the installation of centre line stakes, grade stakes, offsets, site rails and screens.

58.03 The Contractor shall be responsible for the true and proper setting out of the works and for the correctness of the position, levels, dimensions and alignment of all parts of the works, and for the provision of all necessary instruments and labour in connection therewith.

58.04 The Contractor shall not be responsible for the correctness of the information supplied by the Engineer as herein provided for.

58.05 If at any time during the progress of the Work any error shall appear or arise in the position, levels, dimensions or alignment of any part of the works, the Contractor shall, at his own expense, rectify such error to the satisfaction of the Engineer, unless such error is based on incorrect data supplied in writing by the Engineer.

58.06 The checking of the setting out of any line or level by the Engineer shall not in any way relieve the Contractor of his responsibility for the correctness thereof and the Contractor shall carefully protect and preserve all bench marks, stakes and other things used in setting out the works.

GC59 ASSISTANCE

59.01 The Contractor is to furnish the Engineer or any of his assistants with any reasonable help which he or they may require at any time in checking the work. He shall also furnish the said parties or any of the inspectors, at all times, with convenient means of access to all parts of the works, and also with all required assistance to facilitate thorough examination of the same, and inspection, culling and removal of doubtful or defective material, and for any other purpose required in connection with the said works or in the discharge of their respective duties, for which services no additional allowance will be made.

59.02 The Contractor shall, at the request of the Engineer, assist, join in, or at the Owner's expense, make application on behalf of the Owner for any exemption recovery or refund. The Contractor shall provide the Owner with copies, or where required, originals or records, invoices, purchase orders or other documentations as may be necessary to support such application.

GC60 OTHERS RIGHTS

60.01 The contractor must afford all necessary and reasonable facilities to the Owner, or any of its employees or workmen, as well as to any company, corporation or person owning or operating any railway, tramway, wires, pipes or conduits or works or property, on, along, or near the line of the works, or in their vicinity.

60.02 He shall notify all such parties before interfering with any of their property, rights or privileges and must work in harmony with them; otherwise he shall notify the Engineer in writing of his failure so to do, or of any difficulty that may at any time arise which he may be unable to overcome, in which case the Engineer shall deal with the matter as in his judgment may seem right or proper, and the Contractor shall abide by the decision and the direction of the Engineer.

60.03 Any property of such parties which the Engineer orders to be moved by the Contractor must be handled with care, and must be neatly piled up and preserved free from injury or loss, and must be properly and satisfactorily replaced, all of which must be done by the Contractor without extra charge (unless specifically provided for in the contract) and to the satisfaction of the Engineer.

60.04 The Engineer shall have the right, at any time before or during the construction, or after the completion of the work, to open up any portion of the Work or works, or the ground or roadway, or to grant permission for such opening to be made or left by the Contractor, as he, the Engineer, may deem advisable, for the purpose of examining, repairing or laying any water, gas or other pipe, sewer, drain, track or other underground or surface construction or to cause any such work as he may deem necessary or advisable to be done, and such permission, or the exercise of such rights, either by the Engineer or by any other person or corporation having the requisite authority (either statutory or otherwise) shall not relieve the Contractor from any of his responsibilities or obligations, nor shall the opening up of any portion of the Work for these or any other purposes, or by any other parties, relieve the Contractor of such responsibilities or obligations, except only for the portion of the work actually torn up and destroyed, and then only in case the Contractor applies in writing for such relief at the time the work is being done, or within ten days afterwards, and can furnish sufficient cause, in the opinion of the Engineer, why such relief should be granted.

60.05 The placing, installation and connection of work by the Owner's own forces or by any other Contractors on and to the Contractor's Work does not relieve the Contractor of his responsibility to provide the specified warranties.

GC61 MONIES DUE OWNER

61.01 All monies payable to the Owner by the Contractor under any stipulation herein or to the Workers' Compensation Board, may be retained out of any monies then due or which may become due, from the Owner to the Contractor under this or any other contract with the Owner, or otherwise howsoever, or may be recovered from the Contractor or his surety jointly or severally in any court of competent jurisdiction, as a debt due to the Owner, and the Owner shall have full power to withhold any estimate or certificate, if circumstances arise which may indicate to it the advisability of so doing, though the sum to be retained may be unascertained.

GC62 LIENS

62.01 The Contractor and his surety, executors, administrators, successors and assigns, (if assignment is approved as herein provided), and any and all other parties in any way concerned, shall fully relieve and indemnify the Owner and all its officers, servants and employees from any and all liability or expenses in respect to any claim which may be made for a lien or charge at law or in equity or to any claim or liability or to any attempted attachment for debt, garnishee, process or otherwise.

62.02 The Owner shall not in any case be liable to any greater extent than the amount owing by it to the Contractor, his executors, administrators, successors and assigns, pursuant to this Contract.

GC63 REMOVAL OF PERSONNEL

63.01 Should any superintendent, foreman, mechanic or workman employed on or about the work or in connection therewith, give any just cause for complaint (of which the Engineer shall be the sole judge), the Engineer may instruct the Contractor to remove such person from the works forthwith.

63.02 The Contractor shall keep on site, personnel that are compatible to other tradesmen working on the project. Where labour disputes do occur due to the personnel employed by this contract, they will be immediately removed from the site and replaced with personnel that do not impede the progress of the work at no extra cost to the Owner.

GC64 NON-FULFILMENT OF THE CONTRACT

64.01 If in the opinion of the Engineer and at any time or times prior to the issuance of the Final Completion Certificate, the Contractor

(1) neglects, or

(2) fails to commence work within seven days after the date of the Engineer's written order to commence work, or

(3) becomes bankrupt or insolvent, or compounds with his creditors, or commits any act of insolvency, or transfers, assigns or sub-lets the Contract or any part thereof without the written consent of the Engineer, or

(4) has not executed or is not executing the work or any part thereof in a sound and workmanlike manner and in accordance with the Contract, or

(5) is not performing the work so as to ensure its completion within the time stipulated in the Contract, or

(6) has failed to complete the Work within the said time, or

(7) fails or refuses to take down, re-build, repair or rectify any imperfect work for which the Contractor is responsible, or

(8) fails to remove any condemned material or to replace such material with proper material, or

(9) fails to comply with any reasonable order given to him by the Engineer, or

(10) abandons the Work, or fails to observe or perform any of the provisions of the Contract,

then in each and any such case the Engineer shall, after giving the Contractor 48 hours' written notice, have the right and power, at his discretion without process or action at law, to take possession and control of the whole Work, or any part or parts thereof specified in the said notice, from the Contractor, and the Contractor, upon receiving the said notice, shall give possession and control of the said Work, or the part or parts thereof specified in the said notice, peaceably to the Engineer, and the Engineer may employ such means as he may deem necessary or advisable to complete the Work to his satisfaction with such changes therein as in the Engineer's opinion are necessary or advisable by reason of the Contractor's non-fulfilment of the Contract as set out herein.

64.02 In the event of an emergency in any manner due to the Contractor's non-fulfilment of the Contract as set out above or in GC52.02 hereof, the Engineer shall have the right and power at his discretion without process or action at law or any notice to the Contractor to take possession and control of the Work, or any part thereof, from the Contractor and the Engineer may take such measures as he may deem necessary or advisable to deal with the emergency and the decision of the Engineer as to the existence of such an emergency and as to the measures to be taken in regard thereto shall be final. If, in the event of an emergency as aforesaid, the Engineer takes measures in regard thereto as provided for above, he shall notify the Contractor thereof as soon after the commencement of the emergency as is practicable.

64.03 The Contractor and his surety in every case provided for above shall be liable for all loss, damage, expense, expenditure and cost which may be incurred by reason of the Engineer's exercise of the rights and powers provided for herein, and without limiting the generality of the foregoing, including costs of engineering and investigation and all costs of administration, or sustains damage or loss of any kind, the Contractor and his surety or sureties shall be liable to the Owner for such costs, damage and loss.

64.04 If the said loss, damage, expense, expenditure or cost exceeds the sum which would have been payable under the Contract if the same had been completed by the Contractor, the Contractor or his surety shall pay the amount of such excess to the Owner together with the amount of liquidated damages from the date fixed for the completion of the work, and the same may be deducted or collected by the Owner as provided for in GC61 - MONIES DUE OWNER.

64.05 All the powers of the Engineer with respect to the determination of any doubts, disputes and differences, and the determination of the sum or sums, or balance of money to be paid to or received from the Contractor or his surety in respect of the Contract, shall nevertheless continue in force. The fulfilment by the Contractor of any stipulation in the Contract may be enforced by legal proceedings and judgment, or order of court, without prejudice to any other remedy herein contained.

64.06 In case possession and control of the Work, or any part thereof, is taken from the Contractor as herein provided, the decision of the Engineer with respect thereto shall be final but the relative obligations of the Owner and the Contractor and his surety in respect of the Contract shall not be affected nor shall the completion of the Work be delayed.

64.07 All property, materials, articles and things whatsoever including all machinery, tools, plant and equipment, and all rights, proprietary or otherwise, licenses, powers and privileges, whether relating to or affecting real or personal property, acquired, possessed or provided by the Contractor for the purpose of the work, or by the Engineer under the provisions of this Contract, shall be the property of the Owner and may be used, exercised and employed by the Owner as fully as they might have been used, exercised and employed by the Contractor, and the Owner may sell or otherwise dispose of, at public auction or private sale or otherwise, the whole or any portion or number of such property, materials, articles and things, at such price or prices as it may deem fit and retain the proceeds of any sale or disposition and all other amounts then or thereafter due by the Owner to the Contractor, on account of or in part satisfaction of any loss, damage, expense or cost which the Owner may sustain or has sustained by reason aforesaid.

64.08 If any balance of the contract price, or any other money payable by the Owner hereunder, shall remain in the hands of the Owner upon the completion of the measures taken by the Engineer and the fulfilment of the Contract, the same shall be payable to the Contractor or the person legally representing him, but neither the Owner nor any officer, employee or agent thereof shall be liable or accountable to the Contractor or his surety in any way for the manner in which, or the price at which, the said work or any portion thereof, may have been or may be done or completed by the Engineer.

64.09 Neither an extension of time for any reason beyond the date fixed herein for the completion of the Contract, nor the payment for any portion of the Work shall be deemed to be a waiver by the Engineer or the Owner of their rights under this Contract.

GC65 BRIBERY

65.01 Should the Contractor or any of his agents give or offer any gratuity to, or attempt to bribe, any member of the Council of the Owner, or any officer or servant of the Owner or of the Council of the Owner or of the agent of the Engineer, the Owner shall be at liberty to cancel the Contract forthwith, or to direct the Engineer to take the whole or any part of the Work out of the hands of the Contractor, under the same provisions as those specified in the preceding section hereof.

GC66 DISPUTES

66.01 Contractor's Claims

66.01.1 Any claim which the Contractor may have against the Owner based on any dispute or difference of any kind whatsoever arising out of the Contract or Work shall not be ground for delay in the Work but shall be referred by the Contractor in writing to the Engineer, not later then 15 working days after the Contractor becomes aware of the circumstances giving rise to such dispute or difference. Such reference to the Engineer shall contain a concise statement of the relevant facts. The Engineer may require any additional information.

66.01.2 The claim shall be settled by the Engineer who shall communicate his decision in writing to the Contractor and such decision shall forthwith be given effect by the Contractor, and the Contractor shall proceed with the Work with all due diligence in accordance therewith whether or not such claim shall be referred to arbitration as hereinafter provided.

66.01.3 If the Contractor disputes the Engineer's decision, the Contractor shall give written notice of such dispute to the Engineer no later then 15 working days after the receipt of its decision. Such notice shall set forth particulars of the matters in dispute, the probable extent and value of the damage and the relevant provisions of the Contract. The Engineer shall reply to such notice no later then 15 working days after he receives or is considered to have received it, setting out in such reply his grounds and other relevant provisions of the Contract.

66.01.4 If the matter in dispute is not resolved promptly, the Engineer will give such instructions as in his opinion are necessary for the proper performance of the Work and to prevent delays pending settlement of the dispute. The parties shall act immediately according to such instructions, it being understood that by so doing neither party will jeopardize any claim they may have.

66.01.5 If it is determined that the Contractor's interpretation of the Contract Document is not reasonably based in light of the intent of the Contract Document and the context of the Project, the Contractor shall reimburse the Owner for any delay costs the Owner may have incurred as a result of the dispute.

66.01.6 It is agreed that no act by either party shall be construed as a renunciation or waiver of any of his rights or recourse, provided he has given the required notices and has carried out the required instructions as provided above.

66.01.7 The parties may agree to submit disputes to arbitration and if the parties so agree then the dispute shall be submitted to arbitration in accordance with the provisions of the **Arbitration Act of Ontario**.

66.02 Owner's Claim

66.02.1 Any claim which the Owner may have against the Contractor based on any dispute or difference of any kind whatsoever arising out of the Contract or Work may, at the option of the Owner and after notification in writing to the Contractor, be settled in accordance with the procedure set out in GC66.01 hereof and the provisions thereof shall apply mutatis mutandis.

GC67 OCCUPATIONAL HEALTH AND SAFETY ACT

67.01 The Contractor, for purposes of the Ontario Occupational Health and Safety Act, shall be designated as the Constructor for this project and shall assume all of the responsibilities of the Constructor as set out in that Act and its regulations. The foregoing shall apply notwithstanding that the successful Tenderer has been referred to as the “Contractor” in this and any other related document.

(a) The Contractor acknowledges that they have read and understood the Occupational Health and Safety Act (R.S.O. 1990, C-0.1, as amended).

(b) The Contractor covenants and agrees to observe strictly and faithfully the provisions of the said Occupational Health and Safety Act and all regulations and rules promulgated thereunder.

(c) The Contractor agrees to indemnify and save the Owner harmless for damages or fines arising from any breach or breaches of the said Occupational Health and Safety Act.

(d) The Contractor agrees to assume full responsibility for the enforcement of the said Occupational Health and Safety Act to ensure compliance therewith.

(e) The Contractor further acknowledges and agrees that any breach or breaches of the Occupational Health and Safety Act whether by the Contractor or any of its sub-contractors may result in the immediate termination of this contract.

(f) The Contractor shall allow access to the work site on demand to representatives of the Owner to inspect work sites to ensure compliance with the Occupational Health and Safety Act.

(g) The Contractor agrees that any damages or fines that may be assessed against the Owner by reason of a breach or breaches of the Occupational Health and Safety Act by the Contractor or any of its sub-contractors will entitle the Owner to set-off the damages so assessed against any monies that the Owner may from time to time owe the Contractor under this contract or under any other contract whatsoever.

67.02 The Contractor shall provide a list of all controlled hazardous materials or products containing hazardous materials, all physical agents or devices or equipment producing or omitting physical agent and any substance, compound, product or physical agent that is deemed to be or contains a designated substance in accordance with the Workplace Hazardous Materials Information System (WHMIS) as defined under the Ontario Occupational Health and Safety Act and shall provide appropriate Material Health and Safety Data Sheets for these substances used for the performance of the required work, all prior to the performance of the work.

67.03 Where hazardous materials, physical agents and/or designated substances are used in the performance of the required work, the successful Contractor shall ensure that the requirements of the Ontario Occupational Health and Safety Act and associated regulations are complied with.

67.04 The Owner reserves the right to cancel any contract for non-compliance with the terms set out herein, health and safety regulations, the Environmental Protection Act, associated regulations and other applicable legislation.

67.05 The Contractor shall perform the Work so as to cause the public the least inconvenience possible. In particular, the Contractor shall not obstruct any street, thoroughfare, or footwalk longer or to a greater extent than necessary.

67.06 The Contractor shall take all reasonable precaution necessary to ensure the safety of the workers and the general public, particularly children who may play in the area of work.

FORM OF AGREEMENT

THE CORPORATION OF THE TOWN OF DEEP RIVER

CONTRACT 2025-RFT-001

DEEP RIVER WATER TREATMENT PLANT

UPGRADES

CIMA PROJECT A001332

FORM OF AGREEMENT

THIS INDENTURE made in quadruplicate this_____of 2025

BETWEEN:

THE CORPORATION OF THE TOWN OF DEEP RIVER

hereinafter called the "Owner"

_____of the FIRST PART

AND:

_____

hereinafter called the "Contractor".

of the SECOND PART

WITNESSETH that the Owner and the Contractor in consideration of the fulfilment of their respective promises and obligations herein set forth covenant and agree with each other as follows:

ARTICLE 1

(a) The Contractor shall provide at his own expense all the labour, materials, equipment, plant and services (except as specifically stipulated otherwise in the Contract Documents), and perform all the work and fulfil all obligations set out in the Contract documents for Contract No. 2025-RFT-001, Deep River Water Treatment Plant Upgrades.

(b) The Contractor shall forthwith according to the instructions of the Engineer of the Owner commence the works and diligently execute the respective portions thereof, and deliver the works complete in every particular to the Owner within the time specified in the Form of Tender attached hereto.

ARTICLE 2

In case of inconsistency or conflict between the provisions of any of the Contract documents, then the provisions of such documents shall take precedence and govern in the following order:

1. Agreement
2. Addenda
3. Information for Tenderers
4. General Conditions
5. Contract Drawings
6. Specifications
7. Tender
8. Shop Drawings

The above Contract documents are all to be read into and form part of this Agreement and the whole shall constitute the Contract between the parties and it shall enure to the benefit of and be binding upon them and their successors, executors, administrators and assigns.

ARTICLE 3

The Owner shall pay to the Contractor for and in respect of the works and performance and observance by the Contractor of the provisions of this Contract, in lawful money of Canada,

_____

_____ ($ _____)

subject to such additions and deductions as may properly be made under the terms of this Contract, and subject to the provisions that the Owner may make payments on account monthly or otherwise as may be provided in the General Conditions attached hereto.

ARTICLE 4

The Contractor shall not without the consent in writing of the Engineer of the Owner, and without restricting in any way the provisions of the General Conditions attached hereto, make any assignment of any part or the whole of any monies due or to become due under the provisions of this Contract.

ARTICLE 5

All communications in writing between the parties shall be deemed to have been received by the addressee if delivered to the individual or to a member of the firm or to an officer of the Owner for whom they are intended or if sent by post or by telegram addressed as follows:

The Contractor: _____

The Owner: The Corporation of the Town of Deep River
100 Deep River Road
Deep River, Ontario K0J 1P0

ARTICLE 6

No implied obligation of any kind by or on behalf of the Owner shall arise or be implied from anything contained in the Contract documents, nor from any position or situation of the parties at any time. The express covenants and agreements contained herein made by the Owner shall be the only covenants and agreements upon which any rights against the Owner may be founded.

ARTICLE 7

The Contractor declares that in tendering for the works and in entering into this Contract he has either investigated for himself the character of the work and all local conditions that might affect his tender or his acceptance of the work, or that not having so investigated, he is willing to assume and does hereby assume all risk of conditions arising or developing in the course of the work which might or could make the work, or any items thereof, more expensive in character, or more onerous to fulfil, than was contemplated or known when the Tender was made or the Contract signed. The Contractor also declares that he did not and does not rely upon information furnished by the Owner or its employees, being aware that any information from such sources was and is approximate and speculative only, and was not in any manner warranted or guaranteed by the Owner.

IN WITNESS WHEREOF the parties have executed this Agreement the day and year first above written.

SIGNED, SEALED AND DELIVERED

Contractor

_____

_____

(Seal)

Town of Deep River

_____
MAYOR

_____

(Seal)

PERFORMANCE BOND

THE CORPORATION OF THE TOWN OF DEEP RIVER

CONTRACT 2025-RFT-001

DEEP RIVER WATER TREATMENT PLANT

UPGRADES

CIMA PROJECT A001332

PERFORMANCE BOND

Bond No._____ Project No. _____

Amount: **$**_____ Contract No. _____

KNOW ALL BY THESE PRESENTS, that we _____

_____ hereinafter called "the Principal",

and

_____ hereinafter called "the Surety",

are jointly and severally held and firmly bound unto the Corporation of the Town of Deep River**,** hereinafter called "the Obligee", its successors and assigns, in the sum of _____/100 Dollars ($_____) of lawful money of Canada, to be paid unto the Obligee, for which payment well and truly to be made we the Principal and Surety jointly and severally bind ourselves, our and each of our respective heirs, executors, administrators, successors and assigns by these presents.

WHEREAS by an agreement in writing dated the_____day of_____in_____, the Principal has entered into a contract with the Obligee, hereinafter called "the Contract", for the construction of the Deep River Water Treatment Plant Upgrades as in the Contract provided, which Contract is by reference herein made a part hereof as fully to all intents and purposes as though recited in full herein.

NOW THEREFORE THE CONDITION OF THIS OBLIGATION IS SUCH that if the Principal shall at all times duly perform and observe the Contract including the provisions of Section 52 (Warranty and Guarantee Period) of the General Conditions or as the same be changed, altered or varied as hereinafter provided, to the satisfaction of the Obligee and shall at all times fully indemnify and keep indemnified the Obligee from and against all and any manner of loss, damage, expense, suits, actions, claims, liens, proceedings, demands, awards, payments and liabilities arising out of or in any manner based upon or attributable to the Contract and shall fully reimburse and repay the Obligee for all outlay, expense, liabilities, or payments incurred or undertaken to be made by the Obligee pursuant to the Contract, then this obligation shall be void, but otherwise it shall be and remain in full force and effect.

Provided further and it is hereby agreed and declared that there shall be no liability under this instrument of the Principal and Surety for payment of any claims for labour, material or services used or reasonably required for use in the performance of the Contract to the extent the amount of such claims is paid pursuant to a Labour and Materials Payment Bond.

Provided always and it is hereby agreed and declared that the Obligee and the Principal have the right to change, alter and vary the terms of the Contract and that the Obligee may in its discretion at any time or times take and receive from the Principal any security whatsoever and grant any extension of time thereon or on any liability of the Principal to the Obligee.

Provided further and it is hereby agreed and declared that the Principal and the Surety shall not be discharged or released from liability hereunder and that such liability shall not be in any way affected by any such changes, alterations, or variations, taking or receiving of security, or extension of time, as

aforesaid, or by the exercise by the Obligee of any of the rights or powers reserved to it under the Contract or by its forbearance to exercise any such rights or powers, including (but without restricting the generality of the foregoing) any changes in the extent or nature of the works to be constructed, altered, repaired or maintained under the Contract, or by any dealing, transaction, forbearance or forgiveness which may take place between the Principal and the Obligee.

Provided further and it is hereby agreed and declared that the Surety shall not be liable for a greater sum than that specified in this bond.

In Witness Whereof the Principal and the Surety have affixed their signatures and Corporate Seals this _____day of_____in_____.

SIGNED AND SEALED BY THE PRINCIPAL
In the presence of:

_____
*Witness

_____
Occupation

_____
Address

Per: _____

Per:_____c/s

Per:_____c/s
Surety

*Not necessary if corporate seal is affixed.

LABOUR AND MATERIAL PAYMENT BOND

THE CORPORATION OF THE TOWN OF DEEP RIVER

CONTRACT 2025-RFT-001

DEEP RIVER WATER TREATMENT PLANT

UPGRADES

CIMA PROJECT A001332

LABOUR & MATERIAL PAYMENT BOND

Bond No._____ Project No. _____

Amount: **$**_____ Contract No. _____

KNOW ALL BY THESE PRESENTS, that we _____

_____ hereinafter called "the Principal",

and

_____ hereinafter called "the Surety",

are jointly and severally held and firmly bound unto the Corporation of the Town of Deep River as Trustee, hereinafter called "the Obligee", for the use and benefit of the Claimants, their and each of their heirs, executors, administrators, successors and assigns, in the amount of _____/100 Dollars ($_____) of lawful money of Canada, for the payment of which sum well and truly to be made we the Principal and Surety jointly and severally bind ourselves, our and each of our respective heirs, executors, administrators, successors and assigns by these presents.

WHEREAS by an agreement in writing dated the_____day of_____in_____, the Principal entered into a contract with the Obligee, hereinafter called "the Contract", for the construction of the Deep River Water Treatment Plant Upgrades with Contract is by reference herein made a part hereofas fully to all intents and purposes as though recited in full herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Principal shall make payment to all Claimants for all labour and material used or reasonably required for use in the performance of the Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1. A Claimant for the purpose of this Bond is defined as one having a direct contract with the Principal for labour, material, or both, used or reasonably required for use in the performance of the Contract, labour and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment, directly applicable to the Contract provided that a person, firm or corporation who rents equipment to the Principal to be used in the performance of the Contract under a contract which provides that all or any part of the rent is to be applied towards the purchase price thereof shall only be a Claimant to the extent of the prevailing industrial rental value of such equipment for the period during which the equipment was used in the performance of the Contract.

2. The Principal and the Surety hereby jointly and severally agree with the Obligee, as Trustee, that every Claimant who has not been paid as provided for under the terms of its contract with the Principal, before the expiration of a period of ninety (90) days after the date on which the last of such Claimant's work or labour was done or performed or materials were furnished by such Claimant, may as a beneficiary of the trust herein provided for, sue on this Bond, prosecute the suit to final judgment for such sum or sums as may be justly due to such Claimant under the terms of its contract with the

Principal and have execution thereon. Provided that the Obligee is not obliged to do or take any act, action or proceeding against the Surety on behalf of the Claimants, or any of them, to enforce the provisions of this Bond. If any act, action or proceeding is taken either in the name of the Obligee or by joining the Obligee as a party to such proceeding, then such act, action or proceeding, shall be taken on the understanding and basis that the Claimants, or any of them, who take such act, action or proceeding shall indemnify and save harmless the Obligee against all costs, charges and expenses or liabilities incurred thereon and any loss or damage resulting to the Obligee by reason thereof. Provided still further that, subject to the foregoing terms and conditions, the Claimants or any of them, may use the name of the Obligee to sue on and enforce the provisions of this Bond.

3. No suit or action shall be commenced hereunder by any Claimant:

   (a) Unless such Claimant shall have given written notice within the time limits hereinafter set forth to each of the Principal, the Surety and the Obligee, stating with substantial accuracy the amount claimed.

   Such notice shall be served by mailing the same by registered mail, or served in any manner in which legal process may be served in the Province of Ontario, to the Principal and Surety at any place where an office is regularly maintained for the transaction of business by such persons, and to the Obligee addressed to the attention of the Town Clerk, Town of Deep River, Town Hall, 100 Deep River, Ontario K0J 1P0.

   Such notice shall be given:

   (1) in respect of any claim for the amount or any portion thereof required to be held back from the Claimant by the Principal under either the terms of the Claimant's contract with the Principal or under the *Construction Act*, R.S.O. 1990, c.C.30 applicable to the Claimant's contract with the Principal, whichever is the greater, within one hundred and twenty (120) days after such Claimant should have been paid in full under the Claimant's contract with the Principal.

   (2) in respect of any claim other than for the holdback, or portion thereof, referred to above, within one hundred and twenty (120) days after the date upon which such Claimant did or performed the last of the work or labour, or furnished the last of the materials for which such claim is made, under the Claimant's contract with the Principal.

   (b) After the expiration of one (1) year following the date on which the Principal ceased work on the Contract, including work performed under the guarantees provided in the Contract.

   (c) Other than in a Court of competent jurisdiction in the Province of Ontario, and the parties hereto agree to submit to the jurisdiction of such Court.

4. The amount of this Bond shall be reduced by and, to the extent of any payment or payments made in good faith and in accordance with the provisions hereof, inclusive of the payment by the Surety of claims under the *Construction Act*, whether or not such claims be presented under and against this Bond.

PROVIDED ALWAYS and it is hereby agreed and declared that the Obligee and the Principal have the right to change, alter and vary the terms of the Contract, and that the Obligee may in its discretion at any time

or times take and receive from the Principal any security whatsoever and grant any extension of time thereon or on any liability of the Principal to the Obligee.

PROVIDED FURTHER and it is hereby agreed and declared that the Principal and the Surety shall not be discharged or released from liability hereunder and that such liability shall not be in any way affected by any such changes, alterations, or variations, taking or receiving of security, or extension of time, as aforesaid, or by the exercise by the Obligee of any of the rights or powers reserved to it under the Contract or by its forbearance to exercise any such rights or powers, including (but without restricting the generality of the foregoing) any changes in the extent or nature of the works to be constructed, altered, repaired or maintained under the Contract, or by any dealing, transaction, forbearance or forgiveness which may take place between the Principal and the Obligee.

PROVIDED FURTHER and it is hereby agreed and declared that the Surety shall not be liable for a greater sum than that specified in this Bond.

IN WITNESS WHEREOF the Principal and the Surety have **AFFIXED THEIR SIGNATURES AND CORPORATE SEALS** this_____day of_____in_____.

SIGNED AND SEALED BY THE PRINCIPAL
In the presence of:

_____
*Witness

_____
Occupation

_____
Address

Per: _____

Per: _____ c/s

Per: _____ c/s
Surety

*Not necessary if corporate seal is affixed.

CERTIFICATE OF INSURANCE

THE CORPORATION OF THE TOWN OF DEEP RIVER

CONTRACT 2025-RFT-001

DEEP RIVER WATER TREATMENT PLANT

UPGRADES

CIMA PROJECT A001332

CERTIFICATE OF INSURANCE

THE CORPORATION OF THE TOWN OF DEEP RIVER

This is to certify that the Insured named below is insured as described below.

PROJECT / CONTRACT / AGREEMENT - MUST BE SPECIFIED

NOTE: **ORIGINAL CERTIFICATES SIGNED BY YOUR INSURER OR INSURANCE BROKER ONLY WILL BE ACCEPTED**

NAME OF INSURED		TELEPHONE NUMBER	AREA CODE
ADDRESS OF INSURED	STREET NAME	CITY	POSTAL CODE

TYPE OF INSURANCE	INSURER'S NAME	POLICY NUMBER	EFFECTIVE DATE YR. MO. DAY	EXPIRY DATE YR. MO. DAY	LIMITS OF LIABILITY
COMMERCIAL GENERAL LIABILITY					**$10,000,000**
o UMBRELLA o EXCESS o OTHER					

AMOUNT OF DEDUCTIBLE (property damage and/or bodily injury)

$

Commercial General Liability – Occurrence Basis, Including Personal Injury, Property Damage Broad Form Property Damage, Contractual Liability, Non-Owned Automobile Liability, Owner's and Contractor's Protective Coverage, Products – Completed Operations, Contingent Employers Liability, Cross Liability Clause and Severability of Interest Clause.

Tenant's Legal Liability ☐ NO *or* ☐ YES (Limit) $ _____

MOTOR VEHICLE LIABILITY					**$ 5,000,000**

Motor Vehicle Liability – must cover all vehicles owned, or operated by, or on behalf of the insured.

The Corporation of the Town of Deep River and **CIMA Canada Inc.**, have been added as an additional Insured, but only with respect to their interest in the operations of the Named Insured.

This is to certify that the Policies of Insurance as described above have been issued by the undersigned to the Insured named above and are in force at this time.

If cancelled or changed in any manner that would affect the Town of Deep River and/or CIMA Canada Inc., as outlined in coverage specified herein for any reason so as to affect this certificate, thirty (30) days prior written notice by registered mail or facsimile transmission will be given by the insurer(s) to:

The Corporation of the Town of Deep River
100 Deep River Road
Deep River, Ontario K0J 1P0

DATE	YR. MO DAY	NAME OF INSURANCE COMPANY OR BROKER (COMPLETING FORM)		
ADDRESS OF INSURER OR INSURANCE BROKER		TELEPHONE NO.	FAX NO.	AUTHORIZED REPRESENTATIVE OR OFFICIAL BY:

SPECIFICATIONS FOR ALL RISK INSURANCE

THE CORPORATION OF THE TOWN OF DEEP RIVER

CONTRACT 2025-RFT-001

DEEP RIVER WATER TREATMENT PLANT

UPGRADES

CIMA PROJECT A001332

This Policy of all Risk Insurance to be furnished by the Contractor in accordance with his Contract with the Owner shall comply with the requirements of this Specification.

The Corporation of the Town of Deep River
Specification for All Risk Insurance
Contract 2025-RFT-001

1. INSURING CLAUSE

This Policy, subject to the limitations, exclusions, terms and conditions hereinafter mentioned is to insure, in respect of occurrences happening during the period of this Policy, against all risks of direct physical loss or damage including general average and salvage charges to:

(a) Property in course of construction, installation, demolition, reconstruction or repair whilst at the risk of the Insured and whilst at the location of the said construction, installation, erection, demolition, reconstruction or repair operations (hereinafter called the "Construction Operations");

(b) Property of every kind and description (including materials and supplies) owned by the Insured and used or to be used in, a part of, or incidental to the construction operations wherever the said property may be located in Canada, the Continental United States of America (comprising all the States of the Union and the District of Columbia) in transit or storage within and between Canada and the Continental United States of America on or over land, inland and/or coastal waters;

(c) Property of others used or to be used in, a part of, or incidental to the construction operations, for which the Insured may be responsible or shall prior to any occurrence for which claim may be made hereunder, have assumed responsibility.

2. EXCLUSIONS: THIS POLICY DOES NOT COVER

(a) Any loss of use or occupancy howsoever caused;

(b) Penalties or liquidated damages for non-completion of or delay in completion of Contract or Contracts or non-compliance with Contract conditions;

(c) Cost of making good faulty workmanship, construction or design; but this exclusion shall not apply to damage resulting from such faulty workmanship, construction or design;

(d) Wear, tear, normal upkeep and normal making good;

(e) Loss or damage caused by frost or freezing caused by natural forces unless resulting from damage occasioned by fire, lighting, explosion, impact by aircraft or vehicles, riot, smoke damage, sprinkler leakage, windstorm, hail, malicious damage or vandalism;

(f) Automobiles or motor trucks;

(g) Loss due to disappearance or revealed by inventory shortage alone;

(h) Mechanical breakdown but this exclusion shall not be deemed to exclude loss or damage arising as a consequence of mechanical breakdown;

(i) Infidelity of the Insured's employees;

(j) Contractor's equipment of every description except scaffolding, temporary structures, wood and metal forms and tarpaulins provided that the value of such items is included in the values reported;

(k) Loss or damage to material and/or equipment whilst in the course of ocean marine shipment except as provided in clause 1(b);

(l) Loss or damage caused by war, invasion, act of foreign enemy, hostilities (whether war be declared or not), civil war, rebellion, revolution, insurrection or military power;

(m) Loss or damage caused by contamination by radioactive material directly or indirectly resulting from a peril insured under this Policy.

3. SUBCONTRACTORS

In respect of operations performed by subcontractors for the Insured such subcontractors may, at the request of the Insured, be included in the name of the Insured but only as regards property of the aforesaid subcontractors, the value of which shall have been included in the Contract price shown in the Schedule.

LOSS, if any, arising under this Paragraph 3 shall be adjusted with and paid to the Insured.

4. TERMINATION OF LIABILITY

The property referred to in Clause 1 shall be deemed at the risk of the Insured during the period of the construction operations and until the said property has been formally completed, tested and accepted by the Owner and during such further period thereafter as any payment provided for under the contract entered into between the Owner and the Insured (other than the holdback for the period of maintenance) shall remain unpaid by the Owner but only to the extent of the amount so remaining unpaid.

Permission is hereby granted for necessary operation of the property insured for testing, adjusting and handover purposes.

5. LIMIT OF LIABILITY

The Insurers are not to be liable for more than the amount stated under “Limit of Liability” in the Schedule, in any one occurrence, unless otherwise agreed upon.
This Policy shall not be reduced by the sum paid in any one loss and shall continue for the full amount during the period of this insurance.

6. OCCURRENCE

The word “Occurrence” shall mean any one loss, disaster or casualty or series of losses, disasters or casualties arising out of one event.

7. DEDUCTIBLE

Each claim for loss or damage arising hereunder shall be adjusted separately and from the amount of each adjusted claim shall be deducted a sum equal to one half of one percent (1/2%) of the completed contract price for the job. This Deductible shall, however, be no less than $500.00, nor no more than $2,500.00. Such Deductible shall not apply, however, to loss or damage by fire, windstorm, hail, lighting, explosion, riot, impact by aircraft or vehicles, smoke, sprinkler leakage, vandalism, malicious damage or burglary. “Each claim” as used herein shall be construed as loss or damage arising from any one contingency.

8. DEPOSIT PREMIUM

It is condition of this insurance that the premium charged at inception is a deposit premium only, based on the estimated amount of contract and will be adjusted on the final full completed value of the contract and/or risk on completion of the contract.

9. PREMIUM ADJUSTMENT

The deposit premium is calculated at the rate per $100.00 of estimated completed value for the period of insurance as stated heretofore. Such deposit premium is to be due and payable at the commencement of work but to be subject to adjustment back to inception date of the Policy following acceptance of the work by the Owner, on the basis of the actual completed value. If extension of insurance is required beyond the period of insurance as hereto before stated, any additional premium will be calculated at pro rata of the stated rates for such extension.

10. OTHER INSURANCE

If on the happening of any loss or damage to property insured there is in force other insurance covering the same interest this Policy shall act as contributory insurance and shall be liable only for its ratable proportion of the loss.

11. ADVICE OF LOSS

In the event of loss or damage the Insured shall:

(a) Give immediate advice thereof to the Insurers or their Agents;

(b) Protect the property from further loss or damage;

(c) As soon thereafter as is practicable render a Proof of Loss to the Insurers signed and sworn to by the Insured stating the knowledge and belief of the Insured as to the time and cause of the loss or damage and the interest of the Insured and all others in the property.

(d) Exhibit to any person designated by the Insurers all that remains of any property herein described.

(e) Produce for examination all books of account, bills, invoices, and vouchers and any and all documents pertaining to the interest of the Insured hereunder or a certified copy thereof if originals be lost, at such reasonable place as may be designated by the Insurers or their representatives and permit extracts and copies thereof to be made.

12. PARTIAL LOSS

The Insurers hereby grant permission to the Insured to carry out repairs in respect of any partial damage to the property insured hereby which conveniently and advantageously can be undertaken by them. The Insurers will reimburse the Insured for the actual cost of such repairs subject always to the Deductible and the Limit of Liability stated in the Schedule.

13. APPRAISAL

If the Insured and the Insurers shall fail to agree as to the amount of loss or damage, they shall each nominate a competent and disinterested appraiser and the two so chosen shall first select a competent and disinterested umpire; the appraisers together shall then estimate and appraise the loss or damage, stating separately the sound values and damage and, failing to agree, shall submit their differences to the umpire, and the award in writing of any two shall determine the amount of the loss or damage. The parties hereto shall pay the appraisers respectively selected by them, and shall bear equally the expense of the appraisal and umpire.

14. SUBROGATION

Upon the payment of any claim under this Policy the Insurers shall be subrogated to all the rights and remedies of the Insured arising out of such claim against any person or corporation whatsoever except that any release from liability entered into by the Insured prior to a loss, shall not affect the right of the Insured to recover hereunder.

It is further understood and agreed that the Insurers on paying a loss, hereby waive their right to a transfer of such rights:

(a) Of the Insured against any person, corporation or organization, (including their directors, officers, employees, servants or agents) owned or controlled by any Insured named herein or affiliated or associated with or subsidiary to any Insured named herein, by whose fault or negligence the loss or damage was caused.

(b) Of any Insured named herein against any other Insured named herein (including their respective directors, officers, employees, servants or agents), by whose fault or negligence the loss or damage was caused.

(c) Of the Insured against any subcontractor, (including their directors, officers, employees, servants or agents) engaged in performing the work herein, by whose fault or negligence the loss or damage was caused.

15. ASSIGNMENT

No assignment of interest under this Policy shall bind the Insurers until their consent is endorsed thereon. However, should the Insured die or be adjudged bankrupt or insolvent the Insurers will consent to the assignment of this Policy to the Insured's representative provided that written notice is given to the Insurers within thirty (30) days after the date of such death, bankruptcy or insolvency.

16. NOTICE(S)

It is agreed that any notice(s) required by the Conditions of this Policy to be given to the Insurers may be given by the Insured through their Agents.

17. CANCELLATION

This Policy may be cancelled in its entirety or as to any contract by the Insurers by mailing with or without tender of unearned premium to the Insured at the address shown in this Policy written notice stating the date when such cancellation shall be effective, such date being not less than thirty (30) days after the date of mailing of the said notice. The Insured may cancel this Policy by written notice to the Insurers stating when thereafter such cancellation shall be effective.

The premium to be retained by the Insurers shall be calculated by applying the rate shown in the Schedule to the actual value of the contract(s) up to the date of cancellation.

18. DEBRIS REMOVAL

It is a condition of this Policy that the insurance provided herein covers expenses incurred in the removal of all debris of the property hereby insured which may be occasioned by loss or damage caused by a peril insured against.

19. VALUATION

Loss or damage to the property insured shall be valued at the Replacement Cost Value plus all charges.

20. BREACH OF CONDITION

If any breach of a clause or condition of this Policy of Insurance shall occur prior to a loss under this Policy, such breach shall not void the insurance nor avail the Insurers to avoid the liability unless such breach shall exist at the time of such loss under this Policy.

21. NOON

It is understood that the time of the beginning and ending of the term of insurance of this Policy shall be 12 o'clock noon, according to Standard Time at the place where the property is located.

22. ERRORS AND OMISSIONS

It is hereby understood and agreed that any error and/or omission in the name of the Insured and/or in title, map reference, description of location of the property insured hereunder, shall not void or impair the insurance.

23. ADJUSTED CLAIMS

All adjusted claims shall be paid or made good to the Insured within thirty (30) days after presentation and acceptance of satisfactory proof of interest and loss.

24. LOSSES COLLECTED FROM OTHERS

No loss shall be paid hereunder if the Insured has collected the same from others.

25. BENEFIT FROM INSURANCE

Unless otherwise provided herein, it is warranted by the Insured that this insurance shall in no wise inure directly or indirectly to the benefit of any carrier or other bailee.

26. SUE AND LABOUR

In case of loss or damage, or threatened loss or damage, it shall be lawful and necessary for the Insured, their factors, servants or assigns, to sue, labour and travel for in and about the defence, safeguarding and recovery of the property insured hereunder, or any part thereof, without prejudice to this insurance; to the charges whereof the Insurers will contribute according to the rate and quantity of the sum herein insured, nor shall the acts of the Insured or the Insurer in defending, safeguarding the recovering the property insured in case of loss or damage be considered a waiver or an acceptance of abandonment.

IN WITNESS WHEREOF THE INSURERS, through their representatives duly authorized by them for this purpose, have executed and signed this policy.

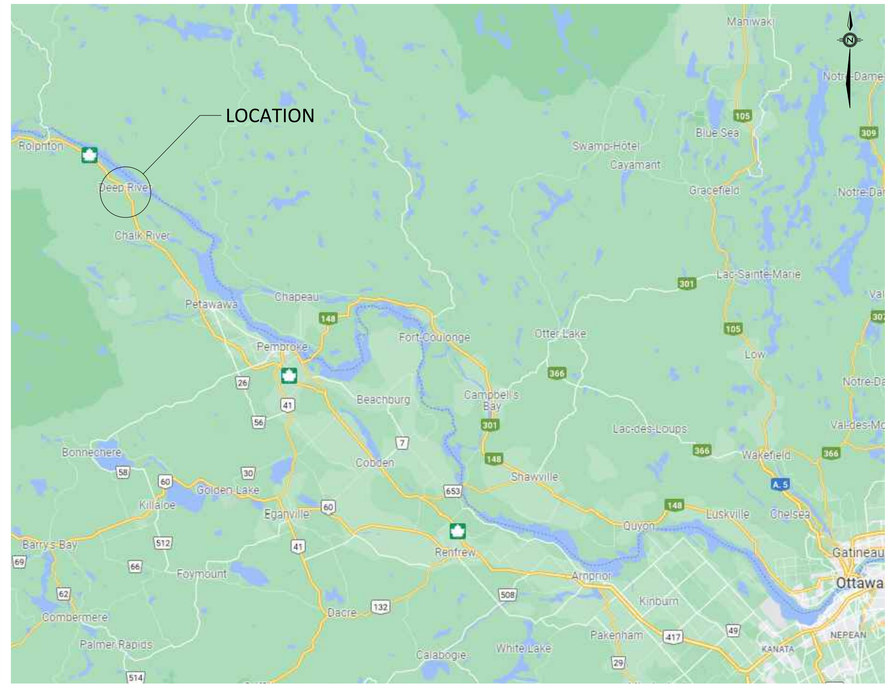
Authorized Representatives,

by

.....

Dated at_____this_____day of_____, 2025

The Town of Deep River



LOCATION PLAN

NTS

DEEP RIVER WATER TREATMENT PLANT UPGRADES

OCTOBER 2025 - ISSUED FOR TENDER

TTLB v2020.10.21

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DRAWING LIST

GENERAL

G-001	COVER PAGE
G-002	DRAWING INDEX

PROCESS

DR-101	PROCESS REMOVALS
D-101	FLOOR PLAN
D-102	FLOOR PLAN (2)
D-301	SECTION VIEW AND PHOTOS
D-501	PHOTOS
D-502	PROCESS DETAILS
D-601	PROCESS INSTRUMENTATION SCHEMATIC CLARIFIERS #1 & #2
D-602	PROCESS INSTRUMENTATION SCHEMATIC RAPID SAND FILTERS
D-603	PROCESS INSTRUMENTATION SCHEMATIC HIGH LIFT PUMPS AND BACKWASH PUMPS
D-604	PROCESS INSTRUMENTATION SCHEMATIC CHEMICAL SYSTEMS
D-605	PROCESS INSTRUMENTATION SCHEMATIC CHEMICAL SYSTEMS
D-606	PROCESS INSTRUMENTATION SCHEMATIC AMMONIUM SULPHATE CHEMICAL SYSTEMS

MECHANICAL

M-101	MECHANICAL - GENERAL NOTES, LEGENDS, AND SPECIFICATIONS
M-102	FLOOR PLANS

ELECTRICAL

ER-001	POWER LAYOUT REMOVALS
E-001	ELECTRICAL LEGEND
E-002	POWER LAYOUT (1)
E-003	POWER LAYOUT (2)
E-501	SINGLE LINE DIAGRAM (1)
E-502	SINGLE LINE DIAGRAM (2)
E-601	SINGLE LINE DIAGRAM - MCC 2
E-602	ELECTRICAL PANEL SCHEDULES
E-901	ELECTRICAL DETAILS

INSTRUMENTATION

I-001	NETWORK LAYOUT RETROFITS
I-002	MAIN PLC ANALOG INPUT MODULE #1-B RETROFITS
I-003	MAIN PLC ANALOG INPUT MODULE #1-A RETROFITS
I-004	MAIN PLC ANALOG INPUT MODULE #2-A RETROFITS
I-005	MAIN PLC ANALOG INPUT MODULE #3-A RETROFITS
I-006	MAIN PLC DIGITAL INPUT MODULE #5 RETROFITS
I-007	CHEMICAL PLC POWER DISTRIBUTION RETROFITS
I-008	CHEMICAL PLC ANALOG INPUT MODULE #1-B RETROFITS
I-009	CHEMICAL PLC ANALOG OUTPUT MODULE #3 RETROFITS
I-010	CHEMICAL PLC DIGITAL INPUT MODULE #3 RETROFITS
I-011	CHEMICAL PLC DIGITAL OUTPUT MODULE #1 RETROFITS

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

DESIGNED BY

APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
DRAWING INDEX

DISCIPLINE:
GENERAL

DRAFTER: N.G.	SCALE:
DESIGNER: A.A.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: A.S.
PROJECT No: A001332	DRAWING No: G-002
SHEET No: 02 of 36	

PRINT DATE: 2026-10-22 3:12:46 PM
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TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21



1 PHOTO 1: ACTIFLO POLYMER DAY TANK TO BE REMOVED
SCALE: N.T.S

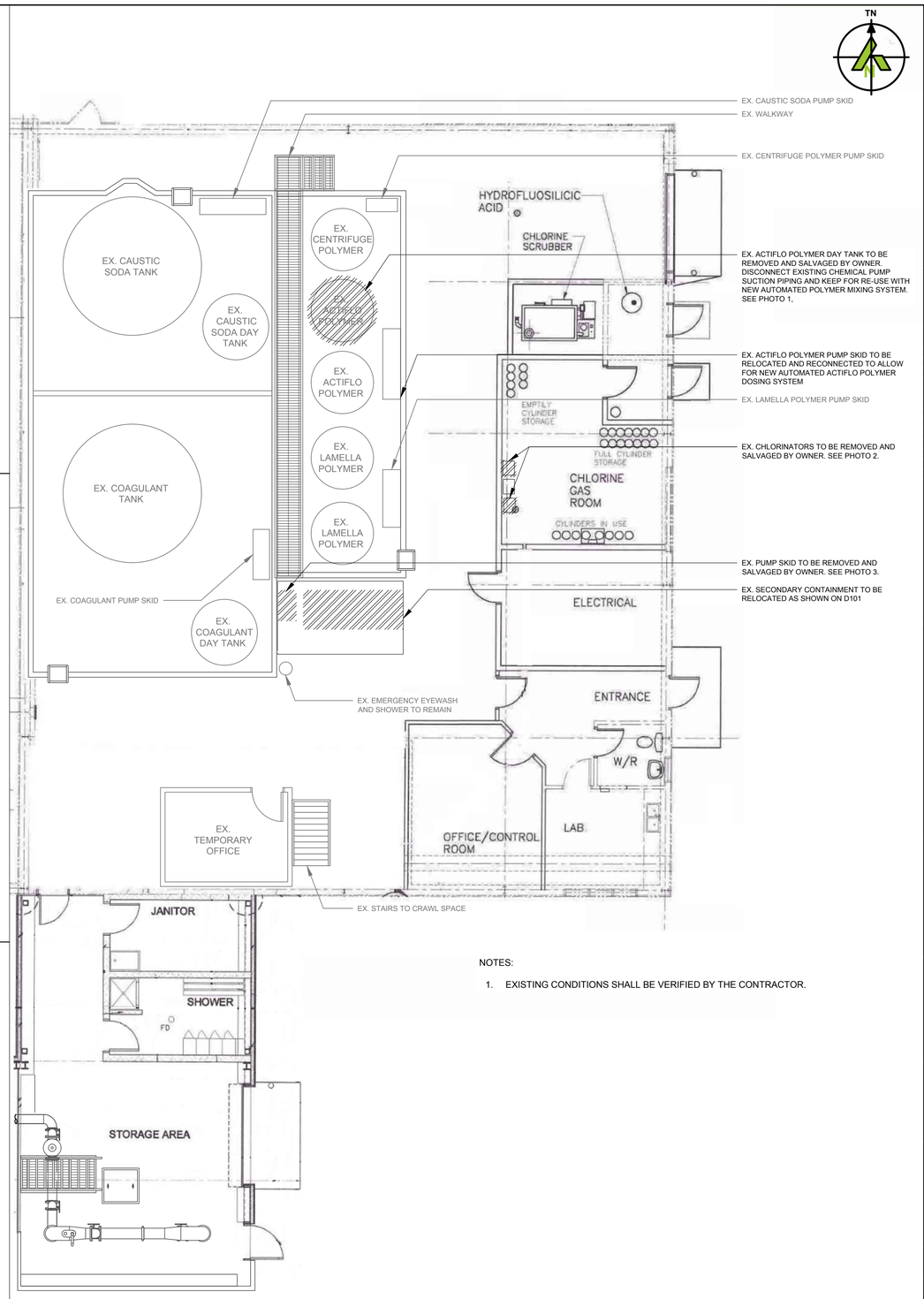


2 PHOTO 2: CHLORINATORS TO BE REMOVED
SCALE: N.T.S



EX. SECONDARY CONTAINMENT TO BE RELOCATED AS SHOWN ON D101

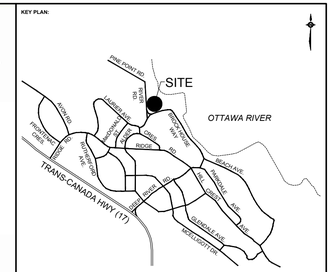
3 PHOTO 3: PUMP SKID TO BE REMOVED AND SECONDARY CONTAINMENT TO BE RELOCATED
SCALE: N.T.S



NOTES:

1. EXISTING CONDITIONS SHALL BE VERIFIED BY THE CONTRACTOR.

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
2025/10/22
A. T. SEYMOUR
100515838
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

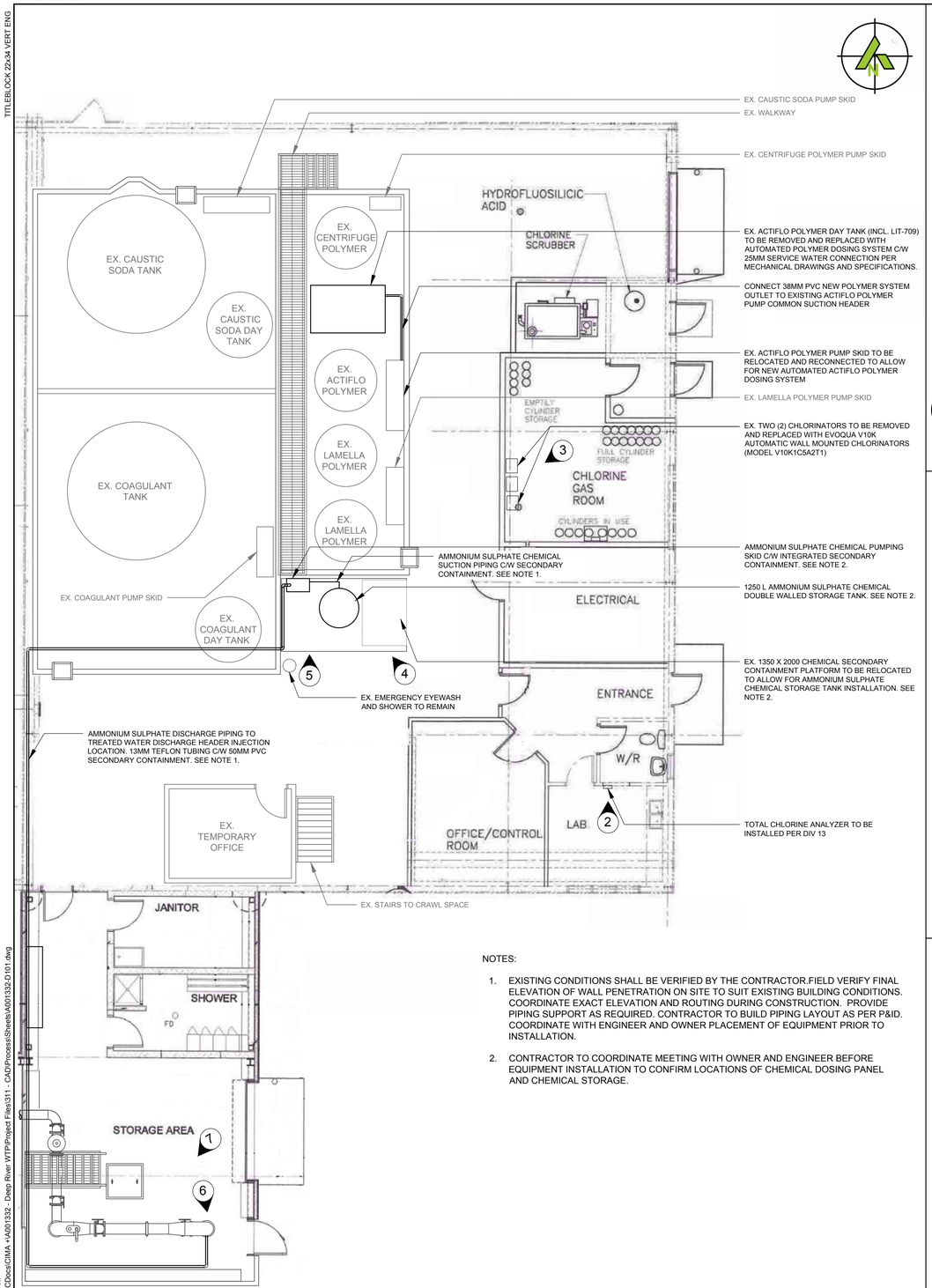
SHEET TITLE:
PROCESS REMOVALS

DISCIPLINE:
PROCESS

DRAFTER: N.P.	SCALE: 1:80
DESIGNER: A.S.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: A.S.
PROJECT No: A001332	DRAWING No: DR-001
SHEET No: 03 of 36	

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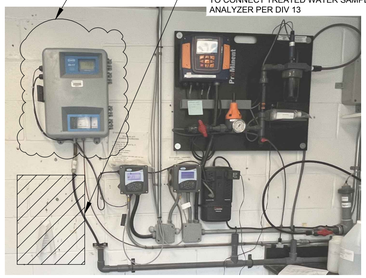
TTLB v2020.10.21
TTLEBLOCK 22x34 VERT ENG



NOTES:

1. EXISTING CONDITIONS SHALL BE VERIFIED BY THE CONTRACTOR.FIELD VERIFY FINAL ELEVATION OF WALL PENETRATION ON SITE TO SUIT EXISTING BUILDING CONDITIONS. COORDINATE EXACT ELEVATION AND ROUTING DURING CONSTRUCTION. PROVIDE PIPING SUPPORT AS REQUIRED. CONTRACTOR TO BUILD PIPING LAYOUT AS PER P&ID. COORDINATE WITH ENGINEER AND OWNER PLACEMENT OF EQUIPMENT PRIOR TO INSTALLATION.
2. CONTRACTOR TO COORDINATE MEETING WITH OWNER AND ENGINEER BEFORE EQUIPMENT INSTALLATION TO CONFIRM LOCATIONS OF CHEMICAL DOSING PANEL AND CHEMICAL STORAGE.

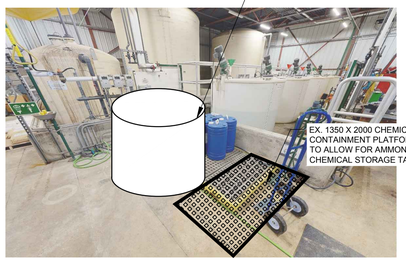
1 FLOOR PLAN
SCALE: 1:80



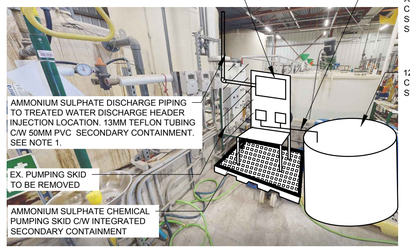
2 PHOTO 2: PROPOSED TOTAL CHLORINE ANALYZER INSTALLATION LOCATION
SCALE: N.T.S



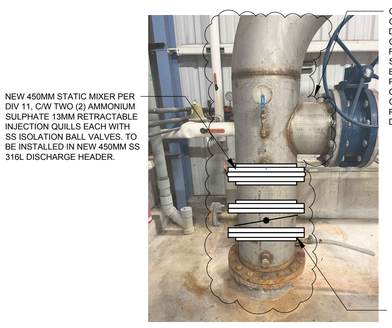
3 PHOTO 3: CHLORINATORS TO BE REPLACED
SCALE: N.T.S



4 PHOTO 4: PROPOSED AMMONIUM SULPHATE CHEMICAL STORAGE
SCALE: N.T.S



5 PHOTO 5: PROPOSED AMMONIUM SULPHATE PUMPING SKID
SCALE: N.T.S

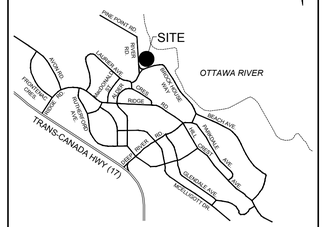


6 PHOTO 6: TREATED WATER DISCHARGE HEADER
SCALE: N.T.S



7 PHOTO 7: TREATED WATER DISCHARGE HEADER
SCALE: N.T.S

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
2025/10/22
A. T. SEYMOUR
100515838
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
FLOOR PLAN

DISCIPLINE:
PROCESS

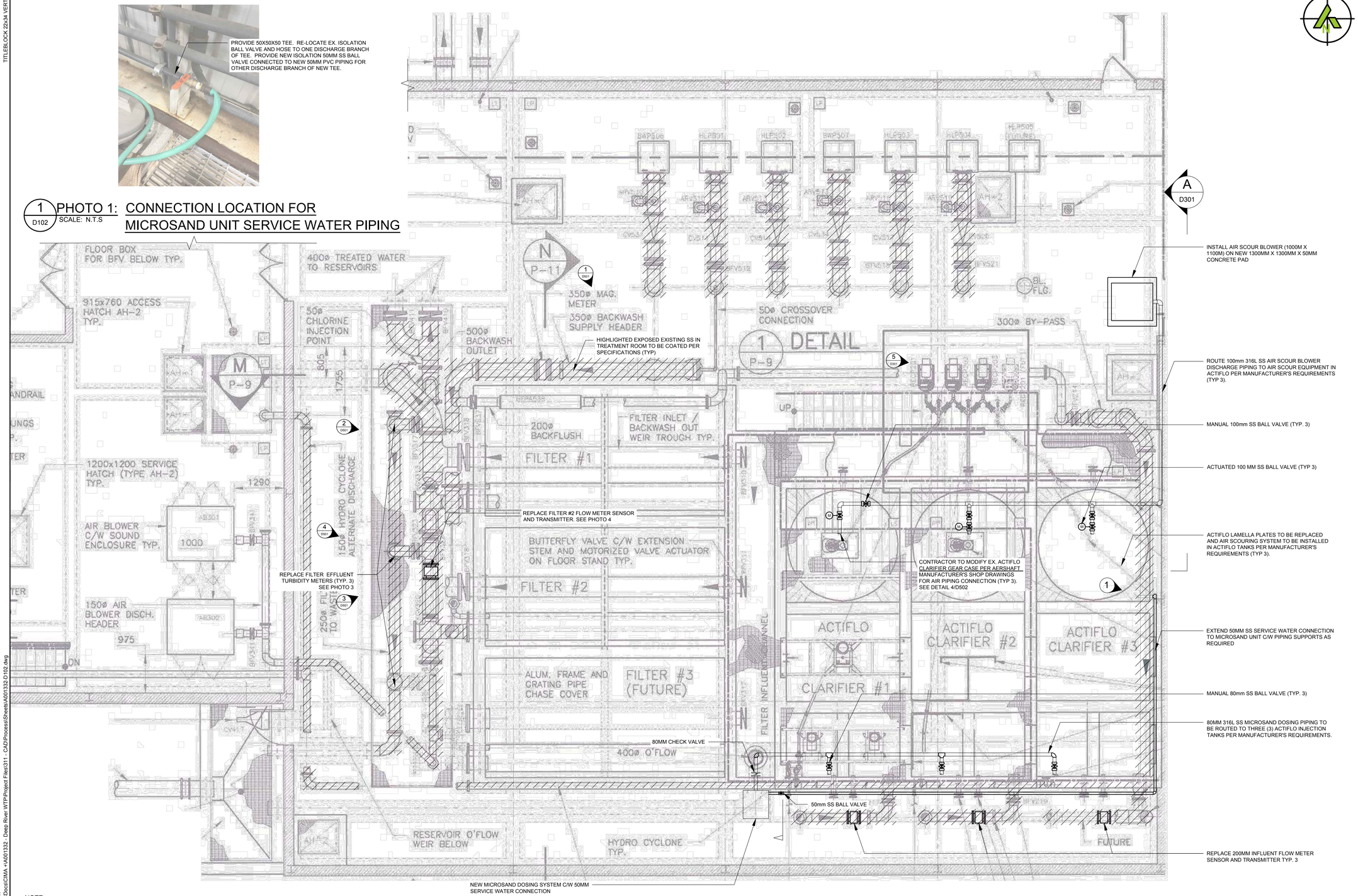
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DESIGNER: A.S.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: A.S.
PROJECT No: A001332	DRAWING No: D-101
SHEET No: 04 of 36	

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TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21

PROVIDE 50X50X50 TEE. RE-LOCATE EX. ISOLATION BALL VALVE AND HOSE TO ONE DISCHARGE BRANCH OF TEE. PROVIDE NEW ISOLATION 50MM SS BALL VALVE CONNECTED TO NEW 50MM PVC PIPING FOR OTHER DISCHARGE BRANCH OF NEW TEE.

1 / D102 PHOTO 1: CONNECTION LOCATION FOR MICROSAND UNIT SERVICE WATER PIPING
SCALE: N.T.S



NOTE:

HIGHLIGHTED EXPOSED EXISTING SS IN TREATMENT ROOM TO BE COATED PER SPECIFICATIONS (TYP)

2 / D501 FLOOR PLAN (2)
SCALE: 1:80

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
2025/10/22
A. T. SEYMOUR
100515838
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

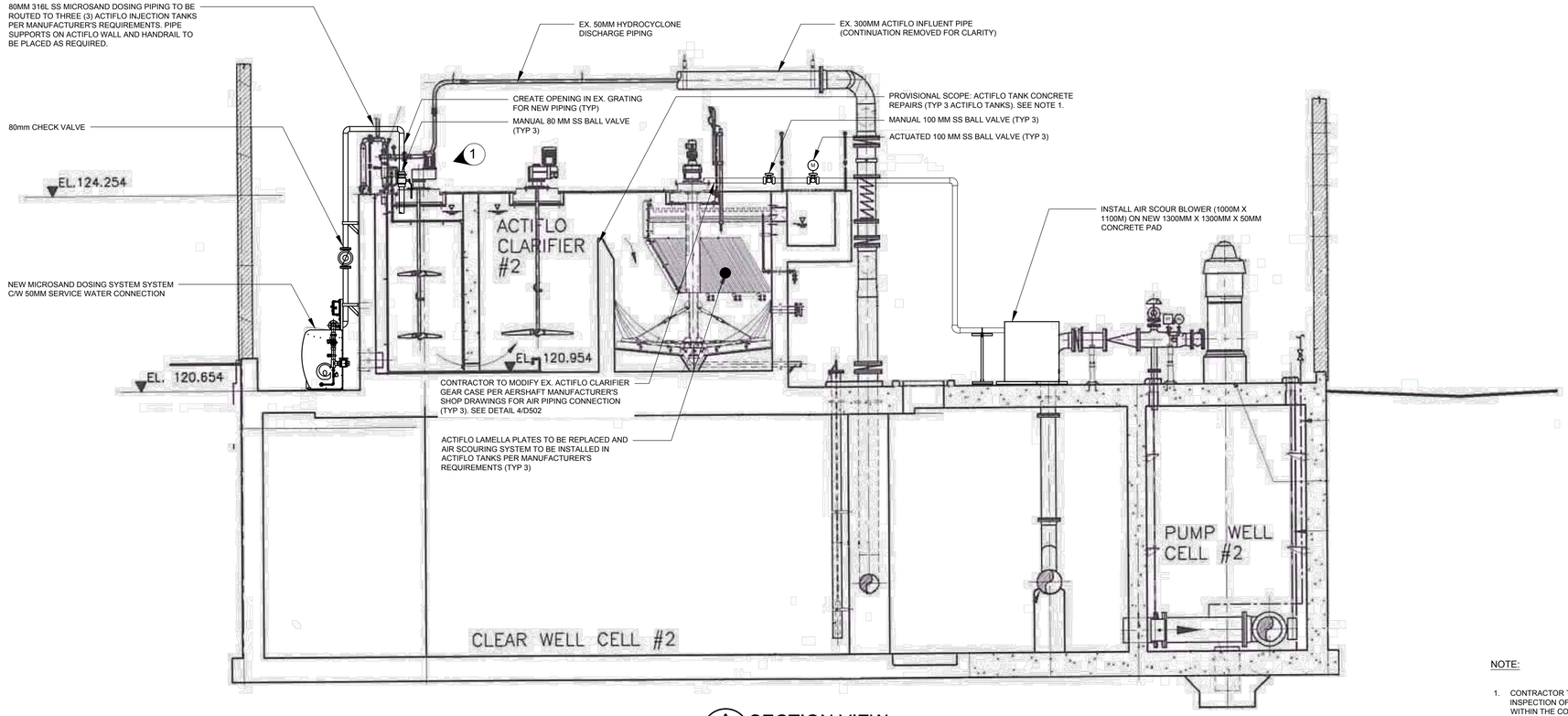
SHEET TITLE:
FLOOR PLAN (2)

DISCIPLINE:
PROCESS

DRAFTER: N.P.	SCALE: N.T.S
DESIGNER: A.S.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: A.S.
PROJECT No: A001332	DRAWING No: D-102
SHEET No: 05 of 36	

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A / D102 SECTION VIEW
SCALE: 1:50

NOTE:

1. CONTRACTOR TO ALLOW FOR ONE (1) WEEK FOR ENGINEER INSPECTION OF EACH ACTIFLO TANK'S CONCRETE WALLS WITHIN THE CONSTRUCTION SCHEDULE DURING EACH ACTIFLO TANK SHUTDOWN FOR EQUIPMENT REPLACEMENT. REQUIRED CONCRETE REPAIRS IDENTIFIED DURING THE STRUCTURAL INSPECTION SHALL BE COMPLETED BY THE CONTRACTOR DURING THE ACTIFLO TANK SHUTDOWN PER SPECIFICATIONS (PROVISIONAL SCOPE)



5 / D102 PHOTO 5: PROPOSED AIR SCOUR BLOWER AND DISCHARGE PIPING INSTALLATION
SCALE: N.T.S



1 PROPOSED MICROSAND DOSING LOCATION ADJACENT TO HYDROCYCLONE
SCALE: N.T.S

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
2025/10/22
A. T. SEYMOUR
100515838
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
SECTION VIEW AND PHOTOS

DISCIPLINE:
PROCESS

DRAFTER: N.P.	SCALE: N.T.S
DESIGNER: A.S.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: A.S.
PROJECT No: A001332	DRAWING No: D-301
SHEET No: 06 of 36	

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TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21



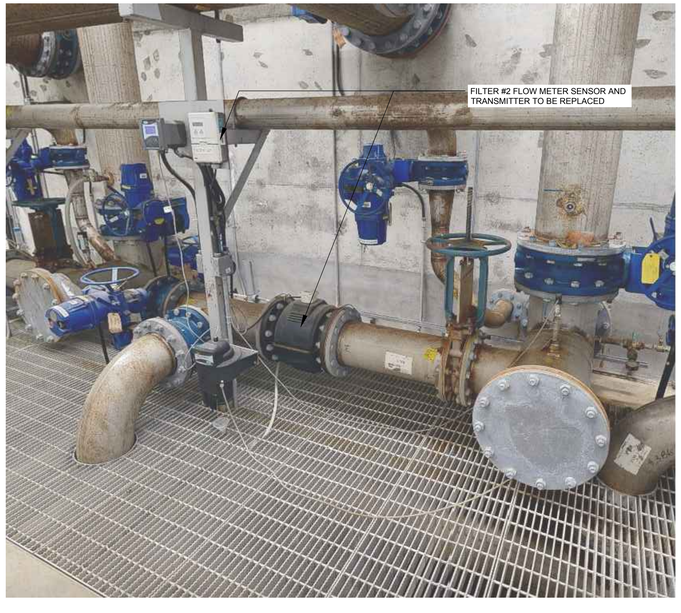
1 D102 PHOTO 1: SS PIPING TO BE COATED PER SPECIFICATIONS (TYP. FOR SS PIPING IN TREATMENT ROOM)
SCALE: N.T.S



2 D102 PHOTO 2: SS PROCESS PIPING TO BE COATED PER SPECIFICATIONS (TYP. FOR SS PIPING IN TREATMENT ROOM), TURBIDITY METER REPLACEMENT
SCALE: N.T.S

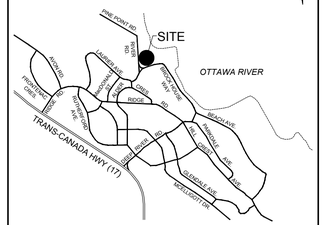


3 D102 PHOTO 3: TURBIDITY METER REPLACEMENT
SCALE: N.T.S



4 D102 PHOTO 4: FILTER #2 FLOW METER REPLACEMENT
SCALE: N.T.S

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:



DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

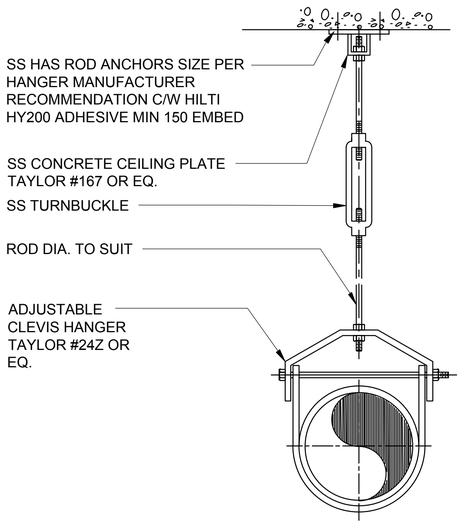
SHEET TITLE:
PHOTOS

DISCIPLINE:
PROCESS

DRAFTER: N.P.	SCALE: N.T.S
DESIGNER: A.S.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: A.S.
PROJECT No: A001332	DRAWING No: D-501
SHEET No: 07 of 36	

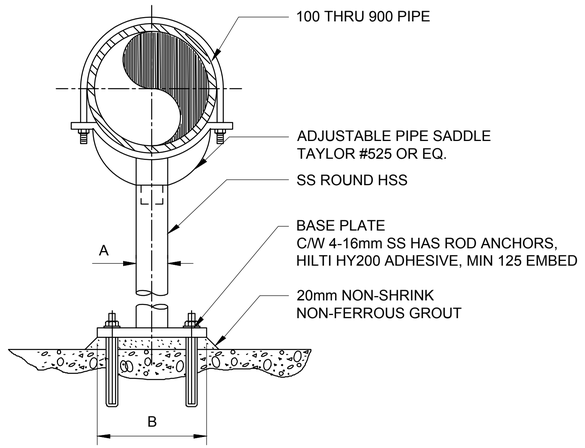
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TITLB v2020.10.21



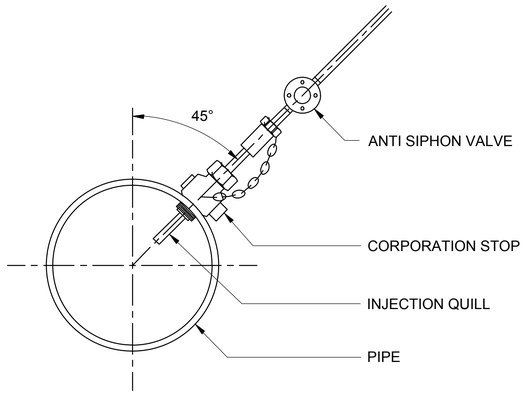
PIPE SIZE	ROD DIA.
25	10
30	10
40	10
50	10
65	12
75	12
100	16
150	20

1 - DETAIL- PIPE HANGER
SCALE: N.T.S

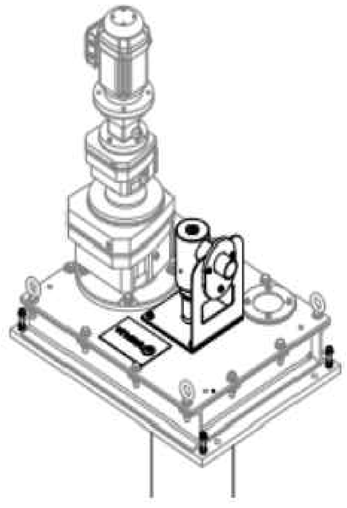


DIMENSION TABLE		
PIPE SIZE	A	B
100	75	200
150	75	200
200	75	250
250	75	250
300	75	250
350	100	250
400	100	250
450	100	250
500	150	300
550	150	300
600	150	300
650	150	300
750	150	300
800	150	300
900	200	400

2 - DETAIL- PIPE STANCHION SUPPORT
SCALE: N.T.S



3 - DETAIL- CHEMICAL INJECTION
SCALE: N.T.S



NOTE:

DETAIL SHOWN FOR ILLUSTRATION PURPOSES ONLY. CONTRACTOR TO REFER TO VEOLIA SHOP DRAWINGS FOR INSTRUCTIONS ON REQUIRED GEAR CASE MODIFICATIONS FOR THE AERSHAFT SYSTEM.

4 - DETAIL- GEAR CASE MODIFICATIONS FOR AERSHAFT SYSTEM
SCALE: N.T.S

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
2025/10/22
A. T. SEYMOUR
100515838
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
PROCESS DETAILS

DISCIPLINE:
PROCESS

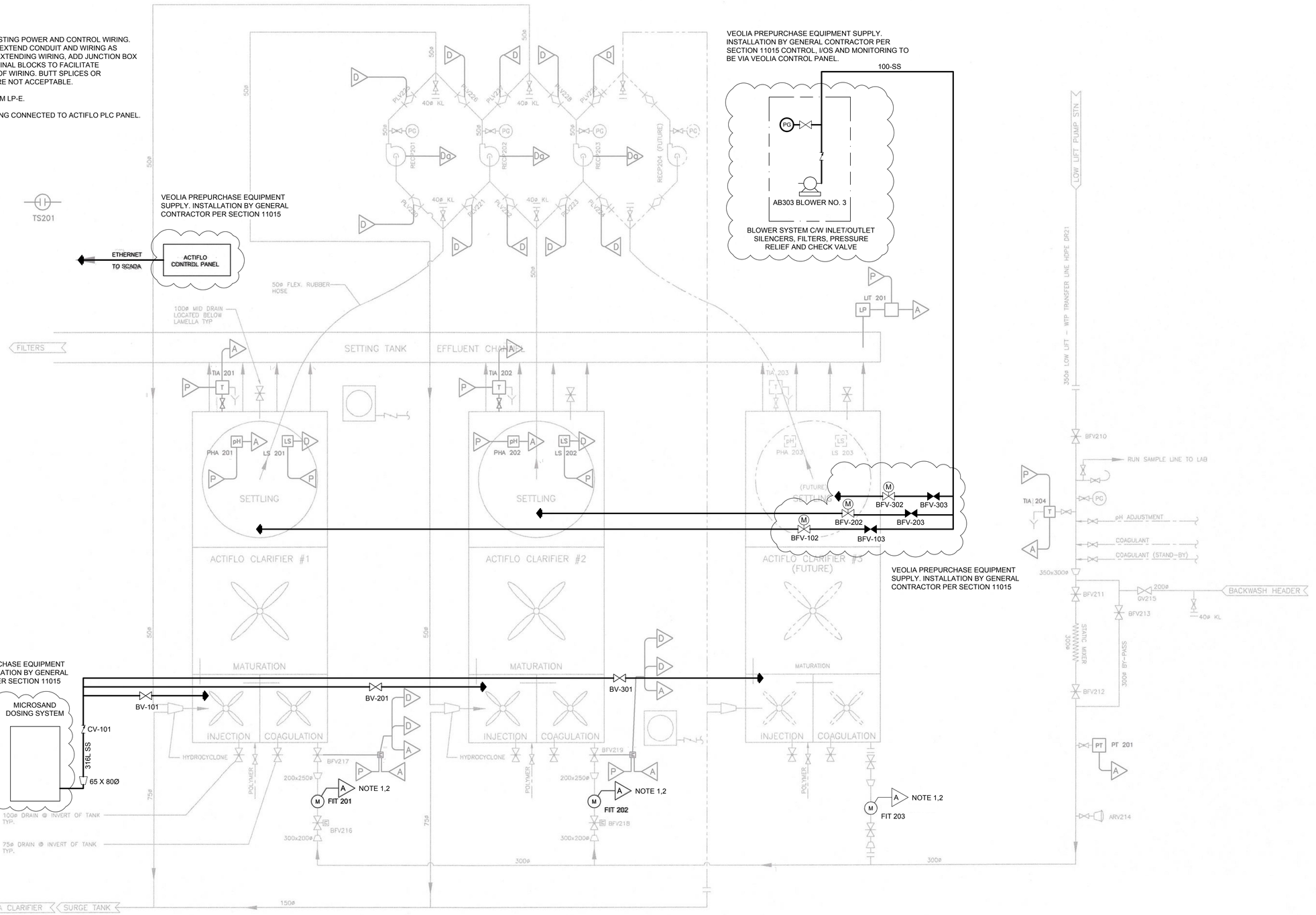
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N.P.	N.T.S
DESIGNER:	DATE:
A.S.	OCT 2025
APPROVER:	CHECKER:
A.S.	A.S.
PROJECT No:	DRAWING No:
A001332	D-502
SHEET No:	
0 of 36	

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TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21

NOTES:

1. RE-UTILIZE EXISTING POWER AND CONTROL WIRING. RE-WORK AND EXTEND CONDUIT AND WIRING AS REQUIRED. IF EXTENDING WIRING, ADD JUNCTION BOX AND USE TERMINAL BLOCKS TO FACILITATE TERMINATION OF WIRING. BUTT SPLICES OR MARRETTES ARE NOT ACCEPTABLE.
2. POWERED FROM LP-E.
3. CONTROL WIRING CONNECTED TO ACTIFLO PLC PANEL.



KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
2025/10/22
A. T. SEYMOUR
100515838
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
PROCESS INSTRUMENTATION SCHEMATIC CLARIFIERS #1 & #2

DISCIPLINE:
PROCESS

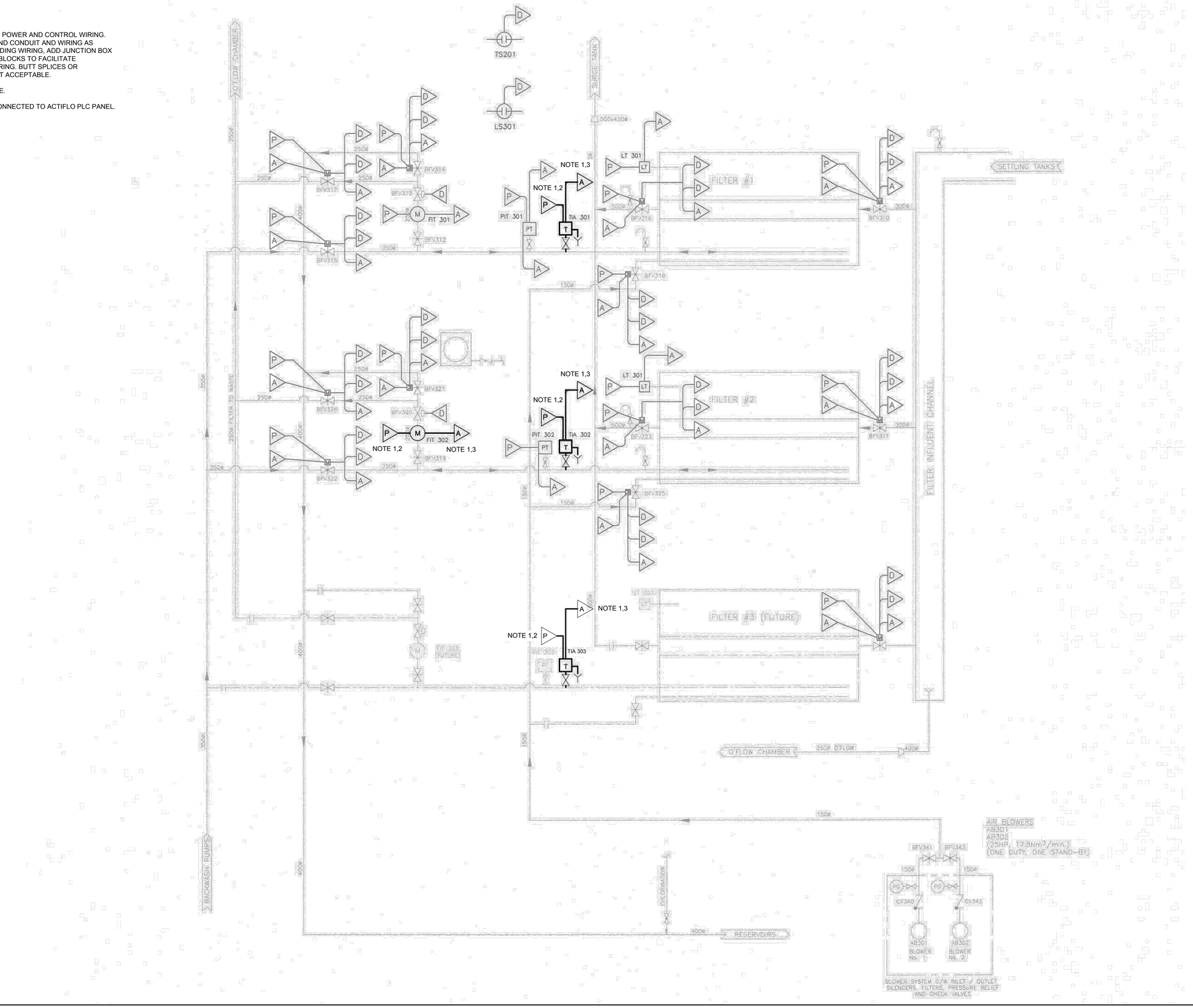
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A.S.	OCT 2025
APPROVER:	CHECKER:
A.S.	A.S.
PROJECT No:	DRAWING No:
A001332	D-601
SHEET No:	
01 of 36	

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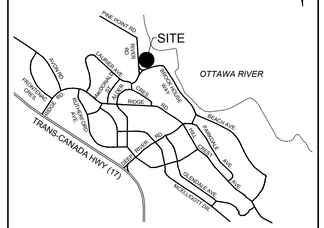
TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21

NOTES:

1. RE-UTILIZE EXISTING POWER AND CONTROL WIRING. RE-WORK AND EXTEND CONDUIT AND WIRING AS REQUIRED. IF EXTENDING WIRING, ADD JUNCTION BOX AND USE TERMINAL BLOCKS TO FACILITATE TERMINATION OF WIRING. BUTT SPLICES OR MARRETTES ARE NOT ACCEPTABLE.
2. POWERED FROM LP-E.
3. CONTROL WIRING CONNECTED TO ACTIFLO PLC PANEL.



KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
2025/10/22
A. T. SEYMOUR
100515838
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:

DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:

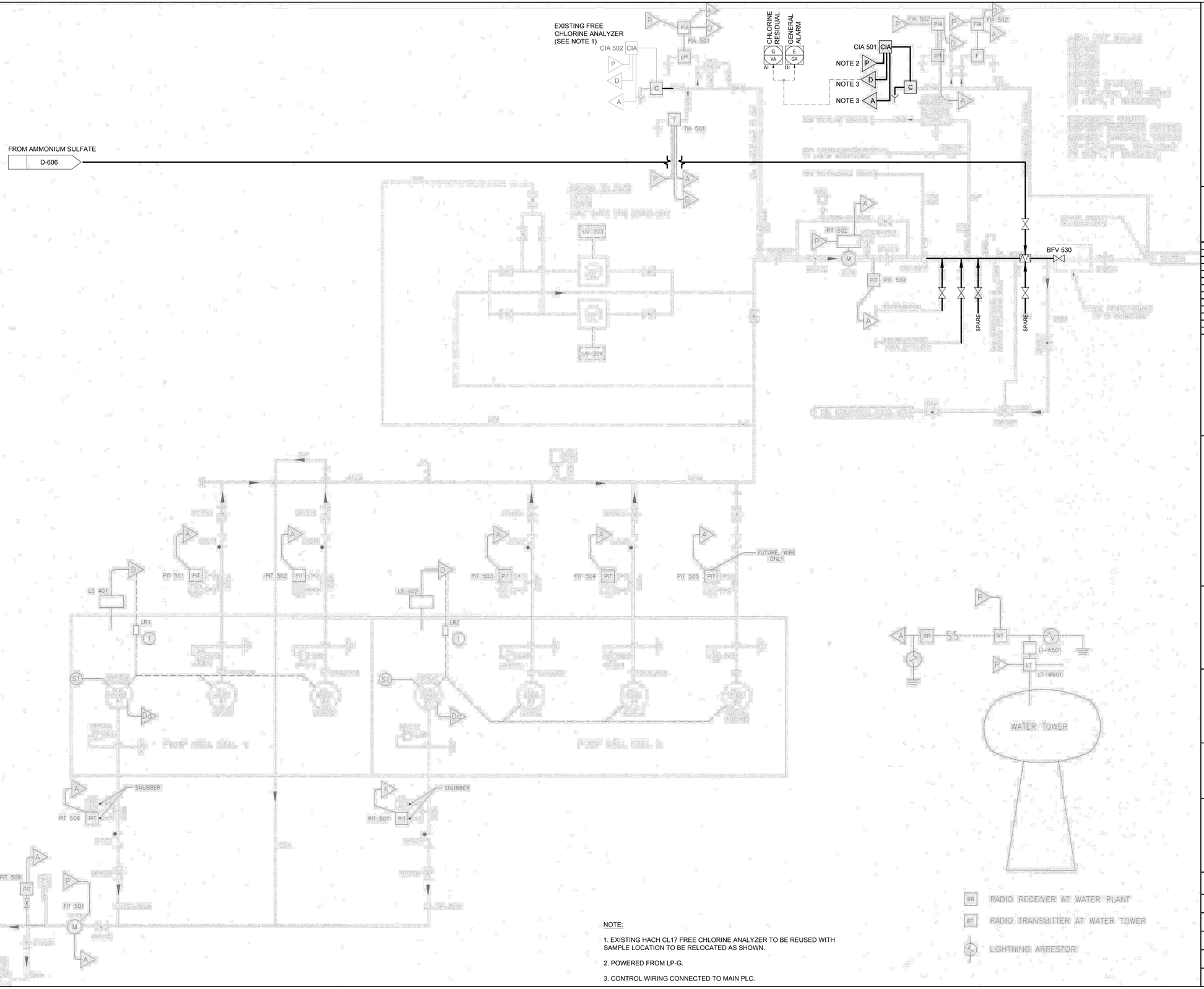
PROCESS INSTRUMENTATION SCHEMATIC RAPID SAND FILTERS

DISCIPLINE: PROCESS

DRAFTER: N.P.	SCALE: N.T.S
DESIGNER: A.S.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: A.S.
PROJECT No: A001332	DRAWING No: D-602
SHEET No: 10 of 36	

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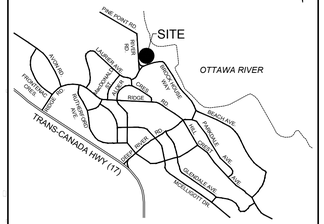
TITLEBLOCK 22x34 VERT ENG



NOTE:

1. EXISTING HACH CL17 FREE CHLORINE ANALYZER TO BE REUSED WITH SAMPLE LOCATION TO BE RELOCATED AS SHOWN.
2. POWERED FROM LP-G.
3. CONTROL WIRING CONNECTED TO MAIN PLC.

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
2025/10/22
A. T. SEYMOUR
100515838
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

PROJECT NAME:

DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:

PROCESS INSTRUMENTATION SCHEMATIC HIGH LIFT PUMPS AND BACKWASH PUMPS

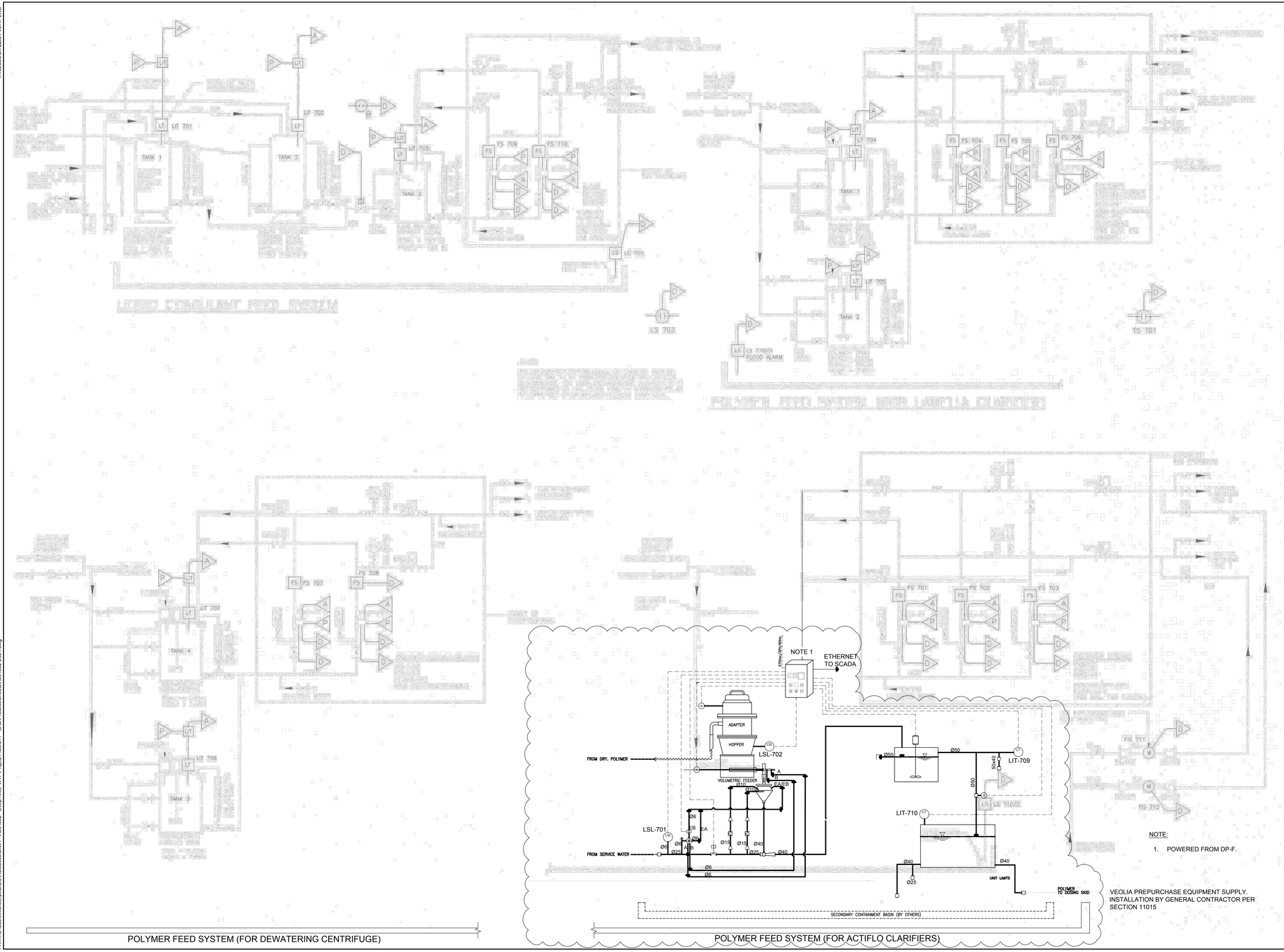
DISCIPLINE:

PROCESS

DRAFTER: N.P.	SCALE: N.T.S
DESIGNER: A.S.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: A.S.
PROJECT No: A001332	DRAWING No: D-603
SHEET No: 11 of 36	

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TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21



NOTE:

1. POWERED FROM DP-F.

VEOLIA PREPURCHASE EQUIPMENT SUPPLY, INSTALLATION BY GENERAL CONTRACTOR PER SECTION 11015

POLYMER FEED SYSTEM (FOR DEWATERING CENTRIFUGE)

POLYMER FEED SYSTEM (FOR ACTIFLO CLARIFIERS)

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
2025/10/22
A. T. SEYMOUR
100515838
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

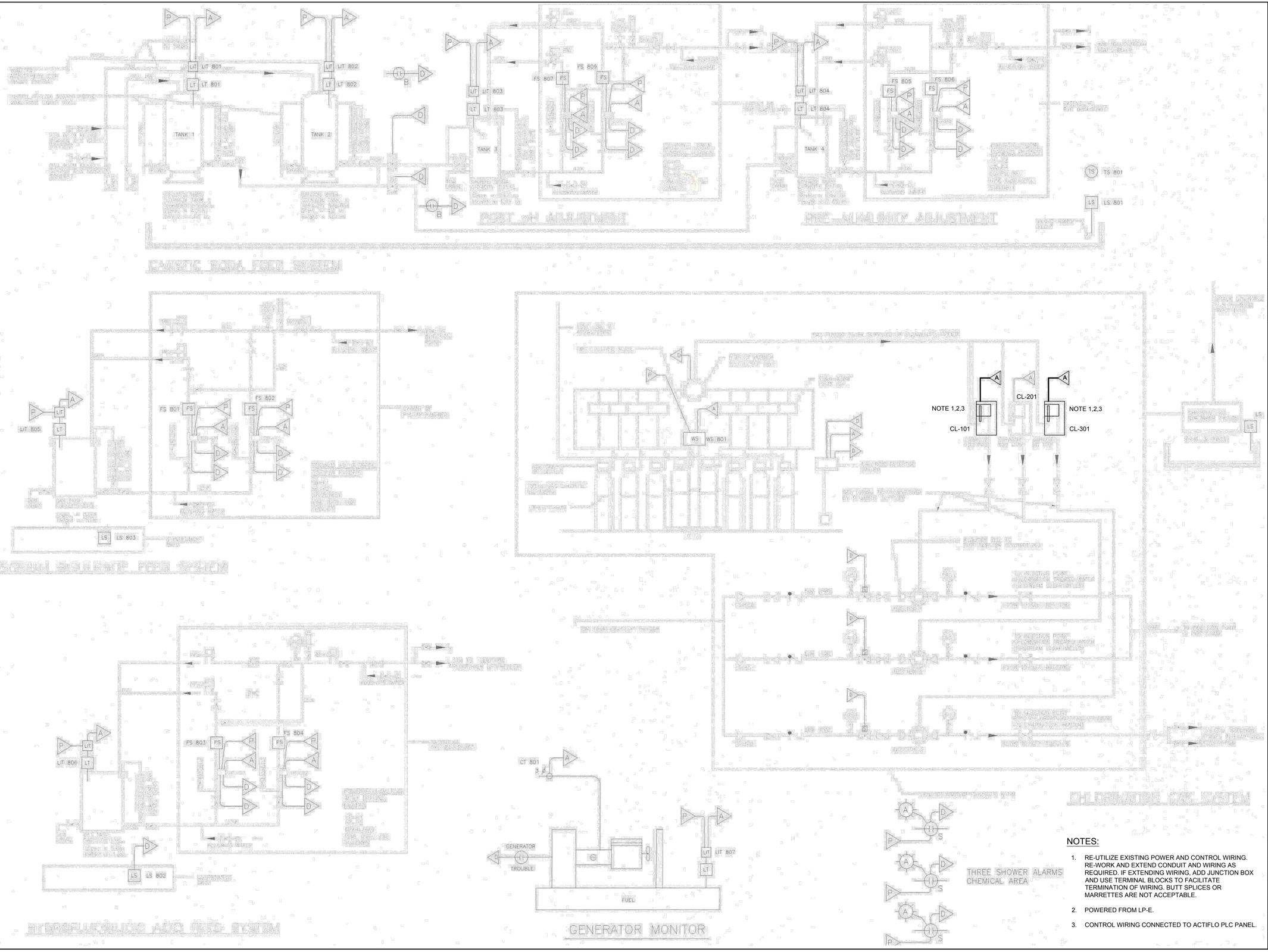
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PROCESS INSTRUMENTATION SCHEMATIC CHEMICAL SYSTEMS

DISCIPLINE: PROCESS

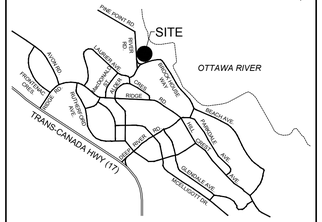
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DESIGNER: A.S.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: A.S.
PROJECT No: A001332	DRAWING No: D-604
SHEET No: 12 of 36	

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KEY PLAN:


SITE
OTTAWA RIVER
ONE TONY RD
ARCHIBALD
FRENCHETTE DRIVE
CAMBRIDGE
ROSEMARY
ROSEMARY
ROSEMARY

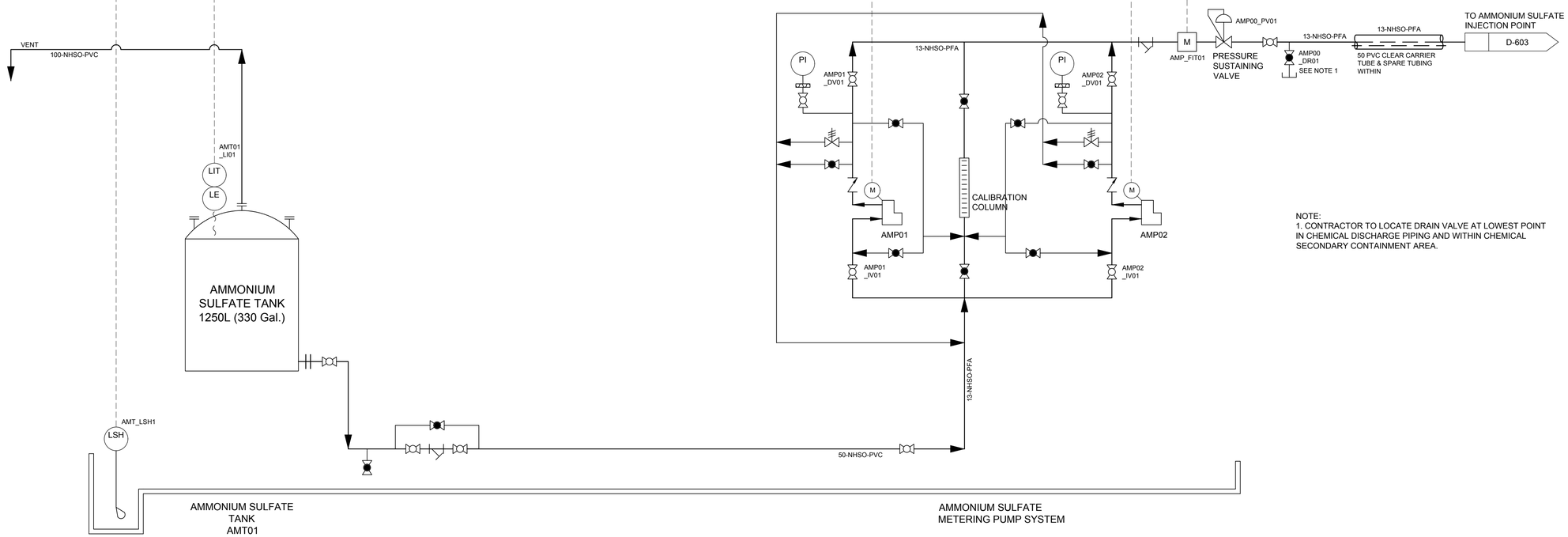
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TTLB v2020.10.21

PLC PANEL
ICP CONTROL PANEL
FIELD/VENDOR PANEL

SPILL DETECTION (LA) — DI
LEVEL INDICATION (VA) — AI
GENERAL ALARM (GA) — DI
SPEED INDICATION (VA) — AI
SPEED CONTROL (SC) — AO
START/STOP (TS) — DO
RUNNING STATUS (RS) — DI
CONTROL MODE STATUS (CM) — DI
GENERAL ALARM (GA) — DI
LEAK DETECTOR (TUBE FAILURE) (LA) — DI
SPEED INDICATION (VA) — AI
SPEED CONTROL (SC) — AO
START/STOP (TS) — DO
RUNNING STATUS (RS) — DI
CONTROL MODE STATUS (CM) — DI
GENERAL ALARM (GA) — DI
LEAK DETECTOR (TUBE FAILURE) (LA) — DI
FLOW INDICATION (VA) — AI
GENERAL ALARM (GA) — DI

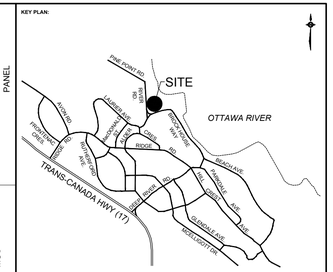
ICP CHEM

PLC PANEL
MCC
FIELD/VENDOR PANEL



NOTE:
1. CONTRACTOR TO LOCATE DRAIN VALVE AT LOWEST POINT IN CHEMICAL DISCHARGE PIPING AND WITHIN CHEMICAL SECONDARY CONTAINMENT AREA.

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
2025/10/22
A. T. SEYMOUR
100515838
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
PROCESS INSTRUMENTATION SCHEMATIC AMMONIUM SULPHATE CHEMICAL SYSTEMS

DISCIPLINE: PROCESS

DRAFTER: N.P.	SCALE: N.T.S
DESIGNER: A.S.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: A.S.
PROJECT No: A001332	DRAWING No: D-606
SHEET No: 14 of 36	

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TITLEBLOCK-22x34 VERT ENG

GENERAL NOTES:

CONDITIONS OF CONTRACT

1. THE OWNER'S INSTRUCTIONS TO BIDDERS AND THE GENERAL CONDITIONS OF THE DESIGNER'S SPECIFICATIONS ARE AN INTEGRAL PART OF THIS CONTRACT AND SHALL BE READ IN CONJUNCTION HEREWITH. THESE INSTRUCTIONS TO BIDDERS AND GENERAL CONDITIONS SHALL BE FULLY BINDING ON THE GENERAL CONTRACTOR AND THEIR SUBCONTRACTORS TO THE FULL SATISFACTION OF THE DESIGNER, ENGINEER AND PROJECT MANAGER.

2. THE RESPONSIBILITY AND SCOPE OF EACH SUB-TRADE RESTS SOLELY WITH THE CONTRACTOR. EXTRAS WILL NOT BE CONSIDERED BASED ON THE GROUNDS OF DIFFERENCE IN INTERPRETATION OF SPECIFICATIONS AND DRAWINGS AS TO WHICH TRADE INVOLVED SHALL PROVIDE CERTAIN SPECIALTIES OR MATERIALS.

3. IT IS A CONDITION OF THIS CONTRACT, THAT THE CONTRACTOR WILL, IN THE PERFORMANCE OF THE SERVICES FOR THE PROJECT MANAGER AS DESCRIBED IN THIS CONTRACT, PERFORM WORK IN ACCORDANCE WITH ONTARIO BUILDING CODE LATEST EDITION, THE ONTARIO HYDRO ELECTRICAL SAFETY CODE, THE SEWAGE SYSTEMS ENVIRONMENTAL PROTECTION ACT ONTARIO INCLUDING DISPOSAL OF WASTE, WORKPLACE HAZARDOUS MATERIAL INFORMATION SYSTEM (WHMIS), THE ONTARIO GAS UTILIZATION CODE, AND ANY OTHER CODE OF PROVINCIAL OR LOCAL APPLICATION, INCLUDING HOURS OF WORK, RATES OF PAY, JOB SAFETY AND ALL OTHER MATTERS IN WHICH THE MUNICIPAL OR FEDERAL AUTHORITIES HAVE JURISDICTION, PROVIDED THAT IN ANY CASE OF CONFLICT OR DISCREPANCY, THE MORE STRINGENT REQUIREMENTS SHALL APPLY.

4. CLOSEOUT DOCUMENTS INCLUDING O&M MANUALS, AS-BUILT DRAWINGS, APPROVED AIR & HYDRONIC TAB REPORTS, SEISMIC LETTERS, NFPA LETTERS, ETC. SHALL CONSTITUTE 5% OF THE TOTAL MECHANICAL CONSTRUCTION COST AND SHALL BE APPROVED AS A SINGLE LUMP SUM LINE ITEM AFTER SUBMISSION TO AND FINAL ACCEPTANCE BY ENGINEER. CONTRACTOR TO INDICATE COST AS A SEPARATE LINE ITEM IN PROGRESS BILLING.

6. ALTERNATE MATERIAL TO BE APPROVED BY ADDENDUM ONLY. SUBMIT TO BOARD FOR REVIEW NO LATER THAN 7 DAY CALENDAR DAYS PRIOR TO TENDER CLOSE. ALTERNATE TO BE APPROVED BY ADDENDUM IF DEEMED ACCEPTABLE.

7. ALL MECHANICAL EQUIPMENT TO BE SUPPLIED WITH MANUFACTURER INSTALLED DISCONNECTS.

8. INSTALL ALL MECHANICAL EQUIPMENT AND APPURTENANCES IN ACCORDANCE WITH MANUFACTURERS' RECOMMENDATIONS, CONTRACT DOCUMENTS, AND APPLICABLE CODES AND REGULATIONS.

9. COMPLY WITH STANDARD FOR BUILDING CONSTRUCTION OPERATIONS, ISSUED BY THE ONTARIO FIRE MARSHALS OFFICE AND ALL APPLICABLE FIRE SAFETY CODES, LAWS, AND REGULATIONS.

10. IT IS INCUMBENT UPON THE CONTRACTOR TO INFORM ITSELF OF ANY SUCH LEGISLATION AND THE CONTRACTOR AGREES THAT IN THE EVENT OF NON- COMPLIANCE WITH THIS LEGISLATION, IT WILL INDEMNIFY AND HOLD HARMLESS THE OWNER FROM ANY COSTS AND DAMAGES RESULTING FROM SUCH NON-COMPLIANCE.

11. ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH STANDARDS OF GOOD PRACTICE SUCH AS, BUT NOT LIMITED TO, SMACNA AND ASHRAE, MEET OR EXCEED REQUIREMENTS OF CONTRACT DOCUMENTS, SPECIFIED STANDARDS, CODES AND REFERENCED DOCUMENTS DESCRIBED IN THESE INSTRUCTIONS.

12. THE WORD "PROVIDE" SHALL MEAN SUPPLY AND INSTALL.

13. ALL MATERIALS AND EQUIPMENT TO BE NEW AND FREE FROM DEFECTS, GUARANTEE IN WRITING, INCLUDING THE MANUFACTURERS WARRANTEE, THE MATERIAL AND WORKMANSHIP, FOR A PERIOD OF ONE YEAR AFTER ACCEPTANCE.

14. EMPLOY SERVICES OF THE BUILDINGS CONTROL CONTRACTOR AND PAY ALL COSTS TO REMOVE AND REINSTATE CONTROL SYSTEM. COMMISSION SYSTEM OPERATION AND ALL SEQUENCE OF OPERATIONS AFTER INSTALLMENT. SEE SPECIFICATION FOR DETAILS. LOW VOLTAGE WIRING TO BE PERFORMED BY MECHANICAL CONTRACTOR. CONTROL WIRE AND CONDUIT SHALL COMPLY WITH THE CANADIAN ELECTRIC CODE AND THIS SPECIFICATION.

EXAMINATION OF WORK

15. DRAWINGS INDICATE APPROXIMATE LOCATION OF EQUIPMENT AND SERVICES. PERFORM SITE MEASUREMENTS PRIOR TO INSTALLATION. DO NOT SCALE DRAWINGS.

16. TO AVOID INTERFERENCE, CLOSELY COORDINATE INSTALLATION OF MECHANICAL SERVICES AND EQUIPMENT WITH OTHER TRADES. ADVISE OF ANY POSSIBLE INTERFERENCE IN TIMELY FASHION. DO NOT PROCEED WITH SYSTEM OR EQUIPMENT INSTALLATION WITHOUT ENGINEER INSTRUCTION. IN CASE THAT SYSTEM HAS TO BE RELOCATED WITHIN 1.5m RADIUS FROM ANTICIPATED LOCATION, NO ADDITIONAL CHARGE OR CREDIT WILL BE EXPECTED OR APPROVED.

INTENT

1. IT IS THE INTENT OF THIS SPECIFICATION AND DRAWINGS TO PROVIDE FOR A COMPLETE AND FULLY OPERATING SYSTEM IN COMPLETE ACCORD WITH ALL APPLICABLE CODES. THESE DOCUMENTS MAY NOT SHOW OR DESCRIBE EACH AND EVERY ITEM REQUIRED FOR THE COMPLETE INSTALLATION; THEREFORE, THE CONTRACTOR SHALL MAKE PROVISIONS FOR ALL LABOUR, MATERIAL AND EQUIPMENT DEEMED NECESSARY TO COMPLETE THE WORK INDICATED OR REASONABLY IMPLIED ON ALL DRAWINGS.

LIABILITY

1. THIS CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR LAYING OUT THEIR WORK AND FOR ANY DAMAGE OR EXTRA COSTS CAUSED TO THE OWNER OR OTHER CONTRACTORS BY IMPROPER LOCATION OR CARRYING OUT OF WORK. CARRY ALL NECESSARY INSURANCE COVERAGE.

PERMITS, CERTIFICATES, FEES, ETC.

1. GIVE ALL NOTICES, OBTAIN ALL PERMITS AND PAY ALL FEES SO THAT THE WORK SPECIFIED HEREIN MAY BE CARRIED OUT, EXCEPT FOR BUILDING AND OCCUPANCY PERMITS WHICH WILL BE OBTAINED BY THE GENERAL CONTRACTOR AT THE ENGINEER'S REQUEST, FURNISH ANY CERTIFICATES AS EVIDENCE THAT THE WORK INSTALLED CONFORMS WITH THE LAWS AND REGULATIONS OF ALL AUTHORITIES HAVING JURISDICTION.

GUARANTEE

1. THE CONTRACTOR, AS A CONDITION PRECEDENT TO FINAL PAYMENT AFTER COMPLETION OF THIS WORK, SHALL GIVE THE OWNER A WRITTEN GUARANTEE WARRANTING ALL APPARATUS FURNISHED UNDER THE CONTRACT TO REMAIN IN PERFECT SERVICEABLE CONDITION FOR A PERIOD OF ONE YEAR FROM THE DATE OF SUBSTANTIAL PERFORMANCE OF THEIR WORK AS ESTABLISHED BY THE PROJECT MANAGER AND ENGINEER.

DOCUMENTS REQUIRED

1. MAINTAIN AT JOB SITE ONE COPY OF EACH OF THE FOLLOWING DOCUMENTS:
   - 1.1. SPECIFICATIONS,
   - 1.2. ADDENDA,
   - 1.3. CHANGE ORDERS,
   - 1.4. OTHER MODIFICATIONS TO CONTRACT,
   - 1.5. FIELD TEST REPORTS,
   - 1.6. AND MANUFACTURERS INSTALLATION AND APPLICATION INSTRUCTIONS.

EXTRA WORK

1. ALL INCIDENTAL WORK REQUIRED TO COMPLETE THIS PROJECT SHALL BE THE FULL RESPONSIBILITY OF THE CONTRACTOR. WHEN ADDITIONAL WORK IS REQUIRED, A QUOTE WILL BE REQUESTED IN THE FORM OF A CONTEMPLATED CHANGE NOTICE (CCN) FROM THE CONTRACTOR. THIS QUOTE WILL BE SUBMITTED TO THE PROJECT MANAGER WITHIN FIVE (5) DAYS OF THE REQUEST, TO AVOID DELAYS IN THE PERFORMANCE OF THE WORK REQUIRED. QUOTE TO INCLUDE ITEMIZED MATERIAL AND LABOR BREAKDOWN.

2. MATERIAL WILL BE PRICED AT THE CONTRACTORS COST. COPIES OF SUPPLIERS INVOICES WILL BE REQUIRED TO SUBSTANTIATE MATERIAL COSTS WHEN REQUESTED.

3. LABOUR WILL BE PRICED ON ACTUAL NUMBERS OF HOURS SPENT TO PERFORM EXTRA WORK. TIMESHEET LOG SIGNED BY SITE SUPERVISOR MAY BE REQUESTED TO SUBSTANTIATE LABOUR HOURS.

4. THE AMOUNT OF MARKUP ALLOWED FOR PROFIT AND OVERHEAD WILL BE IN ACCORDANCE WITH THOSE STATED IN THE CONTRACT DOCUMENTS WITH THE TENDER. THE CCN BREAKDOWN FORM REFERRED TO IN ITEM 1 ABOVE IS TO BE MODIFIED TO REFLECT THE ALLOWED PROFIT AND OVERHEAD STATED IN THE CONTRACT DOCUMENTS.

5. NO WORK IS TO BE PERFORMED BY THE CONTRACTOR WITHOUT WRITTEN APPROVAL OF THE PROJECT MANAGER. ANY REQUEST FROM OTHERS MUST BE DIRECTED TO THE PROJECT MANAGER FOR APPROVAL.

AS-BUILT AND RECORD DRAWINGS

1. KEEP IN THE JOB OFFICE AN EXTRA TWO (2) SETS OF WHITE PRINTS AND SPECIFICATIONS ON WHICH ALL CHANGES AND DEVIATIONS SHALL BE RECORDED, AS THEY OCCUR, ONTO ONE (1) SET. AT COMPLETION OF THE PROJECT, TRANSFER ALL CHANGES TO THE SECOND, CLEAN SET OF "AS-BUILT" DRAWINGS AND TURN THESE OVER TO THE ENGINEER WHO WILL PROVIDE THE PROJECT MANAGER A CAD SET OF "RECORD" DRAWINGS.

SHOP DRAWINGS

1. BEFORE FABRICATION OR DELIVERY OF ANY MATERIALS OR EQUIPMENT, SUBMIT ONE (1) COMPLETE SET OF SHOP DRAWINGS AND DATA SHEETS COVERING ALL ITEMS OF EQUIPMENT FURNISHED AND INTENDED FOR INSTALLATION UNDER THIS CONTRACT FOR APPROVAL BY THE ENGINEER IN ELECTRONIC PDF FORMAT. HARD COPY SHOP DRAWINGS WILL NOT BE ACCEPTED.

CLOSEOUT DOCUMENTATION REQUIRED BY CONTRACTOR

1. TWO (2) SETS OF HARDCOPY IN THREE RING BINDERS AS WELL AS AN ELECTRONIC COPY OF THE FOLLOWING:
   - 1.1. O & M MANUALS.
   - 1.2. AS-BUILT DRAWINGS.
   - 1.3. AIR BALANCING REPORT.
   - 1.4. ELECTRICAL HYDRO CERTIFICATE.
   - 1.5. SEISMIC LETTERS
   - 1.6. MANUFACTURER START-UP REPORTS.

GENERAL SPECIFICATIONS:

HVAC:

1. DUCTWORK:
   - .1 GENERAL:
     - .1 DETAILS, CONSTRUCTION AND MATERIALS HEREIN SHALL BE AS PER SMACNA STANDARDS AND MANUFACTURER INSTRUCTIONS.
   - .2 ALL GALVANIZED DUCTWORK INDICATED TO BE FABRICATE FROM 0.2% COPPER CONTENT GALVANIZED SHEET STEEL WITH 1-1/4 CLASS ZINC COATING.
   - .3 RECTANGULAR AND FITTINGS:
     - .1 GALVANIZED SHEET STEEL NOT LESS THAN THE FOLLOWING THICKNESS:
       - .1 24 GA. - 750MM (30") WIDE AND SMALLER.
     - .2 THE FIRST 3M OF SUPPLY AND RETURN DUCTWORK CONNECTED TO ROOFTOP AND AIR HANDLING UNITS SHALL BE MINIMUM 16 GAUGE, ACOUSTIC LINED.
   - .4 ROUND DUCT AND FITTINGS SHALL BE SPIRAL GALVANIZED STEEL MEETING THE ASTM A-527-71 & NOT LESS THAN THE FOLLOWING THICKNESS:
     - .1 26 GA. - 75MM TO 350MM (3" TO 14")DIA.
     - .2 24 GA. - 350MM (14") DIA. & LARGER.
   - .5 SEAL CLASSIFICATION: SMACNA SEAL CLASS A.
   - .6 DUCTWORK IN CHLORINE AND HYDROFLUOSILICIC ACID ROOMS TO BE PVC, SYSTEM 15.

2. IDENTIFICATION DUCTWORK SYSTEMS:
   - .1 2" HIGH STENCILLED LETTERS AND DIRECTIONAL ARROWS 6" LONG X 2" HIGH.
   - .2 COLOURS: BLACK, OR CO-ORDINATED WITH BASE COLOUR TO ENSURE STRONG CONTRAST.

3. BACKDRAFT DAMPER:
   - .1 MULTI-LEAF,PARALLEL BLADE TYPE.
   - .2 EXTRUDED ALUMINUM INTERLOCKING BLADES, VIBRATION FREE
   - .3 ACCEPTABLE MATERIAL: TAMCO, NAILOR OR EQUAL

4. LOUVRES:
   - .1 GENERAL:
     - .1 SIZE AS PER DRAWINGS.
     - .2 CONSTRUCTION:
       - .1 LOUVRE TO BE DRAINABLE TYPE.
       - .2 MADE FROM 6063-T3 EXTRUDED ALUMINUM.
       - .3 LOUVRES TO BE FITTED WITH 1/2" ALUMINUM BIRD SCREEN. BIRD SCREEN TO MOUNTED ON INTERIOR OF LOUVRE FACE.
       - .4 ACCEPTABLE MANUFACTURERS: E.H. PRICE DE439, TAMCO, OR APPROVED EQUAL.

5. EXHAUST FAN EF-1:
   - .1 FAN HOUSING CONSTRUCTION OF CORROSION RESISTANT PLASTIC HOUSING.
   - .2 UNIT TO BE SUPPLIED WITH MANUFACTURER SUPPLIED DISCONNECTS.
   - .3 WALL BRACKET TO BE STAINLESS STEEL, 11 GAUGE 304 STAINLESS STEEL.
   - .4 ACCEPTABLE MATERIAL: PLASTEC JET 20 OR APPROVED EQUAL.

6. UNIT HEATER (UH-1):
   - .1 NATURAL GAS, DIRECT VENT UNIT HEATERS, 82% EFFICIENCY.
   - .2 CONSTRUCTION:
     - .1 TITANIUM-STABILIZED ALUMINIZED-STEEL HEAT EXCHANGER
     - .2 HINGED ACCESS DOOR PANEL WITH QUARTER-TURN LATCH.
     - .3 STEEL CABINET WITH REMOVABLE FRONT FACE.
     - .4 FOUR-POINT SUSPENSION.
   - .3 ELECTRICAL: 120V/1PH/60Hz WITH REMOTE THERMOSTAT C/W BUILT IN DISCONNECT SWITCH.
   - .4 ACCEPTABLE MATERIAL: REZNOR NORTEK GLOBAL OR APPROVED EQUAL.

7. EMERGENCY EYE WASH STATION:
   - .1 TYPE 304 STAINLESS STEEL PIPING AND FITTINGS WITH CAST STAINLESS STEEL FLOOR FLANGE.
   - .2 LAMINAR INVERTED DIRECTIONAL FLOW.
   - .3 TYPE 316 STAINLESS STEEL BALL VALVE
   - .4 INTEGRAL 3.7 GPM FLOW CONTROL
   - .5 STAINLESS STEEL 11" ROUND BOWL WITH A YELLOW PLASTIC DUST COVER.
   - .6 ACCEPTABLE MATERIAL: HAWS MODEL 7777 OR APPROVED EQUAL.

8. COMBINATION EMERGENCY EYE WASH/SHOWER:
   - .1 CORROSION-RESISTANT PVC PLASTIC COMBINATION SHOWER AND EYE/FACE WASH
   - .2 LAMINAR INVERTED DIRECTIONAL FLOW EYEWASH.
   - .3 TYPE 316 STAINLESS STEEL BALL VALVE
   - .4 INTEGRAL 3.7 GPM FLOW CONTROL
   - .5 PLASTIC 11" ROUND BOWL WITH A YELLOW PLASTIC DUST COVER.
   - .6 PLASTIC SHOWERHEAD WITH 20 GPM FLOW CONTROL
   - .7 GREEN EPOXY FINISH, SCHEDULE 80 PVC 2 1/2" FLOOR FLANGE, SCHEDULE 80 PVC PLASTIC VERTICAL PIPING, UNIVERSAL SIGN, 1-1/4" IPS SUPPLY, AND 1-1/2" SLIP WASTE.
   - .8 ACCEPTABLE MATERIAL: HAWS MODEL 8336 OR APPROVED EQUAL.

9. FORCE FLOW HEATERS:
   - .1 HEATER TO BE DESIGNED FOR HIGH CORROSION AREAS, HYDRONIC HEATED.
   - .2 ACCEPTABLE MATERIAL: ENGINEERED AIR, SIGMA, ROSEMEX, OR APPROVED EQUAL.

10. DEHUMIDIFICATION UNIT:
    - .1 CABINET
      - .1 CABINET CONSTRUCTION: ALL CABINET 16, 20 AND 24 GAUGE SHEET METAL SHALL BE GALVANIZED G90 STEEL OR GALVALUMETM ALLOY WITH MILL-APPLIED ZINC PHOSPHATE PRIMER FOLLOWED BY AN EXTERIOR GRADE WHITE SILICONE MODIFIED POLYESTER TOP COAT. THE SHEET METAL IS ENGINEERED TO FORM A CABINET WITH MAXIMUM STRENGTH AND RIGIDITY. ALL SEAMS SHALL BE CAULKED WITH SILICONE TO PREVENT AIR AND WATER LEAKAGE OR INFILTRATION
        - .1 BASE RAILS: THE CABINET SHALL HAVE A BASE FRAME COMPRISED OF FORMED 12 GAUGE MILL-GALVANIZED G90 STEEL THAT ALLOWS ACCESS TO THE DRAIN CONNECTION THROUGH THE FORKLIFT SLOTS
        - .2 THE CABINET WALLS SHALL BE OF SINGLE-WALL CONSTRUCTION USING 20 GAUGE PRE-PAINTED STEEL WITH 1 INCH OF FIBERGLASS INSULATION PROTECTED BY AN ANTI-MICROBIAL TOP COAT
        - .3 THE CABINET FLOOR SHALL BE OF 2-INCH DOUBLE-WALL CONSTRUCTION USING 20-GAUGE PRE-PAINTED STEEL ENGINEERED WITH STRUCTURAL BENDS FOR MAXIMUM RIGIDITY. MECHANICALLY FASTENED TO THE BASE FRAME
        - .4 THE CABINET ROOF SHALL BE ENGINEERED WITH STRUCTURAL BENDING FOR MAXIMUM RIGIDITY WITH 20-GAUGE STEEL AND SHALL BE MECHANICALLY FASTENED TO THE WALLS OF THE UNIT
        - .5 THE CABINETS SHALL BE MECHANICALLY ASSEMBLED WITH STAINLESS STEEL 5/32" SEALED BLIND RIVETS, WHERE BOLTS ARE REQUIRED BRIGHT ZINC PLATED BOLTS SHALL BE USED
        - .6 ACCESS DOORS SHALL BE REMOVABLE, SECURED TO CABINET USING HEAVY-DUTY STAINLESS STEEL HEX-HEAD BOLTS WITH STAINLESS STEEL WASHERS INSULATED WITH RUBBER GASKETS
      - .2 INSULATION: THE UNIT SHALL BE INSULATED PER THE FOLLOWING STANDARDS:
        - .1 ONE INCH THICK, SURFACE COATED WITH AN ANTI-MICROBIAL LAYER, PROTECTED AGAINST PERFORATION AND FIBER AIR ENTRAINMENT WITH A REINFORCING MESH
        - .2 FIRE RESISTANT RATING TO CONFORM TO NFPA STANDARD 90A AND 90B
        - .3 SOUND ATTENUATION COEFFICIENT SHALL NOT BE LESS THAN 1.00 AT A FREQUENCY OF 1,000 HZ AS PER ASTM STANDARD C423
        - .4 THERMAL CONDUCTIVITY SHALL NOT EXCEED 0.23 BTU/HR-SQFT-FT AT 75 °F
      - .3 CABINET CONFIGURATION SHALL INCLUDE:
        - .1 A FILTER RACK WITH SEPARATE ACCESS DOORS SHALL BE PROVIDED FOR THE RETURN AIR AND MINIMUM OUTDOOR AIR STREAMS
        - .2 MECHANICAL VESTIBULE: THE UNIT SHALL HAVE THE COMPRESSOR, RECEIVER, SOLENOID VALVES AND THE ELECTRICAL PANEL IN A SEPARATE COMPARTMENT OUT OF THE PROCESSED AIR STREAM. ALL COMPONENTS SHALL BE SERVICEABLE WHILE THE UNIT IS IN OPERATION WITHOUT DISTURBING THE AIRFLOW
        - .3 ELECTRICAL PANEL: THE UNIT SHALL HAVE A BUILT-IN ELECTRICAL CONTROL PANEL IN A SEPARATE COMPARTMENT IN ORDER NOT TO DISTURB THE AIRFLOW WITHIN THE DEHUMIDIFIER DURING ELECTRICAL SERVICING. ALL ELECTRICAL COMPONENTS SHALL BE MOUNTED ON A 16 GAUGE GALVANIZED SUB-PANEL

11. TESTING, ADJUSTING AND BALANCING (TAB):
    - .1 GENERAL:
      - .1 TAB MEANS TO TEST, ADJUST AND BALANCE TO PERFORM IN ACCORDANCE WITH REQUIREMENTS OF CONTRACT DOCUMENTS AND TO DO ALL OTHER WORK AS SPECIFIED IN THIS SECTION.
    - .2 TOLERANCES:
      - .1 DO TAB TO FOLLOWING TOLERANCES OF DESIGN VALUES:
        - .1 HVAC SYSTEMS: PLUS OR MINUS 5%.
      - .2 ADJUST OR REPLACE SHEAVES AS REQUIRED TO MEET DESIGN PERFORMANCE.
      - .3 DO TAB OF COMPLETE MECHANICAL SYSTEMS OVER ENTIRE OPERATING RANGE IN ACCORDANCE WITH MOST STRINGENT CONDITIONS OF AABC (ASSOCIATED AIR BALANCE COUNCIL) & NABC (NATIONAL AIR BALANCE COUNCIL).
    - .3 TAB REPORT:
      - .1 FORMAT TO BE IN ACCORDANCE WITH ASSOCIATED AIR BALANCING COUNCIL (AABC/CAABC).
    - .4 SYSTEMS:
      - .1 AIR SYSTEMS:
        - .1 INCLUDE BOTH SPECIFIED AND MEASURED DATA:
          - .1 MINIMUM & MAXIMUM PRIMARY & SECONDARY MAXIMUM PRIMARY & SECONDARY AIRFLOWS
          - .2 OPERATING PRESSURES
          - .3 DUCT SIZE & TRANSVERSE READINGS
          - .4 MOTOR VOLTS, AMPS & POWER
        - .2 FOR THE FOLLOWING EQUIPMENT:
          - .1 FANS
          - .2 SUPPLY DUCTWORK
    - .5 VERIFICATION:
      - .1 ALL REPORTED RESULTS SUBJECT TO VERIFICATION BY ENGINEER.
      - .2 PROVIDE MANPOWER AND INSTRUMENTATION TO VERIFY UP TO 30% OF ALL REPORTED RESULTS.
      - .3 NUMBER AND LOCATION OF VERIFIED RESULTS TO BE AT DISCRETION OF ENGINEER.
      - .4 BEAR COSTS TO REPEAT TAB AS REQUIRED TO SATISFACTION OF ENGINEER.
      - .5 PRODUCE "AS-BUILT" FULL SYSTEM SCHEMATICS. USE AS-BUILT PRODUCE "AS-BUILT" FULL SYSTEM SCHEMATICS. USE AS-BUILT DRAWINGS FOR REFERENCE.
      - .6 TAB TO BE CONSIDERED COMPLETE ONLY WHEN FINAL TAB REPORT RECEIVED AND APPROVED BY ENGINEER.

UNIT HEATER SCHEDULE

TAG	INPUT (MBH)	OUTPUT (MBH)	AIRFLOW (CFM)	FUEL TYPE	ELECTRICAL DATA		BASIS OF DESIGN	NOTES
					FLA/MOP	V/PH/HZ		
UH-1	250	207.5	3,202	NG	7.5/15	120/1/60	REZNOR UDXC-250	-

NOTES:
1. UNIT TO BE SUPPLIED WITH MANUFACTURER SUPPLIED DISCONNECT.
2. UNIT TO BE SEALED COMBUSTION WITH INTAKE AND EXHAUST BREECHING AS PER CSA B149.1
3. UNITS TO BE SUPPLIED WITH REMOTE THERMOSTATS.

EXHAUST FAN SCHEDULE

TAG	AIRFLOW (CFM)	E.S.P. (" W.C.)	TYPE	ELECTRICAL DATA		BASIS OF DESIGN	NOTES
				HP	V/PH/HZ		
EF1	420	0.45	EXHAUST	0.25	120/1/60	PLASTEC J20SS6P025	FAN TO BE CONTINUOUS ENERGIZED

NOTES:
1. ALL EXHAUST FANS TO BE CHEMICAL RESISTANT, NON-METALLIC TYPE.

DEHUMIDIFIER UNIT SCHEDULE

INDOOR UNIT												OUTDOOR DRY COOLER						
TAG	AIRFLOW (CFM)	E.S.P. (" W.C.)	REF. TYPE	EVAPORATOR COIL			REHEAT COIL (MBH)	FILTER (MERV)	ELECTRICAL DATA		BASIS OF DESIGN	TAG	CAPACITY (MBH)	No. FANS	ELECTRICAL DATA		BASIS OF DESIGN	NOTES
				SENS CAP. (MBH)	TOTAL CAP. (MBH)	MOISTURE REMOVAL CAPACITY (LBS/HR)			FLA/MCA/MOP	V/PH/HZ					FLA/MCA/MOP	V/PH/HZ		
DEHUM	3400	1.0	R410A	76.1	101.0	23.0	126.2	13	14.4/17/25	575/3/60	DECTRON DS-040-NV-I-G0NT1342N0G5AN3H	COND	126.2	1	3.7/7/15	575/3/60	DECTRON NG-V-02	FAN TO BE CONTINUOUS ENERGIZED

NOTES:
1. UNITS TO BE PROVIDED WITH MANUFACTURER SUPPLIED DISCONNECTS.

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	J.G.

STAMPS:

LICENCED PROFESSIONAL ENGINEER
10/20/2025
J. J. GORDON
100078762
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

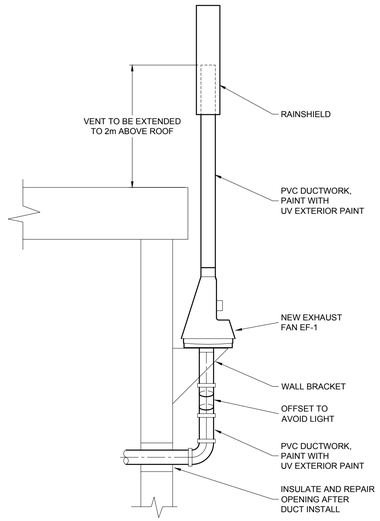
PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
MECHANICAL
GENERAL NOTES, LEGENDS, AND SPECIFICATIONS

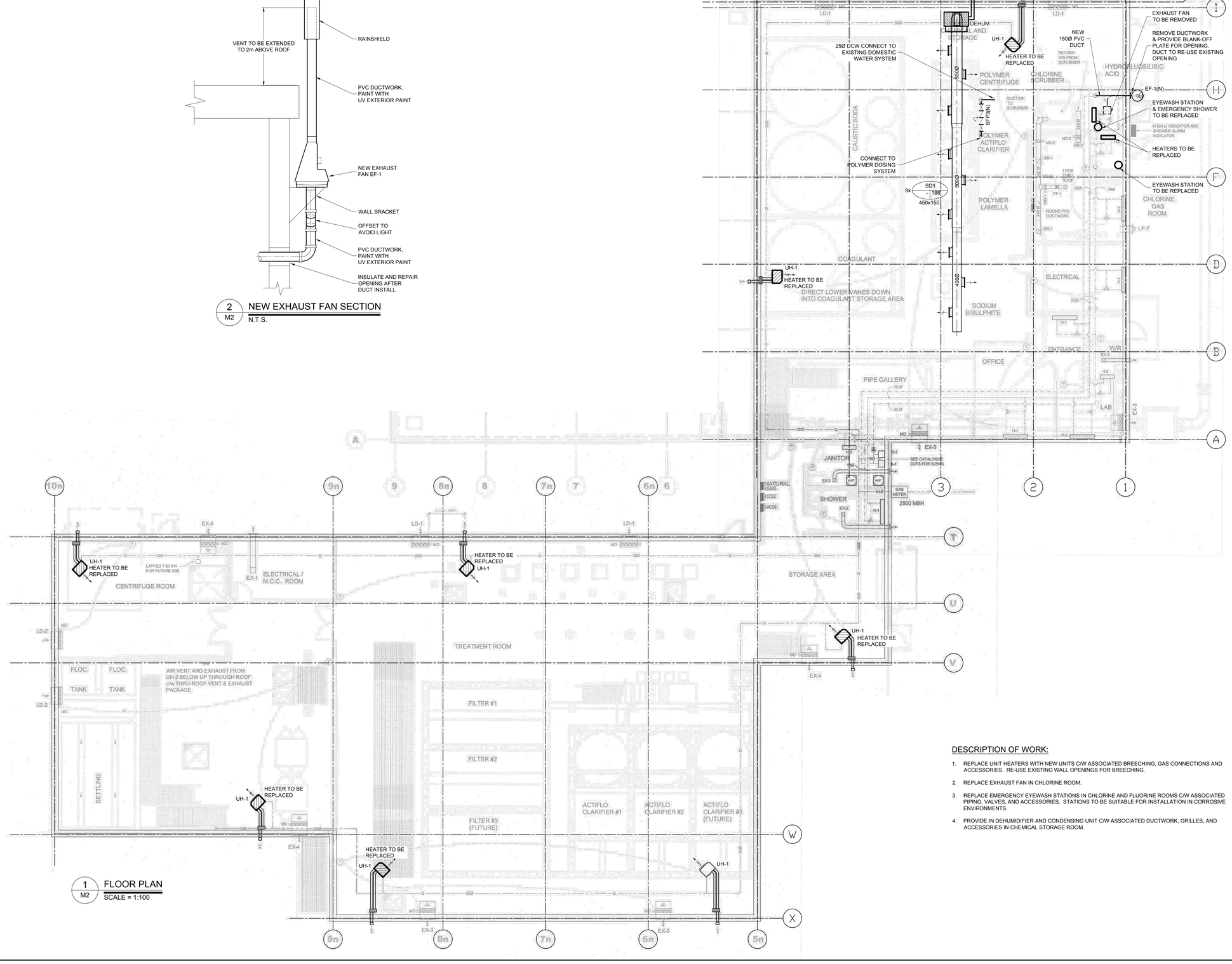
DISCIPLINE:
MECHANICAL

DRAFTER: J.G.	SCALE: 1:100
DESIGNER: J.G.	DATE: OCT 2025
APPROVER: J.G.	CHECKER: -
PROJECT No: A001332	DRAWING No: M-101
SHEET No: 15 of 36	

TITLEBLOCK 22x34 VERT ENG



2 / M2 NEW EXHAUST FAN SECTION
N.T.S.



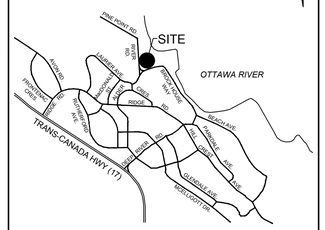
1 / M2 FLOOR PLAN
SCALE = 1:100

DESCRIPTION OF WORK:

1. REPLACE UNIT HEATERS WITH NEW UNITS C/W ASSOCIATED BREECHING, GAS CONNECTIONS AND ACCESSORIES. RE-USE EXISTING WALL OPENINGS FOR BREECHING.
2. REPLACE EXHAUST FAN IN CHLORINE ROOM.
3. REPLACE EMERGENCY EYEWASH STATIONS IN CHLORINE AND FLUORINE ROOMS C/W ASSOCIATED PIPING, VALVES, AND ACCESSORIES. STATIONS TO BE SUITABLE FOR INSTALLATION IN CORROSIVE ENVIRONMENTS.
4. PROVIDE IN DEHUMIDIFIER AND CONDENSING UNIT C/W ASSOCIATED DUCTWORK, GRILLES, AND ACCESSORIES IN CHEMICAL STORAGE ROOM.

TN

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	J.G.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
10/20/2025
J. J. GORDON
100078762
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

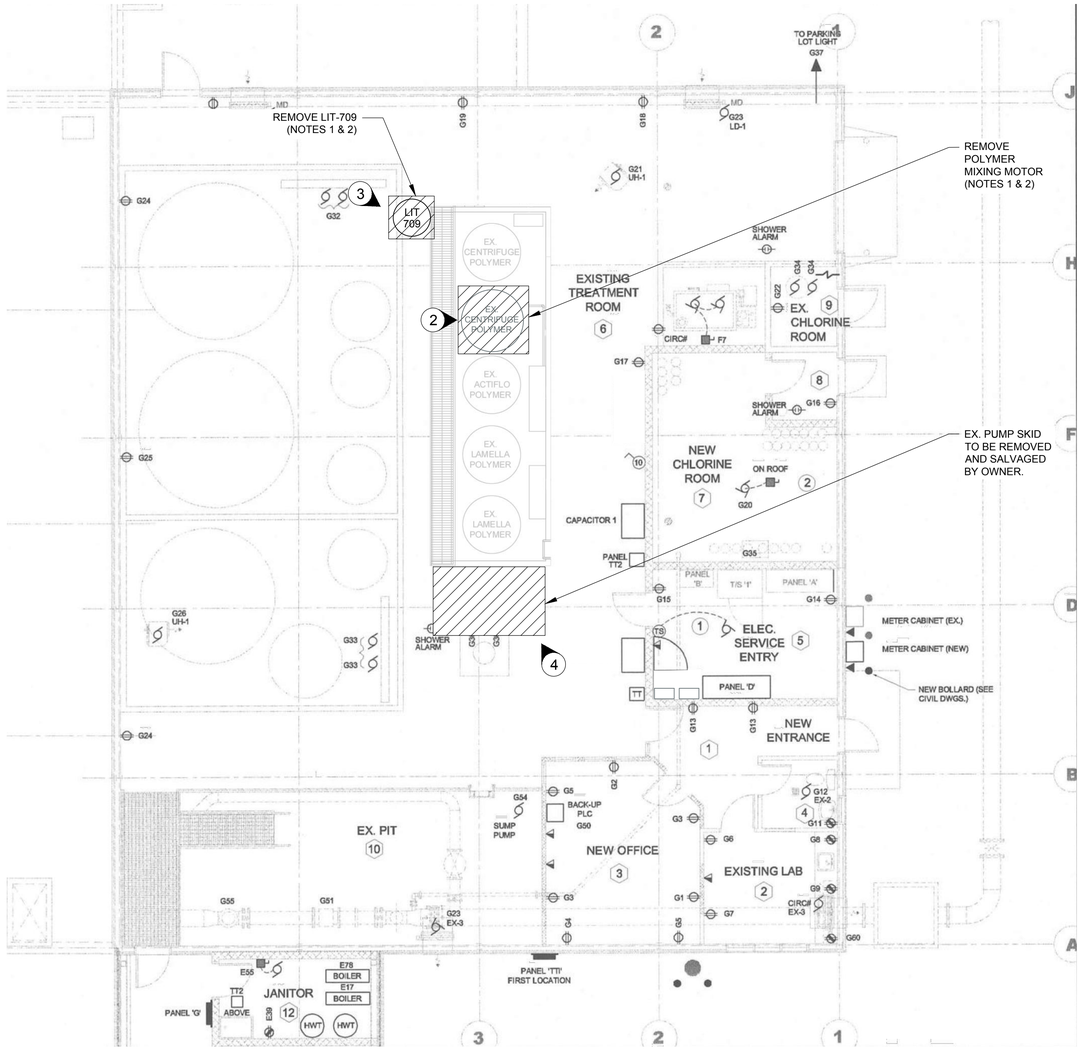
PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
FLOOR PLANS

DISCIPLINE:
MECHANICAL

DRAFTER: J.G.	SCALE: 1:100
DESIGNER: J.G.	DATE: OCT 2025
APPROVER: J.G.	CHECKER: -
PROJECT No: A001332	DRAWING No: M-102
SHEET No: 16 of 36	

TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21



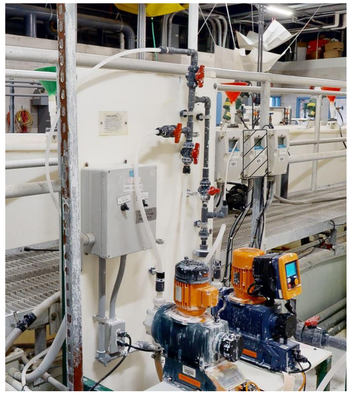
1 FLOOR PLAN
SCALE: 1:80

NOTES:

1. REMOVE POWER AND CONTROL WIRING TO EXISTING POLYMER DAY TANK MIXER AND LIT-709. POWER DISTRIBUTION IDENTIFIED FOR REMOVAL IS TO BE DISCONNECTED FROM THE POINT OF OVER CURRENT/ISOLATION.
2. DISCONNECT AND REMOVE EQUIPMENT INCLUDING ALL JUNCTION BOXES, PULL BOXES, ABANDONED CONDUITS, HANGERS, CABLE TRAYS, ECT.
3. PHOTOS PROVIDED FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO VERIFY EXACT LAYOUT AND WIRING PRIOR TO MAKING ANY MODIFICATIONS.



2 PHOTO OF POLYMER TANK
SCALE: N.T.S.



3 PHOTO OF LIT-709
SCALE: N.T.S



4 PHOTO OF PUMP SKID
SCALE: N.T.S

TN

LEGEND:

EQUIPMENT TO
BE REMOVED

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
POWER LAYOUT REMOVALS

DISCIPLINE: ELECTRICAL

DRAFTER: J.P.	SCALE: 1:80
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: ER-001
SHEET No: 17 of 36	

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GENERAL ELECTRICAL LEGEND

TRANSFORMER
△ : DENOTES DELTA CONNECTION
: DENOTES WYE CONNECTION WITH RESISTANCE GROUND
: DENOTES WYE CONNECTION WITH SOLID GROUND

CONTACTOR & OVERLOAD

FUSE

NON FUSED INTERRUPTER SWITCH

FUSED INTERRUPTER LOAD BREAK SWITCH

FUSED CONTACTOR

CIRCUIT BREAKER, C/W MAG. & THERM TRIP

XC
CONTACTOR-XC
BC: BYPASS CONT.
CC: CAPACITOR CONT.
IC: INLINE CONT.

(X)
FUSED POTENTIAL TRANSFORMER(S)
X: DENOTES QUANTITY

CAPACITOR

CIRCUIT BREAKER MOLDED CASE

SOLID STATE OVERLOAD

XX HP
MOTOR SYMBOL
"XX" DENOTES HORSEPOWER RATING

X
SS, FRP, XPY
HEAVY DUTY SAFETY SWITCH NON FUSED, 600V, 3P
X: DENOTES AMPACITY RATING AS FOLLOWS:
A=30A (20HP)
B=60A (50HP)
C=100A (75HP)
D=200A (150HP)
ALL DISCONNECTS TO INCLUDE A LATE MAKE, EARLY BREAK AUXILIARY 120V, 2A STATUS CONTACT
SS: DENOTES NEMA 4X STAINLESS STEEL ENCLOSURE
FRP: DENOTES NEMA 4X FIBERGLASS REINFORCED POLYESTER
XP: DENOTES EXPLOSION PROOF
Y=1 CLASS 1, DIVISION 1 RATED
Y=2 CLASS 1, DIVISION 2 RATED

XX
CABLE SCHEDULE TAG

COMBINATION MAGNETIC STARTER, FULL VOLTAGE NON-REVERSING BREAKER TYPE PROVIDE EEMAC SIZE STARTER TO SUIT MOTOR HORSEPOWER APPLICATION

VFD
VFD MOTOR STARTER, NEMA RATED TO SUIT MOTOR HP, COMPLETE WITH LINE SIDE VFD FILTER FOR MOTOR APPLICATIONS EQUAL TO OR GREATER THAN 50HP. UNIVERSAL HARMONIC LINE FILTER EQUIPPED WITH A CAPACITOR ISOLATION CONTACTOR SIZED TO SUIT MOTOR HP. PROVIDE MIRUS LINEATOR TYPE

ELECTRICAL UNIT HEATER

CP
MOTOR CONTROL PANEL

SPD
SURGE PROTECTION DEVICE, TOTAL POWER SOLUTIONS SERVICE TRACK (ST) TYPE. PROVIDE SURGE CURRENT RATING, VOLTAGE AND CONNECTION CONFIGURATION TO SUIT THE APPLICATION.

RVSS
REDUCED VOLTAGE SOFT STARTER

STORED ENERGY CIRCUIT BREAKER DRAWOUT TYPE COMPLETE WITH INTEGRAL 50/51, 50/51G, LSIG TRIP MODULE M.O.D.O. AND ARC FLASH REDUCTION MAINTENANCE SWITCH

TRANSFER SWITCH

CAPACITOR

POWER LAYOUT LEGEND

DISCONNECT SWITCH

THREE PHASE MOTOR

SINGLE PHASE MOTOR

ELECTRIC UNIT HEATER C/W REMOTE WALL MOUNT THERMOSTAT AND LOCAL DISCONNECT AND LOCAL DISCONNECT

AA/FA	DRY TYPE SELF COOLED/FORCED AIR COOLED
ATS	AUTOMATIC TRANSFER SWITCH
CCTV	CLOSED CIRCUIT TELEVISION SECURITY SYSTEM
CPT	CONTROL POWER TRANSFORMER
DIS	LOCAL DISCONNECT AUXILIARY POSITION STATUS CONTACT 2A, 120VAC, LATE MAKE EARLY BREAK TO SUIT VFD APPLICATIONS.
DP	DISTRIBUTION PANEL
HV-SG	DENOTES HIGH VOLTAGE SWITCHGEAR
LP	LIGHTING PANEL
MCC	MOTOR CONTROL CENTER
MFR	MULTI FUNCTION RELAY
MMR	MOTOR MANAGEMENT RELAY
OESC	ONTARIO ELECTRICAL SAFETY CODE
ONAF	OIL IMMERSED, FORCED AIR COOLED
ONAN	OIL IMMERSED, SELF COOLED
PFCC	POWER FACTOR CORRECTION CAPACITOR
PSDG	PEEL PUMPING STATION DESIGN GUIDELINES
RVAT	REDUCED VOLTAGE AUTOTRANSFORMER STARTER
SDBC	SOFT DRAWN BARE COPPER GROUND CONDUCTOR
SLD	SINGLE LINE DIAGRAM
SPD	SURGE PROTECTION DEVICE
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION

CONTROL SCHEMATIC SYMBOLS

NORMALLY OPEN PUSHBUTTON

NORMALLY CLOSED PUSHBUTTON

NORMALLY OPEN MUSHROOM HEAD PUSHBUTTON

NORMALLY CLOSED MUSHROOM HEAD PUSHBUTTON

TOGGLE SWITCH

SELECTOR SWITCH

TWO POSITION SELECTOR SWITCH
X: INDICATES CONTACT CLOSED POSITION FOR RESPECTIVE MODE

THREE POSITION SELECTOR SWITCH
X: INDICATES CONTACT CLOSED POSITION FOR RESPECTIVE MODE
OFF: INDICATES ALL SWITCH CONTACTS OPEN

XX
STARTER/CONTACTOR OPERATING COIL DESIGNATION
XX=M:STARTER COIL
XX=MR: MOTOR STARTER
XX=CR: CONTROL RELAY
XX=TR: ELECTRIC TIMER COIL WITH ADJUSTABLE TIMING RANGE

NORMALLY OPEN CONTACT

NORMALLY CLOSED CONTACT
O/L DENOTES THERMAL OVERLOAD CONTACT

NORMALLY-OPEN, TIMED-CLOSED CONTACT (TIME DELAY ON ENERGIZATION)

NORMALLY CLOSED CONTACT TIME DELAY OPENING

NORMALLY OPEN CONTACT TIME DELAY OPENING

NORMALLY CLOSED CONTACT TIME DELAY CLOSING

TEMPERATURE SWITCH, NORMALLY OPEN CLOSE ON RISE

TEMPERATURE SWITCH, NORMALLY CLOSED OPEN ON RISE

P.T.T.
C
INDICATING LIGHT (PUSH TO TEST, C: COLOR)
C=A: AMBER C=W: WHITE
C=Y: YELLOW C=B: BLUE
C=G: GREEN C=R: RED

NX
SOLENOID VALVE
NX=NO: NORMALLY OPEN WHEN DE-ENERGIZED
NX=NC: NORMALLY CLOSED WHEN DE-ENERGIZED

ETM
ELAPSED TIME METER

DIGITAL DISPLAY

ELECTRICAL CONDUCTORS

EARTH GROUND

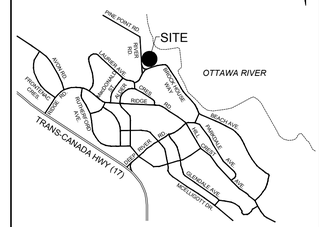
CHASSIS GROUND

NEUTRAL GROUNDING RESISTOR (NGR)

GENERAL NOTES:

1. REFER TO DIVISION 1, CONTRACTOR SHALL DEVELOP AND SUBMIT A SEQUENCE OF CONSTRUCTION AND A PROJECT PLAN TO ENGINEER PRIOR TO STARTING ANY WORK.
2. THE CONTRACTOR SHALL PROVIDE ALL MATERIALS, LABOUR, AND COORDINATION TO SET UP TEMPORARY POWER AND BELL SERVICE FOR PURPOSE OF CONSTRUCTION AND MAINTAINING A SITE OFFICE.
3. CONTRACTOR SHALL PROVIDE LABELS ON ALL EQUIPMENT PER SECTION 16090.
4. ALL CONTROL CONDUITS SHALL HAVE 20% SPARE CONTROL CONDUCTORS INSTALLED OR AT MINIMUM 1 PAIR OF EACH TYPE, WHICH EVER IS THE GREATER NUMBER.
5. ALL SAFETY SWITCHES SHALL BE HEAVY DUTY, NEMA 4X RATED FOR OUTDOOR AREAS AND NEMA 12 FOR INDOOR AREAS.
6. ALL INDOOR ELECTRICAL AND CONTROLS CONDUIT SHALL BE RIGID PVC UNLESS INDICATED OTHERWISE. SEE SECTION 16133.
7. ALL POWER DISTRIBUTION CABLE INSTALLED UNDER THIS PROJECT SHALL BE COPPER.
8. PROVIDE LIQUID TIGHT METAL ARMOUR FLEXIBLE CONDUIT FOR ALL MOTOR TERMINATIONS. FLEX CONNECTIONS NOT TO EXCEED MAX. ALLOWABLE LENGTH PERMITTED UNDER THE ONTARIO ELECTRICAL SAFETY CODE - LATEST REVISION.
9. REFERENCE P&I DRAWING LEGEND FOR DETAILED DESCRIPTION OF THE INSTRUMENTATION AND FIELD DEVICE SYMBOLS.
10. ALL NEW POWER DISTRIBUTION CABLES SHALL BE CONTINUOUS FROM PRIMARY OVER CURRENT PROTECTION SUPPLY POINT TO THE LOAD APPLICATION TERMINATION. NO SPLICES ARE PERMITTED UNLESS INDICATED OTHER WISE. SPLICES ARE ONLY PERMITTED FOR EXTENSION OF EXISTING POWER CABLES.
11. PROVIDE BUILDING GROUNDING AND GROUNDED CONDUCTORS TO SUIT METAL DISTRIBUTION EQUIPMENT IN ACCORDANCE WITH THE OESC LATEST REVISION.
12. ALL ELECTRICAL EQUIPMENT & INSTALLATION TO BE INSPECTED BY THE ESA. THE CONTRACTOR IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH ESA REVIEW AND INSPECTION.
13. ALL ELECTRICAL EQUIPMENT MUST BE CSA APPROVED. THE CONTRACTOR IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH ESA REVIEW AND SPECIAL INSPECTION TO FACILITATE EQUIPMENT APPROVAL INSPECTION.
14. ALL ELECTRICAL AND CONTROLS CONDUIT INSTALLED UNDER THIS PROJECT SHALL BE SURFACE MOUNTED UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
15. ALL CONDUIT ROUTES NOT SHOWN SHALL BE FINALIZED ON SITE.
16. CONTRACTOR IS TO PROVIDE MOUNTING EQUIPMENT FOR ALL FIELD LOCAL CONTROL PANELS AND TRANSMITTERS SUCH AS ALUMINUM PEDESTAL/POSTS, BRACKETS, AS REQUIRED. TRANSMITTERS AND FIELD LOCAL CONTROL PANELS SHOWN ON POWER LAYOUTS ARE FOR ILLUSTRATION ONLY. FINAL LOCATIONS ARE TO BE DETERMINED ON SITE WITH THE APPROVAL OF THE ENGINEER FIELD STAFF. THE CONTRACTOR IS TO CONFIRM LOCATIONS AND INSTALLATION/MOUNTING REQUIREMENTS ON SITE PRIOR TO PURCHASING ANY INSTRUMENTS. THE CONTRACTOR IS RESPONSIBLE FOR ALL MOUNTING HARDWARE BASED ON LOCATION FINALIZED ON SITE. ALL DIMENSIONS SHOWN ON THE DRAWINGS ARE IN mm.
17. ALL RIGID PVC DUCTS TO BE BURIED MIN. 760mm BELOW FINISHED GRADE. ALL UNDERGROUND DUCTBANKS TO BE INSTALLED IN ACCORDANCE WITH OESC REQUIREMENTS.
18. RIGID PVC DBII DUCT FOR UNDERGROUND APPLICATIONS TO BE IPEX SUPER DUCT.
19. ALL DUCT TO BE TERMINATED AT BOTH ENDS WITH A "BELL END" COUPLING.
20. DUCT TO BE JOINED TOGETHER WITH AN APPROVED COUPLING.
21. ADJACENT COUPLINGS SHALL BE STAGGERED BY AT LEAST 200mm.
22. WHEN COMPLETED THE DUCTS SHALL BE CLEANED AND ENDS PLUGGED WITH DUCT PLUGS. TEST DUCTS FOR CLEARANCE BY PULLING A STEEL WIRE BRUSH AND MANDRILL THROUGH THE COMPLETE LENGTH IN THE PRESENCE OF ENGINEER. MANDREL TO BE SIZED ACCORDING TO THE CONDUIT DIAMETER FOR UNDERGROUND CONDUITS THAT ARE 75mm OR GREATER.
23. CONTRACTOR TO PROVIDE A LOCAL DISCONNECT SWITCH FOR EACH MOTOR POWERED FROM A SWGR, MCC, 600V DISTRIBUTION PANEL, OR A LIGHTING PANEL. CONTRACTOR IS RESPONSIBLE FOR PROVIDING POWER FEEDS FROM THE SOURCE SUCH AS A LIGHTING PANEL TO THE DISCONNECT SWITCH AND FROM THE DISCONNECT SWITCH TO THE MOTOR. THE DISCONNECT SWITCHES ARE TO BE SIZED TO SUIT THE MOTOR RATING. ALL DISCONNECT SWITCHES ARE TO BE MOUNTED ADJACENT THE RESPECTIVE MOTOR IN A LOCATION APPROVED BY THE SITE INSPECTOR.
24. ANY ABANDONED PENETRATIONS INCLUDING WALL, FLOOR, CEILING ARE TO BE FILLED/FIRE STOPPED. ALL NEW PENETRATIONS TO BE FIRE STOPPED.
25. ALL NEW ELECTRICAL DISTRIBUTION EQUIPMENT SHALL BE RATED FOR SEISMIC RESTRAINT IN ACCORDANCE WITH OBC REQUIREMENTS INCLUDING MCCS, RACEWAYS, PANELS, AND CABLE BUS.
26. CONTRACTOR IS REQUIRED TO COORDINATE WITH LOCAL DISTRIBUTION COMPANY (LDC) AS REQUIRED FOR THE DURATION OF THE PROJECT. LDC FOR THIS PROJECT IS HYDRO ONE.
27. THE CONTRACTOR IS REQUIRED TO SUPPLY AND INSTALL AS BUILT LAMINATED 'D' SIZE WALL MOUNTED ELECTRICAL SINGLE LINE DIAGRAMS IN THE ELECTRICAL ROOM. REPLACE EXISTING SINGLE LINE DIAGRAMS AS REQUIRED.
28. SEAL ALL PENETRATIONS WITH ULC LISTED FIRE STOPPING MATERIAL TO MAINTAIN A 1-HOUR FIRE RATING.
29. PROVIDE ALL REQUIRED CONCRETE CORING AND CUTTING FOR CONDUIT/DUCT ENTRY THRU WALLS AND FLOORS.
30. CONTRACTOR TO INSTALL INTERPOSING RELAYS WITH LED STATUS INDICATION FOR ALL DIGITAL STATUS SIGNALS AS REQUIRED. MODIFY OR RETROFIT EXISTING PLC PANELS AS NECESSARY TO ACCOMMODATE THE ADDITIONAL RELAYS.

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:
LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER:
CIMA+

CLIENT:
deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
ELECTRICAL LEGEND

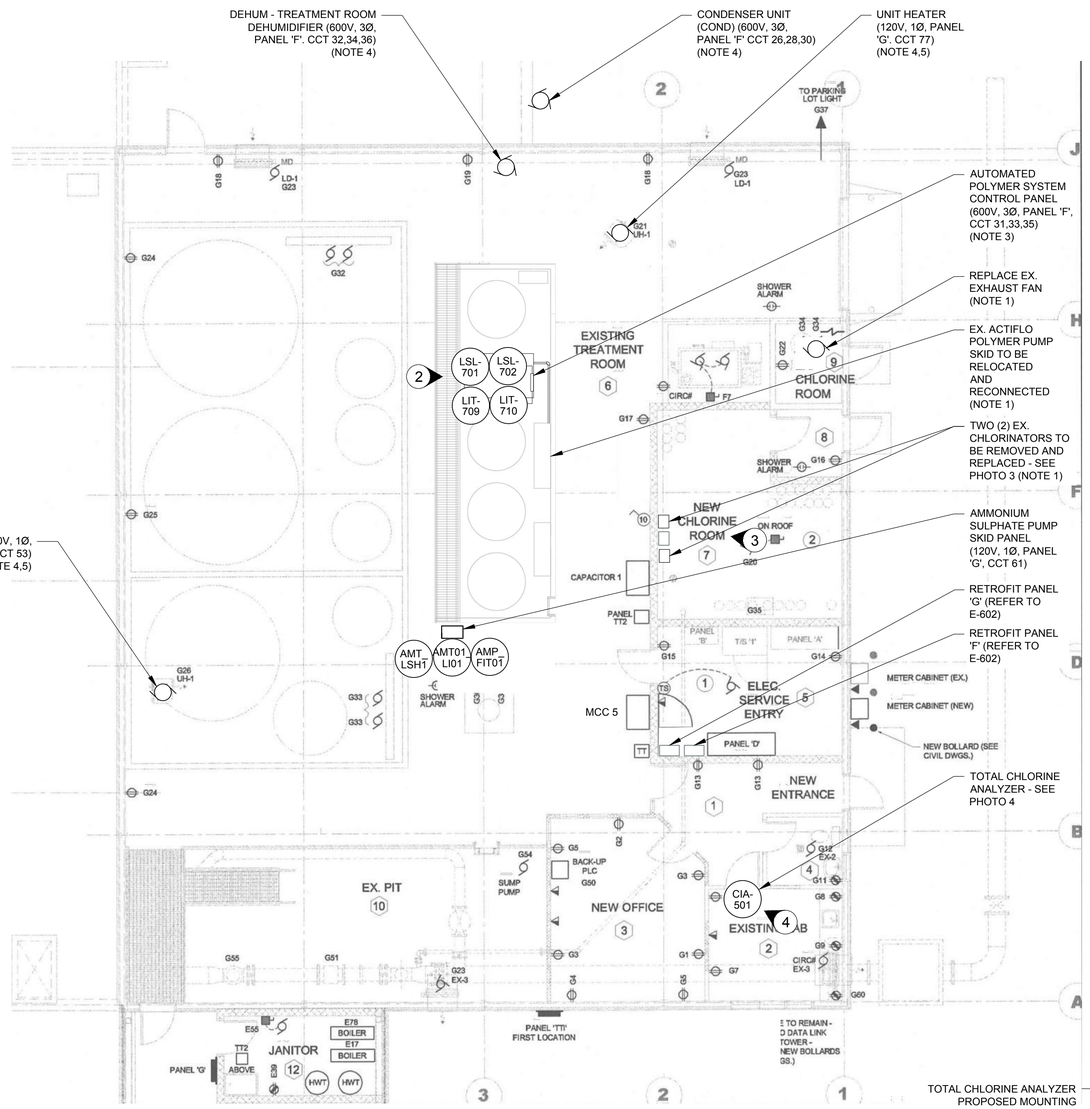
DISCIPLINE:
ELECTRICAL

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: E-001
SHEET No: 10 of 36	

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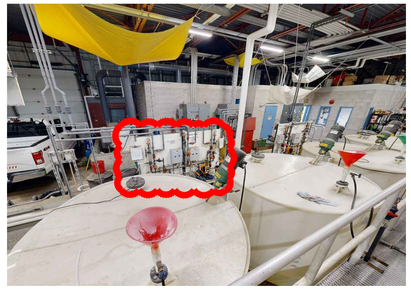
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1 FLOOR PLAN (1)
SCALE: 1:80

NOTES:

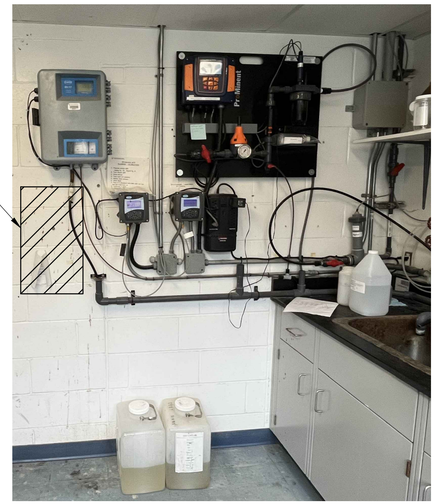
1. RE-UTILIZE EXISTING POWER AND CONTROL WIRING. RE-WORK AND EXTEND CONDUIT AND WIRING AS REQUIRED. IF EXTENDING WIRING, ADD JUNCTION BOX AND USE TERMINAL BLOCKS TO FACILITATE TERMINATION OF WIRING. BUTT SPLICE OR MARRETTES ARE NOT ACCEPTABLE.
2. PHOTOS PROVIDED FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO VERIFY EXACT LAYOUT AND WIRING PRIOR TO MAKING ANY MODIFICATIONS.
3. PRE-PURCHASED PACKAGED EQUIPMENT SUPPLIED BY VEOLIA. INSTALLATION BY CONTRACTOR INCLUDING PROVISION OF ALL REQUIRED POWER, CONTROL, AND SIGNAL WIRING FOR COMPLETE AND FUNCTIONAL INTEGRATION WITH THE PLANT'S ELECTRICAL AND INSTRUMENTATION SYSTEMS. COORDINATE INSTALLATION AND CONNECTION DETAILS WITH VEOLIA.
4. CONTRACTOR TO PROVIDE POWER AND FIELD WIRING BETWEEN MECHANICAL EQUIPMENT (THERMOSTATS, DEHUMIDIFIER, AIR CONDITIONER, ETC.) PROVIDED UNDER DIVISION 15.



2 PHOTO OF POLYMER SKID TO BE RELOCATED
SCALE: N.T.S.



3 PHOTO OF CHLORINATORS TO BE REPLACED
SCALE: N.T.S.



4 PHOTO OF PROPOSED TOTAL CHLORINE ANALYZER INSTALLATION LOCATION
SCALE: N.T.S.

TN

LEGEND:
EXISTING
NEW

KEY PLAN:



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STAMPS:
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PROVINCE OF ONTARIO
DESIGNED BY
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CONSULTANT(S):

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CIMA+

CLIENT:
deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

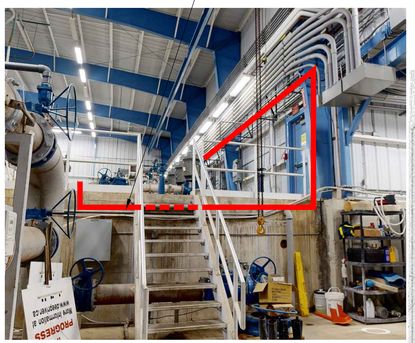
SHEET TITLE:
POWER LAYOUT (1)

DISCIPLINE:
ELECTRICAL

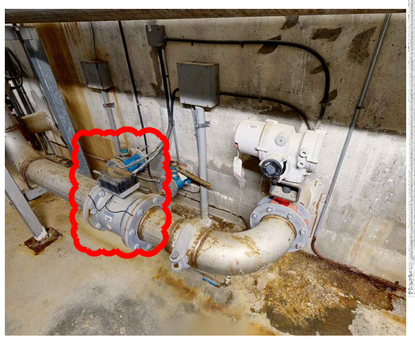
DRAFTER: J.P.	SCALE: 1:80
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: E-002
SHEET No: 1 of 36	

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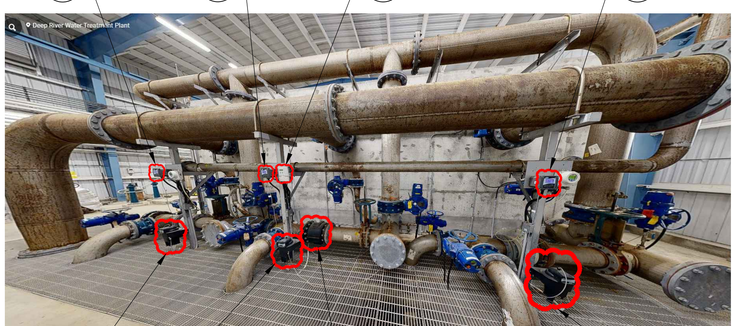
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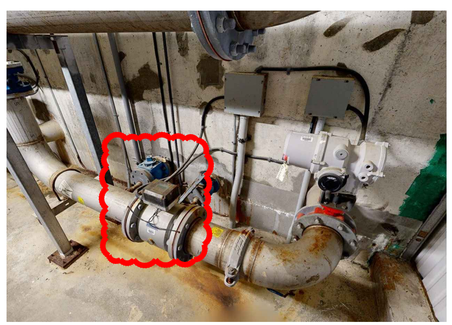
2 PHOTO OF PROPOSED PVC CONDUIT ROUTE
SCALE: N.T.S



3 PHOTO OF FIT-202
SCALE: N.T.S



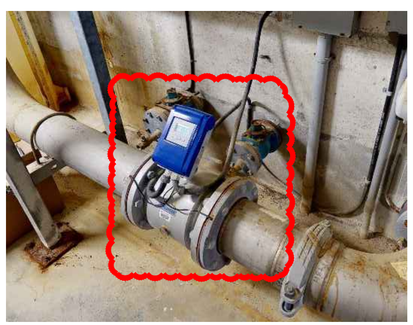
4 PHOTO OF EFFLUENT FLOWMETER AND TURBIDITY ANALYZER
SCALE: N.T.S



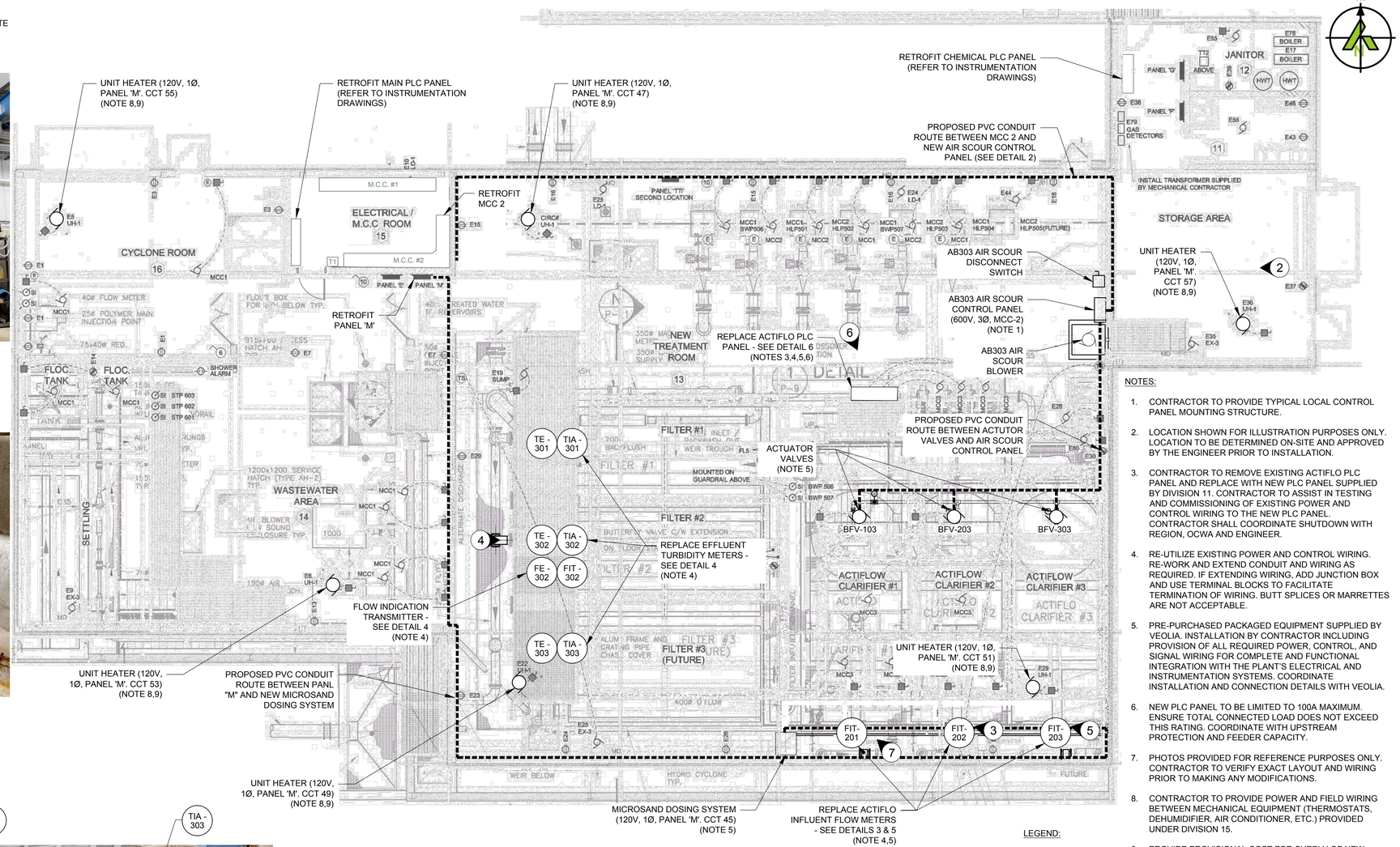
5 PHOTO OF FIT-203
SCALE: N.T.S



6 PHOTO OF ACTIFLO PLC PANEL
SCALE: N.T.S



7 PHOTO OF FIT-201
SCALE: N.T.S



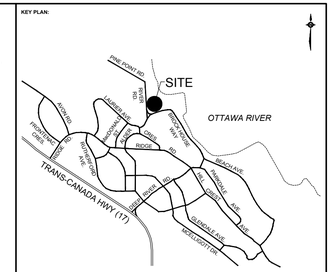
1 FLOOR PLAN (2)
SCALE: 1:80

NOTES:

1. CONTRACTOR TO PROVIDE TYPICAL LOCAL CONTROL PANEL MOUNTING STRUCTURE.
2. LOCATION SHOWN FOR ILLUSTRATION PURPOSES ONLY. LOCATION TO BE DETERMINED ON-SITE AND APPROVED BY THE ENGINEER PRIOR TO INSTALLATION.
3. CONTRACTOR TO REMOVE EXISTING ACTIFLO PLC PANEL AND REPLACE WITH NEW PLC PANEL SUPPLIED BY DIVISION 11. CONTRACTOR TO ASSIST IN TESTING AND COMMISSIONING OF EXISTING POWER AND CONTROL WIRING TO THE NEW PLC PANEL. CONTRACTOR SHALL COORDINATE SHUTDOWN WITH REGION, OCWA AND ENGINEER.
4. RE-UTILIZE EXISTING POWER AND CONTROL WIRING. RE-WORK AND EXTEND CONDUIT AND WIRING AS REQUIRED. IF EXTENDING WIRING, ADD JUNCTION BOX AND USE TERMINAL BLOCKS TO FACILITATE TERMINATION OF WIRING. BUTT SPLICES OR MARRETTES ARE NOT ACCEPTABLE.
5. PRE-PURCHASED PACKAGED EQUIPMENT SUPPLIED BY VEOLIA. INSTALLATION BY CONTRACTOR INCLUDING PROVISION OF ALL REQUIRED POWER, CONTROL, AND SIGNAL WIRING FOR COMPLETE AND FUNCTIONAL INTEGRATION WITH THE PLANT'S ELECTRICAL AND INSTRUMENTATION SYSTEMS. COORDINATE INSTALLATION AND CONNECTION DETAILS WITH VEOLIA.
6. NEW PLC PANEL TO BE LIMITED TO 100A MAXIMUM. ENSURE TOTAL CONNECTED LOAD DOES NOT EXCEED THIS RATING. COORDINATE WITH UPSTREAM PROTECTION AND FEEDER CAPACITY.
7. PHOTOS PROVIDED FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO VERIFY EXACT LAYOUT AND WIRING PRIOR TO MAKING ANY MODIFICATIONS.
8. CONTRACTOR TO PROVIDE POWER AND FIELD WIRING BETWEEN MECHANICAL EQUIPMENT (THERMOSTATS, DEHUMIDIFIER, AIR CONDITIONER, ETC.) PROVIDED UNDER DIVISION 15.
9. PROVIDE PROVISIONAL COST FOR SUPPLY OF NEW CIRCUIT BREAKER AND FIELD WIRING. THIS WILL ONLY BE REQUIRED IF NO EXISTING 120V BRANCH CIRCUIT IS AVAILABLE.

LEGEND:
EXISTING
NEW

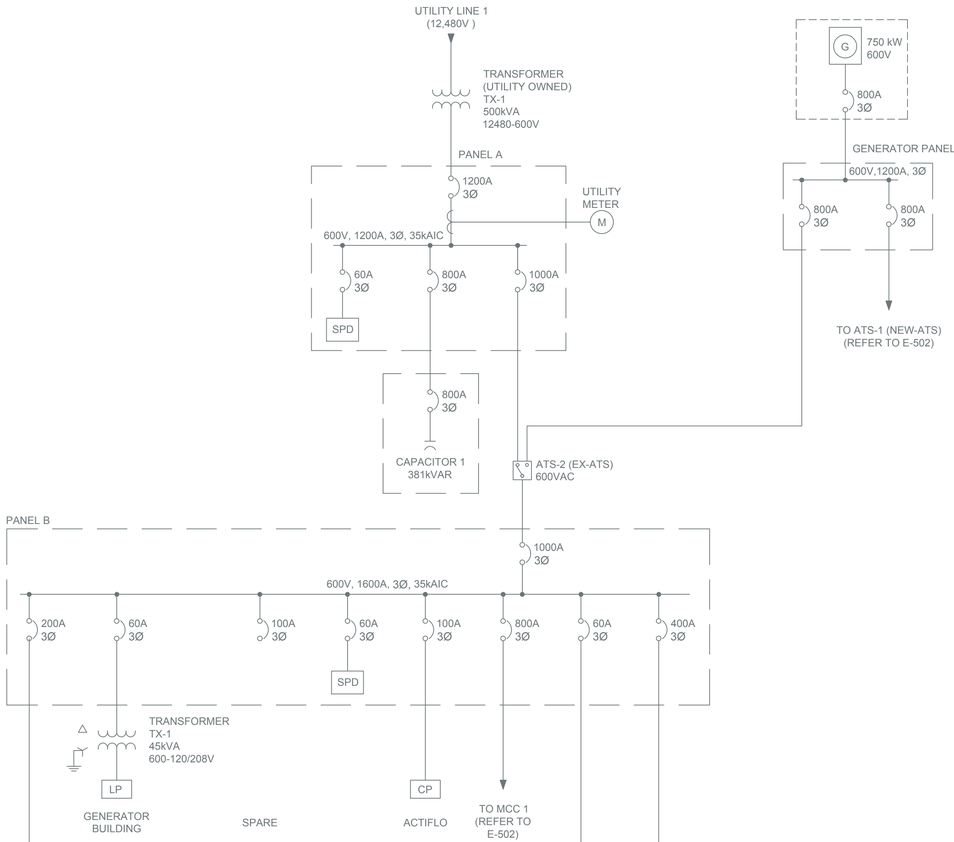
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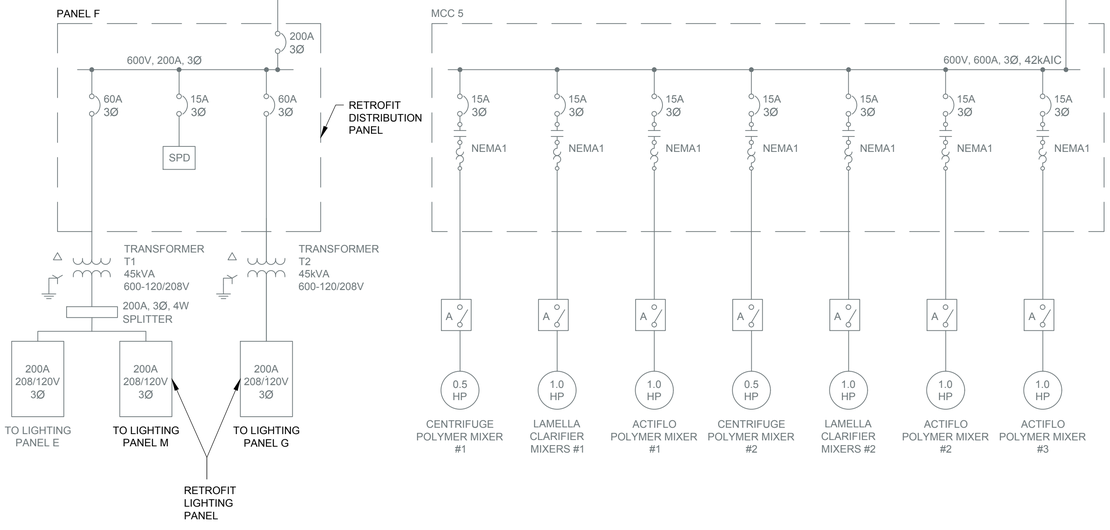

SITE
OTTAWA RIVER
TRANS-CANADA HWY (17)
ONE TONY RD
RD
CARMICHAEL
FRONTENAC
CRES
ARCHIBALD
PEMBROKE
MACKAY
MOORE
ST
ALGONQUIN
AVE
RAGLAN
RAGLAN
RAGLAN
RAGLAN
BROADWAY
HENDERSON
HENDERSON
HENDERSON

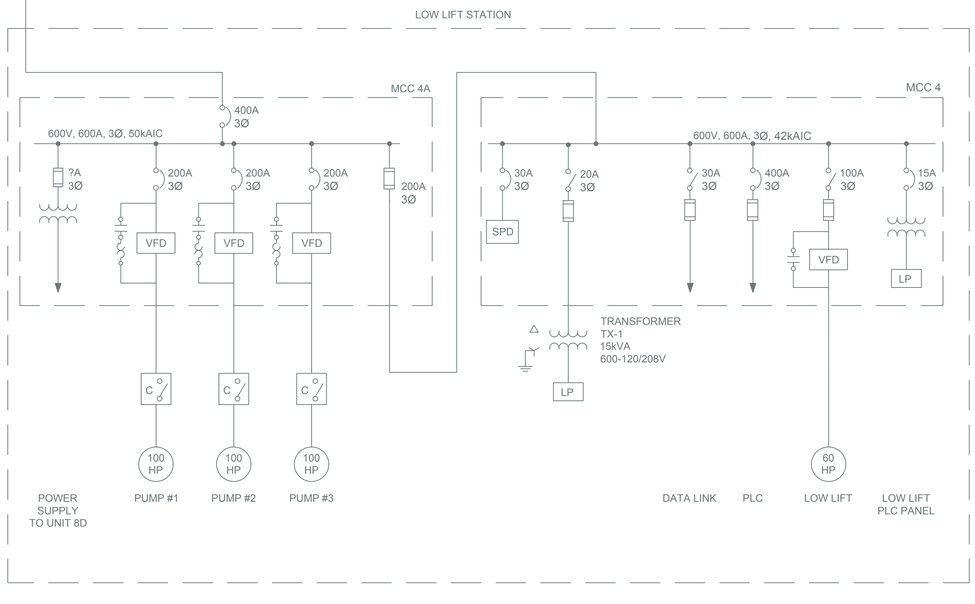
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NOTE:

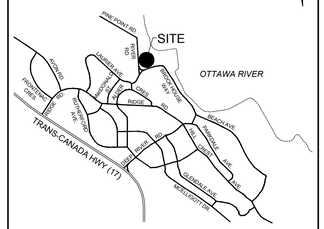
1. SINGLE LINE DIAGRAM PROVIDED FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO VERIFY EXACT LAYOUT AND WIRING PRIOR TO MAKING ANY MODIFICATIONS.







KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

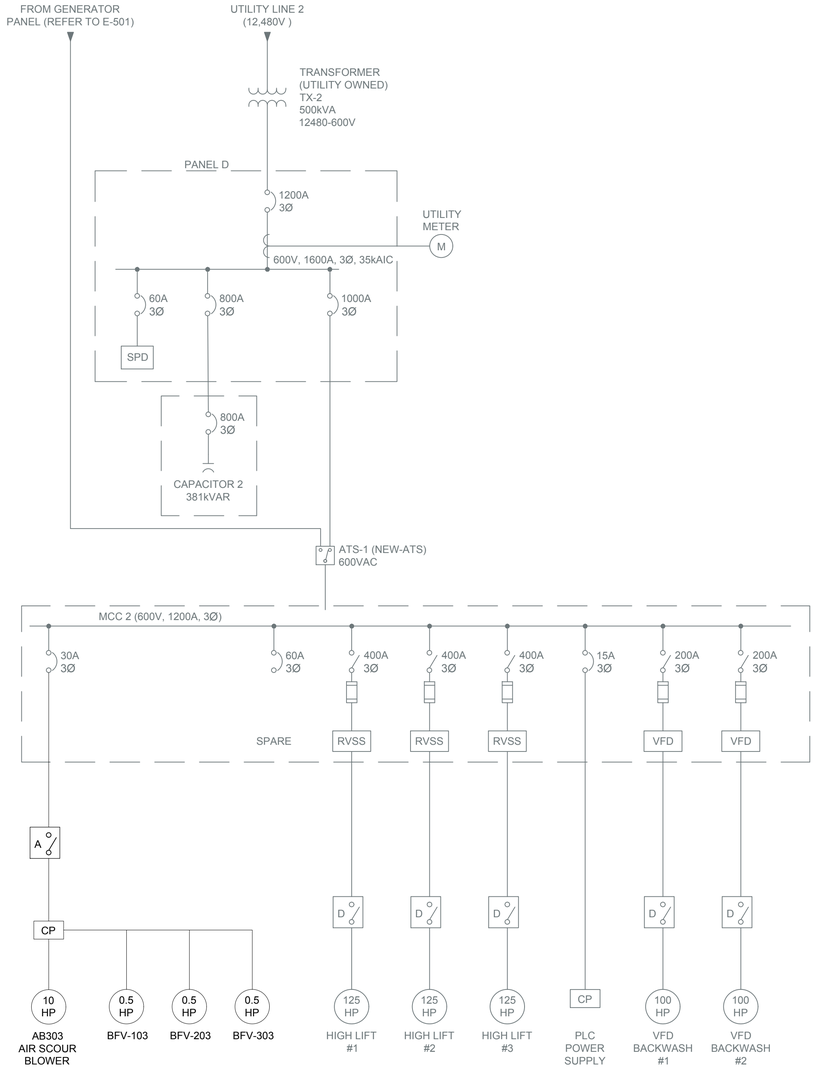
SHEET TITLE:
SINGLE LINE DIAGRAM (1)

DISCIPLINE:
ELECTRICAL

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: E-501
SHEET No: 21 of 36	

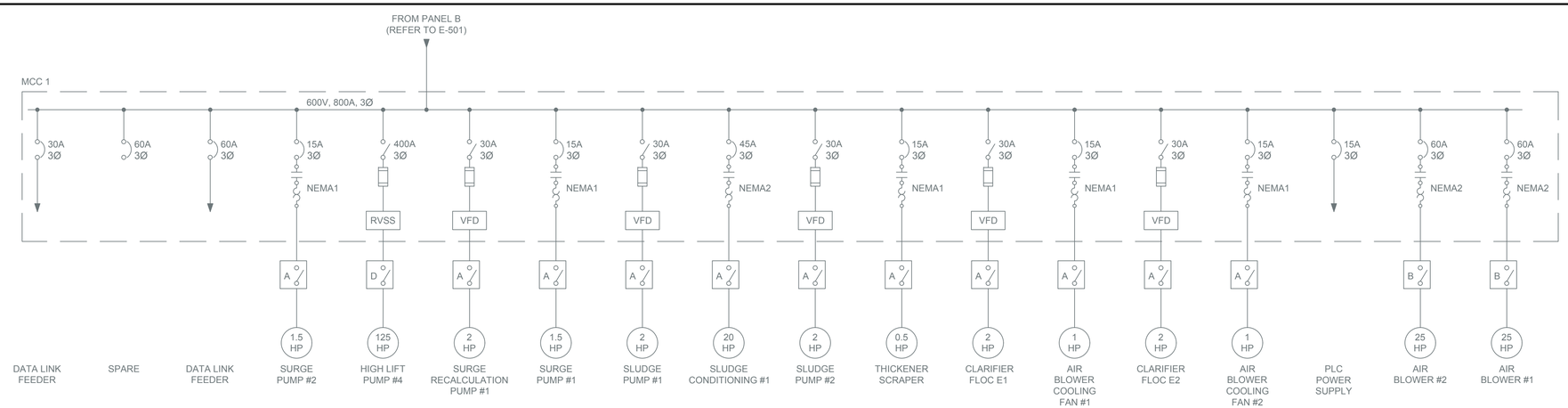
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NOTE:

1. SINGLE LINE DIAGRAM PROVIDED FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO VERIFY EXACT LAYOUT AND WIRING PRIOR TO MAKING ANY MODIFICATIONS.



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

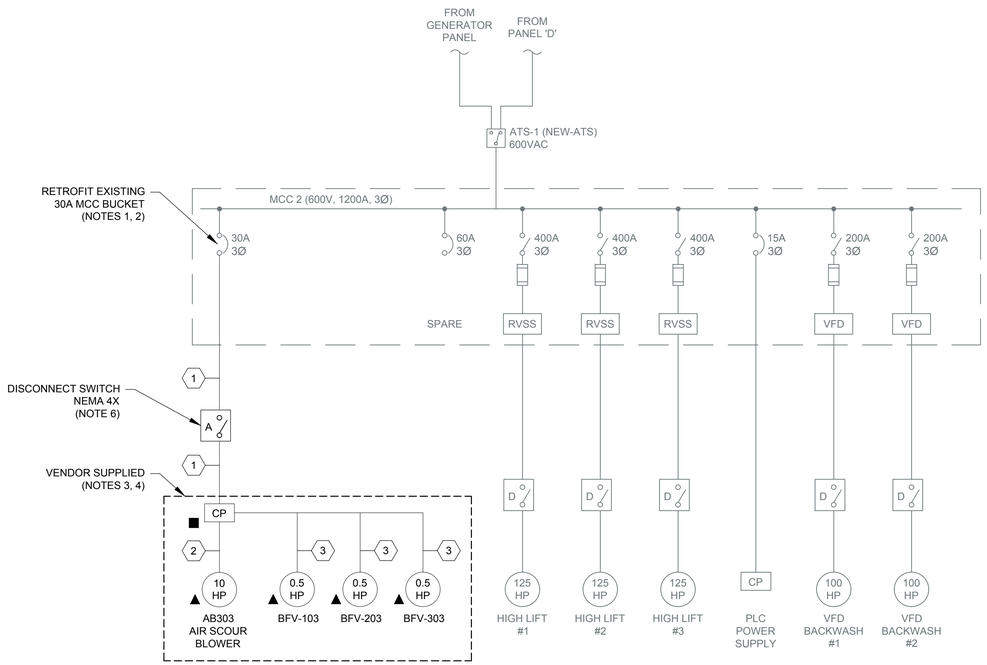
SHEET TITLE:
SINGLE LINE DIAGRAM (2)

DISCIPLINE:
ELECTRICAL

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: E-502
SHEET No: 22 of 36	

PRINT DATE: 2025-04-22 1:01:09 PM
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1 SINGLE LINE DIAGRAM
SCALE: N.T.S.

LEGEND:

- EXISTING
- NEW
- ■ SUPPLIED BY OTHER DIVISIONS AND INSTALLED BY DIVISION 16
- ▲ SUPPLIED BY OTHER DIVISIONS. CONTRACTOR TO COORDINATE WITH PACKAGED EQUIPMENT SUPPLIER FOR POWER AND CONTROL FIELD WIRING.



2 EX. MCC 2 ELEVATION
SCALE: N.T.S.

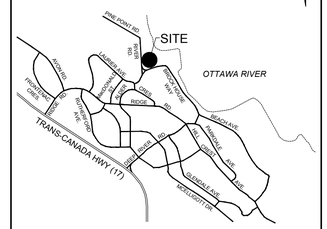
NOTES:

1. CONTRACTOR TO COORDINATE TERMINATION OF THE NEW CONDUCTORS TO THE EXISTING 30A BREAKER TO COINCIDE WITH THE SHUTDOWN FOR THE ACTIFLO PLC REPLACEMENT. THE INTENT IS TO LIMIT THE AMOUNT OF SHUTDOWNS TO ONE (1). CONTRACTOR SHALL COORDINATE SHUTDOWN WITH REGION, OCWA AND ENGINEER.
2. INSTALL NEW LAMACOID ON THE MCC BUCKET.
3. PRE-PURCHASED PACKAGED EQUIPMENT SUPPLIED BY VEOLIA. INSTALLATION BY CONTRACTOR INCLUDING PROVISION OF ALL REQUIRED POWER, CONTROL, AND SIGNAL WIRING FOR COMPLETE AND FUNCTIONAL INTEGRATION WITH THE PLANT'S ELECTRICAL AND INSTRUMENTATION SYSTEMS. COORDINATE INSTALLATION AND CONNECTION DETAILS WITH VEOLIA.
4. CONTRACTOR TO COORDINATE CONDUIT AND WIRE SIZES WITH PACKAGED EQUIPMENT SUPPLIER.
5. PHOTOS PROVIDED FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO VERIFY EXACT LAYOUT AND WIRING PRIOR TO MAKING ANY MODIFICATIONS.
6. A SEPARATE DISCONNECTING MEANS IS NOT REQUIRED IF THE VENDOR SUPPLIED LOCAL CONTROL PANEL IS PROVIDED WITH AN INTEGRAL, LOCKABLE DISCONNECTING MEANS THAT IS CAPABLE OF ISOLATING ALL SOURCES OF POWER TO THE EQUIPMENT.

CABLE SCHEDULE

1. 3-1/C #8 AWG + GND, Cu., RW90, 1kV IN 27mm PVC CONDUIT
2. 3-1/C #10 AWG + GND, Cu., RW90, 1kV IN 27mm PVC CONDUIT (NOTES 3,4)
3. 2-1/C #12 AWG + GND, Cu., RW90, 1kV IN 27mm PVC CONDUIT (NOTES 3,4)

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
SINGLE LINE DIAGRAM - MCC 2

DISCIPLINE:
ELECTRICAL

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: E-601
SHEET No: 23 of 36	

PRINT DATE: 2025-04-22 1:01:09 PM
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TITLEBLOCK 22x34 VERT ENG

LEGEND:

EXISTING

NEW

LIGHTING PANEL "G"

VOLTS: 120/208V
PHASES: 3
WIRES: 4

LOCATION: ELECTRICAL ROOM
FEEDER: PANEL "F"

BUSSING: 225A
MAIN BKR: 225A
MOUNTING: WALL
NO. CIR: 84

DESCRIPTION	CCT	BKR	P	A	B	C	P	BKR	CCT	DESCRIPTION
SPARE	1	15A	1	●			1	15A	2	OFFICE OUTLET
OFFICE RECEPTACLE	3	15A	1		●		1	15A	4	OFFICE OUTLET
OFFICE RECEPTACLE	5	15A	1			●	1	15A	6	LAB
LAB	7	15A	1	●			1	20A	8	LAB
LAB	9	15A	1		●		1	20A	10	LAB
WASHROOM OUTLET	11	15A	1			●	1	20A	12	WASHROOM LIGHTS/FAN
ENTRANCE OUTLET	13	20A	1	●			1	15A	14	HEATER
OUTLET - ROOM 5	15	15A	1		●		1	20A	16	HEATER
OUTLET - ROOM 6	17	20A	1			●	1	15A	18	RECEPTACLE - ROOM 6
OUTLET - ROOM 6	19	20A	1	●			1	15A	20	CHLORINE ROOM - EXHAUST FAN
UNIT HEATER	21	20A	1		●		1	20A	22	SPARE
EXHAUST FAN - ROOM 6	23	20A	1			●	1	15A	24	RECEPTACLE - ROOM 6
OUTLET - ROOM 6	25	15A	1	●			1	15A	26	UNIT HEATER
CHEMICAL PUMP - CENTRIFUGE	27	15A	1		●		1	15A	28	CHLORINE DET.
CHEMICAL PUMP - POLYMER LAMELLA	29	15A	1			●	1	15A	30	CHEMICAL PUMP - SODIUM BISULPHATE
CHEMICAL PUMP - ALUM	31	15A	1	●			1	15A	32	CHEMICAL PUMP - CAUSTIC SODA
CHEMICAL PUMP - ALUM	33	15A	1		●		1	15A	34	CHEMICAL PUMP - FLOURIDE
SCALE - CHLORINE CYLINDERS	35	15A	1			●	1	15A	36	SPARE
PARKING LOT LIGHTS	37	15A	1	●			1	15A	38	OUTSIDE LIGHTS
OUTSIDE LIGHTS	39	15A	1		●		1	15A	40	OUTSIDE
LIGHTS - OFFICE, LAB, ENTRANCE	41	15A	1			●	2	20A	42	ELECTRICAL ROOM HEATER
LIGHTS ROOM 5,6,7	43	15A	1	●					44	
LIGHTS - ROOM 6	45	15A	1		●		1	15A	46	SECURITY
LIGHTS - ROOM 6	47	15A	1			●	1	15A	48	FIRE ALARM
LIGHTS - ROOM 6	49	15A	1	●			1	15A	50	BACK - UP PLC
FLOW METER	51	15A	1		●		1	15A	52	INSTRUMENTS - CHLORINE ROOM
UNIT HEATER 1 (G53-UH-1)	53	15A	1			●	1	15A	54	SUMP PUMP
GFCI, EXISTING LAB	55	15A	1	●			1	15A	56	EMERGENCY SHOWER
DRYER	57	30A	2		●		1	15A	58	LIGHTS
	59					●	1	15A	60	OUTLET ROOM 8
AMMONIA SULPHATE	61	15A	1	●			1	15A	62	USED
LIGHTS BACKWALL	63	15A	1		●		1	15A	64	USED
CHEMICAL GARAGE DOOR	65	15A	1			●	1	15A	66	OUTLET & LIGHTS ROOM 9 FLOURIDE
	67		1	●			1	15A	68	CHLORINE INJECTORS
LUNCH ROOM AND LIGHTS	69	15A	1		●		1	15A	70	SPARE
SOLANOID VALVES	71	15A	1			●	1	15A	72	GARAGE DOOR LINK
LIGHTS GARAGE DOOR	73	15A	1	●			1		74	
TOTAL CHLORINE ANALYZER (CIA-501)	75	15A	1		●		1	30A	76	OUTSIDE A/C UNIT
UNIT HEATER (G77-UH-1)	77	20A	1			●	1		78	
EXHAUST FAN	79	20A	3	●			3	20A	80	EXHAUST FAN #1
	81				●				82	
	83					●			84	

RE-USE CCT 20 FOR CHLORINE ROOM EXHAUST FAN

USE CIRCUIT #53 (1-POLE, 15A BREAKER) FOR THE UNIT HEATERS IN THE EX. TREATMENT ROOM (NOTE 6,7)

USE CIRCUIT #61 (1-POLE, 15A BREAKER) FOR AMMONIA SULPHATE PUMP SKID

USE CIRCUIT #75 (1-POLE, 15A BREAKER) FOR THE TOTAL CHLORINE ANALYZER

USE CIRCUIT #77 (1-POLE, 20A BREAKER) FOR THE NEW UNIT HEATERS IN THE EX. TREATMENT ROOM (NOTE 6,7)

1 LIGHTING PANEL "G" SCHEDULE - MODIFICATIONS

SCALE: N.T.S.

LEGEND:

EXISTING

NEW

LIGHTING PANEL "M"

VOLTS: 120/208V
PHASES: 3
WIRES: 4

LOCATION: ELECTRICAL ROOM
FEEDER: PANEL "A"

BUSSING: 225A
MAIN BKR: 225A
MOUNTING: WALL
NO. CIR: 84

DESCRIPTION	CCT	BKR	P	A	B	C	P	BKR	CCT	DESCRIPTION
SPARE	1	30A	3	●			3	30A	2	SPARE
	3				●				4	
	5					●			6	
SPARE	7	30A	3	●			3	30A	8	SPARE
	9				●				10	
	11					●			12	
SPARE	13	20A	3	●			3	20A	14	SPARE
	15				●				16	
	17					●			18	
GARAGE FAN	19	20A	1	●			1	15A	20	LOWER GALLERY GFCI
GARAGE LIGHTS	21	20A	1		●		1	20A	22	LOWER GALLERY GFCI
WATE WATER AREA NIGH FIGHT	23	20A	1			●	1	15A	24	LOWER GALLERY SHOWER ALARM
SHOWER ALARM	25	15A	1	●			1	15A	26	CYCLONE ROOM
FLOW METER FLOCK BANL	27	15A	1		●		1	15A	28	CYCLONE ROOM / SETTLING LIGHTS
GFCI FLOC TANK	29	15A	1			●	1	15A	30	CYCLONE ROOM
HEATER WASTE WATER AREA	31	15A	1	●			1	15A	32	WASTER WATER AREA
WASTE WATER AREA LIGHTS	33	15A	1		●		1	15A	34	LEVEL TRANS. WASTE WATER AREA
WASTE WATER AREA	35	15A	1			●	1	15A	36	TREATMENT ROOM
LOUVER GALLERS, GFCI	37	15A	1	●			1	15A	38	GARAGE PLUG
LOWER GALLER, GFCI	39	15A	1		●		1	15A	40	GARAGE BATTERY PACC
LOWER GALLER, FIT / LIT	41	15A	1			●	2	15A	42	GARAGE PLUG
SHOWER ALARM	43	15A	1	●					44	SPACE
MICROSAND DOSING SYSTEM	45	15A	1		●		1	15A	46	GARAGE BOILER
UNIT HEATER (M47-UH-1)	47	15A	1			●	1		48	SPACE
UNIT HEATER (M49-UH-1)	49	15A	1	●			1		50	SPACE
UNIT HEATER (M51-UH-1)	51	15A	1		●		1		52	SPACE
UNIT HEATER (M53-UH-1)	53	15A	1			●	1		54	SPACE
UNIT HEATER (M55-UH-1)	55	15A	1	●			1		56	SPACE
UNIT HEATER (M57-UH-1)	57	15A	1		●		1		58	SPACE
SPACE	59		1			●	1		60	SPACE
SPACE	61		1	●			1		62	SPACE
SPACE	63		1		●		1		64	SPACE
SPACE	65		1			●	1		66	SPACE
SPACE	67		1	●			1		68	SPACE
SPACE	69		1		●		1		70	SPACE
SPACE	71		1			●	1		72	SPACE
SPACE	73		1	●			1		74	SPACE
SPACE	75		1		●		1		76	SPACE
SPACE	77		1			●	1		78	SPACE
SPACE	79		1	●			1		80	SPACE
SPACE	81		1		●		1		82	SPACE
SPACE	83		1			●	1		84	SPACE

PROVIDE 1-POLE 15A BREAKER (NOTE 6)

PROVISIONAL: PROVIDE 1-POLE, 15A BREAKER (NOTE 6,7)

2A LIGHTING PANEL "M" SCHEDULE - MODIFICATIONS

SCALE: N.T.S.



3B DISTRIBUTION PANEL "F" NAMEPLATE

SCALE: N.T.S.

DISTRIBUTION PANEL "F"

VOLTS: 600V
PHASES: 3
WIRES: 4

LOCATION: ELECTRICAL ROOM
FEEDER: PANEL "B"

BUSSING: 200A
MAIN BKR: 200A
MOUNTING: WALL
NO. CIR: 42

DESCRIPTION	CCT	BKR	P	A	B	C	P	BKR	CCT	DESCRIPTION
TRANSFORMER T1 PANEL "E"	1	60A	3	●			3	60A	2	TRANSFORMER T2 PANEL "G"
	3				●				4	
	5					●			6	
CHLORINE SCRUBBER	7	20A	3	●			3	15A	8	FILTER 1 VALVES
	9				●				10	
	11					●			12	
MOTORIZED VALVES 310, 320, 330, 630, 631	13	15A	3	●			3	15A	14	FILTER 2 VALVES
	15				●				16	
	17					●			18	
UNKNOWN LOAD	19	15A	3	●			3	15A	20	FILTER 3 VALVES
	21				●				22	
	23					●			24	
UNKNOWN LOAD	25	15A	3	●			3	15A	26	CONDENSER UNIT
	27				●				28	
	29					●			30	
AUTOMATED POLYMER SYSTEM CONTROL PANEL	31	25A	3	●			3	25A	32	TREATMENT ROOM DEHUMIDIFIER
	33				●				34	
	35					●			36	
SPARE	37	15A	1	●			1	15A	38	SPARE
SPARE	39	15A	1		●		1	15A	40	SPARE
SPARE	41	15A	1			●	1	15 A	42	SPARE

PROVIDE 3-POLE, BREAKER (NOTE 6)

PROVIDE 3-POLE, BREAKER (NOTE 6)

3A DISTRIBUTION PANEL "F" SCHEDULE - MODIFICATIONS

SCALE: N.T.S.



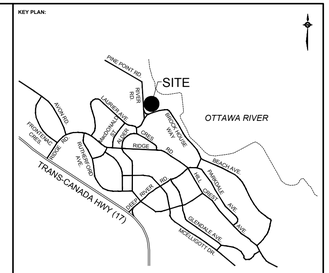
2B DISTRIBUTION PANEL "M" NAMEPLATE

SCALE: N.T.S.

NOTES:

1. PANEL SCHEDULE AND PHOTOS PROVIDED FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO VERIFY EXACT LAYOUT AND WIRING PRIOR TO MAKING ANY MODIFICATIONS
2. CONTRACTOR TO RETROFIT THE EXISTING LIGHTING/DISTRIBUTION PANEL. REPLACE EXISTING BREAKERS WITH NEW BREAKERS AS REQUIRED.
3. NEW BREAKERS MAKE AND MODEL TO MATCH EXISTING LIGHTING/DISTRIBUTION PANEL BREAKERS.
4. UPDATE THE LIGHTING/DISTRIBUTION PANEL SCHEDULE TO INCLUDE THE MODIFICATIONS MADE TO THE LIGHTING /DISTRIBUTION PANEL.
5. CONTRACTOR TO RETAIN THE ORIGINAL LIGHTING/DISTRIBUTION PANEL MANUFACTURER (SQUARE D/SCHNEIDER ELECTRIC) TO RETROFIT THE LIGHTING/DISTRIBUTION PANEL.
6. CONTRACTOR TO COORDINATE CIRCUIT BREAKER INSTALLATION TO COINCIDE WITH THE SHUTDOWN FOR THE PLC ACTIFLO CONTROL PANEL REPLACEMENT. THE INTENT IS TO LIMIT THE AMOUNT OF SHUTDOWNS. CONTRACTOR SHALL COORDINATE SHUTDOWN WITH REGION, OCWA AND ENGINEER.
7. PROVIDE PROVISIONAL COST FOR SUPPLY OF NEW CIRCUIT BREAKER AND FIELD WIRING. THIS WILL ONLY BE REQUIRED IF NO EXISTING 120V BRANCH CIRCUIT IS AVAILABLE.

KEY PLAN:



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0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY

APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

PROJECT NAME:

DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:

ELECTRICAL PANEL SCHEDULES

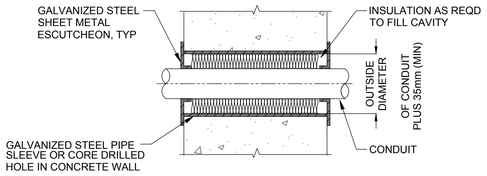
DISCIPLINE:

ELECTRICAL

DRAFTER: J.P.	SCALE: 1:80
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: E-602
SHEET No: 24 of 36	

PRINT DATE: 2025-05-29 10:36:33 PM
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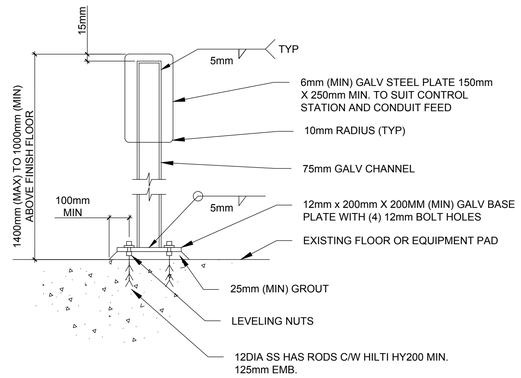


NOTES:

1. CONDUITS WHICH INDIVIDUALLY PASS THRU AN INTERIOR WALL SHALL BE INSTALLED IN ACCORDANCE WITH THIS DETAIL. IF WALL IS A FIRE WALL, FILL CAVITY WITH FIRE STOP SEALANT.

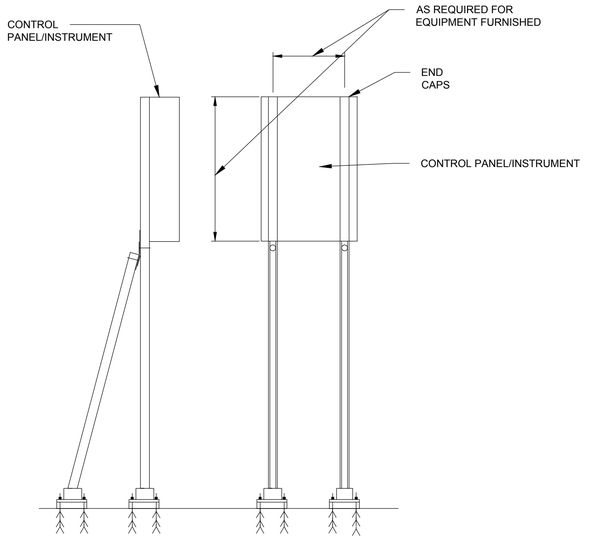
1 TYPICAL INTERIOR WALL PENETRATION

SCALE: NTS



2 TYPICAL LOCAL DISCONNECT SWITCH AND ELECTRICAL EQUIPMENT MOUNTING DETAIL

SCALE: NTS

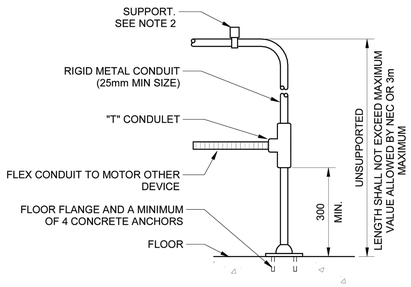


3 TYPICAL LOCAL CONTROL PANEL/ INSTRUMENTATION EQUIPMENT MOUNTING DETAIL

SCALE: NTS

NOTES:

1. USE STAINLESS STEEL BOLTS, NUTS, WASHERS, AND ANCHOR BOLTS.
2. DETAIL FOR ILLUSTRATION PURPOSES ONLY. CONTRACTOR TO COORDINATE WITH VEOLIA TO PROVIDE A SUPPORT STRUCTURE AS RECOMMENDED BY VEOLIA.

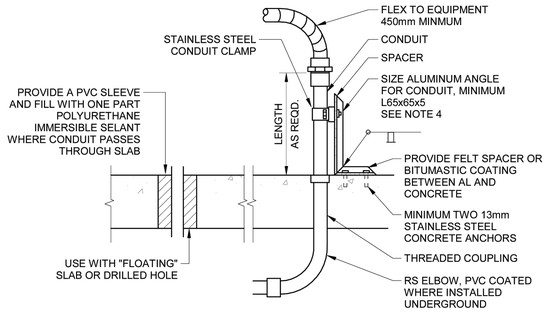


NOTES:

1. INSTALLATION OF CONDUIT TO A MOTOR OR OTHER DEVICE WHERE A FLEXIBLE CONNECTION IS REQUIRED AND NO JUNCTION BOXES OR CONTROL DEVICES ARE REQUIRED SHALL BE MADE IN ACCORDANCE WITH THIS DETAIL.
2. ALL HARDWARE SHALL BE STAINLESS STEEL.

4 TYPICAL CONDUIT TO EQUIPMENT FROM CEILING

SCALE: NTS

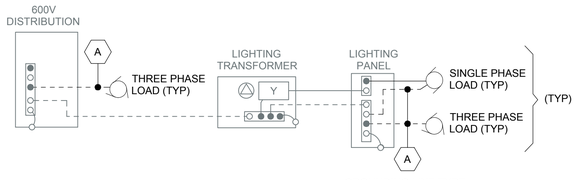


NOTES:

1. PROVIDE SUPPORT FOR ALL METAL CONDUITS WHICH EXTEND MORE THAN 450mm OUT OF THE SLAB WITHIN 75mm OF THE END OF THE CONDUIT.
2. PROVIDE SUPPORT FOR ALL PVC CONDUIT WITHIN 75mm OF THE END OF THE CONDUIT.
3. THIS DETAIL SHALL BE USED FOR SUPPORT OF ALL CONDUITS WHICH ARE NOT OTHERWISE SUPPORTED IN A RIGID MANNER SUCH AS AGAINST AN EQUIPMENT BASE, WALL, COLUMN, ETC. AS REQUIRED ABOVE.
4. FOR ANY ANGLE GREATER THAN 65mm TALL, SIZE ANGLE SUPPORT AND ANCHORS FOR SEISMIC LOADS.

5 TYPICAL CONDUIT TRANSITION AND SUPPORT

SCALE: NTS



NOTES:

1. PHASE CONDUCTORS NOT SHOWN FOR CLARITY.
2. ALL BOLTED FAULTS TO BE CLEARED WITHIN 0.5s.
3. SERVICE ENTRANCE IS THE FIRST MAIN OVER CURRENT PROTECTION DEVICE THAT IS SUPPLIED BY THE 28KV STEP DOWN TRANSFORMER. PROVIDE GROUND/BOND UP TO THE 28 KV STEP DOWN TRANSFORMER, INCLUDING THE TRANSFORMER XO
4. CONNECT GROUND CONNECTIONS TO THE BUILDING STRUCTURAL STEEL MEMBERS. PROVIDE MULTIPLE GROUND CONNECTIONS FOR THE RESPECTIVE BUILDING STRUCTURAL STEEL.

6 TYPICAL GROUNDING & BOUNDING SCHEMATIC

SCALE: NTS

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER:

CLIENT:

PROJECT NAME:

DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:

ELECTRICAL DETAILS

DISCIPLINE:

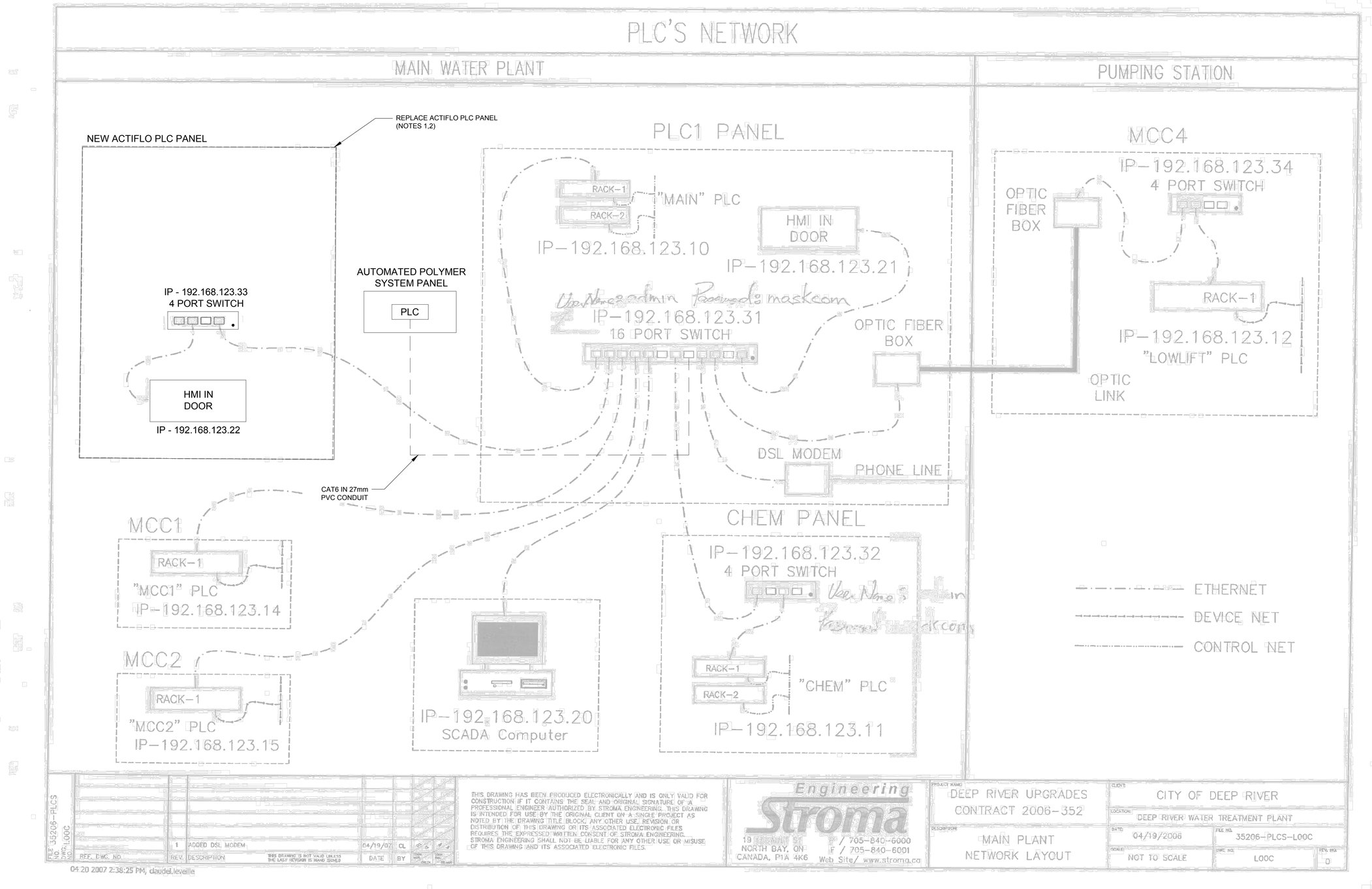
ELECTRICAL

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: E-901
SHEET No: 25 of 36	

PRINT DATE: 2025-05-29 12:56:33 PM
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TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21

PLC'S NETWORK



NOTES:

1. CONTRACTOR TO REMOVE EXISTING ACTIFLO AND REPLACE WITH NEW PLC PANEL SUPPLIED BY DIVISION 11. CONTRACTORS TO ASSIST IN TESTING AND COMMISSIONING OF EXISTING POWER AND NETWORK WIRING TO THE NEW PLC PANEL. CONTRACTORS SHALL COORDINATE SHUTDOWN WITH REGION, OCWA AND ENGINEER.
2. RE-UTILIZE EXISTING POWER, CONTROL AND COMMUNICATIONS WIRING.
3. NETWORK DRAWINGS PROVIDED FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO VERIFY EXACT LAYOUT AND WIRING PRIOR TO MAKE ANY MODIFICATIONS.

LEGEND:
EXISTING
NEW

FILE NO. 35206-PLCS
DWG NO. L00C
REF. DWG. NO.

No.	REV. DESCRIPTION	DATE	BY	CHK'D	APP'D
1	ADDED DSL MODEM	04/19/07	CL		

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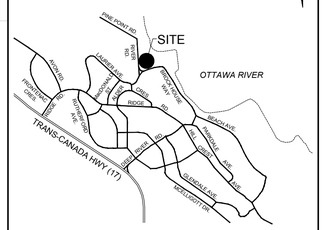
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19 GRAHAM ST. NORTH BAY, ON CANADA, P1A 4K6
P / 705-840-6000
F / 705-840-6001
Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION: MAIN PLANT NETWORK LAYOUT
DATE: 04/19/2006
FILE NO.: 35206-PLCS-L00C
SCALE: NOT TO SCALE
DWG. NO.: L00C
REV. NO.: 0

04-20 2007 2:38:25 PM, daudel.leveille

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:
LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME: DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE: NETWORK LAYOUT RETROFITS

DISCIPLINE: INSTRUMENTATION

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: I-001
SHEET No: 26 of 36	

PRINT DATE: 2025-04-22 1:01:09 PM
PATH: C:\Users\jef.jfaveligon\DOCS\DocsCIMA +\A001332 - Deep River WTP\Project Files\311 - CAD\Electrical\Sheets\A001332-E001.dwg

TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21

PLC1 ANALOG INPUT MODULE # 1-B

FIELD

PANEL TERMINALS

RACK 1 SLOT 5, 4-20mA ANALOG, 8 INPUT

35206-PLC1-E005 — DC24 24CON — 35206-PLC1-E007

TB-9 / TB-7

FIELD			PANEL TERMINALS		RACK 1 SLOT 5, 4-20mA ANALOG, 8 INPUT
Finished Water Turbidity (to Distribution)	TEA-501	(TIA501-AIT)	3-8 (Ai1:05/08)	RED/GREEN BLUE/RED	RED/GREEN 20 BLUE/RED 19
UV 303 Requested Lamp Power	UV-303	(UV303-LMT-RQT)	3-9 (Ai1:05/09)	BLACK/WHITE - RED ORANGE/GREEN	BLACK/WHITE - RED 22 ORANGE/GREEN 21
UV 303 Actual Lamp Power	UV-303	(UV303-LMT-ACT)	3-10 (Ai1:05/10)	RED/BLACK - WHITE WHITE/BLACK - RED	RED/BLACK - WHITE 24 WHITE/BLACK - RED 23
High Lift Pump #1 Pressure	PIT-501	(PIT501-AIT)	3-11 (Ai1:05/11)	ORANGE/BLACK - WHITE GREEN/BLACK - WHITE	NOT TERMINATED BLUE/BLACK - WHITE 27 ORANGE/BLACK - WHITE 26 GREEN/BLACK - WHITE 25
Generator Phase A CT	GENCT-A	(GENCT-A) MORE INFO ON PAGE 35206-PLC1-E027	3-12 (Ai1:05/12)	RED/BLACK - GREEN WHITE/RED - GREEN	NOT TERMINATED BLACK/RED - GREEN 28 RED/BLACK - GREEN 30 WHITE/RED - GREEN 29
			3-13 (Ai1:05/13)	ORANGE/BLACK - GREEN GREEN/BLACK - ORANGE	ORANGE/BLACK - GREEN 32 GREEN/BLACK - ORANGE 31
			3-14 (Ai1:05/14)	BLACK/WHITE - ORANGE BLUE/WHITE - ORANGE	BLACK/WHITE - ORANGE 34 BLUE/WHITE - ORANGE 33
			3-15 (Ai1:05/15)	ORANGE/WHITE - BLUE WHITE/RED - ORANGE	ORANGE/WHITE - BLUE 36 WHITE/RED - ORANGE 35

All: POWERED THROUGH BASE (DC24-F1)

TB-6 F6

REFER TO NOTES

Total Chlorine Analyzer — CIA-501 (+/−) — (CIA501-AIT) — W / BLK

ANALOG INPUT MODULE AB # 1756-IF16

MODULE TERMINALS

IN-0	2	1	RTN-0
IN-1	4	3	RTN-1
IN-2	6	5	RTN-2
IN-3	8	7	RTN-3
RTN	10	9	RTN
IN-4	12	11	RTN-4
IN-5	14	13	RTN-5
IN-6	16	15	RTN-6
IN-7	18	17	RTN-7
IN-8	20	19	RTN-8
IN-9	22	21	RTN-9
IN-10	24	23	RTN-10
IN-11	26	25	RTN-11
RTN	28	27	RTN
IN-12	30	29	RTN-12
IN-13	32	31	RTN-13
IN-14	34	33	RTN-14
IN-15	36	35	RTN-15

WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

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Stroma
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P / 705-840-6000
F / 703-840-6001
Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
LOCATION: ANALOG INPUT CARD #1 LOOP DRAWING
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DATE: 04/19/2006 — FILE NO.: 35206-PLC1-E006
SCALE: NOT TO SCALE — DWG NO.: E006 — REVISION: 0

04.20.2007 2:35:50 PM, claudel.neville

NOTES:

1. PACKAGED EQUIPMENT SUPPLIED BY DIVISION 11. CONTRACTOR TO PROVIDE POWER AND CONTROL WIRING. COORDINATE WITH DIVISION 11 AS REQUIRED.
2. CONTRACTOR IS REQUIRED TO CONFIRM ALL FIELD CONDITIONS AND PROVIDE UPDATE/ORIGINAL SHOP DRAWINGS FOR THE FINAL CONDITIONS.
3. CONTRACTOR SHALL PROVIDE ALL MATERIALS NECESSARY TO COMPLETE THE CIRCUIT MODIFICATIONS SHOWN ON THESE DRAWINGS. PARTS SHALL BE SELECTED FROM THE ORIGINAL BILL OF MATERIALS AS MUCH AS PRACTICALLY POSSIBLE.
4. LOOP DRAWINGS PROVIDED FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO VERIFY EXACT LAYOUT AND WIRING PRIOR TO MAKE ANY MODIFICATIONS.

LEGEND:
——— EXISTING
——— NEW

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:
LICENSED PROFESSIONAL ENGINEER — 21/10/2025 — M. ALZAYED 100559294 — PROVINCE OF ONTARIO

DESIGNED BY — APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME: DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE: MAIN PLC ANALOG INPUT MODULE #1-B RETROFITS

DISCIPLINE: INSTRUMENTATION

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: I-002
SHEET No: 27 of 36	

PRINT DATE: 2025-04-22 1:01:09 PM
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TITLEBLOCK 22x34 VERT ENG
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PLC1 ANALOG INPUT MODULE # 1-A

(ALL ANALOG INPUTS) COME FROM FIELD BELDEN CABLE W - Wt Bk - Blk

FIELD

PANEL TERMINALS

RACK 1 SLOT 5, 4-20mA ANALOG, 8 INPUT

TB-6 F1 — 3A — (DC24-F1) — DC24 / 24COM

TB-7 PTB-1 — 1+ 2- 3 NC 4 NC 5 6 NC 7 NC 8

PTB-1 PROVIDES POWER TO ANALOG INPUT SIGNAL ISOLATORS THROUGH THE BASE

35206-PLC1-E004 — DC24 / 24COM — 35206-PLC1-E006

TB-9

FIELD			PANEL TERMINALS		RACK 1 SLOT 5, 4-20mA ANALOG, 8 INPUT
Filter #1 Valve Position Filtered Water to Reservoir	BFV-314	(BFV314-VPI)	(AI:1:05/00)	3-0	WHITE / BLACK — POWERED THROUGH BASE (DC24-F1)
Filter #1 Surge Tank Valve Position	BFV-316	(BFV316-VPI)	(AI:1:05/01)	3-1	GREEN / RED — POWERED THROUGH BASE (DC24-F1)
Filter #1 Valve Position Filtered Water to Waste	BFV-317	(BFV317-VPI)	(AI:1:05/02)	3-2	BLUE / ORANGE — POWERED THROUGH BASE (DC24-F1)
Filter #1 Effluent Flow Rate	FIT-301	(FIT301-AIT)	(AI:1:05/03)	3-3	RED/BLACK / WHITE/BLACK — POWERED THROUGH BASE (DC24-F1)
Filter #1 Effluent Pressure	PIT-301	(PIT301-AIT)	(AI:1:05/04)	3-4	BLACK/WHITE / BLUE/BLACK — POWERED THROUGH BASE (DC24-F1) — TB-6 F5
Filter #1 Turbidity Level	TIA-301	(TIA301-AIT)	(AI:1:05/05)	3-5	GREEN/WHITE / RED/WHITE — POWERED THROUGH BASE (DC24-F1)
Filter #1 Water Level	LIT-301	(LIT301-AIT)	(AI:1:05/06)	3-6	BLACK/RED / BLUE/WHITE — POWERED THROUGH BASE (DC24-F1)
Finished Water Free Chlorine Residual (to Distribution)	CIA-502	(CIA502-AIT)	(AI:1:05/07)	3-7	ORANGE/RED / WHITE/RED — POWERED THROUGH BASE (DC24-F1)
Chart Recorder Chlorine Residual Pen #1	CHART-RECORDER	(CIA502-AIT2)			

MODULE TERMINALS

WHITE	2
BLACK	1
GREEN	4
RED	3
BLUE	6
ORANGE	5
NOT TERMINATED	GREEN/BLACK 9
RED/BLACK	8
WHITE/BLACK	7
NOT TERMINATED	ORANGE/BLACK 10
BLACK/WHITE	12
BLUE/BLACK	11
GREEN/WHITE	14
RED/WHITE	13
BLACK/RED	16
BLUE/WHITE	15
ORANGE/RED	18
WHITE/RED	17

ANALOG INPUT MODULE
AB # 1756-IF16

WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE: 35206-PLC1 ANALOG INPUT CARD #1 DWG: E005

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DESIGN MGR. CHECK	GROUP MGR. APPROVE
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PROJECT NAME:	DEEP RIVER UPGRADES CONTRACT 2006-352
CLIENT:	CITY OF DEEP RIVER
LOCATION:	DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION:	ANALOG INPUT CARD #1 LOOP DRAWING
DATE:	04/19/2006
FILE NO.	35206-PLC1-E005
SCALE:	NOT TO SCALE
DWG. NO.	E005
REV. NO.	0

04 20 2007 2:35:54 PM, claudel.leveille

NOTES:

1. PACKAGED EQUIPMENT SUPPLIED BY DIVISION 11. CONTRACTOR TO PROVIDE POWER AND CONTROL WIRING. COORDINATE WITH DIVISION 11 AS REQUIRED.
2. CONTRACTOR IS REQUIRED TO CONFIRM ALL FIELD CONDITIONS AND PROVIDE UPDATE/ORIGINAL SHOP DRAWINGS FOR THE FINAL CONDITIONS.
3. CONTRACTOR SHALL PROVIDE ALL MATERIALS NECESSARY TO COMPLETE THE CIRCUIT MODIFICATIONS SHOWN ON THESE DRAWINGS. PARTS SHALL BE SELECTED FROM THE ORIGINAL BILL OF MATERIALS AS MUCH AS PRACTICALLY POSSIBLE.
4. LOOP DRAWINGS PROVIDED FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO VERIFY EXACT LAYOUT AND WIRING PRIOR TO MAKE ANY MODIFICATIONS.

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY — APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
MAIN PLC ANALOG INPUT MODULE #1-A RETROFITS

DISCIPLINE: INSTRUMENTATION

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: I-003
SHEET No: 2 of 36	

PRINT DATE: 2025-04-22 1:01:09 PM
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TITLEBLOCK 22x34 VERT ENG

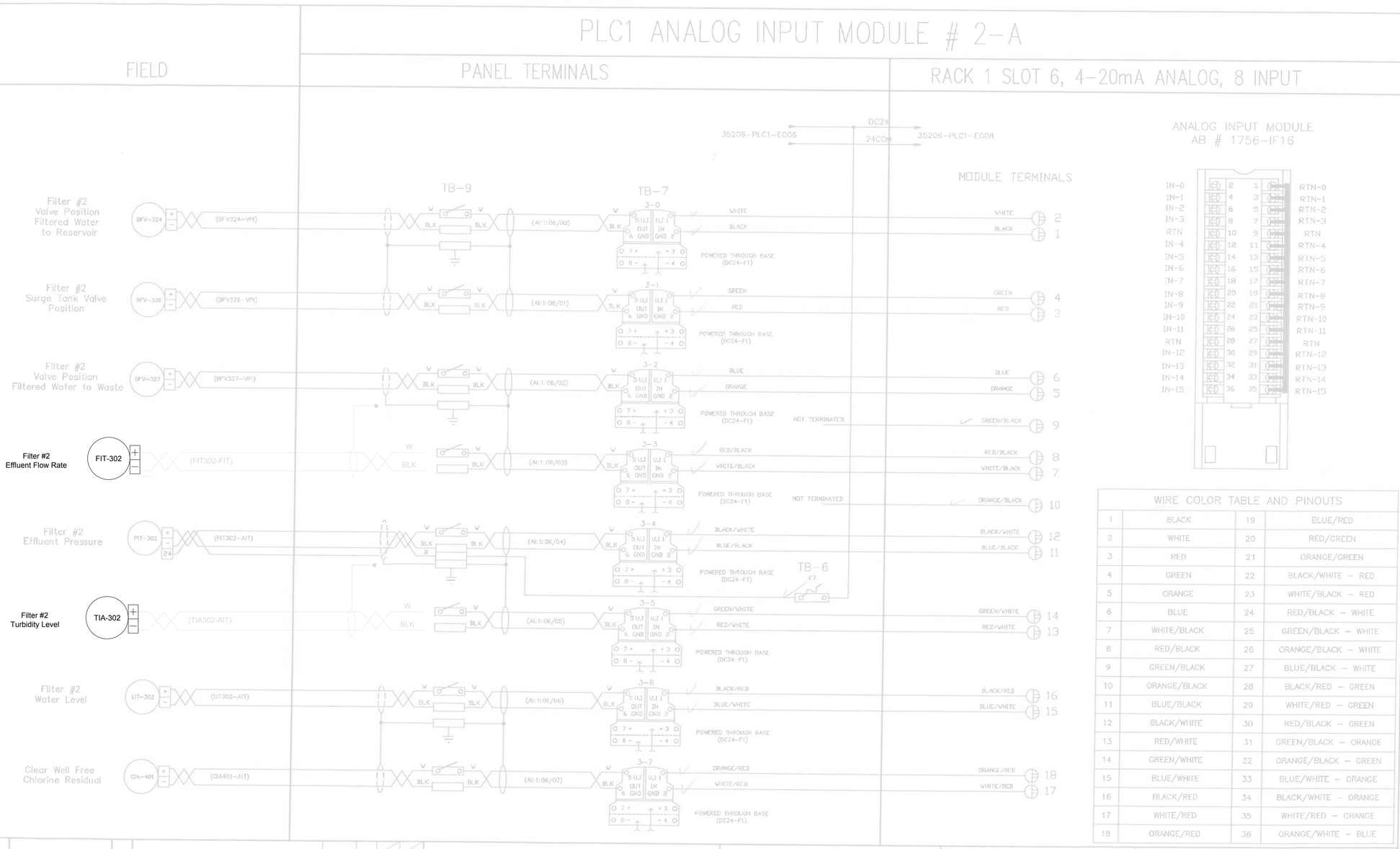
TTLB v2020.10.21

PLC1 ANALOG INPUT MODULE # 2-A

FIELD

PANEL TERMINALS

RACK 1 SLOT 6, 4-20mA ANALOG, 8 INPUT



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NAME: 35206-PLC1 DWG. NO. E007

REF. DWG. NO. | REV. | DESCRIPTION | THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED | DATE | BY | CHKD | ENGR | PM/MGR

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NORTH BAY, ON
CANADA, P1A 4K6
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F / 705-840-6001
Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: ANALOG INPUT CARD #2 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006 | FILE NO.: 35206-PLC1-E007

SCALE: NOT TO SCALE | DWG. NO.: E007 | REV. NO.: 0

NOTES:

1. PACKAGED EQUIPMENT SUPPLIED BY DIVISION 11. CONTRACTOR TO PROVIDE POWER AND CONTROL WIRING. COORDINATE WITH DIVISION 11 AS REQUIRED.
2. CONTRACTOR IS REQUIRED TO CONFIRM ALL FIELD CONDITIONS AND PROVIDE UPDATE/ORIGINAL SHOP DRAWINGS FOR THE FINAL CONDITIONS.
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KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:

DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:

MAIN PLC ANALOG INPUT MODULE #2-A RETROFITS

DISCIPLINE: INSTRUMENTATION

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: I-004
SHEET No: 2 of 36	

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TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21

PLC1 ANALOG INPUT MODULE # 3-A

FIELD

PANEL TERMINALS

RACK 1 SLOT 7, 4-20mA ANALOG, 8 INPUT

35206-PLC1-E008 → DC24, 24COM → 35206-PLC1-E010

TB-9 / TB-7

Filter #3 Valve Position Filtered Water to Reservoir	BFV-334	(BFV334-VPI)	(AI:1:07/00)	3-0	WHITE / BLACK
Filter #3 Surge Tank Valve Position	BFV-336	(BFV336-VPI)	(AI:1:07/01)	3-1	GREEN / RED
Filter #3 Valve Position Filtered Water to Waste	BFV-337	(BFV337-VPI)	(AI:1:07/02)	3-2	BLUE / ORANGE
Filter #3 Effluent Flow Rate	FIT-303	(FIT303-AIT)	(AI:1:07/03)	3-3	RED/BLACK / WHITE/BLACK
Filter #3 Effluent Pressure	PIT-303	(PIT303-AIT)	(AI:1:07/04)	3-4	BLACK/WHITE / BLUE/BLACK
Filter #3 Turbidity Level	TIA-303	(TIA303-AIT)	(AI:1:07/05)	3-5	GREEN/WHITE / RED/WHITE
Filter #3 Water Level	LIT-303	(LIT303-AIT)	(AI:1:07/06)	3-6	BLACK/RED / BLUE/WHITE
Finished Water Fluoride Concentration (to Distribution)	FIA-502	(FIA502-AIT)	(AI:1:07/07)	3-7	ORANGE/RED / WHITE/RED

All channels: POWERED THROUGH BASE (DC24-F1)

TB-6 F9

MODULE TERMINALS

WHITE	2		
BLACK	1		
GREEN	4		
RED	3		
BLUE	6		
ORANGE	5		
GREEN/BLACK	9	NOT TERMINATED	
RED/BLACK	8		
WHITE/BLACK	7		
ORANGE/BLACK	10	NOT TERMINATED	
BLACK/WHITE	12		
BLUE/BLACK	11		
GREEN/WHITE	14		
RED/WHITE	13		
BLACK/RED	16		
BLUE/WHITE	15		
ORANGE/RED	18		
WHITE/RED	17		

ANALOG INPUT MODULE
AB # 1756-IF16

WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE 35206-PLC1 NO. NO. E009

REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DRAWN WORK CHECK	DESIGN CHK. APPROVE

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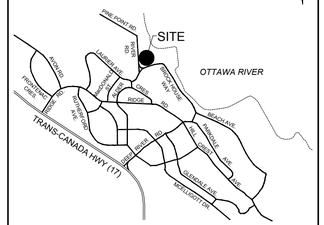
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F / 705-840-6001
Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
DESCRIPTION: ANALOG INPUT CARD #3 LOOP DRAWING
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DATE: 04/19/2006
FILE NO.: 35206-PLC1-E009
SCALE: NOT TO SCALE
DWG. NO.: E009
REV. NO.: 0

NOTES:

1. PACKAGED EQUIPMENT SUPPLIED BY DIVISION 11. CONTRACTOR TO PROVIDE POWER AND CONTROL WIRING. COORDINATE WITH DIVISION 11 AS REQUIRED.
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STAMPS:
LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO
DESIGNED BY
APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
MAIN PLC ANALOG INPUT MODULE #3-A RETROFITS

DISCIPLINE: INSTRUMENTATION

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: I-005
SHEET No: 30 of 36	

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PLC1 DIGITAL INPUT MODULE # 5

FIELD

PANEL TERMINALS

RACK 2 SLOT 9, 110VAC 16 PT. INPUT

Future UV System

UV #2 Common Alarm — UV-304 — UPS-11 — (UV304-XCA)

UV #2 Major Alarm — UV-304 — UPS-11 — (UV304-XMJ)

UV #2 Minor Alarm — UV-304 — UPS-11 — (UV304-XMN)

UV #2 Lamp Status — UV-1304 — UPS-11 — (UV304-LMP-ST)

UV #2 Ready Status — UV-304 — UPS-11 — (UV304-ST)

Sludge Blanket Level Alarm Contact — SBL-601 — UPS-11 — (PLA501-XA)

Shower #1 in Waste Area Alarm Contact — SA-600 — UPS-11 — (SA600-XA)

Shower #2 in Waste Area Alarm Contact — SA-601 — UPS-11 — (SA601-XA)

Shower #2 in Waste Area Alarm Contact — SA-602 — UPS-11 — (SA602-XA)

Spare — SPARE

Spare — SPARE

Spare — SPARE

CIA-501 Total Chlorine Analyzer General Alarm — CIA-501 — UPS-11 — (CIA501-XA)

Lower Gallery High Flood Alarm — LS-610 — (DC24-F30-17) — (LS610-HA)

Filter Room Pipe Gallery High Flood Alarm — LS-301 — (DC24-F30-4) — (LS301-HA)

Spare 24V DC Input — SPARE

TB-1
16 PT. INTERFACE MODULE

UPS-11 — UPS-13 — UPS-REUT.

ALLEN BRADLEY PART #1492-IMF20120

TB-11 — (LS301-HA) — (LS610-HA)

TB-7 — COM 24COM — 24V — (DC2:04/13) — (DC2:04/14) — (DC2:04/15)

TB-6 — F19 — (DC4-F20) — 35205-PLC1-E004

AB # 1756-IA16

IN-0 IN-1 IN-2 IN-3 IN-4 IN-5 IN-6 IN-7 L-2 IN-8 IN-9 IN-10 IN-11 IN-12 IN-13 IN-14 IN-15 L-2

ALLEN BRADLEY PART #1756-CABLE08A

35206-PLC1-E003

NOTES:

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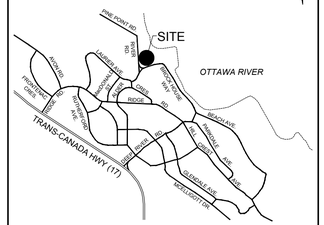
DEEP RIVER UPGRADES
CONTRACT 2006-352

DIGITAL INPUT CARD #5
LOOP DRAWING

CITY OF DEEP RIVER
DEEP RIVER WATER TREATMENT PLANT
04/19/2006 — 35206-PLC1-E022
NOT TO SCALE — E022 — 0

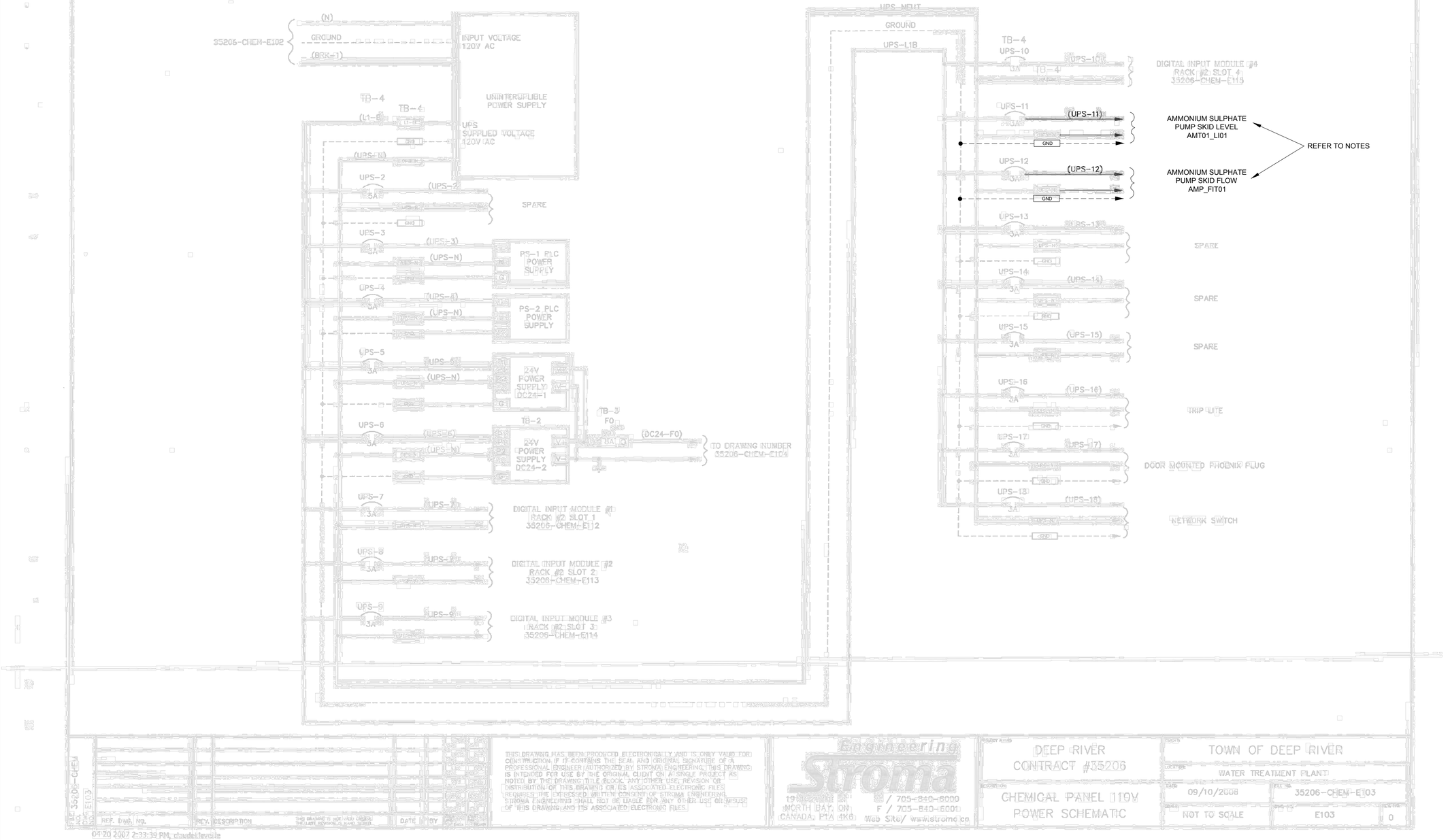
No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

KEY PLAN:


SITE
OTTAWA RIVER
TRANS-CANADA HWY (17)
ARCHIBALD
PROVENCHER
CARMICHAEL
RAPIDES
RAPIDES
RAPIDES

TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21

CHEM CONTROL PANELS UPS-110V POWER DISTRIBUTION



NOTES:

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Web Site/ www.stroma.ca

DEEP RIVER CONTRACT #35206
CHEMICAL PANEL 110V POWER SCHEMATIC
TOWN OF DEEP RIVER
WATER TREATMENT PLANT
09/10/2008 | 35206-CHEM-E103
NOT TO SCALE | E103 | 0

FILE: 35206-CHEM-E103.DWG

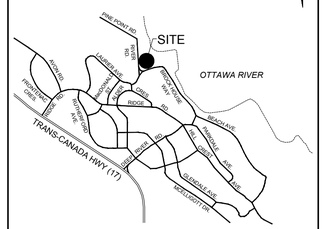
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KEY PLAN:



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STAMPS:

LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
CHEMICAL PLC POWER DISTRIBUTION RETROFITS

DISCIPLINE:
INSTRUMENTATION

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: I-007
SHEET No: 32 of 36	

TITLEBLOCK 22x34 VERT ENG

TTLB v2020.10.21

CHEM ANALOG INPUT MODULE # 1-B

FIELD

PANEL TERMINALS

RACK 1 SLOT 3, 4-20mA ANALOG, 8 INPUT

Ammonium Sulphate Pump 1 Skid Speed Indicator — AMP01_VA — W, BLK

Ammonium Sulphate Pump 2 Skid Speed Indicator — AMP02_VA — W, BLK

Ammonium Sulphate Pump Skid Level — AMT01_LI01 — AMT01_LI01-AIT — W, BLK

REFER TO NOTES

Ammonium Sulphate Pump Skid Flow — AMP_FIT01 — AMP_FIT01-AIT — W, BLK

TB-1 / TB-2

TB-2		TB-1	MODULE TERMINALS
3-8	RED/GREEN	(Al:1:03/08)	20
	BLUE/RED		19
	POWERED THROUGH BASE (DC24-F1)		
3-9	BLACK/WHITE - RED	(Al:1:03/09)	22
	ORANGE/GREEN		21
	POWERED THROUGH BASE (DC24-F1)		
3-10	RED/BLACK - WHITE	(Al:1:03/10)	24
	WHITE/BLACK - RED		23
	POWERED THROUGH BASE (DC24-F1)	NOT TERMINATED	27
3-11	ORANGE/BLACK - WHITE	(Al:1:03/11)	26
	BLUE/BLACK - WHITE		25
	POWERED THROUGH BASE (DC24-F1)	NOT TERMINATED	28
3-12	RED/BLACK - GREEN	(Al:1:03/12)	30
	WHITE/RED - GREEN		29
	POWERED THROUGH BASE (DC24-F1)		
3-13	ORANGE/BLACK - GREEN	(Al:1:03/13)	32
	GREEN/BLACK - ORANGE		31
	POWERED THROUGH BASE (DC24-F1)		
3-14	BLACK/WHITE - ORANGE	(Al:1:03/14)	34
	BLUE/WHITE - ORANGE		33
	POWERED THROUGH BASE (DC24-F1)		
3-15	ORANGE/WHITE - BLUE	(Al:1:03/15)	36
	WHITE/RED - ORANGE		35
	POWERED THROUGH BASE (DC24-F1)		

ANALOG INPUT MODULE AB # 1756-IF16

MODULE TERMINALS

IN-0	2	1	RTN-0
IN-1	4	3	RTN-1
IN-2	6	5	RTN-2
IN-3	8	7	RTN-3
RTN	10	9	RTN
IN-4	12	11	RTN-4
IN-5	14	13	RTN-5
IN-6	16	15	RTN-6
IN-7	18	17	RTN-7
IN-8	20	19	RTN-8
IN-9	22	21	RTN-9
IN-10	24	23	RTN-10
IN-11	26	25	RTN-11
RTN	28	27	RTN
IN-12	30	29	RTN-12
IN-13	32	31	RTN-13
IN-14	34	33	RTN-14
IN-15	36	35	RTN-15

WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE - RED
5	ORANGE	23	WHITE/BLACK - RED
6	BLUE	24	RED/BLACK - WHITE
7	WHITE/BLACK	25	GREEN/BLACK - WHITE
8	RED/BLACK	26	ORANGE/BLACK - WHITE
9	GREEN/BLACK	27	BLUE/BLACK - WHITE
10	ORANGE/BLACK	28	BLACK/RED - GREEN
11	BLUE/BLACK	29	WHITE/RED - GREEN
12	BLACK/WHITE	30	RED/BLACK - GREEN
13	RED/WHITE	31	GREEN/BLACK - ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK - GREEN
15	BLUE/WHITE	33	BLUE/WHITE - ORANGE
16	BLACK/RED	34	BLACK/WHITE - ORANGE
17	WHITE/RED	35	WHITE/RED - ORANGE
18	ORANGE/RED	36	ORANGE/WHITE - BLUE

NOTES:

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LEGEND:
- EXISTING
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P / 705-840-6606
F / 705-840-6001
Web Site / www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DRAWING NAME: ANALOG INPUT CARD #1 LOOP DRAWING
DATE: 04/19/2006
FILE NO.: 35206-CHEM-E106
SCALE: NOT TO SCALE
DRAWING NO.: E106
REV NO.: 0

KEY PLAN:


SITE
OTTAWA RIVER
TRANS-CANADA HWY (17)
ARCHIBALD
FRENCHMAN'S BAY
LAURENTIAN
RAINBOW
BOUNDARY
BROADVIEW
ALGONQUIN
MCKENZIE
MONTREAL
MONTREAL
MONTREAL

TITLEBLOCK 22x34 VERT ENG

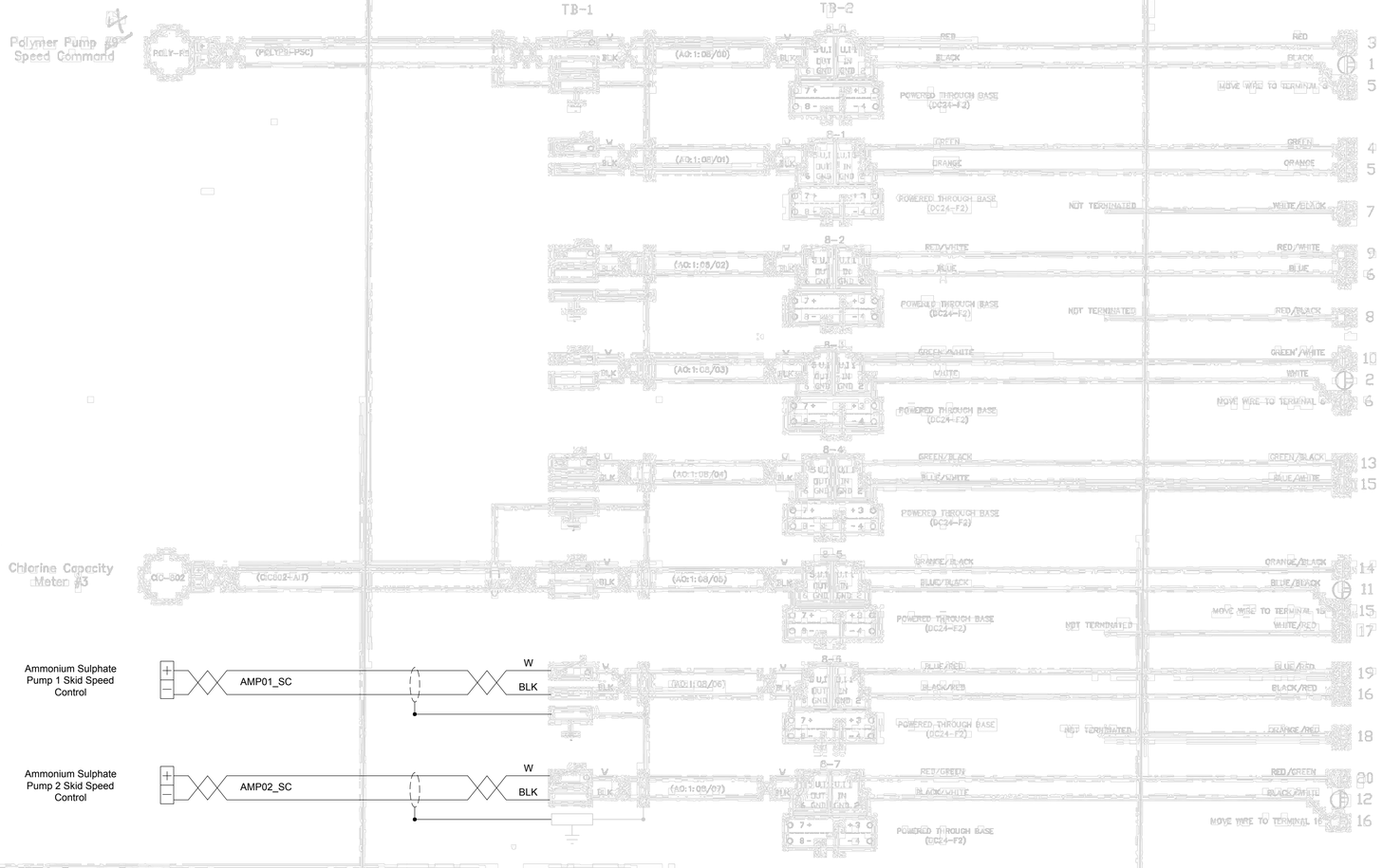
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CHEM ANALOG OUTPUT MODULE # 3

FIELD

PANEL TERMINALS

RACK 1 SLOT 8, 4-20mA ANALOG, 8 OUTPUTS



WIRE COLOR TABLE AND PINOUTS

1	BLACK	11	BLUE/BLACK
2	WHITE	12	BLACK/WHITE
3	RED	13	RED/WHITE
4	GREEN	14	GREEN/WHITE
5	ORANGE	15	BLUE/WHITE
6	BLUE	16	BLACK/RED
7	WHITE/BLACK	17	WHITE/RED
8	RED/BLACK	18	ORANGE/RED
9	GREEN/BLACK	19	BLUE/RED
10	ORANGE/BLACK	20	RED/GREEN

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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
DRAWING: ANALOG OUTPUT CARD #3 LOOP DRAWING
CLIENT: CITY OF DEEP RIVER
BRANCH: DEEP RIVER WATER TREATMENT PLANT
DATE: 06/19/2006
DWG No.: 35206-CHEM-E111
SCALE: NOT TO SCALE
SHEET: E111
REV No.: 0

REF. DWG. NO. | REV. DESCRIPTION | DATE | BY

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NOTES:

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4. LOOP DRAWINGS PROVIDED FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO VERIFY EXACT LAYOUT AND WIRING PRIOR TO MAKE ANY MODIFICATIONS.

KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER
21/10/2025
M. ALZAYED
100559294
PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
CHEMICAL PLC ANALOG OUTPUT MODULE #3 RETROFITS

DISCIPLINE:
INSTRUMENTATION

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: I-009
SHEET No: 34 of 36	

PRINT DATE: 2025-04-22 1:01:09 PM
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TITLEBLOCK 22x34 VERT ENG
TTLB v2020.10.21

CHEM DIGITAL INPUT MODULE # 3

FIELD

Polymer Pump #9

- Status On/Off — POLY-P9 (UPS-9) 5 8 (POLYP9-ST)
- Pump Alarm — POLY-P9 (UPS-9) (POLYP9-XA)

- Chemical Room #1 Temperature — TS-701 (UPS-9) (TS701-LA)
- Chemical Room #2 Temperature — TS-801 (UPS-9) (TS801-LA)
- Remote Vacuum Switchover Unit Valve Position — RVS-800 (UPS-9) (RVS800-ST)
- Ammonium Sulphate Pump 1 Running Status — AMP01_RS (UPS-9) (AMP01-RS)
- Ammonium Sulphate Pump 1 Control Mode Status — AMP01_CM (UPS-9) (AMP01-CM)
- Ammonium Sulphate Pump 1 General Alarm — AMP01_GA (UPS-9) (AMP01-GA)
- Ammonium Sulphate Pump 1 Leak Detector — AMP01_LA (UPS-9) (AMP01-LA)
- Ammonium Sulphate Pump 2 Running Status — AMP02_RS (UPS-9) (AMP02-RS)
- Ammonium Sulphate Pump 2 Control Mode Status — AMP02_CM (UPS-9) (AMP02-CM)
- Ammonium Sulphate Pump 2 General Alarm — AMP02_GA (UPS-9) (AMP02-GA)
- Ammonium Sulphate Pump 2 Leak Detector — AMP02_LA (UPS-9) (AMP02-LA)
- Ammonium Sulphate Secondary Containment Spill Detection — AMT_LSH1
- Ammonium Sulphate Storage Tank Level General Alarm — AMT01_LI01
- Ammonium Sulphate Discharge Flow General Alarm — AMP_FIT01

PANEL TERMINALS

(UPS-9) UPS-9 3A (UPS-9) → 35205-PLC1-E003

TB-1
16 PT. INTERFACE MODULE

(UPS-9) (UPS-9) UPS-NEUT. (UPS-9) L2 L2

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 L2 L2

ALLEN BRADLEY PART #1492-IMF20B120

(UPS-9) UPS-NEUT.

ALLEN BRADLEY PART #1756-CABLE010A

RACK 2 SLOT 3, 110VAC 16 PT. INPUT

AB # 1756-IA16

IN-1	IN-0
IN-3	IN-2
IN-5	IN-4
IN-7	IN-6
L-2	L-2
IN-9	IN-8
IN-11	IN-10
IN-13	IN-12
IN-15	IN-14
L-2	L-2

FILE: 35205-CHEM
DWG NO: E114

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY
		THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED		

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TP / 705-840-6000
F / 705-840-6001
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PROJECT NAME:	DEEP RIVER UPGRADES CONTRACT 2006-352
CLIENT:	CITY OF DEEP RIVER
LOCATION:	DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION:	DIGITAL INPUT CARD #3 LOOP DRAWING
DATE:	04/19/2006
FILE NO.:	35205-CHEM-E114
SCALE:	NOT TO SCALE
DWG. NO.:	E114
REV. NO.:	0

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NOTES:

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KEY PLAN:



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No.	Date	Description	By
0	OCT 2025	ISSUED FOR TENDER	A.S.

STAMPS:

LICENSED PROFESSIONAL ENGINEER — 21/10/2025 — M. ALZAYED 100559294 — PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CONSULTANT(S):

ENGINEER: CIMA+

CLIENT: deep river

PROJECT NAME:
DEEP RIVER WATER TREATMENT PLANT UPGRADES

SHEET TITLE:
CHEMICAL PLC DIGITAL INPUT MODULE #3 RETROFITS

DISCIPLINE:
INSTRUMENTATION

DRAFTER: J.P.	SCALE: N.T.S.
DESIGNER: A.Q.	DATE: OCT 2025
APPROVER: A.S.	CHECKER: M.A.
PROJECT No: A001332	DRAWING No: I-010
SHEET No: 35 of 36	

PRINT DATE: 2025-04-22 1:01:09 PM
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TITLEBLOCK 22x34 VERT ENG

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CHEM DIGITAL OUTPUT MODULE #1

FIELD

Fill Coagulant Day Tank Solenoid's Open Valve Command — (SV709-OVC-A) / (SV709-OVC-B)

Fill Caustic Soda Day Tank #3 Solenoid's Open Valve Command — (SV630-OVC-A) / (SV630-OVC-B)

Fill Caustic Soda Day Tank #4 Solenoid's Open Valve Command — (SV601-OVC-A) / (SV601-OVC-B)

Chlorine Detector System General Alarm — (DP500-XA-A) / (DP500-XA-B)

Chlorine Injectors #1 Solenoid Valve Open Valve Command — (SV811-OVC-A) / (SV811-OVC-B)

Chlorine Injectors #2 Solenoid Valve Open Valve Command — (SV812-OVC-A) / (SV812-OVC-B)

Chlorine Injectors #3 Solenoid Valve Open Valve Command — (SV813-OVC-A) / (SV813-OVC-B)

Ammonium Sulphate Pump 1 Start/Stop — AMP01_TP

Ammonium Sulphate Pump 2 Start/Stop — AMP02_TP

PANEL TERMINALS

RACK 2 SLOT 6, 10-265VAC 5-150VDC, 16 PT OUTPUT

INTERPOSING RELAY

TB-9 / TB-8

35206-PLC1-E104

ANALOG INPUT MODULE
AB # 1756-IF16

L1-0	2	1	OUT-0
L1-1	4	3	OUT-1
L1-2	6	5	OUT-2
L1-3	8	7	OUT-3
L1-4	10	9	OUT-4
L1-5	12	11	OUT-5
L1-6	14	13	OUT-6
L1-7	16	15	OUT-7
L1-8	18	17	OUT-8
L1-9	20	19	OUT-9
L1-10	22	21	OUT-10
L1-11	24	23	OUT-11
L1-12	26	25	OUT-12
L1-13	28	27	OUT-13
L1-14	30	29	OUT-14
L1-15	32	31	OUT-15
L1-16	34	33	NOT USED
NOT USED	36	35	NOT USED

WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

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Web Site / www.stromc.co

DEEP RIVER UPGRADES
CONTRACT 2006-352

CITY OF DEEP RIVER
DEEP RIVER WATER TREATMENT PLANT

DIGITAL OUTPUT CARD #1
LOOP DRAWING

04/19/2006 | 35206-CHEM-E116 | SCALE: NOT TO SCALE | DWG. No.: E116 | REV. No.: 0

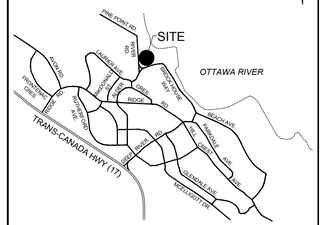
REF. DWG. NO. | REV. | DESCRIPTION | DATE | BY

04 20 2007 2:34:46 PM, claudel.leveille

NOTES:

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KEY PLAN:


SITE
OTTAWA RIVER
TRANS-CANADA HWY (17)
ARCHIBALD
PROSPECT CREEK
CAMBRIDGE
VICTORIA
RAILWAY
RAILWAY
BOUNDARY
HWY
BOUNDARY
HWY
RAILWAY
RAILWAY
RAILWA

TECHNICAL SPECIFICATION SEAL SHEET		DATE OF ISSUE: 10/22/2025	
CLIENT	Corporation of the Town of Deep River	**ISSUED FOR THE FOLLOWING PURPOSE(S) ONLY:**	
PROJECT:	**Deep River Water Treatment Plant Upgrades**	MECP Approval	☐
		Tender	✓
CLIENT REF No	2025-RFT-001	Building Permit	☐
LOCATION:	177 River Road, Deep River, ON	Construction	☐

NOTE: The Professional Seals on this page are in respect to the technical specification comprising Divisions 1 through 16 inclusive. Each seal is limited to the discipline as noted below.

Sheet 1 of 2

PROCESS MECHANICAL		
STRUCTURAL		

TECHNICAL SPECIFICATION SEAL SHEET		DATE OF ISSUE: 10/22/2025	
CLIENT	Corporation of the Town of Deep River	**ISSUED FOR THE FOLLOWING PURPOSE(S) ONLY:**	
PROJECT:	**Deep River Water Treatment Plant Upgrades**	MECP Approval	☐
		Tender	✓
CLIENT REF No	2025-RFT-001	Building Permit	☐
LOCATION:	177 River Road, Deep River, ON	Construction	☐

NOTE: The Professional Seals on this page are in respect to the technical specification comprising Divisions 1 through 16 inclusive. Each seal is limited to the discipline as noted below.

Sheet 2 of 2

ELECTRICAL		
CONTROL AND INSTRUMENTATION		

DIVISION 1 – GENERAL REQUIREMENTS

Section No.	Title
Sec01000	General Requirements
Sec01025	Measurement and Payment
Sec01110	Summary of Work
Sec01120	Coordination and Sequence of Work
Sec01140	Special Project Procedures
Sec01200	Alternatives
Sec01300	Admin. Requirements
Sec01320	Construction Schedule
Sec01330	Submittal Procedures
Sec01330A	SUBMITTALS_SD Transmittal
Sec01330B	SUBMITTALS_SD naming
Sec01351	Health and Safety
Sec01355	Project Waste Management
Sec01400	Environmental Protection
Sec01410	Regulatory Requirements
Sec01420	References
Sec01450	Quality Control
Sec01510	Temporary Utilities
Sec01520	Construction Facilities
Sec01610	Basic Product Requirements
Sec01700	Contract Closeout
Sec01740	Cleaning
Sec01750	Disinfection Water Infrastructure
Sec01760	Warranty Work
Sec01770	Closeout Procedures

Section No.	Title
Sec01780	Closeout Submittals
Sec01810	Testing and Commissioning
Sec01820	Demonstration and Training

1 GENERAL

1.1 General

1.1.1 This Section identifies the general intent and requirements of the overall Contract to be followed by the Contractor, sub-contractors and all trades involved in completing the work.

1.1.2 The Contractor shall study the Contract Documents to determine the extent of work required by each Section and upon which work of other Sections depend and to co-ordinate scope and extent of work to be performed by each trade.

1.1.3 The Contractor shall within 48 hours of becoming aware of circumstances which may require a clarification or change in the Work, give written notice to the Engineer outlining such circumstances and requesting written directions.

1.1.4 As applicable, maintain in good condition and order on site one copy of the documents approved for building permit, addenda, site instructions, proposed changes, change orders, test reports, manufacturer's installation and application instructions, progress photographs, redline drawings, approved progress schedules, minutes of site meetings, and other modifications to the Contract Documents.

1.2 Specification Format

1.2.1 Specifications serve to indicate standards, materials and methods for completing the work.

1.2.2 Where Contract Documents do not provide sufficient information for completing installations, comply with manufacturer's written instructions.

1.2.3 The following definitions apply:

.1 Provide - To Supply and Install, complete and in place, including accessories, finishes, tests and services as required to render item so specified complete and ready for use.

.2 Commission - Start-up and initial operation of equipment as required to demonstrate satisfactory operation of components and entire system including calibration of any control instrumentation as required to maintain operations.

.3 Drawings, Lists or Schedules of Items are intended to show scope and arrangement of work. For locations of items described refer to such Drawings, Lists or Schedules unless locations are stipulated in the Specifications.

.4 Wherever words "reviewed", "selected", "directed", "designated", "permitted", "inspected", "instructed", "required", "report", "submit", "obtain", "consult", or similar words or phrases are used in the Contract Documents, it shall be understood that "by/to/from/with the Engineer" shall follow.

.5 Where specification sections designate authorities such as "Engineer", “Consultant”, or “Contract Administrator”, these designations shall be taken to mean CIMA Canada Inc. Where specification sections designate "Owner" or "Purchaser", these designations shall be taken to mean the Town of Deep River. Where specification sections designate "Owner’s Operator" or "Operator", these designations shall be taken to mean Ontario Clean Water Agency (OCWA).

1.2.4 If there a discrepancy between specifications and/or drawings, the most stringent requirements, clause or note shall take precedent as per the Engineer's interpretation.

1.3 Standards

1.3.1 Conform to the latest editions as amended and revised to date of Contract.

1.3.2 If requested provide copy on Site of such standard(s).

1.3.3 Where standards designate authorities such as "Engineer" or "Consultant", these designations shall be taken to mean CIMA Canada Inc. Where standards designate "Owner" or "Purchaser" or other such designation, these designations shall be taken to mean the Town of Deep River.

1.4 Requirements of Authorities and Agencies

1.4.1 The Contractor shall be responsible for complying fully with the requirements of all Authorities and Agencies that govern any or all of the works under this Contract. These requirements may affect installation and construction methods and may include a written notice to an Authority or Agency prior to the commencement of construction. When a written notice to an Authority or Agency is required, a copy of the notice shall be submitted to the Engineer by the Contractor.

1.4.2 Comply with The Building Code Act including the Building Code, as amended; and Regulations and by-laws of other authorities having jurisdiction including latest amendments thereto: all hereafter referred to as Code. Where Code or Contract Documents do not cover a particular requirement, conform to requirements of the National Building Code, as amended, including its related supplements. Where Drawings and/or Specifications exceed Code requirements satisfy such additional requirements.

1.4.3 Arrange for all inspections as required and as indicated on the Building Permit(s). Comply with all instructions provided by the Building Inspector.

1.5 Reference Information

1.5.1 The drawings governing alterations to existing works if required were prepared using the following assumptions:

.1 The existing structures were built in accordance with the original contract documents, significant details of which have been reproduced on the drawings.

.2 Existing building documents used in preparing the documents for this contract include the following:

Project Title	By	Date
Deep River Water Treatment Plant Upgrades	Jp2g Consultants Inc.	August 22, 2005
Deep River Water Treatment Plant Upgrades (Contract no: 35206) PLC's I/O Loop Drawings	Stroma Engineering	March 30, 2007

1.5.2 Examine the site and buildings or structures on it. Establish conditions under which the work is to be done, and accept the premises as found upon taking possession of the property. Direct all inquiries to the Consultant.

1.5.3 Existing base horizontal and vertical control points will be provided by the Owner.

1.5.4 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

1.5.5 Make no changes or relocations without prior written notice to the Engineer.

1.5.6 Report to the Engineer when a reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

1.5.7 The Owner will replace control points in accordance with the original survey control. The cost of resetting or replacing control points disturbed by the Contractor shall be at the Contractor's expense.

1.5.8 All elevations indicated on the Contract Drawings or Specifications are referred to datum of Geodetic Survey of Canada and to a benchmark established at or near the site of the works.

1.5.9 All general layout required by the Contractor for the purposes of construction shall be carried out by the Contractor. The Contractor shall provide such masts, scaffolds, batter boards, slope stakes, straight edges, templates and other devices as may be necessary to facilitate layout and inspection and construction of the Works within the contract price.

1.6 Protection and Safety

1.6.1 The Contractor shall undertake the role of the "Constructor" as defined in the Occupational Health and Safety Act.

1.6.2 Ensure that those who handle, and/or are exposed to, or are likely to handle or be exposed to, hazardous materials are fully instructed and trained in accordance with WHMIS requirements.

1.6.3 Protect active services. Cap inactive services and remove unwanted portions with approval of Engineer.

1.6.4 Protect finished work. Damaged work shall be restored or redone at the Contractor's expense at the discretion of the Engineer.

1.6.5 Protect public and those employed on Work from injury. Mobile equipment when not in use shall have keys removed and locked up in secure location.

1.6.6 Ensure that working conditions for the Owner are not adversely affected by work under this contract.

1.7 Manufacturer's Instructions

1.7.1 Install or erect products in accordance with manufacturer's direct written instructions.

1.7.2 Handle and store materials in accordance with manufacturers' and suppliers' recommendations and to prevent damage to materials during storage and handling.

1.7.3 Notify the Engineer in writing, of conflicts between the specification and manufacturer's instructions, so that the Engineer may establish the course of action.

1.8 Equipment Pricing by Manufacturers, Distributors or Dealers

1.8.1 The Owner supports open, fair, and competitive pricing practices and expects that all equipment Resellers (Manufacturers, Distributors, and Dealers) adhere to such practices. Resellers must offer equipment individually priced as requested by the Contractor. In addition to individual pricing, equipment offered in a bundle quote to provide further quantity based discounts to Subcontractors is an acceptable practice; however, if the Owner determines that bundled pricing for a group of items is being offered to unfairly restrict competition for the individual equipment involved, the Owner reserves the right to delete that manufacturer from the list of pre-approved manufacturers listed in the tender specifications.

1.8.2 The Owner reserves the right to request that the Successful Bidder provide more detailed equipment price breakdowns than noted in Form of Tender for the establishment and recording of asset and depreciation values.

1.9 Progress Draw Cost Breakdowns

1.9.1 Use Table of Contents of the Specification as basis for identifying line items in the breakdown, unless otherwise indicated in the Form of Tender.

1.10 Concealment of Services

1.10.1 Pipes, conduits, service lines and ducts shall be concealed in chases, behind furring or above ceilings, and such items shall not be exposed to view except where they are noted as being exposed to view or reviewed and approved by the Engineer.

1.10.2 Where no ceiling is provided, such items occurring in ceiling spaces may be exposed. In this case, workmanship must be of the highest quality, all lines etc. shall be run straight and true.

1.11 Mobilization and Demobilization

1.11.1 The Contractor must provide for the mobilization/demobilization of the site in accordance with these contract documents.

1.11.2 Comply with the Engineer’s and Owner’s instructions in regards to the allocation of the mobilization areas of the site; construction fencing, temporary signage, field offices and storage areas, access and parking.

1.11.3 Successful mobilization will generally consist of the following:

.1 Supply and erect all temporary signs, barricades/fences, flashers, delineators, flag persons, and such other protection as may be required to protect the public during construction.

.2 Provide security protection for Site office, plant and stored materials.

.3 Move onto site and set up offices, storage facilities, plant, sanitary facilities, temporary fencing, temporary work areas, temporary hydro and telephone if specified or required by the Contractor to complete the Works.

.4 Provide all necessary access to the project including temporary access as required.

1.11.4 Successful demobilization will generally consist of the following:

.1 Removal of temporary signs, barricades/fences, flashers, delineators, flag persons, and such other protection that was installed at the beginning of the Contract.

.2 Removal of temporary access or work areas, and restoration of all disturbed areas and/or surfaces to original condition or better.

.3 Move off site and remove offices, storage facilities, and all temporary or construction plant or facilities and leave the site clean and tidy.

1.12 Damage to Existing Utilities and Structures

1.12.1 Obtain the necessary drawings and perform any necessary sub-surface investigations in order to determine the exact location of all existing utility services, structures, underground pipes, cables, and other similar items. Notify Engineer immediately of any potential conflicts with proposal buried piping and utilities.

1.12.2 The location for existing structures and underground pipes, cables, utilities, and other similar items as shown on the Contract Drawings do not relieve the Contractor of this responsibility.

1.12.3 Take the necessary steps to ensure that no damage is caused to existing structures, buildings, foundations, roads, sidewalks, property, utility services, and other similar items during the progress of the Work.

1.12.4 If any damage is caused, inform the engineer of the damage and proposed repair methodology, repair and make good such damage at no additional cost within a reasonable time and to the complete satisfaction of the Engineer.

1.13 Occupying the Site

1.13.1 Use only those areas designated by the Owner for the access, except in so far as is necessary for the execution of the Works, and in so doing, do not unnecessarily obstruct the normal traffic of, to, from or about the Site; and do not unreasonably allow any vehicles or materials to stand in front of, or near to, any buildings on the Site or any access thereto.

1.13.2 Areas shown as Contractor’s Limits are areas to be used by the Contractor for construction, parking lot, storage and temporary facilities.

1.13.3 All inquiries and deliveries related to the Contractor’s activities will be directed to the Contractor’s site trailer.

1.13.4 Confine operations within areas designated for construction, storage and access as shown on the Contract Drawings and/or as directed by the Engineer.

1.13.5 Limit access to and from the site as instructed by the Engineer.

1.13.6 Maintain safe access to any existing facilities for the operations staff at all times.

1.13.7 Limit possession of any areas of the Site occupied by operational plant (Restricted Areas) to such times as are necessary for the execution of the works in those areas.

1.13.8 Clearly identify in the schedule when occupation of Restricted Areas or the main work area is required and notify the Engineer in writing when such possession is required at least 10 working days in advance.

1.13.9 Do not occupy or use any of the Restricted Areas for a longer period than is necessary for the execution of any part of the works to be undertaken in those areas. Occupy an area not greater than the minimum required for that part of the works.

1.14 Contractor Use of Premise

1.14.1 Arrange with the Owner and Engineer for storage areas and access to the Works.

1.14.2 Make arrangements with property owners if additional areas are required. Obtain written agreements and submit copies to the Engineer.

1.14.3 Confine operations within working limits for construction, storage and access.

1.14.4 Install and maintain temporary chain link fencing along working and storage areas and access routes.

1.14.5 Carry out the construction of the Works in such a manner that a minimum of inconvenience is caused to the Owner and occupants of properties adjacent to the Works.

1.14.6 Store materials separately on the Site at locations agreed upon with the Engineer, suitably protected to prevent their deterioration or the intrusion of foreign matter. In the opinion of the Engineer, remove any material which has deteriorated or been damaged immediately from the Site at no additional cost to the Owner.

1.14.7 During construction of the facilities, liaise with the Engineer and plant operating staff to schedule work to minimize impacts on plant operations.

1.14.8 Obtain written approval from the Engineer for tie-in work to the existing facilities. Plant operating staff will operate any valve, switch, or other controls on existing facilities.

1.14.9 The contractor shall provide portable washroom facilities to be used by the Contractor’s personnel. They are to be maintained by the Contractor in neat and clean condition for the duration of the contract. Washroom facilities shall be located outside the plant’s buildings. Contractor forces are under no circumstances to use the Owner’s washrooms.

1.15 Owner Occupancy

1.15.1 The Owner and plant operating staff will occupy premises during entire construction period for execution of normal operations.

1.15.2 Cooperate with the Owner and operating staff in scheduling operations to minimize conflict and to facilitate usage by the Owner and plant operating staff.

1.15.3 The Contractor shall ensure that heavy construction equipment, amenities, offices or any potential obstruction in the Work area minimizes disruption and impact to operations and ongoing activities at the plant.

1.15.4 Maintain free access and parking for the Owner, Engineer and plant operating staff.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 Intent

1.1.1 This Section stipulates the Contract requirements and submittals required to develop payment certificates.

1.2 Scope

1.2.1 The Contract Price shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction plant, equipment, and tools; and performing all necessary labour and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Form of Tender shall be considered subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid.

1.3 Measurement for Payment

1.3.1 Contract Administrator will review the Contractor’s application for payment based on the percentage of work completed for the billing period and prices entered in the Form of Tender and related breakdown.

1.3.2 The Contractor’s application will not be considered proper until all quantities and supporting documentation have been accepted by the Contract Administrator.

1.4 Payment Requisitions

1.4.1 Contractor's Responsibilities:

.1 Submit for review a draft payment requisition breakdown to the Contract Administrator within three (3) weeks of the order to commence.

.2 Submit subsequent payment requisitions to Contract Administrator on the date established at the Pre-Construction Meeting. The Contract Administrator will review and respond or make changes as required based on the progress of work completed for the billing period. Payment requisitions shall:

.1 Show estimate of percentage of work completed against each item of Lump Sum Price Breakdown.

.2 Include all labour and materials incorporated in work and all materials stored at site.

.3 Include labour and materials incorporated in work for all agreed extras and deductions.

.3 Supply documentation to support claim for materials on site in the form of itemized lists or unpriced purchase orders showing quantities.

.4 Supply other evidence required by Contract Administrator in support of payment requisition.

1.4.2 Contract Administrator's Responsibilities:

.1 Review Contractor's payment requisition, prepare Progress Payment Certificate and issue to Owner within five (5) Working Days following receipt of the Contractor's proper payment requisition.

.2 The Contract Administrator's estimate of percentage of work completed for the payment requisition period shall govern for all Progress Payment Certificates.

.3 Inform the Contractor of amendments to payment requisition by copy of Progress Payment Certificate.

1.5 Changes in the Work

1.5.1 Complete and promptly return all Request for Quotations (RFQs) issued by Contract Administrator, quoting unit and/or lump sum prices as requested. Include appropriate supporting documentation to verify prices.

1.5.2 Do not proceed with work affected by RFQs until authorized to do so by Change Order, or authorization to proceed in writing by the Contract Administrator.

1.5.3 A Change Order is only valid when signed by Contract Administrator, Owner and Contractor.

1.5.4 The method used to determine the amount of adjustment to the Contract Price, if any, for the proposed change in the Work shall be one of the following:

.1 Negotiated lump sum,

.2 Unit price, as set out in the Contract Documents or subsequently agreed upon, or,

.3 Cost - Plus (Time and Materials), in accordance with the General Conditions of the Contract.

1.5.5 The Contractor’s percentage fee shall include allowances for overhead and profit. Allowances for overhead and profit shall cover all the Contractor's administrative and incidental costs relating to a change, including, without limitation, costs relating to superintendence and supervision, shop drawing production, Site Office and Home Office expenses, workers tools, temporary facilities and controls. No further claim for change in the contract time, delay, prolongation charges, impact costs, loss of anticipated profit or other such claims will be accepted as having resulted from a Change Order, after it has been accepted by the Owner.

1.5.6 The Contractor’s proposal for adjustment of the Contract Price, if any, shall include a breakdown of the labour, Construction Equipment, Products and Subcontractor work which is anticipated to be required by the change in the Work. Allowable mark-ups on labour, Construction Equipment, Products and Subcontractor work shall be applied in accordance with the General Conditions of the Contract.

1.6 Submittals

1.6.1 The format and detail of the submitted payment details shall be provided in accordance with the Owner’s requirements.

1.6.2 Submittals shall be made electronically in accordance with the requirements of Section 01330.

1.6.3 Submittals shall clearly distinguish between the following:

.1 Base scope as defined in the contract documents broken down by Division.

.2 Provisional and allowance items as delineated in the Form of Tender. Note that payment will only be processed for items approved for in writing by the Owner.

.3 Changes to The Work as may arise over the course of the project. Note that payment will only be processed for items approved for in writing by the Owner.

1.7 Schedule of Prices

1.7.1 Lump Sum Work:

.1 Reflect the schedule of Sections and Prices and specified cash allowances in the Form of Tender, as applicable.

.2 Break down by Divisions 1 through 16 including a breakdown by each Specification Section.

1.7.2 Any schedule which is deemed by the Contract Administrator to be unbalanced or front-end loaded will not be acceptable. The Contract Administrator reserves the right to modify any unbalanced payment breakdowns.

1.7.3 Summation of the complete Lump Sum Price Breakdown representing all of the Work shall equal the Contract Price.

1.7.4 Submit the Lump Sum Price Breakdown in a spreadsheet format compatible with the latest version of Microsoft Excel.

1.7.5 Section 01120 – Coordination and Sequence of Work

.1 There shall be a line item in the monthly payment certificate entitled “mobilization and demobilization”. The price provided for this item shall be consistent with the actual costs involved, but should not in any event, exceed 1-10% of the Lump Sum Total Price (not including HST). In the event the amount provided for this item exceeds 1% of the Lump Sum Total Price, the Owner reserves the right, at its sole discretion, to apportion any or all of the cost of this item to the Demobilization component, which shall be paid upon completion of demobilization.

.2 Payment for line items that are required for the duration of Construction shall be pro-rated on a monthly basis based on the duration of Construction.

1.7.6 Section 01320 – Construction Schedule

.1 The price provided for this Section shall be consistent with the actual costs involved, but should not in any event, be less than 0.5% of the Sub-Total of Lump Sum Prices for Divisions 2 to 16 inclusive (not including HST). In the event the amount provided for this Section is less than 0.5% of the Sub-Total of Lump Sum Prices for Divisions 2 to 16

inclusive, the Owner reserves the right, at its sole discretion, to apportion any or all of the cost for this Section from another Section as it sees fit.

1.7.7 Section 01810 – Testing and Commissioning and Section 01820 – Demonstration and Training

.1 The combined price provided for these Sections shall be consistent with the actual costs involved but should not in any event be less than 5% of the Sub-Total of Lump Sum Prices for Divisions 11, 13, 15, and 16 inclusive (not including HST). In the event the amount provided for these Sections is less than 5% of the Sub-Total of the Lump Sum Prices for Divisions 11, 13, 15, and 16 inclusive, the Owner reserves the right, at its sole discretion, to apportion any or all of the cost for these Sections from another Section as it sees fit.

1.7.8 Section 01780 – Closeout Submittals (Redline Drawings and O&M Manuals)

.1 To certify that the “Redline Drawings”, as specified in Section 01330 and Section 01780, are being kept up to date by the Contractor, there shall be a line item in the monthly payment certificate entitled “Redline Drawings” under Section 01780. 50% of the total amount shall be assigned and paid to the Contractor on monthly progress. The balance shall not be paid until Final “Redline Drawings” are submitted and accepted by the Contract Administrator.

.2 There shall be a line item in the monthly payment certificate entitled “O&M Manual” under Section 01780. The total amount shall be assigned and paid to the Contractor after the Contract Administrator’s acceptance of the final submission.

.3 Final 2% of the Sub-Total of Lump Sum Prices for Divisions 11, 13, 15 and 16 shall not be paid until all spare parts have been provided and accepted by the Contract Administrator.

1.7.9 Section 01770 - Close-out Procedures

.1 The price provided for this Section shall be consistent with the actual costs involved, but shall not in any event, be less than 0.5% of the Sub-Total of Lump Sum Prices for Divisions 2 to 16 inclusive (not including HST). In the event the amount provided for this Section is less than 0.5% of the Sub-Total of Lump Sum Prices for Divisions 2 to 16 inclusive, the Owner reserves the right, at its sole discretion, to apportion any or all of the cost for these Sections from another Section as it sees fit.

1.8 Allowance and Contingency Items

1.8.1 Allowance and Contingency payments shall only be made with prior written authorization of the Owner.

1.8.2 Prior to authorization, the Contractor shall – in coordination with the Contract Administrator and Owner – submit a quotation / proposal for the work to be done, including all supporting information including a workplan, labour rates and hours, vendor quotations and expected impact to the project schedule. Contractor may be required to provide a quotation from several vendors.

1.8.3 Approval of allowance and contingency works shall be at the sole discretion of the Owner. The Contractor shall have no claim to any unused portion of the allowances or contingency.

1.9 Estimated Quantities

1.9.1 All estimated quantities stipulated in the Form of Tender or other Contract Documents are approximate and are to be used only:

.1 As a basis for estimating the cost of the Work and

.2 For the purpose of comparing the Bids submitted for the Work.

1.9.2 The actual amounts of work done, and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished. Contractor agrees that it will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of work performed and materials actually furnished and the estimated amounts therefore.

1.9.3 The Contractor shall track and submit verification on an ongoing basis to the Contract Administrator. In the event that the quantities are exceeded or over-estimated, the unit rate provided in the Form of Tender will be used as the basis to calculate additional fees to be paid from the provisional allowance or contingency, or to estimate a credit to the Owner.

1.9.4 No extra work shall take place without the Owner's approval in advance of the work being undertaken.

1.10 Measurement

1.10.1 For items in Divisions 11, 13, 15, and 16, payment will be measured as follows:

.1 Payment for shop drawings shall not exceed 2.5% of line item upon submission and 2.5% of line item following approval of shop drawing.

.2 Payment for equipment delivered to site but not yet installed and incorporated shall not exceed 60% of line item.

.3 Payment for installation of equipment not to exceed 20% of line item.

.4 Under all cases, no more than 90% of each pay item will be released until successful completion of equipment start-up, commissioning and performance testing.

.5 Payment up to 90% of the value of equipment may be considered with proof of value for equipment that is delivered but not yet installed.

1.10.2 Only items that have been shipped and unloaded to site will be eligible for payment. Payment will not be made for surplus materials on hand after the completion of the work.

1.10.3 Payment will not be made for any equipment or materials that have been rejected as defective, failed, or otherwise unacceptable to the Owner. Costs associated with loading, hauling and disposal of rejected materials will be borne by the Contractor.

1.11 Applications for Payment

1.11.1 The Contractor shall use a detailed Application for Payment form in a format acceptable to the Owner and Contract Administrator.

1.11.2 Applications for payment shall be made on a monthly basis and shall include the following elements as a minimum:

.1 A Proper Invoice

.2 Statutory declaration

.3 Copy of current WSIB certificate

.4 Updated Detailed Progress Schedule and associated documents per requirements in Section 01320 – Construction Schedule in the form acceptable to the Contract Administrator.

.5 Updated summary of the divisional price breakdown including all approved allowance and contingency items, holdback and taxes.

.6 Updated cash flow analysis.

1.11.3 The Owner shall not release monies for Payment Certificates until the Contractor has provided all supporting documentation in a satisfactory manner, and as approved by the Contract Administrator. Deviations from these requirements shall require resubmission of the application for payment. No claims will be accepted due to delays in processing payment as a result of rejected applications for payment.

1.11.4 Payment for Mobilization/Demobilization shall be made as follows:

.1 Up to sixty percent (60%) from commencement of construction for full mobilization. The payment of mobilization shall be included in the first payment certificate issued for the Contract subject to the Contract Administrator being satisfied that full mobilization has been carried out. If the Contract Administrator is not so satisfied, the Contract Administrator shall allow a payment amount which, in the opinion of the Contract Administrator, reflects the degree of mobilization effected to date.

.2 Progressively from 40% at the commencement of construction to 80% at Substantial Performance of the Work.

.3 The remaining 20% to be paid immediately prior to completion of the Work for Demobilization.

.4 As referred to in subsection 1.7.5.1 above, in the event that the price of this item exceeds 1% of the Lump Sum Total Price, the Owner reserves the right, at its sole discretion, to apportion the payment of this item, including apportioning any or all of the cost of this item to the Demobilization component, which shall be paid upon the completion of Demobilization.

1.12 Payment

1.12.1 General:

.1 Progress payments will be made monthly.

.2 The date for the Contractor’s submission of the monthly Application for Payment shall be established at the preconstruction Meeting.

1.12.2 Payment for all of the Work shown or specified in the Contract Documents is included in the Contract Price.

1.12.3 Payment for unit price items covers all of the Work necessary to furnish and install the items identified in the schedule of Additional Unit Prices in the form of Tender.

1.13 Nonpayment for Rejected or Unused Products

1.13.1 Payment will not be made for the following:

.1 Loading, hauling, and disposing of rejected material.

.2 Quantities of material wasted or disposed of in a manner not called for under the Contract Documents.

.3 Rejected loads of material, including material rejected after it has been placed by reason of failure of the Contractor to conform to requirements of the Contract Documents.

.4 Material not unloaded from a transporting vehicle.

.5 Defective Work not accepted by the Owner.

.6 Material remaining on hand after completion of the Work.

2 PRODUCTS – NOT APPLICABLE

3 EXECUTION – NOT APPLICABLE

END OF SECTION

1 GENERAL

1.1 Intent

1.1.1 The intent of these specifications is to provide for the works herein enumerated to be fully completed in every detail for the purposes designated. It is hereby understood that the Contractor, in accepting the Contract, agrees to furnish any apparatus, appliances, material or labour not herein specifically mentioned or included, but which is found necessary to complete, perfect, and test every requirement written and implied in these specifications, without extra cost to the owner.

1.2 Work Covered by Contract Documents

1.2.1 The work to be done under this Contract, as specified and/or as shown on the Drawings includes the complete supply of all materials, labour and equipment for the construction of utilities and services required for:

.1 Ammonium sulphate chemical storage, pumping, and dosing lines

.2 Installation of pre-selected equipment, including dry polymer preparation unit, lamella modules and cleaning system, microsand feeding system, and Actiflo PLC panel.

.3 Replacement of existing process equipment and instrumentation (incl. chlorinators, flow meters, turbidity meters, chlorine analyzers)

.4 New HVAC equipment

.5 Associated electrical and I&C upgrades

1.2.2 Work of this Contract comprises general construction associated with:

.1 Drinking water treatment systems

.2 Chemical dosing systems

.3 High voltage electrical panels

1.2.3 This clause is not intended to define the scope of the contract. Use it only as a general guide to the extent of the work.

1.3 Location of Work

1.3.1 Deep River Water Treatment Plant located at 177 River Road, Deep River.

1.4 Hours of Work

1.4.1 Normal working hours shall be Monday to Friday between 7:00 am and 3:30 pm.

1.4.2 The Contractor is advised that night, weekend or holiday work may be required in the Contract. The Owner or Engineer may, where they deem it necessary to speed up the work or deem it necessary or expedient in order to preserve and maintain traffic over or on any street or road, or to restore utility service, order any work to be carried out in whole or in part

at night or on two or three shift basis, or on Sundays or holidays, and the Contractor shall have no claim for extra compensation in respect thereof.

1.4.3 The Contractor shall, as far as possible, refrain from work on days which are legal holidays for the Owner. If it is desired to work on any such holiday, the Contractor shall notify the Owner in writing at least four (4) days in advance of such holiday of their intention to work, stating the areas where the work will be conducted.

1.4.4 If the Contractor fails to give such notice in advance of any holiday, such failure shall be considered as an indication that no work requiring the presence of an authorized representative of the Owner is to be done by the Contractor on such a holiday.

1.5 Work by Others

1.5.1 The Contractor will coordinate all utility Contractors and all testing and commissioning work with the Owners, Staff and Agents.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 General Coordination

1.1.1 The Contractor shall develop and finalize the construction sequence in order to minimize impact on operations, subject to approval of the Engineer, the Owner, and/or the Owner's Operator.

1.1.2 Construct Work in stages to accommodate the Owner's use of the premises during construction, as necessary. Work shall be carried out expeditiously to minimize disruptions to existing operations.

1.1.3 The Contractor shall arrange the timing of, and the method by which the works are carried out so as not to affect the operation of the existing facilities. The work will be carried out in stages to accommodate the Owner's and the Owner's Operator's continued access for operation and maintenance of all facilities during installation. The Contractor's detailed construction schedule shall be coordinated with the Owner, Owner's Operator and the Engineer. It shall show the sequence including the data and duration of equipment or system shutdowns required for construction purposes. No deviation from this schedule shall be permitted without the Contractor having first obtained the Owner's written approval. Any permitted outages will be continuous without interruption.

1.1.4 The Contractor must note the necessity of keeping the existing Deep River Water Treatment Plant in continuous operation for the duration of construction activities.

1.1.5 Any shutdowns shall be in strict accordance with the sequence in the Contractor's schedule and shall be carefully coordinated with the Owner, Engineer and Operating personnel to avoid unplanned impacts to the water supply and distribution system.

1.1.6 Prior to shutdown of any facilities the Contractor must request in writing at least thirty (30) working days in advance of the required shutdown. Depending on demand the Owner may require the shutdown to be done at other than normal working hours or postponed to a time more suitable to plant operation. The Contractor shall reschedule their work to suit plant operation at no additional cost to the Owner.

1.2 Shutdown Coordination

1.2.1 Coordinate all construction activities with the Owner through the Engineer and verify that these activities do not interfere with operations of the Facility. Obtain written permission from The Owner through the Engineer for each shutdown or temporary works at least four (4) weeks in advance. Submit a plan for each shut-down that clearly defines the system to be taken out of service and the length of time of the shut-down. Identify a contingency plan or temporary works necessary to maintain operations of the Facility where necessary. The Owner shall at all times have unhindered access to all portions of the Facility that are in operation.

1.2.2 Provide backup to critical operations in case of failure, including temporary pumping or other measures as required. Indicate backup to be provided including alternate power supplies and controls in shutdown plan.

1.2.3 Shutdown Coordination shall be as follows:

.1 Contractor shall receive approval for their proposed shutdown a minimum of four (4) weeks prior to the actual shutdown or interference.

.2 The date which the Contractor shall submit the Shutdown Notification form shall be known as the Submission Date.

.3 The date which the required shutdown or inference with facility operations falls on shall be known as the Shutdown Date.

.4 Allow minimum two (2) weeks for review and comment by the City and the Engineer. If work cannot commence on either the scheduled or fall back date, reschedule at no extra cost to the Town. Shutdown Notification form shall be provided to the successful bidder.

.5 The Contractor shall arrange a Facility Walkthrough with the Engineer and the Owner. The Plant Walkthrough will be conducted within a week after submitting the Shutdown Notification Form.

.6 The Owner and Engineer shall identify any concerns, operational preparation requirement, maintenance preparation requirement, and any other shutdown requirements that shall be the Contractor's responsibility to fulfill and comply to.

.7 The Contractor shall arrange for a Second Plant Walkthrough with the Engineer and The Owner to be conducted 24 hours before the Shutdown Date.

.8 During the Second Plant Walkthrough, The Owner and Engineer shall identify any concerns that could prevent the shutdown.

.9 If the Owner and Engineer deem the Shutdown acceptable, the Engineer shall approve and sign the Shutdown Notification Form.

.10 The Contractor shall follow the above steps for each shutdown.

.11 The Contractor shall provide two (2) Master Shutdown Calendars.

.1 Calendars will have the scheduled shutdown date, affected processes, area, and duration of shutdown.

.2 One calendar will be given to the Owner and provide an overview of planned shutdowns to the Owner.

.3 The second calendar will be displayed in the Engineers Site office.

.4 The Contractor shall provide updates to both calendars on a weekly basis incorporating any new approved Shutdown Notification Forms.

.5 The lasted Individual Shutdown Notification Forms shall be kept in a binder, in the Engineers site office.

1.2.4 Issues requiring action by the Owner shall be included in the Contractor's shut-down plans. Describe the reason, anticipated length of time, and areas affected by the outage in the shut-down plan. Identify temporary means for continuing power, gas, fuel oil, air, and/or

water supply as appropriate to critical existing facility components if requested by the Owner and Engineer.

1.2.5 Access to certain parts of the Facility is restricted and the space available for the Contractor's staging activities is limited. Stage the Work such that access to the Facility is maintained at all times.

1.2.6 Plan and schedule construction activities recognizing that shutdowns of the existing facilities and systems are to be minimized and can only proceed after reaching agreement with The Owner.

1.2.7 Coordinate the requirements of this Section with all other Specification Sections in Division 1, and with all other applicable specification sections contained herein.

1.2.8 The Contractor shall coordinate and facilitate confined space entry operations where multiple parties are involved in accordance with O. Reg. 628/05.

1.2.9 When shutdown and/or switch-over of any plant process or electrical systems are required, the Contractor shall coordinate all trades involved. Coordination with Owner shall be through the Engineer, using the Shutdown Notification form attached to the end of this Section. Detailed written sequences are required to be submitted to the Engineer to permit such coordination. Refer to Clause 3.4 for scheduling constraints and limitations of construction.

1.2.10 There is no guarantee that permission will be granted to take any system off line.

1.3 Submittals for Review

1.3.1 Submit detailed sequence of work that meets the requirements of Section 01330 – Submittals.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION

3.1 General

3.1.1 The Contractor shall take responsibility for carefully coordinating all aspects of the work including all permanent and temporary connections whether identified on the Contract Drawings or not, to successfully complete the Works. Designate a fully qualified individual, as a General Superintendent, to be responsible for directing the progress of this Contract continuously, including the coordination and work of sub-contractors.

3.1.2 Coordinate Progress Schedule and coordinate with the Owner occupancy during construction.

3.1.3 Some equipment or supplies may require lengthy delivery times and as such must be ordered as soon as a notice to proceed is given by the Engineer. The Owner will not entertain extra claims or waive damages as a result of late delivery of such items.

3.1.4 Existing systems or individual equipment items will be isolated by the Owner. The Contractor is responsible for unwatering, disposal, de-commissioning, de-energizing, de-pressurizing, cleaning, pressure-washing and disinfecting, as required. Perform all such

work in accordance with the shutdown plan submitted by the Contractor and approved by the Engineer. The Owner will operate all valves and gates as required. The Contractor shall not rely on existing equipment to unwater existing systems or equipment.

3.1.5 Contractor shall assume that Actiflo tanks have not been previously cleaned and contain substantial mircosand and raw water solids. Contractor shall arrange for disposal of such wastes in an appropriate manner, in accordance with appropriate regulations.

3.1.6 The Owner will remove from service process units, tanks, and pipelines only once, unless otherwise specified. If the Contractor requires that a process unit, tank, or pipeline be removed from service more than once, then the Contractor shall bear all costs for such removal from service, emptying, cleaning, and placement back into service.

3.1.7 The Contractor shall provide protection against tank/structure flotation for all emptying operations throughout construction phases done by the Contractor.

3.1.8 The Contractor shall be responsible for maintaining any equipment that is taken out of service as a result of construction activities.

3.1.9 The Contractor shall be responsible for emptying and cleaning process units, tanks, and pipelines.

3.1.10 Provide all necessary temporary pumps, temporary screening/grinding, blinds, valves, piping, electrical wiring, controls, and labour incidental to complete the Work. Any pumps and water level must be continuously monitored by the Contractor during any tie-ins to make all provisions necessary to prevent flooding and bypassing during all diversion pumping operations or tie-ins.

3.1.11 The Contractor shall retain an Engineer to design all temporary systems. All temporary system designs shall be stamped by a Professional Engineer licensed in Ontario.

3.1.12 Some shutdowns will have to take place outside normal working hours, i.e. nighttime and/or weekends in order to comply with shutdown limitations as described in this Section.

3.1.13 Coordinate tie-ins to allow staged construction by area. Supply and install additional temporary isolation valves to ensure only one shutdown is required for each connection.

3.1.14 Coordinate scheduling, submittals, and work of the various Sections of the Project Specifications and other requirements of the Contract Documents to ensure efficient and orderly sequence of installation of interdependent construction elements.

3.1.15 Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such elements.

3.1.16 Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on the Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.

3.2 Monitoring and Emergency Response

3.2.1 Contractor shall have and include in his bid the resources, materials, personnel, and equipment necessary to provide continuous 24-hours per day, 7-days per week, monitoring

and emergency repair of sheeting, shoring, stop log installations, bypass pumping operations, and controlling sewage flows where, in the opinion of the Owner or Engineer, the failure of such temporary systems could adversely impact plant operations.

3.2.2 Contractor shall provide and operate temporary systems to contain and/or remove leakage through the gates, valves, and stop logs that are used to accommodate scheduled construction activities.

3.2.3 Contractor shall supply appropriate rescue and emergency response resources and plans as required by O. Reg. 628/05.

3.3 Permitted Outages

3.3.1 All outages to be coordinated with the Owner, Engineer and the Owner's Operator. The Owner will decide the maximum length of equipment shutdown following the review of the Contractor's work plan submittal.

3.3.2 Three levels of facility shutdown will be considered:

.1 One (1) hour shutdown. To facilitate any short term works or connections required, the Owner will allow short term duration shutdowns for up to one hour. The station will remain fully powered and all piping fully charged with water, ready to return to service at the completion of the shutdown.

.2 Overnight shutdown. To facilitate any medium term works or connections required, the Owner will allow medium term duration shutdowns for up to one working day. The station may be disconnected from main power sources, all piping will remain fully charged with water, ready to return to service at the completion of the shutdown. Shutdown shall commence at 10 p.m and be complete at 4 a.m.

.3 One (1) week shutdown or longer. To facilitate any long term works or connections required, the Owner will allow long term duration shutdowns for up to one working week, or longer as required to complete the proposed work. The treatment train to be shutdown may be disconnected from main power sources, and all piping and tanks may be drained of water as required. Prior to returning to service at the completion of the shutdown once all testing required has been completed, the Owner will require one working day to complete the restarting of the facility. Where possible, shutdowns shall be confined outside of weekends.

3.3.3 All outages shall be strictly coordinated with the Owner and Owner's Operator. All required shutdowns in the Facility will be contingent upon prior coordination with the Owner and the Owner's operator.

3.4 Operation/Construction Constraints

3.4.1 The following operation/construction constraints to be considered in scheduling the work.

3.4.2 Operational Constraints:

.1 Priority will be given to operation of Deep River WTP which is required to meet potable water demand for the Town of Deep River and CNL.

3.5 Suggested Sequence of Construction

3.5.1 This Section is not intended to describe the full extent of the work to be done under this Contract. It is intended to outline the general construction sequence only. The Contractor will be responsible for scheduling the detailed construction of the works within the general sequence and permitted outages.

3.5.2 The Contractor shall schedule his work and conform with the intent of the following requirements, and ample allowance shall be made in the schedule to comply therewith. The following is not intended to imply the Contractor must carry out the work in the exact manner indicated but is intended to indicate the restrictions that shall be imposed on construction work sequence and to set out the time duration of shutdowns.

3.5.3 Upon award of the Contract, the Contractor shall begin work as described in the following sequence of construction. The following suggests the general chronological order in which construction activities are proposed to take place. This list is not intended to be comprehensive in all activities required to complete the works but is intended to identify the main constraints on the scheduling of construction activities. The construction of the works is proposed to proceed as follows:

.1 Replacement of the existing chlorinators, sequentially, to allow for continued chlorination during replacement.

.2 Replacement of the filter effluent turbidity meters and Filter #2 effluent flow meter, sequentially, to allow only a single filter out of service at any time.

.3 Installation of the Microsand dosing system.

.4 Installation of the of the dry polymer preparation and dosing system, including draining and removal of the existing polymer storage tank and mixer.

.5 Installation of Aershaft blower, control panel, and air piping outside of the Actiflo units.

.6 Installation of the Actiflo equipment, sequentially, to allow only a single Actiflo unit out of service at any time, including draining and cleaning of tanks, concrete repairs (provisional), influent flow meter replacement, lamella modules replacement, and installation of Aershaft air scouring system within each Actiflo.

.7 Replacement of the existing Actiflo PLC panel.

.8 Installation of total chlorine analyzer in the lab.

.9 Installation of the ammonium sulphate dosing system, including dosing pump skid, storage tank, secondary containment, chemical piping c/w carrier, injection quills and static mixer. Maximum of 3 hour plant shutdown required for draining and replacement of section of treated water discharge header to install static mixer and injection quills per Contract Drawings.

3.5.4 The exact construction sequence must be developed by the Contractor based on his own work plan and projections of the required time required to complete the work. The Contractor may have to stage equipment shutdowns, to accomplish a task, in order to meet the constraints identified herein. The Contractor’s detailed schedule submitted after award of the Contract shall provide the number of shutdowns and the duration of each shutdown.

The Owner and the Engineer reserve the right to adjust the suggested construction sequence based on operational requirements of the system at no extra cost to the Owner. The Contractor shall provide ample float in the construction schedule to allow the Engineer to make adjustments to activities affecting shutdowns of components in the Facility.

3.5.5 The Contractor is encouraged to combine activities during shutdowns to minimize impact on the Facility. Following review of the construction schedule, the Engineer may reduce the number of total shutdowns, if, in the opinion of the Engineer, there are excessive number of shutdowns. In this case, the Contractor will be required to adjust the construction schedule to accommodate the reduced number of shutdowns, at no extra cost to the Owner.

3.6 Contractor Use of Premises and Restricted Areas

3.6.1 The Contractor shall arrange with the Owner for easements for construction, storage and access to all of the Works within the Owner's property line.

3.6.2 Make arrangements with property owners if additional areas are required. Obtain written agreements and submit copies to the Engineer.

3.6.3 Confine operations within easements for construction, storage and access.

3.6.4 Install and maintain adequate security or construction fencing and gates around storage areas or the construction site and maintain during the construction period.

3.6.5 Do not enter upon or occupy with workers, tools or materials any lands other than public streets, roadways, right-of-ways or easements shown on the Contract Drawings except after written consent has been received from the property owner.

3.6.6 The construction of the Works shall be carried out in such a manner that a minimum of inconvenience is caused to the Owner and occupants of properties adjacent to the Works.

3.6.7 Materials shall be stored separately on the Site at locations agreed upon with the Engineer and shall be suitably protected to prevent their deterioration or the intrusion of foreign matter. In the opinion of the Engineer, any material which has deteriorated or been damaged shall be removed immediately from the Site at the Contractor's expense.

3.6.8 The Owner's Operating staff will operate any valve, switch, or other control on existing facilities.

3.7 Owner Occupancy

3.7.1 The use or occupancy of the Work or any part thereof by the Owner shall not be taken in any manner as an acceptance by the Owner of any work or material not in accordance with the Contract or to relieve the Contractor or their surety from liability, whether heretofore or here after incurred or arising, in respect of the observance or performance of any covenant or condition in the Contract not then performed, whether such covenant or condition be by way of indemnity to the Owner or otherwise, save to the extent that loss or damage is caused during such use or occupancy by the Owner or by employees of the Owner for whom the Owner is responsible.

3.7.2 Entry by the Owner's own forces and by other Contractors does not mean acceptance of the Work and does not relieve the Contractor of their responsibility to complete the Contract. In particular, without limiting the generality of the foregoing, the use or occupancy

of the Work or any part thereof by the Owner shall not release the Contractor from liability to pay to the Owner, or waive or impair the right of the Owner to deduct and retain, liquidated damages and engineers' and inspectors' fees, in accordance with the Contract.

3.7.3 The Owner shall have the right to enter upon and take possession of the Work, in whole or in part, for the purpose of placing fittings and equipment or other use before completion, if in the opinion of the Engineer such action does not prevent or interfere with the Contractor in the performance of total completion of the Contract within the time specified. Such entry and possession shall not be considered as acceptance of the Work nor in any way relieve the Contractor of responsibility to complete the Contract.

3.7.4 The Contractor shall ensure that Operators have unlimited, unobstructed, 24/7 access to the existing facilities. Access shall be made available by the Contractor without exception.

3.8 Partial Owner Occupancy

3.8.1 Provide additional warranty for all equipment, materials and workmanship placed into service and used by the Owner to maintain operations in accordance with the sequence of construction until issuance of Substantial Performance for the entire Works.

3.8.2 For any equipment or process that enters into operation or service prior to Substantial Performance, the Contractor will carry out regular maintenance in accordance with the manufacturer’s recommendation.

3.8.3 The Owner and operating staff will occupy designated areas for the purpose of operation to ensure plant compliance. Contractor to provide free and clear access at all times.

END OF SECTION

1 GENERAL

1.1 Intent of Section

1.1.1 This Section includes temporary controls not incorporated into the final or permanent Works.

1.1.2 Read this Section in conjunction with all other Division 1, and Divisions 2 through 16 Specification Divisions.

1.2 Regulations

1.2.1 Occupational Health & Safety Act R.S.O. 1990 (as amended).

1.2.2 Ontario Ministry of Labour - O. Reg. 278/05 - Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations, under the Occupational Health & Safety Act.

1.2.3 Ontario Ministry of Labour - R.R.O. 1990, Reg. 837 – Designated Substances – Asbestos, as amended by O. Reg 279/05.

1.2.4 Ontario Ministry of Environment - R.R.O. 1990, Reg. 347 - General – Waste Management, under the Environmental Protection Act, as amended to O. Reg. 395/07.

1.2.5 Ontario Ministry of Transportation - R.R.O. 1990, Regulation 261 - General, under the Dangerous Goods Transportation Act, as amended to O. Reg. 252/02.

1.2.6 CSA Standard Z94.4-02: Selection, Use, and Care of Respirators.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION

3.1 General

3.1.1 The Contractor shall take responsibility for the proper functionality of all devices in the scope, including existing modified devices, at the conclusion of their work. Prior to beginning work and upon the Contractor's request, with five working days' notice, the Owner will demonstrate the functionality of any piece of existing equipment.

3.1.2 Where existing active mechanical, electrical or other services, concealed or exposed, extend through or are within the area to be renovated, include for concealing existing services behind new finishes wherever they would be exposed in new finished areas.

3.1.3 Carefully remove existing fixtures, equipment, construction and finishes shown on the Contract Documents to be removed employing experienced tradesmen. Salvage, identify and store the Products that are to be reused or delivered to the Owner.

3.1.4 Where mechanical or electrical fixtures and equipment are removed, cut back obsolete piping, ductwork and conduit behind finishes, unless otherwise specified, and cap. Cap piping watertight. Remove obsolete wiring back to its source. Provide blank cover plates on obsolete outlet boxes.

3.1.5 Remove and dispose of the site products not designated for reuse or delivery to the Owner.

3.1.6 Be responsible for and enforce fire protection methods and procedures and adherence to local fire regulations, including requirement of the Occupational Health and Safety Act.

3.1.7 Maintain fire access/control at all times.

3.1.8 Whenever soldering, welding or any open-flame work is performed, ensure the area is suitable for such work, ensure the proper incombustible shields are provided to protect combustible products and materials and have an observer present at all times to ensure adjacent products and materials are not ignited and welding, soldering or open flame work does not produce a hazardous condition.

3.1.9 Ensure the existing fire protection and alarm systems are not obstructed, shutoff or made inactive at any time. Do not use any fire hydrant, standpipe, or hose system for other than fire protection purposes.

3.1.10 Open fires and burning of rubbish are not permitted on the site.

3.1.11 Smoking is not permitted in hazardous areas or any other buildings on the site.

3.1.12 Comply with Chapter 321 of OHSA Regulations for Construction Projects.

3.2 Welding and Cutting

3.2.1 All welding and cutting within the existing works is to follow National Fire Protection Association (NFPA) Standard 51B “Fire Prevention During Welding, Cutting, and Other Hot Work”.

3.3 Work in Confined Spaces

3.3.1 Confined locations include manholes, underground chambers, tunnels, or other locations where the atmosphere may be contaminated by combustible gas or lack of oxygen.

3.3.2 Make all Contractor staff including subcontractors aware of confined spaces and the requirements for entering such spaces.

3.3.3 Where work is to be done in confined space conditions, follow the requirements listed in Paragraph 3.4, below.

3.4 Work Procedures for Confined Spaces

3.4.1 Hazardous Locations are to be classified and managed as Confined Spaces (as defined by O. Reg. 628/05, OHSA). All work and entry into the identified Confined Spaces is to be done in accordance with the Regulation (O. Reg. 628/05).

3.4.2 Where workers are required to enter a confined space, as defined by the OHSA, O. Reg. 632/05 Section 221.2, ensure that workers of the Contractor and all Subcontractors follow the requirements of the above legislation, including but not limited to:

.1 Having a method for recognizing each confined space to which the program applies

.2 Having a method for assessing the hazards to which workers may be exposed

.3 Having a method for the development of confined space entry plans (which include on-site rescue procedures)

.4 Having a method for training workers

.5 Having an entry-permit system.

3.4.3 The Contractor is responsible for all confined space entry permitting, assessment, entry, control and rescue planning in accordance with the Regulation.

3.4.4 The Contractor shall maintain all appropriate documentation required under the Regulation and provide daily copies to the Engineer.

3.4.5 The Contractor shall supply all required safety, control and personal protective equipment required for confined space entry operation, including, but not limited to entry and rescue equipment, atmosphere monitors and breathing apparatus/respiratory protection.

3.4.6 The Contractor shall ensure that all workers entering or interacting with the identified confined spaces are appropriately trained and that proof of training is supplied to the Owner.

3.4.7 The Contractor shall make provisions for the Engineer to enter the identified confined spaces, if needed and as required, under the Contractor's confined space entry permits and plans with one (1) days notice (or less under emergency conditions).

3.5 Assistance

3.5.1 Give reasonable help to the resident services staff in checking the setting out of the work. Arrange for ready access to work.

3.6 Work in Hazardous Locations

3.6.1 In hazardous areas provide and use safe mechanical and electrical devices and equipment.

3.6.2 All construction activities that occur in hazardous locations require continuous combustible gas monitoring by the Contractor's forces as specified herein.

3.6.3 Test for explosive or toxic gases, or oxygen deficiency before commencing the day's work and continuously while working in areas which may contain an explosive, toxic or oxygen deficient atmosphere. If a hazardous condition is found, make the work area safe before commencing or continuing work.

3.6.4 Use non-sparking tools in Class 1, Division 1 areas or where an explosive atmosphere may exist and hazard cannot be eliminated by Contractor.

3.6.5 The areas considered electrically classified by virtue of the possible presence of explosive gases are specified elsewhere. However, caution must be exercised everywhere in the Plant.

3.6.6 Conform to Ministry of Labour requirements for work in hazardous locations. Establish and implement written procedures to assure compliance. Construction activities, except wire pulling and cleaning, that occur in hazardous locations require continuous combustible gas monitoring, by the Contractor. Provide documentation of tests for gas and oxygen deficiency prior to starting work in hazardous locations.

3.6.7 Metering for Toxic Gas, Combustible Gas and Oxygen Deficiency: Monitor toxic gas, combustible gas, and oxygen deficiency at all levels in hazardous locations as per requirements of Ontario Occupational Health and Safety Act.

3.6.8 Gas Metering: Maintain a minimum of two portable gas detection meters. These meters continuously monitor for combustible gas, oxygen deficiency, carbon monoxide, metal oxide, and hydrogen sulphide in the surrounding atmosphere and alarms at a pre-set warning level. Recharge as necessary in accordance with manufacturer's specifications. Recalibration will be completed every three weeks or more frequently if required. Update and provide records of calibration and re-calibration and provide this information upon request from the Engineer.

3.6.9 Meter Operator: Provide a trained person to operate and read the portable meter continuously while construction activities occur in the designated hazardous locations. This meter operator is not permitted to assist in the construction activity in any way since this person's function is to watch the combustible gas and oxygen deficiency dials at all times. The meter operator must be located in the immediate vicinity of the construction activity. If work in two or more different hazardous locations is required at the same time, provide the additional meter operator(s) and meter(s) at no additional cost to the Owner.

3.6.10 Training: Provide for the manufacturer's representative to supply site training to all designated meter operators. Provide as many training sessions as required so that every meter operator attended a session.

3.6.11 Hazardous Event Procedure: If a dial on the meter deflects to indicate 10% of the Lower Explosive Limit (LEL), 19.5% oxygen, 10 ppm hydrogen sulphide or 35 ppm carbon monoxide, then discontinue the construction activity, evacuate the area, and notify the Owner's site representative.

3.6.12 Log Book: maintain a log book that will contain the following information:

.1 Date

.2 Name of meter operator

.3 Explosive gas, oxygen deficiency, hydrogen sulphide and carbon monoxide readings every ½ hour

.4 Construction activity type

.5 Location of construction activity

3.6.13 Submit the logbook to the Engineer when construction is complete and make available for inspection by Owner when requested.

3.6.14 Firefighting Equipment: Provide and maintain suitable firefighting equipment when working in the designated hazardous locations. Train Contractor's personnel working in these areas in the use of firefighting equipment.

3.7 Explosion-Proof Construction

3.7.1 Certain areas may be designated on the Drawings as "explosion proof", "hazardous", or may be classified under Section 18 of CSA C22.1. In areas having such designations, the

Contractor shall provide explosion proof electrical equipment, wiring devices and installation which meets the requirements of CSA C22.1, Section 18.

3.7.2 In hazardous areas as defined above, the Contractor shall provide intrinsically safe mechanical devices and equipment such as non-sparking aluminum wheels for fans, pneumatic operators for dampers and aluminum clappers for check valves on pipelines conveying gaseous fuels.

3.7.3 The Contractor shall provide, mount and maintain signs warning of all hazards and the proper procedure required for working in the hazardous areas.

3.7.4 The Contractor shall ensure compliance with CGA-B105-M93 and the applicable safety codes when working on or in the area of natural or digester gas pipes and systems. The Contractor shall purge all gas lines and tanks with nitrogen prior to proceeding with Work. Note the existing gas lines passing through the Work area may need to be maintained in service during the construction. The Contractor shall take suitable safety precautions to protect personnel and to protect these services from damage during the Work.

3.8 Protection of, and Modification to Existing Work

3.8.1 All existing structures, mechanical and electrical systems to remain shall be protected in a manner satisfactory to the Engineer. The Contractor shall document existing conditions prior to completing any new works.

3.8.2 Should any parts of the existing structures or systems become heaved, cracked or otherwise damaged after commencement of the work by the Contractor, all such damaged portions of the work shall be completely repaired and made good by the Contractor at its own expense and to the satisfaction of the Engineer, notify the Engineer of any conditions that would not permit the required repairs to be affected. If, in the final inspection of the work any defects, faults or omission are found, the Contractor shall cause the same to be repaired or removed and replaced by proper material and workmanship without extra compensation for the labour and materials required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein for at least the guarantee period described in the General Conditions of the Contract.

3.8.3 The Contractor shall be held fully responsible by the Owner for any damage to utilities, properties, buildings, homes or structures adjacent to, or in the general area of, the Work, through settlement of ground, vibration or shock resulting from any cause relating to the execution of the Work carried out under this Contract. The Contractor shall make good and repair such damage at the Contractor’s expense.

3.8.4 The Contractor shall sustain in their place and protect from direct or indirect injury, water and gas mains, public and private sewers and drains, conduits, cables, service pipes, poles, sidewalks, curbs, embankments, structures, equipment and other property in the vicinity of the Work.

3.8.5 The Contractor shall sustain and support structures that are uncovered, weakened, endangered or threatened.

3.8.6 The Contractor shall provide a plastic covering or tarp over equipment and/or employ other measures to prevent dust and dirt from entering buildings or areas where equipment is stored or is operating.

3.8.7 The Contractor shall provide a plastic covering or tarp over equipment and/or employ other measures to prevent dust, water or other deleterious substances from entering areas with existing electrical, heating, ventilating, pumping and other equipment.

3.8.8 Where existing wall sections are removed or where pipes are installed through existing walls or where any dust generating operation is necessary, the Contractor shall provide a suitable temporary wall or enclosure suitably reinforced and sealed to prevent dust from entering the existing area. When execution of the Work is completed remove temporary dust control devices and thoroughly clean all areas affected by the Work.

3.8.9 The Contractor shall comply with the requirements of Section 01400 – Environmental Protection.

3.9 Salvage of Existing Equipment

3.9.1 The following existing equipment shall be salvaged and placed inside the existing Facility:

.1 Existing chlorinators.

.2 Existing pumping skid in the area designated for ammonium sulphate chemical storage and pumping.

.3 Existing polymer day tank, mixer, and level sensor.

3.9.2 All other equipment not listed in Clause 3.9.1, that has been marked for demolition or removal in the Contract Documents shall be disposed off accordingly by the Contractor following confirmation from Operations.

3.10 Protection, Soundness, and Repair of New Construction

3.10.1 The Contractor shall protect newly constructed Work from damage. The Contractor shall prevent heavy loading of newly constructed Work and repair any damage. The Contractor shall construct the Works watertight and correct any rejected work.

3.10.2 If, in the final inspection, deficiencies are found, the Contractor shall repair or replace defective work as directed by the Engineer. The Contractor shall be responsible for satisfactory maintenance and repair of Work undertaken for the specified warranty period. The Contractor shall protect and store all equipment supplied under this Contract.

3.11 Storage and Protection of Materials and Equipment

3.11.1 The Contractor shall be governed by the direction of the Owner or the Engineer in all matters connected with, or concerning, storage of machinery, materials and supplies along the line of Work and shall, at its own cost, shift or remove such machinery, materials and supplies immediately upon receipt of notice from the Owner or the Engineer and to a location or locations acceptable to the Owner or the Engineer.

3.11.2 The Contractor shall arrange for delivery to the Site, and protection of materials and equipment:

.1 The Contractor shall schedule delivery of equipment to protect units from weather and construction dust and debris.

.2 The Contractor shall provide equipment and labour to unload, move and place units in their final position.

.3 The Contractor shall protect materials and equipment from damage.

3.11.3 The Contractor shall protect existing materials that are being modified as part of the Work and shall ensure that all existing materials being modified remain in the same condition as they were prior to modifications.

3.11.4 The Contractor shall protect materials and equipment after unloading from weather, dust, dirt and moisture both before and after erection and placing. The Contractor shall observe the manufacturer's written instructions for temporary storage.

3.11.5 The Contractor shall provide dry, heated 15°C temporary housing for pumps, motors, valves and other equipment or materials which may be injured by weather, dust, dirt or moisture.

3.11.6 The Contractor shall maintain shafts and bearings in good condition by rotating them weekly.

3.11.7 The Contractor shall provide the manufacturer's written instructions for the storing of equipment during the construction period well in advance of equipment delivery.

3.11.8 The Contractor shall store specialty items to ensure protection from damage to materials or finish.

3.11.9 The Contractor shall store materials which may be susceptible to water absorption off the ground. Protect materials from other damage due to environmental conditions under waterproof covers.

3.11.10 The Contractor shall promptly, as the Work proceeds, and upon completion, clean up and remove from the Site all surplus materials resulting from the foregoing Work.

3.12 Dewatering of Existing Structures

3.12.1 Contractor shall be responsible for dewatering channels, tanks, pipes, sewers and all existing water retaining structures, as required, to facilitate construction. Provide temporary sump and pump if required.

3.12.2 Cleaning shall be in accordance with Specification Section 01740.

3.12.3 Provide temporary pumps to dewater and control water levels in existing channels. Discharge pump flows to channels in service.

3.12.4 Empty pipelines by draining to a temporary sump and pump to an area identified by the Engineer. Flush pipelines clean prior to making connections.

3.12.5 Contractor shall not rely on existing equipment to drain the existing infrastructure. Provide temporary pumps and piping as required to facilitate dewatering activities.

3.12.6 Contractor shall assume that tanks, wet wells, manholes and other water retaining structures have not been previously cleaned and will have accumulated microsand, grit, sedimentation and other waste typically found in raw surface water undergoing Actiflo treatment. This waste is not suitable to be discharged to other areas of the Facility. The Contractor shall remove all microsand, grit, sedimentation and other waste and dispose of it accordingly as hazardous

waste. The Contractor shall also assume that microsand, grit, sedimentation and other waste typically found in Actiflo treatment may have solidified at the bottom of the tanks and other water retaining structures and will require pressure washing or sand blasting for removal.

3.12.7 Required areas to be drained throughout the project are, but not limited to, the following:

.1 Each Actiflo unit

.2 Existing polymer holding tanks

END OF SECTION

1 GENERAL

1.1 General

1.1.1 After Contract Award, the Contractor may submit an alternate material or piece of equipment to the Engineer and Owner for review. An Alternate will only be evaluated and considered acceptable if it meets the intent of the original design and specifications, and where there is a credit offered, an advancement to the schedule, or provision of an enhanced design.

1.2 Requests for Substitution

1.2.1 Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier or manufacturer, the naming of the item is regarded as the basis of design to establish the type, function and quality required.

1.2.2 Material or equipment of equal or better performance and quality may be offered in substitution for those specified. Requests for review of substitute items of material and equipment will not be accepted by the Contract Administrator from anyone other than the Contractor.

1.2.3 All requests for substitution must be accompanied by a detailed listing of the expected cost savings, advancement to the schedule, or provision of an enhanced design.

1.2.4 Substitutions will not be considered when they are indicated or implied on Shop Drawings or product data submittals without a separate written request.

1.2.5 Requests for substitution include any request for changes from the Contractor that require significant design changes, redesign or significant design reviews.

1.2.6 A request for substitution constitutes a representation that the Contractor:

.1 Has investigated the proposed product and determined that it meets or exceeds the quality level of the specified product.

.2 Will provide the same warranty for the substitution as for the specified product.

.3 Will coordinate the installation and make changes to other Work which may be required for the Work to be complete at the Contractor’s expense and at no additional cost to the Owner.

.4 Waives claims for additional costs or time extension which may subsequently become apparent.

.5 Will reimburse the Owner for review or redesign services.

1.2.7 Request for substitution to be made by written application to the Engineer and is to include sufficient data to enable the Engineer to assess the acceptability of requirements, including the following:

.1 All submittal information required for the specified equipment, including all deviations from the specified requirements and/or necessitated by the requested substitution.

.2 Materials of construction, including material specifications and references.

.3 Dimensional drawings, showing required access and clearances, including any changes to the work required to accommodate the proposed substitution.

.4 Drawings and details showing changes if the offered substitution necessitates changes to or coordination with other portions of the Work. Perform these changes as part of the substitution of material or equipment at no additional cost.

.5 Certification that the proposed substitute will adequately perform the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified with the same or better warranty.

.6 Information and performance characteristics for all system components and ancillary devices to be furnished as part of the proposed substitution.

.7 Certification that acceptance of the proposed substitute will not prejudice achievement of Substantial Completion.

.8 Itemization of all costs including any licenses fee or royalty that will result directly or indirectly from the acceptance of the proposed substitution. Include redesign and cost of claims of any other contract affected by the resulting change.

.9 Guaranteed credit or cost reduction offered if the proposed substitution is accepted and a waiver of claims for additional expenses which may subsequently become apparent.

.10 Recommended maintenance requirements and availability of spare parts and service.

.11 Written confirmation from subcontractors and suppliers on cost, schedule, and technical requirements if requested by the Engineer.

1.3 Engineer's Review

1.3.1 Engineer will evaluate each proposed substitution. Engineer will be the sole judge of acceptability, and no substitute will be ordered, installed or utilized without the Engineer's prior written acceptance by either a Change Order or a reviewed shop drawing. The burden of proof is on the Contractor.

1.3.2 Pay the Engineer's cost for evaluating the requested substitution even though the request may be denied, or for additional redesign work required as a result of any substitution. Costs will be charged on a time and expense basis and will be deducted from progress payments due the Contractor.

2 PRODUCTS

2.1.1 Not used.

3 EXECUTION

3.1.1 Not used.

END OF SECTION

1 GENERAL

1.1 Description

1.1.1 This section describes the minimum administrative requirements expected by the Contractor to coordinate the work, under the administration of the Engineer.

1.1.2 Involves coordination of project schedules, submittals, meetings, use of site, temporary utilities, construction facilities, construction progress of the work, required shut-downs and commissioning.

1.2 Responsibilities of Engineer

1.2.1 Schedule and administer pre-construction and construction progress (site) meetings, as well as responses to requests for information, and clarification of the scope of work.

1.2.2 Prepare the agenda with copies for all participants and preside at the meeting.

1.2.3 Record minutes and distribute copies of minutes within five working days after each meeting and transmit to meeting participants, affected parties not in attendance, the Contractor and the Owner. The Engineer will include and identify significant proceedings, decisions or actions with ‘Action By’ in the minutes.

1.3 Responsibilities of Contractor

1.3.1 Provide physical space for meetings.

1.3.2 Comply with Engineer's allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities in accordance with Section 01510 – Temporary Utilities and 01520 – Construction Facilities.

1.3.3 Provide information required to the Engineer and be prepared to discuss all items on the agenda, such as schedule updates, two-week look-ahead schedules, responses to previous or outstanding action items.

1.3.4 Representatives of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of the party each represents.

1.3.5 Identify any errors in minutes to the Engineer in writing within three days of receipt. Any conflicts shall be coordinated with the Engineer. Otherwise, it will be interpreted that the Contractor resolves the interference issues at his own responsibility.

1.3.6 During construction coordinate use of site and facilities through Engineer's procedures for intra-project communications, submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.

1.4 Pre-construction Kick-off Meeting

1.4.1 Within 15 days from award of the Contract, the Engineer will convene a pre-construction meeting to discuss and resolve administrative procedures and responsibilities from the start of the project.

1.4.2 Representatives of the Owner, the Engineer and the Contractor and major Sub-Contractors shall be in attendance.

1.4.3 The Engineer will establish a time and location for the meeting and notify concerned parties a minimum of five working days before the meeting.

1.4.4 The meeting agenda will include such items for discussions as:

.1 Appointment of official representative of participants in Work.

.2 Schedule of Work, progress scheduling and delivery schedule of major equipment in accordance with Section 01320 – Construction Schedule.

.3 Schedule of submission of shop drawings, samples and colour chips in accordance with Section 01330 – Submittals.

.4 Requirements and location for temporary facilities, site sign, offices, storage sheds, utilities, and fences in accordance with Section 01510 – Temporary Utilities.

.5 Site security in accordance with Section 01520 – Construction Facilities.

.6 Contemplated changes and change orders procedures, approvals required, mark-up percentages permitted, time extensions and administrative requirements.

.7 Owner supplied products.

.8 Redline drawings in accordance with Section 01780 – Closeout Submittals.

.9 Maintenance materials and manuals in accordance with Section 01780 – Closeout Submittals.

.10 Take-over procedures, acceptance and warranties in accordance with Section 01760 – Warranty Work and 01780 - Closeout Submittals.

.11 Monthly progress claims, administrative procedures, progress photographs and holdbacks.

.12 Appointment of independent inspection and testing agencies or firms (i.e., concrete, geotechnical, compaction, asphalt, etc.).

.13 Insurance.

.14 Safety issues.

.15 Environmental issues, including spills reporting.

.16 Other items of discussion

1.4.5 The Engineer will document the responsibilities and necessary activities of the participants during construction as discussed.

1.5 On-Site Documents

1.5.1 Maintain at job site, one copy each of the following:

.1 Contract drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed shop drawings.

.5 Contract Change Directives.

.6 Other modifications to Contract.

.7 Field test reports.

.8 Copy of approved Work schedule.

.9 Manufacturers' installation and application instructions.

.10 Notice of Project

.11 Health and Safety Plan and related documents

1.5.2 The Owner will supply electronic copies of drawings and specifications in digital format to the Contractor. The Contractor shall reproduce additional copies for his use, if required.

1.6 Schedule Management

1.6.1 Submit to the Engineer within five working days of award of the Contract, the preliminary construction progress schedule, based on the tender, and all required schedules, in accordance with Section 01320 - Construction Schedule.

1.6.2 After review by the Engineer, revise and resubmit all schedules to comply with revised project schedule.

1.6.3 Identify and track all critical items on all schedules and advise the Engineer of any changes to the schedules.

1.6.4 Actively manage and coordinate the work to avoid delays against reviewed schedules.

1.6.5 Revise schedules, reorganize and replace construction to minimize the impact of any identified delays.

1.7 Coordination of Construction

1.7.1 This is a lump sum contract to be completed in its entirety by the Contractor using the Contractor’s own forces or the forces of individual subcontractors and sub-trades.

1.7.2 All of the specifications and drawings shall be interpreted as one contract and the Contractor shall be wholly responsible for coordination of all work by the Contractor's own forces, sub-trades or subcontractors to complete the work.

1.7.3 No Section or Division of these specifications shall be construed or interpreted as being the responsibility of any sub-trade, subcontractor or supplier.

1.7.4 The Contract Drawings provide general routing of piping and general location of equipment unless specific dimensions are indicated. Locate piping and equipment to avoid interference with walkways, other equipment and required headroom.

1.7.5 The Engineer may furnish supplementary drawings to assist in proper execution of the Works. Such drawings will be issued for clarification only and will have the same meaning and intent as if part of the plans referred to in the Contract Documents.

1.7.6 The Contractor shall examine the work of all trades and ensure that conditions are satisfactory for the completion of any subsequent work.

1.7.7 The Contractor shall notify the Engineer immediately of any adverse conditions which may affect subsequent work and shall not proceed with any subsequent work until such conditions are rectified.

1.8 Submittals

1.8.1 Make all necessary submittals to the Engineer for review and approval.

1.8.2 Submit preliminary shop drawings, product data and samples in accordance with Section 01330 – Submittals for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to the work of other contracts. After review, revise and resubmit by transmittal to the Engineer.

1.8.3 Submit all requests for payment to the Engineer.

1.8.4 Submit requests for interpretation of Contract Documents, requests for information or clarification of the scope of work to the Engineer.

1.8.5 Submit requests for use of Alternatives to the Engineer.

1.8.6 Submit requests for Contemplated Contract Changes to the Engineer.

1.8.7 Deliver all closeout submittals to the Engineer.

1.9 Construction Progress or Site Meetings

1.9.1 Site meeting frequency shall be bi-weekly, or more frequently as required, at no additional cost to the Contract, if performance and schedule are not to the satisfaction of the Engineer and the Owner, or for additional coordination as required.

1.9.2 The Owner, Engineer and Contractor will be in attendance. The purpose of these meetings is to discuss the progress of the Work and related matters including:

.1 Review approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems and conflicts.

.4 Problems which may impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revisions to construction schedule.

.8 Progress, schedule, during succeeding work period.

.9 Review submittal schedules (shop drawing, RFI, etc.): expedite as required.

.10 Maintenance of quality standards.

.11 Pending changes and substitutions.

.12 Review proposed changes for effect on construction schedule and on completion date.

.13 Safety issues.

.14 Environmental issues.

.15 Other business.

1.10 Shut-Down Coordination Meetings

1.10.1 Shutdown coordination shall be per Section 01120, Clause 1.2.

1.10.2 The Contractor shall request a meeting for any shut-down that may impact the flow of water through the facility and/or has a duration of greater than one (1) hour.

1.10.3 Require attendance of all parties directly affecting, or affected by, work of the specific equipment or facility that must be shut-down.

1.10.4 Notify the Engineer, in writing, ten working days in advance of the meeting date so that the Engineer may coordinate with the Owner.

1.10.5 At least 20 working days in advance of the requested meeting the Contractor shall:

.1 Prepare and distribute a draft agenda

.2 Submit the proposed shut-down sequence and procedure

.3 Submit the proposed start date and time and duration of shut-down

.4 Provide the isolation and assistance requirements needed by operating staff

.5 Provide a contingency response approach in the event of problem or extended shut-down duration.

1.10.6 The Engineer will record minutes and distribute copies to participants and those affected by decisions made.

1.10.7 Identify errors in the minutes, if any, to the Engineer in writing within three days of receipt.

1.11 Pre-Commissioning Meeting(s)

1.11.1 A pre-commissioning meeting shall be held ten working days prior to any commissioning activities to review the pre-commissioning and final commissioning plan and schedule. Where work requires staggered commissioning of unit processes, hold a dedicated pre-commissioning meeting for each unit process.

1.11.2 Attendance at the pre-commissioning meeting shall include the Owner, Engineer, Operator, Contractor-appointed commissioning supervisor, and key Contractor personnel involved with the commissioning of the Work.

1.12 Contractor’s Representative at Meetings

1.12.1 The Contractor shall attend all Construction Progress Meetings or other such coordination meetings as directed by the Engineer.

1.12.2 The Contractor's representative at these meetings shall be the Site Supervisor or Project Manager/Contract Administrator and/or a competent and reliable person who is familiar with the Work. The Contractor's representative shall have full authority to make decisions on the Contractor's behalf.

END OF SECTION

1 GENERAL

1.1 Description

1.1.1 This section specifies requirements and procedures for preparing and updating construction schedules and reports for planning, coordinating, executing and monitoring the progress of the work. The construction work shall be scheduled using the Critical Path Method (CPM) of network analysis.

1.2 Scheduling

1.2.1 The CPM type construction schedule will be used to monitor job progress. The Contractor will be responsible for providing all information concerning sequencing, logic and duration of all activities as well as providing the initial CPM logic network diagram and tabular report data. Once the initial logic network diagram is accepted, the contractor will be responsible for providing regular schedule updates including information on logic, percent complete, actual start and finish dates and duration changes.

1.2.2 The Contractor shall dedicate the necessary resources for updating the Detailed Progress Schedule monthly such that the schedule is always current and accurately reflects the activities occurring on site. Furthermore, the Contractor shall store a live version of the schedule on a File Transfer Protocol (FTP) and provide viewing access to the Engineer - such that the Engineer, at any time, may view a current and accurate version of the Detailed Progress Schedule.

1.2.3 The Contractor shall retain a third-party scheduler if the Contractor does not have the technical resources to provide a schedule that meets the requirements of this Section. The Contractor shall retain a third-party scheduler if the first submission of the Detailed Preliminary Baseline Schedule does not demonstrate that the Contractor has the technical resources to provide a schedule that meets the requirements of this Section.

1.2.4 There shall be sufficient cause for Default by the Contractor, should the Contractor fail to comply with the requirements of this Section.

1.2.5 Failure of the Contractor to comply with the requirements of this provision shall subject the Contractor to, at the Owner's Sole discretion, a withholding, in partial or in total of payments otherwise due to the Contractor for work performed under this Contract. The Contractor agrees that any withholding of money is not a penalty for noncompliance, but is an assurance for the Owner that funds will be available to implement these requirements should the Contractor fail to do so, since failure of the Contractor to comply with these requirements shall mean that the Contractor failed to execute the work with such diligence as to ensure its completion within the time for completion.

1.3 Schedule Preparation and Submittal Requirements

1.3.1 Baseline Schedules:

.1 Summary Level Preliminary baseline Schedule:

.1 Shall be submitted to the Engineer and the Owner by the Contractor a minimum of two (2) Working Days prior to the preconstruction meeting.

.2 Detailed Preliminary Baseline Schedule:

.1 Shall be submitted to the Engineer and the Owner by the Contractor within ten (10) Working Days after the date of the Order to Commence or prior to the first progress payment, whichever occurs first.

.2 To ensure that the schedule is being developed according to the requirements of the Contract Documents, the Contractor shall be required to attend an initial schedule planning meeting and may be required to attend weekly meetings at which it will present to the Engineer the then-current version of the schedule. The Contractor will provide both hard copy and electronic copies of the schedule as it is developed, and as required by the Engineer. If requested by the Engineer, the Contractor will require Subcontractors to attend these meetings.

.3 Shall be a CPM schedule using the latest commercially available version of MS Project.

.4 Shall be submitted with accompanying narrative report.

.5 Shall be submitted as a shop drawing in accordance with Section 01330 – Submittals.

.6 The Contractor shall provide the electronic copy of the schedule as both a MS Project file and PDF file.

.3 Detailed Final Baseline Schedule

.1 Shall be submitted to the Engineer and the Agency by the Contractor within twenty (20) Working Days after the date of the Order to Commence or prior to the first progress payment, whichever occurs first.

.2 Same requirements and format as specified above for Detailed Preliminary Baseline Schedule.

1.3.2 Progress Schedules:

.1 Detailed Progress Schedules:

.1 Shall be submitted to the Engineer and the Agency by the Contractor on a monthly basis or more frequently as required.

.2 Shall be accompanied by a narrative itemising and describing any changes made to the schedule.

.3 Shall be subject to the same requirements and format as specified above for the Detailed Final Baseline Schedule.

.4 Shall be submitted with accompanying construction photographs.

1.4 Schedule Preparation

1.4.1 With the exception of the Summary Level Preliminary Baseline Schedule, the Contractor shall prepare schedules using the latest commercially available version of MS Project.

1.4.2 The scheduling software shall be used to produce a resource-loaded CPM schedule in the form of time-scaled diagrams with the critical path activities highlighted.

1.4.3 Schedules shall be submitted to the Engineer in both MS Project file and PDF file. The schedule shall be formatted as follows:

.1 Formatted to print on 279mm x 432mm sheet size

.2 Title Block: Show the name of the project, project number, Contract number, Owner, Date, date submitted, revision or update number, and the name of the scheduler.

.3 The Detailed Baseline Schedule will be numbered ‘0.0’. Revisions, if required, will be numbered ‘0.1’, ‘0.2’, etc. Numbering for the Progress Schedule updates shall reflect the number of months elapsed since the Contract commenced: that is, the first update will be numbered ‘1.0’; second month ‘2.0’, etc.

.4 The Contractor shall identify horizontally, across the top of the schedule, the time frame by year, month and day.

.5 The Contractor shall identify each activity with a unique number and activity code and a brief description of the Work associated with that activity.

.6 The Contractor shall reflect sequences of the Work, restraints, delivery windows, review times, shutdowns, Contract Times and Project Milestones.

.7 The Contractor shall identify the duration of each activity and show early start, early finish, late start, late finish, and completion, and float for each activity and sub-activity.

.8 The Contractor shall identify the Work of separate stages and other logically grouped activities, and clearly identify critical path activities.

.9 Legend to describe standard and special symbols and bars.

1.4.4 Scheduling Software:

.1 File Transfer and Back-up: The Contractor, if required, shall provide a copy of all baselines and update files electronically.

.2 Settings: The Contractor shall provide the Engineer with all of the software settings it has used in the baseline schedules and updates. Examples of the information required include but are not limited to: Calendar Settings, User Preferences, Schedule Settings, etc.

.3 The Contractor will produce schedule layouts and reports according to the Engineer’s requirements and instructions. Reports such as the following will be required in the indicated file formats:

.1 Detailed Schedule Layout [.pdf and .mpp]

.2 Critical Path Layout [.pdf and .mpp]

.3 Early and Late Resource Curves [.pdf and .xls]

1.5 Summary Level Preliminary Baseline Schedule

1.5.1 The purpose of this schedule submission is to convey to the Owner at an early stage the Contractor's original plan to achieve overall and milestone(s) completion in accordance with the Contract Documents. Since this schedule is only expected to be developed to a summary level, it may be a bar chart, as opposed to a Critical Path Method schedule, and may be created using an MS Excel spreadsheet or other software application. The schedule should contain as much detail as is necessary to fully articulate the Contractor's plan up to and including Total Performance of the Work. The Contractor is also required to provide an accompanying narrative, describing in general terms how it intends to resource the project as well as assumed rates of production for major items of Work. The Contractor will provide any information requested by the Owner that the Owner considers necessary in order to understand the Contractor's original plan.

1.5.2 The Contractor must submit the Summary Level Preliminary Baseline Schedule a minimum of two (2) Working Days prior to the Pre-Construction meeting and be prepared to discuss the schedule at the same meeting.

1.6 Detailed Preliminary Baseline Schedule

1.6.1 The Detailed Preliminary Baseline Schedule must be submitted within ten (10) Working Days after the date of Order to Commence or prior to the first progress payment whichever occurs first.

1.6.2 The Detailed Preliminary Baseline Schedule shall cover all phases of the Work and shall represent the Contractor's practical original plan to complete the Work, considering restrictions of access and availability of Work areas, and availability and use of manpower, material and equipment. It is to be a fully resource-loaded schedule, with labour, material and equipment resources provided at an activity level or as required by the Engineer.

1.6.3 The Detailed Preliminary Baseline Schedule shall show the sequence and interdependencies of construction and commissioning activities, as well as project related activities reasonably required to complete the Work, and shall address the following, at a minimum:

.1 The issuance and the Contractor's receipt of the Order to Commence Work.

.2 Obtaining any applicable permits, design drawings, specifications and shop drawings for early product procurement, and long lead time items. Refer to Section 01330 - Submittals.

.3 Mobilization and other preliminary activities.

.4 Setup of Engineer's trailer

.5 Site Access

.6 Any initial Site Work as applicable

.7 Specified Work sequences, constraints, and Milestones, including Substantial and Total Performance of the Work date(s).

.8 Type of Work to be performed by the Subcontractor(s) involved.

.9 Major equipment design, fabrication, factory testing, and delivery dates.

.10 Delivery dates for Owner-furnished pre-purchased equipment, if applicable.

.11 Submittals such as shop drawings that are critical or near critical to schedule completion.

.12 Major components of the Work and other relevant details, including at a minimum:

.1 Concrete Work

.2 Equipment Work

.3 Mechanical Work

.4 Electrical Work

.5 Leakage testing of tanks, pipes and structures

.6 Shutdowns and Tie-ins

.1 Work by Owner

.2 Work by Contractor

.7 Instrumentation, SCADA design and control Work

.8 Any applicable interfaces with Owner pre-purchased equipment, if applicable

.9 Other important Work for each major facility

.10 Equipment and system start-up, training, and test activities. Refer to Section 01810 Testing and Commissioning.

.11 Project close-out and cleanup

.12 Demobilization

1.6.4 The Contractor shall break the work into activities with a duration of minimum 5/maximum 20 (5-20) working days each, except for non-construction activities (such as procurement of materials and delivery of equipment) and other activities which may require a longer duration and shutdowns, tie-ins and connections, which may require a shorter duration. To the extent feasible, activities related to a specific physical area of the project shall be grouped on the network for ease of understanding and simplification. The selection and number of activities shall be subject to review by the Engineer and Owner.

1.6.5 The activities defined in the Detailed Preliminary Baseline Schedule shall represent the planned durations in anticipation of normal manpower and equipment utilization in durations of whole Working Days. The Engineer may require that the duration of major activities be calculated by the scheduling software on the basis of the planned rate of daily production. The Contractor will resource load the schedule using labour, and not crew, hours unless otherwise instructed by the Engineer.

1.6.6 In calculating activity durations, normally adverse weather conditions shall be considered. The Contractor shall include sufficient float in the schedule to account for normally adverse weather conditions.

1.6.7 The Contractor shall schedule the Work to minimize the effect of adverse weather, and to allow for protection of the Work from such effects.

1.6.8 Activity Descriptions

.1 Activity names shall: describe action; identify building elements; and specify location.

1.6.9 Activity Numbering

.1 Activity numbering shall be alphanumeric and conform to the Engineer's instructions.

1.6.10 Activity Coding

.1 The Contractor shall make extensive use of the activity coding capabilities of the scheduling software in order to satisfy the grouping, sorting, filtering and report generating requirements of the Agency.

1.6.11 Examples of the activity codes that will be required are: phase; area; location; responsibility; work type, etc.

1.6.12 The Detailed Final Baseline schedule shall be accompanied by a narrative that provides a detailed description of the labour, materials, plant, means and methods that the Contractor intends to use to carry out the Work and achieve the planned rate of production required to support the activity durations shown in the schedule. The narrative shall also provide explanations supporting the use of lead-lag relationships and constrained dates.

1.6.13 The Contractor shall submit all revisions and/or additional information requested by the Engineer pursuant to its review should the Engineer consider that these additions are necessary for the Detailed Preliminary Baseline Schedule in order to comply with the requirements of this Section.

1.6.14 Submission of the schedules (including Baseline and Progress Schedules) referred to in this Specification Section, and any subsequent updates to such schedules, shall constitute the Contractor's representation that:

.1 The Contractor and its Subcontractor(s) intend to execute the Work in the sequence indicated in such schedule.

.2 The Contractor has distributed the proposed schedule to Subcontractor(s) and Equipment Vendors for their review and comment and has obtained their concurrence.

.3 All elements of the Work required for the performance of the Contract are included. Failure to include any such element shall not excuse the Contractor from completing the Work within the milestone dates and Contract Time and other constraints specified in the Contract Documents.

.4 The Contractor has thoroughly inspected the Site, considered the work of other Contractors and where necessary to complete the Work under this Contract, coordinated its plan with other Contractors retained by the Owner.

.5 The Contractor has incorporated any other special conditions in planning the Work such as specified or required Work restriction periods, etc.

.6 The express or implied acceptance by the Owner and/or the Engineer of the final baseline schedule and any progress schedules shall not constitute an approval or acceptance of the Contractor's construction means, methods, or sequencing or its ability to complete the Work in a timely manner, and shall not place any obligation or responsibility on the Owner or Engineer toward the Contractor nor shall it, in any way, limit or restrict the Contractor's obligations and responsibilities under the Contract.

1.7 Detailed Final Baseline Schedule

1.7.1 The required revisions must be made and the Detailed Preliminary Baseline Schedule finalized to the satisfaction of the Owner and Engineer, whereupon it will become the Detailed Final Baseline Schedule, against which progress will be measured.

1.7.2 The Detailed Final Baseline Schedule must be submitted within twenty (30) Working Days after the date of Order to Commence or prior to the first progress payment, whichever occurs first. The Owner shall withhold all or part of the monthly progress payment until the Detailed Final Baseline Schedule is acceptable by the Owner and Engineer.

1.7.3 The Contractor acknowledges and understands that time is of the essence of this Contract and therefore that Baseline Early dates for activities, and not the late dates, reflect the target dates for project planning and execution. The Contractor will plan for, and enlist, resources with the goal of achieving the early dates.

1.8 Detailed Progress Schedules

1.8.1 The Contractor shall submit a Detailed Progress Schedule to the Engineer at the end of each month, with each application for payment starting with the second monthly progress payment. The schedule, together with the related data and reports specified in this Section, shall be submitted along with the monthly progress payment application. The progress payment will not be reviewed until the schedule along with all the related data and reports specified in this Section are submitted. The Owner may withhold all or part of the monthly progress payment until the updated Detailed Progress Schedule is updated in a manner acceptable to the Engineer.

1.8.2 Each Detailed Progress Schedule shall record and report data and report actual completion and/or start dates for each completed or in-progress activity, activity percent complete for in-progress activities and forecast completion dates for all activities that are not yet complete. As-built logic will be adjusted as required to reflect the actual sequence of the Work. The Detailed Progress Schedule shall show the projected Completion Date of the Work based on the progress information inserted into it, without changes to the schedule logic or the original duration of any activity. The Contractor shall use the retained logic option when executing schedule calculation. The Detailed Progress Schedule will be shown as a target schedule to indicate whether the current progress schedule remains on target, has slipped or is ahead of schedule.

1.8.3 The Contractor may then, in a second and subsequent update to the progress schedule, incorporate any logic and duration changes that represent its revised planning, provided all such changes are identified and documented in the schedule narrative and are agreed to by the Engineer.

1.8.4 If it appears that the progress schedule submitted by the Contractor no longer represents the actual sequencing and progress of the Work, the Engineer may instruct the Contractor to revise the Detailed Progress Schedule. The Owner may withhold all or part of the monthly progress payment until the Detailed Progress Schedule is updated in a manner acceptable to the Engineer.

1.8.5 A complete schedule update submission (to be submitted with each monthly progress payment application) must include the following schedule and progress reports:

.1 An updated Detailed Progress Schedule, comparing actual and target progress.

.2 A resource-loaded graph, comparing targeted to actual labour and material.

.3 A schedule narrative, including:

.1 Detailed description of progress, including comparison of planned to actual rates of production, key deliveries to the Site, construction, erection, testing and commissioning.

.2 A discussion of the basis for any Work sequencing, logic, interdependencies or original activity duration revisions incorporated into an updated schedule.

.3 Comparisons of actual and planned progress, with a brief commentary on any actual or forecast delays or problems that might have an impact on the completion date of the Work, and a discussion of the measures being (or to be) adopted to overcome these.

.4 Records of all Contractor and Subcontractor(s) personnel and construction equipment on Site.

.5 Progress photographs

.6 Any other information specifically required by the Engineer

.4 The Contractor shall provide the Engineer with a complete weekly list of personnel, plant and construction equipment as well as production rates actually achieved on all major activities, and labour hours for all major trades such as, for example, the formwork, mechanical, and electrical trades.

.5 The Contractor shall incorporate and logically connect approved Contract changes into the CPM schedule. Each change will be identified by number and description.

.6 In the case of a potentially critical delay occurring between the regular schedule updates, and if requested by the Engineer, the Contractor shall update the schedule at the beginning of the delay event and at the resolution of the delay issue. Activities will be added to the schedule as required to analyze the delay using the Time Impact Analysis method.

.7 In order to further define (beyond the level of detail shown in the Detailed Final Baseline Schedule) critical portions of the Work such as facility shutdowns, the Contractor shall, if requested, develop detailed schedule fragments.

.8 The Contractor shall also maintain, in an MS Excel worksheet provided by the Engineer, a weekly as-built bar chart schedule that will record Work actually performed against each schedule activity.

1.9 Completion, Milestones and Constraints

1.9.1 The Owner has set out a Substantial Performance date for the Work based on the Time for Completion clauses in the Contract Documents. These dates shall be strictly adhered to; in this regard, the Contract provides for liquidated damages.

1.9.2 Float is defined as the amount of time between the earliest start date and the latest start date of an activity or chain of activities on the CPM schedule. Float shall not be for the exclusive use of either the Contractor or Owner.

1.9.3 Use of float suppression techniques such as software constraints, preferential sequencing, special lead/lag logic restraints, extended activity times, or imposed dates, other than as required by the Contract, shall be cause for the rejection of any schedule submitted by the Contractor.

1.9.4 In the event that the Contractor's progress schedule indicates completion prior to the stipulated overall completion (or other milestones) date, such float will not be for exclusive use of either the Contractor or Owner.

1.10 Compliance with Schedule

1.10.1 The Contractor shall comply with the latest schedule approved by the Owner and Engineer.

1.10.2 If the Contractor fails to complete a major activity, critical event or milestone by the date indicated in the latest update to the construction schedule and such failure is anticipated to extend the Contract Time or milestones, the Contractor shall, within seven (7) calendar days of such failure, submit an updated construction schedule with a narrative clearly indicating how the Contractor intends to correct the non-performance and return to the accepted construction schedule. Actions by the Contractor to complete the Work within the Contract Time (and milestones) shall not be justification for an adjustment to the Contract Time or Contract Price unless such failure is due to a delay in accordance with the provisions of Clause 3.1 below.

1.10.3 The Owner may, at no additional cost to the Owner, order the Contractor to increase Construction Equipment, labour force or working hours if the Contractor fails to:

.1 Complete a milestone activity by its scheduled completion date, or

.2 Satisfactorily perform the Work as necessary to prevent delay to the overall completion of the Work., but only to the extent required to return to the agreed upon construction schedule.

1.11 Progress Photographs

1.11.1 The Contractor must photographically document all phases of the Contract including pre-construction, construction progress, and post-construction.

1.11.2 The Contractor must ensure that a digital camera is available at the Site for its own use and for the use of the Engineer. The Contractor shall take photographs of the various parts of

the construction on a regular basis and when problems or matters of particular interest or importance arise.

1.11.3 Copies of such photographs shall be retained on Site until completion of the Work and should be identified with the following information:

.1 Date when photograph was taken and by whom;

.2 Contract number;

.3 Contractor's name;

.4 Location (e.g. – grid lines);

.5 Direction of view;

.6 Description; and Contractor's photo file number (so that each photo and negative may be readily identified).

1.11.4 The Engineer shall have the right to select the subject matter and vantage point from which photographs are taken. Matters of importance or interest which are to be photographed include:

.1 After the effective date of the agreement and before the Work at the Site is started, and again upon issuance of Substantial Performance, take photographs of the construction Site as well as the property adjacent to the perimeter of the construction Site;

.2 Structures, both inside and outside the Site. The pre-construction records will be compared to the post-construction records to assess damage or displacement of existing structures.

.3 Faulty work;

.4 Type of excavation; width of trench, etc.;

.5 Sheeting and shoring used;

.6 Dewatering methods, condition of bottom of excavation;

.7 Work on elements.

1.11.5 A complete set of photographs shall be prepared by the Contractor in accordance with the above requirements and submitted to the Engineer on USB when the Monthly Progress Report is submitted. The photos shall demonstrate how the Work is actually progressing and the planned and detailed sequencing of the Work at the time of the report. The Engineer may direct the contractor to obtain additional photographic records of structures and features within the site limit. The cut-off date for the Monthly Progress Report shall be as instructed by the Engineer.

1.11.6 Allow for quarterly aerial photos for the entire project site for the duration of the Work.

1.12 Look-Ahead Schedule

1.12.1 Provide by 4:00 pm EST on the last workday of each week a Three-Weekly Progress and Planning Report including the following:

.1 An overview of the previous working week's progress including quantification where applicable.

.2 An updated schedule showing progress to date, critical path, and planned activities for the upcoming three weeks (on a rolling basis). All major upcoming items are to be highlighted, especially where coordination is required (e.g., shutdowns, inspections).

.3 General summary of staff utilization including downtimes for training, maintenance of equipment, waiting on others (such as Engineer, Owner or others), etc.

.4 Summary log of all Issues/Concerns, RFIs, RFCs, and their current status.

.5 Health and Safety summary including the names of all those who have received the Contractor's and the site-specific training and any incident reports.

.6 Summary of all external visitors to site including but not limited to the Owner, the Engineer, regulatory authorities, the testing companies, the subcontractors and the suppliers.

2 PRODUCTS – NOT APPLICABLE

3 EXECUTION

3.1 Contract Completion Time

3.1.1 Causes for Extension of Time

.1 The contract completion time will be adjusted only for causes specified in the Contract Documents. In the event the Contractor requests an extension of any contract completion date, the Contractor shall furnish justification and supporting evidence. The Engineer will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof. If the Engineer finds that the Contractor is entitled to an extension of the Contract completion date under the provisions of the Contract, the Engineer's determination as to the total number of days' extension shall be based upon the current accepted and updated CPM schedule and on all data relevant to the extension. Such data shall be included in the next monthly updating of the schedule. The Contractor acknowledges and agrees that actual delays in activities which, according to the CPM schedule, do not affect any contract completion date shown by the critical path in the network do not have any effect on the contract completion date or dates and therefore will not be the basis for a change in Contract Time.

.2 The Contractor shall submit to the Engineer a detailed account of the claim and the grounds upon which the claim is based. Such claim shall be submitted within a reasonable time, and in any event no later than Thirty (30) Calendar Days after completion of the specific Work affected by the situation. Oral arrangements will not be considered. The Contractor must produce written evidence in support of the claim and shall advance no claim in the absence of such written evidence. Claims submitted later

than Thirty (30) Calendar Days after completion of the specific Work affected by the situation will not be considered.

END OF SECTION

1 GENERAL

1.1 Summary

1.1.1 This section defines necessary submittals to be made to the Engineer, before, during and after construction. These include, but are not limited to:

.1 Proposed location and details of temporary buildings

.2 Shop drawings for permanent and temporary Works

.3 Shutdown Notifications

.4 Shutdown Master-list

.5 Samples

.6 Site progress reports

.7 Tests and reports

.8 Certificates and transcripts

.9 Maintenance data and operating instructions

.10 Interference drawings

.11 Redline drawings

.12 Other specific submittals as requested in individual specification sections

1.2 Administrative

1.2.1 The Contractor’s responsibility for errors and omissions in submittals is not relieved by the Engineer's review of submittals. The review of shop drawings by the Engineer is for the sole purpose of ascertaining conformance with the general design concept on the Contract Drawings and documents. This review shall not mean that the Engineer approves detail design inherent in the manufacture of specific pieces of equipment, or those details required for construction, the responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting all requirements of construction and the Contract Documents. Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all sub trades.

1.2.2 The Contractor’s responsibility for deviations in submittals from requirements of Contract Documents is not relieved by the Engineer's review.

1.2.3 Submit all submittals to the Engineer for review as specified.

1.2.4 Submit with reasonable promptness and in orderly sequence so as to not cause delay in the Works. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

1.2.5 The Contractor shall be responsible for:

.1 The accuracy and completeness of the information contained in each submittal and ensure that the material, equipment or method of work is as described in the submittal.

.2 Verifying that features of products conform to the specified requirements.

.3 Editing submittal documents to indicate only those items, models, or series of equipment that are being submitted for review. Cross out or otherwise obliterate extraneous materials.

.4 Coordinating submittals among the subcontractors and suppliers and ensure there is no conflict with other submittals

.5 Notifying the Engineer in each case where a submittal may affect the work of trades or the Owner.

1.2.6 Verify that the materials and equipment to be furnished and method of work comply with the provisions and the intent of the Contract as a whole. The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all.

1.2.7 Verify and guarantee that features and characteristics of materials, equipment and other items to be incorporated into the work, and for which no submittals are required, conform to the Contract requirements.

1.2.8 Work affected by submittals shall not proceed until the review process is complete.

1.2.9 Present shop drawings, product data, samples and mock ups in SI Metric units.

1.2.10 The Contractor shall review submittals prior to submission to the Engineer. This review confirms that each submittal has been checked and coordinated with requirements of the Works and Contract Documents. Submittals not stamped, signed, and dated by the General Contractor will be returned without being examined and shall be considered rejected. The Contractor shall specifically identify whether or not they have any comments on the shop drawings submitted by their sub-contractors and suppliers. If it is evident that the Contractor has not performed their own review of the submittal then the Engineers review of the submittal will cease and the submittal returned to the Contractor immediately.

1.2.11 Notify the Engineer in writing identifying deviations from the Contract Documents stating reasons for deviations. Also refer to Section 01200 – Alternatives.

1.2.12 Verify that field measurements have been taken and affected adjacent work has been coordinated.

1.2.13 The Engineer has allowed for up to two shop drawing submittals and reviews as part of the normal review process. Any more than two shop drawing submittals will be considered a deviation for which the Engineer may seek compensation from the Contractor for the additional time and effort of shop drawing review. This does not include initial submittal data such as shop tests and field tests that are submitted after initial submittal.

1.2.14 Keep one reviewed copy of each submission on site.

1.2.15 Compliance Statement: Include in every shop drawing submission, a copy of the relevant specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included. Check-mark each paragraph to indicate compliance with the specification or mark otherwise to indicate requested deviations from specified requirements. Check marks (√) denote full compliance with a paragraph in its entirety. If deviations from the specifications are indicated, underline each point of deviation and denote by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance with the specified requirements. Provide in the submittal a detailed, written justification for each deviation.

1.2.16 Certificate of Proper Equipment Application: With the initial shop drawing submittal or substitution request, provide a signed letter from the Equipment Manufacturer stating that the manufacturer has reviewed the Contract Documents and the equipment being supplied is suitable for the intended application. Submittal review will not be conducted without this completed certificate.

1.3 Shop Drawings and Product Data

1.3.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Works.

1.3.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Works. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of where they are specified or on which drawings the work appears. Indicate cross-references to Contract Drawings and Specifications.

1.3.3 Provide a list of all shop drawings that the Contractor will be submitting to the Engineer 14 working days after the Order to Commence has been issued.

1.3.4 Allow 15 working days for the Engineer’s review of each submission. The Contractor must stage the submittals such that the Engineer can review in the allotted time.

1.3.5 Adjustments made on shop drawings by the Engineer do not address the issue of Contract Price. If adjustments affect the value of the Works, state this in writing to the Engineer prior to proceeding with the work. Any changes affecting Contract Price or Contract Time require a Change Order to be issued.

1.3.6 Make all changes to shop drawings as required by the Engineer and consistent with Contract Documents. When resubmitting, notify the Engineer in writing of any revisions other than those requested.

1.3.7 Submittals:

.1 Submittals must be submitted with a Submittal Transmittal Form to Engineer for official submission.

.2 The marked-up copies will be returned to the Contractor via the submission method received.

.3 The final submittals will be retained by the Engineer and stored at the site office.

.4 The Contractor is responsible for producing hardcopies and sharing softcopies with Equipment Manufacturers and with subcontractors.

.5 Submittal Cover Page

.1 For each discrete submittal, type or print the appropriate information on a cover page to fully describe the submittals being sent for review. Include the cover page for each discrete submittal. The title page shall include the following:

.1 Project Title

.2 Project / Contract Number

.3 Submittal / Shop Drawing Title

.4 Contractor Reference Number (if applicable)

.5 Specification number

.6 Revision Number

.7 Filename

1.3.8 Submissions shall include:

.1 Contractor’s name, contact phone no. and address.

.2 Date and revision dates.

.3 Project title and number.

.4 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Section of Contract where specified and location to be installed.

.6 Apply shop drawing stamp, signed by Contractor’s authorized representative certifying their review and approval of submissions, verification of field measurements and compliance with Contract Documents.

.7 Compliance statement, refer to Clause 1.2.15

.8 Certificate of Proper Equipment Application, refer to Clause 1.2.16

.9 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating Weight and forces.

.8 Details of anchorage including bolt diameter, location and projection.

.9 Complete piping drawings, including size and location of all sleeves and/or openings to be formed into structural works.

.10 Submit all equipment and instrument shop drawings in advance of MCC and control panel shop drawings to allow coordination and any vendor specific power, I/O or control wiring requirements.

.11 Wiring diagrams.

.12 Single line and schematic diagrams.

.13 Relationship to adjacent work.

.14 Enclosure ratings (NEMA or IEC) for electrical equipment

.15 Electrical supply requirements including:

.1 Acceptable voltage range for mains and control power

.2 Current draw at full load

.3 Maximum and/or minimum setting of upstream protection

.4 Withstand and interrupt ratings

1.3.9 Submit one copy of product data sheets or brochures for requirements requested in the specifications and as requested by the Engineer where shop drawings will not be prepared due to standardized manufacture of product.

1.3.10 Submit shop drawings for each requirement requested in specification Sections and as Engineer may reasonably request.

1.3.11 Softcopy submittals

.1 All softcopy submittals shall be named using the following nomenclature: [5]-[3]-R[2]-[4]-[1].pdf, where the fields in the filename are defined as follows:

.1 [1] = Contractor specific unique reference number (if applicable)

.2 [2] = Revision number

.3 [3] = Specification number

.4 Submittal number – some specs have more than one submittal, need a way to track those.

.5 [4] = Submittal/Shop Drawing title

.6 [5] = Project/Contract number

.2 Each discrete shop drawing submittal shall be a single complete PDF document complete with cover page as the first page.

.3 At the request of the engineer, the Contractor shall submit native files of certain submittals (MS Word, MS Excel, MS Project, Primavera, etc.) to help expedite the review process.

.4 The Engineer reserves the right to request hardcopy submissions of any shop drawing submittal where it is deemed by the Engineer to be of benefit to have a complete hard copy version of the shop drawing for review.

1.3.12 Submittals will be returned with one or of the following notations. Take action as noted:

.1 "NO COMMENT" - Make and distribute additional copies promptly as required for execution of Work. Instruct parties to report promptly any inability to comply with provisions.

.2 "REVISE & RESUBMIT" - Make the necessary revisions and resubmit revised drawings for review. This procedure will not relieve the responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of Contract. Show the drawing number of the first such revised drawing and show the latest revision number applicable to the drawing by increasing the revision index – “R0”, “R1”, “R2”, etc. Refer to 01330 – Submittals – Supplement B: Shop Drawing File Naming Convention Instructions for instructions on how to apply revision numbers.

.3 “AS NOTED” – Make the necessary revisions prior to commencing with the execution of work. A resubmission for Engineer review is not required. Resubmit with all necessary revisions for record and coordination purposes.

.4 “REJECTED” – This notation indicates that the Engineer has received the submission and has deemed it incomplete or improper for review.

.5 "NOT REVIEWED" - This notation indicates when Engineer has acknowledged receipt of the shop drawing and that a review is not required.

1.3.13 Use only those shop drawings on the work that bear the "NO COMMENT" or “AS NOTED” notation.

1.3.14 Do not revise shop drawings marked "NO COMMENT" unless resubmitted to the Engineer for further review.

1.3.15 Ship one set of reviewed shop drawings, installation instructions, lubrication schedules, parts lists and other information along with each piece of equipment to the Site and clearly mark "DO NOT REMOVE FROM SITE".

1.3.16 Neither the Engineer nor the Owner will accept responsibility for the cost of changes necessary if any equipment is fabricated without prior review of shop drawings. Completion of the Engineer's review will be designated by the presence of the Engineer's initialed reviewed stamp on the returned drawings.

1.3.17 Where more than one type of shop drawing has been specified for one item, e.g., wiring diagrams, layout details, and dimensional drawings, the shop drawings will be submitted together, to enable Engineer to review the drawings as a package.

1.3.18 Catalogue pages or drawings applicable to an entire family or range of equipment will not be accepted as shop drawings unless they are clearly marked to show the pertinent data for the particular materials.

1.3.19 Manufacturers' catalogues, manuals, or price lists will not be accepted as shop drawings. Such materials may be used as supplemental information to the shop drawings.

1.3.20 Indicate the tag number of all instruments and valves and clearly show the features and details applicable to the equipment being supplied.

1.3.21 Determine which shop drawings have, in addition to those drawings specifically mentioned in the Contract, design elements requiring the seal of a Professional Engineer registered in the Province of Ontario, in accordance with the applicable provincial or federal engineering acts or other governing legislation. Seal such drawings before submitting them for review. Submit for review engineering calculations signed by the registered Professional Engineer responsible for the shop drawing design elements.

1.3.22 If upon review by Engineer, no errors or omissions are discovered or if only minor corrections are made, a copy will be returned denoted "AS NOTED", and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned denoted "REVISE AND RESUBMIT", and resubmission of corrected shop drawings, through the same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.3.23 Owner may deduct, from payments due, costs of additional engineering work incurred if equipment Manufacturer does not submit correct shop drawings after one review.

1.3.24 Review by Engineer is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Engineer approves the detail design inherent in the shop drawings, responsibility for which remains with the Contractor, and such review does not relieve the responsibility for errors or omissions in the shop drawings or of the responsibility for meeting all requirements of the Contract Documents. It also does not relieve the responsibility for dimensions to be confirmed and correlated at the job-site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades.

1.3.25 As per Clause 1.6, prepare and submit proposed sleeve location drawings showing the location and size of sleeves, openings and miscellaneous items to be formed in the work with the reinforcing steel drawings to allow full coordination. Any reinforcing steel modifications required as a result of failure of the contractor to provide these drawings, will be at no cost to the Owner.

1.3.26 Delete information not applicable to project from all submittals.

1.3.27 Supplement standard information to provide details applicable to project as required.

1.3.28 When corrected copies are resubmitted, the Contractor shall direct specific attention to all revisions in writing and shall list separately any revisions made other than those called for by the Engineer on previous submittals. Requirements specified for initial submittals shall also apply to resubmittals.

1.3.29 If more than one resubmittal is required because of failure of the Contractor to provide all previously requested corrected data or additional information, the Contractor shall reimburse the Owner for the charges of the Engineer for review of the additional resubmittals. This does not include initial submittal data such as shop tests and field tests that are submitted after initial submittal.

1.3.30 When resubmittals are needed, resubmittals shall be made within 15 business days. The Contractor may submit an acceptable request for an extension of time, listing the reasons why the resubmittal cannot be completed within the stipulated time.

1.3.31 The need for more than one resubmittal, or any other delay in obtaining the Engineer review of submittals, will not entitle the Contractor to extension of the Contract Times unless delay of the Work is the direct result of a change in the Work authorized by a Change Order.

1.3.32 The maximum size of shop drawings shall be 600 mm x 900 mm to permit red line photocopy reproduction.

1.3.33 Shop drawings which require the approval of a legally constituted authority having jurisdiction shall be submitted by Contractor to such authority for approval. Such shop drawings shall receive final approval of authority having jurisdiction before Consultant's final review.

1.3.34 Drawings stamped “AS NOTED” must be revised for inclusion in the Operation and Maintenance Manuals. Returned copies containing review comments shall not be included in the Operation and Maintenance Manual.

1.3.35 Submit hardcopy and softcopy sets of final shop drawings as part of the O&M submission.

1.4 Shop Drawings for Temporary Works

1.4.1 Submit for review shop drawings of temporary works which:

.1 Control the dimensions and locations of any part of the structures to be constructed under the contract.

.2 Impose loads on parts of the works which are still under construction or on existing structures.

1.4.2 Payment will not be made for work started or completed without the required drawing review. Submit shop drawings well in advance of the time when they are required for construction. Coordinate shop drawings prepared by different trades so that information is available to prevent conflict or errors where the work of one trade affects the work of another.

1.4.3 One (1) digital copy of submitted shop drawings will be returned to the Contractor after review.

1.4.4 Shop drawings will be reviewed for conformity with the required arrangement and dimensions of the permanent structures and for general conformity with the specifications.

1.4.5 If resubmittal is requested, discuss the comments made and resolve all issues raised by them, then resubmit the shop drawings amended accordingly.

1.4.6 Do not begin construction of temporary works before review of the shop drawings is completed.

1.4.7 Review of the Contractor's drawings does not relieve the Contractor of the responsibility for the results arising from errors or omissions of design or from the use or abuse of the temporary works.

1.4.8 Keep one copy of each stamped, reviewed drawing at the site of the work for reference during the duration of the construction work.

1.4.9 Make no changes to drawings after they have been reviewed.

1.4.10 Submit shop drawings in SI metric units.

1.4.11 Use either ANSI size A (8.5" x 11") for text and drawings or size B (11" x 17") for drawings. Do not reduce originals to a degree that compromises legibility.

1.4.12 Have no lettering, symbols, and characters less than Font 11 in size.

1.4.13 The Contractor shall retain the services of a Professional Engineer to design and stamp all temporary works.

1.5 Samples

1.5.1 Submit samples in duplicate for review as requested in respective specification Sections. Submit samples with identifying labels bearing material or component description, manufacturer's name and brand name, Contractor's name, project name, location in which material or component is to be used, and date.

1.5.2 Deliver samples prepaid to the Engineer's business address, or as otherwise directed by the Engineer.

1.5.3 Notify the Engineer in writing, at time of submission of deviations in samples from requirements of the Contract Documents.

1.5.4 Where colour, pattern or texture is a selection criterion, submit the full range of samples.

1.5.5 Adjustments made on samples by the Engineer do not address the issue of Contract Price. If adjustments affect the value of the Works, state such in writing to the Engineer prior to proceeding with the work.

1.5.6 Make all changes to samples as required by the Engineer and consistent with Contract Documents.

1.5.7 Reviewed and accepted samples will become the standard of workmanship and material against which installed work will be verified.

1.6 Insert and Sleeve Location Drawings

1.6.1 Submit insert and sleeve location drawings showing the location and size of sleeves, anchor bolts, openings and miscellaneous items to be formed in the work. Submit these drawings with the reinforcing steel drawings to allow full coordination.

1.7 Interference Drawings

1.7.1 Prepare composite working/layout/construction/interference drawings, fully dimensioned of cables, conduits, cable trays, cable bus ducts, sleeves, structures, clearances, pipes, ducts etc. and equipment in all areas to avoid conflict of trades. Base drawings on manufacturers' working drawings. Drawings shall be developed from consultation with and the agreement of all trades. All drawings shall be reviewed, checked for compliance with contract documents and stamped as "Reviewed" by the Contractor and Subcontractor prior the submission to the Engineer for review. Drawings that are not stamped as "Reviewed" by the Contractor and Subcontractor will be returned to the Contractor and shall have to be re submitted to the Engineer after review by the General Contractor and Subcontractor.

1.7.2 Before installation of structural, mechanical and electrical systems, prepare an integrated set of interference drawings in cooperation with all trades.

1.7.3 After discussion with Engineer, at no additional cost, make necessary relocations due to interference of trades, as a result of incomplete drawings.

1.8 Professional Engineering Design

1.8.1 Where specifications require Professional Engineer design, such Engineer is required to be licensed in the related discipline in the Province of Ontario.

1.9 Test and Reports

1.9.1 Insofar as practical, test materials and equipment on site. Where shop test is necessary, give Engineer two (2) weeks notice in writing of proposed shop test date.

1.9.2 Complete an equipment report prior to site testing each item of rotating mechanical equipment. During testing complete the remainder of the equipment report. Submit the reports for inclusion in the Installation, Operation and Maintenance manual.

1.9.3 Before operating equipment, engage the services of a qualified manufacturer's service representative to inspect, operate, test and adjust the equipment after installation.

1.9.4 Submit the manufacturer's representative's signed report describing in detail the inspection, tests and adjustments made, quantitative results and suggestions for precautions to be taken

for correct maintenance. Verify that the equipment and its installation conform to the requirements of the Contract for the service intended and is ready for permanent operation. Bind copies of report into the installation, operation and maintenance manuals.

1.9.5 Inspection includes:

.1 Soundness (without cracked or otherwise damaged parts).

.2 Completeness of installation as specified and as recommended by manufacturer.

.3 Correctness of setting, alignment and relative arrangement of various parts of system.

1.9.6 Operate, test and adjust equipment to prove it is correctly installed to operate under the intended conditions.

1.9.7 Equipment will only be accepted after receipt of the manufacturer's representative's report.

1.9.8 Submit notice in writing at least 48 hours before manufacturer's representative is scheduled to perform these services.

1.9.9 Modify or replace equipment or materials failing required tests.

1.9.10 Perform additional testing required due to changes of materials requested by Contractor or due to failure of materials or construction to meet specifications.

1.10 Redline Drawings

1.10.1 The Owner will supply a set of contract drawings. Mark thereon all revisions in red ink as the job progresses to produce a set of redline drawings.

1.10.2 Dimension locations (vertically and horizontally) of buried or concealed work, especially piping and conduit, with reference to exposed structures. Dimension the installed locations of concealed service lines on the site or within the structure by reference from the centre line of the service to the structure column lines or other main finished faces or other structural point easily identified and located in the finished work.

1.10.3 Update these drawings and make available for monthly review. Payment against the Progress Payment line item for updated drawings will be withheld if drawings have not been maintained up-to-date.

1.10.4 Submit redline drawings in SI metric units.

1.10.5 Record on the white prints on a daily basis, work constructed differently than shown on the Contract Documents. Record all changes in the work caused by site conditions, or originated by the Owner, the Engineer, the Contractor, or a sub-contractor and by addenda, supplemental drawings, site instructions, supplementary instructions, change orders, correspondence, and directions of regulatory authorities. Accurately record the location of concealed mechanical services and electrical main feeders, junction boxes and pull boxes. Do not conceal critical work until its location has been recorded.

1.10.6 Do not use these drawings for daily working purposes and make the set available for periodic inspection by the Engineer.

1.10.7 Make records in a neat and legibly printed manner with non-smudging medium.

1.10.8 The Contractor shall scan the complete set of redline drawings in PDF (full resolution) and upload progress redline drawings onto the CIMA FTP site and transmit to the Engineer on a quarterly basis (every 3 months).

1.10.9 To certify that the redline drawings are being kept up to date by the Contractor, there shall be a line item in the monthly payment certificate entitled “Redline Drawings”. Refer to Section 01025 for further details.

1.10.10 Submit all redline drawings to the Engineer prior to Substantial Performance. Substantial Performance will not be issued until redline drawings are completed by the Contractor, submitted to the Engineer and reviewed with no further comments.

1.11 Site Progress Records

1.11.1 All site progress reports shall be provided as required to the Engineer and a copy shall also be kept for the Contractor’s records.

1.11.2 Provide by 10:00 am EST a Daily Progress Report including the following:

.1 The weather conditions with maximum and minimum temperatures

.2 The commencement and the completion dates of the work of each trade in each area of the Contract.

.3 The erection and removal dates of formwork in each area of the Contract

.4 The dates, the quantities, and the particulars of each concrete pour

.5 The dates, the quantities, and the particulars of roofing installation

.6 The dates on which major items are installed.

.7 The numbers and classifications of the Contractor’s and the Sub-contractor’s trades people working at the site and the numbers and classifications of construction machinery and equipment and the number of hours each is operated.

.8 The visits to the site by the Owner, Engineer, the Regulatory Authorities, testing companies, the Sub-contractors and the suppliers.

1.12 Weekly Newsletters

1.12.1 The Contractor shall prepare weekly newsletters and email a PDF copy to the Engineer and Owner every Monday morning by 10 a.m.

1.12.2 Newsletter shall summarize the Work completed the previous week and shall include pictures of the Work per Clause 1.14. A detailed description of the Work completed by all subcontractors/trades daily are to be included in the newsletter and not just a caption of the picture.

1.12.3 Throughout the project, the Owner and Engineer may request the raw (non-PDF) electronic copies of any newsletters, including pictures.

1.12.4 Prior to Substantial Performance, a USB containing all the raw (non-PDF) and PDF copies shall be provided.

1.12.5 Any Work completed between Substantial Performance and the end of Warranty shall also be included in newsletters and the USB updated at the end of the Warranty period to cover the entire Contract.

1.13 Pre-Construction Photographs

1.13.1 Provide pre-construction photographs in digital format, prior to commencement of work on the site. Deliver to the Engineer before starting any construction, two electronic copies by digital devices. The Engineer may direct the Contractor to obtain additional photographic records of structures and features within the site limits. The pre-construction records will be compared to the post-construction records to assess damage or displacement of existing structures.

1.13.2 Pre-construction survey will be performed by an inspection company experienced in this work and approved by the Engineer. The Contractor will be required to indemnify the Owner against any claim by abutting property owners for damages sustained due to any construction activities.

1.13.3 The Contractor shall ensure that advanced notice is given to the residents, advising them of a pre-construction survey. A copy of the pre-construction survey shall be filed with the Engineer and Owner prior to commencement of construction.

1.13.4 Carry-out preconstruction survey of the Facility, including building interior, site, driveway, and access road.

1.13.5 Obtain pre-construction photos of the existing:

.1 Roads, sidewalks and curbs.

.2 Shoulder and grass areas.

.3 Building exterior.

.4 Trees

.5 Interior views of rooms, tunnels, etc., where modifications are planned.

1.14 Progress Photographs

1.14.1 On commencement of work and at monthly intervals thereafter, provide eight (8) different view photographs to illustrate the progress of the work. Photographs are to be taken by a professional photographer from locations selected by the Engineer. The Owner reserves the right to request hard copies of digital pictures as necessary, printed on photo quality media.

1.14.2 Refer to Section 01320 for further details on progress photographs.

1.15 Operation and Maintenance Data

1.15.1 Provide two (2) hard copies and electronic copy of draft manual or sets of manuals, of instruction, in accordance with Section 01780 for review by the Engineer. One copy will be returned with comments and one copy will be retained to assist the Engineer and will be returned after delivery of the final copies. The Contractor shall submit the draft O&M manual at least twenty (20) working days prior to the start of training specified in Section 01820.

1.15.2 Supply two (2) hard copies and one (1) electronic copy final and complete manuals or sets of manual, of instruction, in accordance with Section 01780 for further details on Operation and Maintenance data and manual. Final submission of Operation and Maintenance data is required prior to Substantial Performance.

1.16 Equipment Inventory

1.16.1 Asset tagging facilitates the efficient operation of water and wastewater activities by providing the means to locate, monitor, and keep records and information against specific assets. The Contractor will be required to complete Asset Tagging based on the Asset Inventory created in accordance with the Owner's Asset Inventory and Tagging Guidelines.

1.16.2 Submit a separate binder for the Computerized Maintenance Management System (CMMS) Equipment Inventory and Tagging list.

1.16.3 The Engineer will provide a complete Tagging List for each piece of equipment/material installed

1.16.4 Provide complete and properly formatted inventory information to the Owner. Inventory information shall include specific tag ID, asset name, building location, room location, type, sub-type, vendor, manufacturer, model number, serial number, installation date, purchase cost, estimated service life, warranty expiration date, criticality, dimensions, sizing, capacity, motor rating, material, current, RPM, frequency, voltage, phase, power, output pressure, rated air flow, rated gas flow, rated liquid flow, total dynamic head, rated weight, power safety factor, electrical information, etc.

1.16.5 Contractor shall work on-site to securely affix the Asset Tags to the Assets as per the Owner's standards.

1.16.6 Contractor shall work on-site to complete the Asset Tagging Forms for each Asset using the Owner's hardware or on a Microsoft Excel form to be supplied to the Contractor by the Engineer.

1.16.7 Contractor shall verify that Asset Tagging has been completed prior to Substantial Performance.

1.16.8 Prior to commissioning, the Owner's CMMS shall be updated by the Contractor to include pertinent maintenance data and documentation for new assets and/or modifications made to existing assets. Similarly, data for assets that are planned to be decommissioned shall be documented for removal from the CMMS.

1.16.9 The Contractor shall document Preventative Maintenance and related Job Plans for each Asset. Preventative maintenance information includes the recommended frequency of inspection and the list of assets the preventative maintenance is applicable for. Job plans

include the key steps to perform, and the list of required materials or equipment needed to perform the work.

1.17 Spare Parts

1.17.1 Provide spare parts, in quantities specified in individual specification sections and Section 01780.

1.17.2 Contractor shall include a consolidated list of all spare parts that have been provided as part of the Works. The Spare Parts List shall also indicate the box number in which the equipment is located.

1.18 Maintenance Materials

1.18.1 Provide maintenance material, in quantities specified in individual specification sections and Section 01780.

1.18.2 Contractor shall include a consolidated list of all maintenance materials that have been provided as part of the Works. The Maintenance Material List shall also indicate the box number in which the material is located.

1.19 Special Tools

1.19.1 Provide special tools, in quantities specified in individual specification sections and Section 01780.

1.19.2 Contractor shall include a consolidated list of all special tools that have been provided as part of the Works. The Special Tools List shall also indicate the box number in which the tools are located.

1.20 Warranties and Bonds

1.20.1 Provide warranties and bonds as specified in individual specification sections and Section 01780.

1.20.2 The placing, installation and connection of work by the Owner's own forces or by any other Contractors on and to the Contractor's Work does not relieve the Contractor of their responsibility to provide the specified warranties.

END OF SECTION

Shop Drawing Transmittal

SD Submittal Sheet R1.docx

Date: **Pages (incl. cover):**

To:		**Phone:**	
Company:		**Fax:**	
E-mail Address:		**Other:**	
From:		**Phone:**	
Company:		**Fax:**	
Email Address:		**Other:**	

Project Title:			
Client Project No.:			
Submittal Title:		**Submittal No.:**	
Specification:		**Revision No.:**	
Filename:	SD Submittal Sheet R1.docx		

Issued For:

- ☐ Information
- ☐ Your Comments
- ☐ As requested
- ☐ Tender Purposes
- ☐ Construction Purposes
- ☐ Other

Mode of Delivery:

- ☐ Postal Service
- ☐ Courier Service
- ☐ Hand Delivered
- ☐ For Pick-Up
- ☐ FTP Site
- ☐ Other

CONTRACTOR CERTIFICATION SHOP DRAWING STAMP

600-1400 Blair Towers Place
Ottawa, ON K1J 9B8
Canada

Phone : (613) 860-2462
Fax : (613) 860-1870
www.cima.ca

Shop Drawing File Naming Convention

Four (or five) fields are used to create a file name:

- ***[1]*** **=** *Contract No.*
- **[2] =** Specification Section & Clause
- **[3] =** Revision No.
- **[4]** = Shop Drawing Title
- **[5] =** Contractor Reference # (optional)

Filename format = **[1] - [2] - R[3] - [4] -** ***[5]***

- Field 1 is optional and does not have to be included

[1]	**[2]**		**[3]**		**[4]**
Contractor Reference #	**Revision No.**	**Division**	**Spec. Section – Clause(s) – [2 digit id#]**	**Manufacturer**	**Shop Drawing Title**
001	0	1	01320-3.2-01	General Contractor	Construction Schedule
002	0	1	01400-3.2-01	General Contractor	Contractors Environmental Protection Plan
002	1	1	01400-3.2-01	General Contractor	Contractors Environmental Protection Plan
003	0	1	01400-3.2-02	General Contractor	Contractors Environmental Certificate

Please use the table below as an example of file naming conventions for fictional project **P2015-01 [5]**.
File naming examples:

P2015-01-01320-3.2-01-R0-Construction Schedule-001.pdf

- Basic file name example including fields ***[1]*** through **[4]**

P2015-01-01400-3.2-01-R0-Contractors Environmental Protection Plan-002.pdf

- Note the change of field ***[1],*** **[3], and [4]** for the new shop drawing

P2015-01-01400-3.2-01-R1-Contractors Environmental Protection Plan-002.pdf

- Note the change of field **[2]** to reflect a new **Revision No.** for an existing shop drawing

P2015-01-01400-3.2-02-R0-Contractors Environmental Certificate-003.pdf

- Note field **[3]** as 01400-3.2-*02*, different from the previous 01400-3.2-*01*
- Note the change of field ***[1]***, **[2]**, and **[4]** for the new shop drawing
- For different shop drawings with the same clause reference, use -## to differentiate

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1 GENERAL

1.1 Construction Safety Measures

1.1.1 Contractor shall submit a site-specific Health and Safety Plan within five (5) working days after the date of Notice to Proceed or prior to mobilization on site, whichever occurs first. The site-specific Health and Safety Plan must address the requirements of the Acts. As Constructor, the Contractor will be required to prepare a Site-Specific Health and Safety plan to be submitted for review by the Owner. The Contractor is to submit the draft plan at the Pre-Construction Meeting which shall be revised, if needed, before construction begins.

1.1.2 The contractor shall meet the requirements of the following:

.1 Occupational Health and Safety Act, Regulations for construction projects, O.Reg. 213/91 (as amended. by O.Reg. 631/94), Part II General Construction.

.2 Occupational Health and Safety Act, Industrial Establishments Regulation, R.R.O. 1990, Reg. 851 (as amended by O.Reg. 516/92; 630/94; 230/95; and 450/97), Part I Safety Requirements.

.3 Revised Statutes of Ontario 1980, Chapter 321, Revised Regulation of Ontario 1980, Regulation 691 as amended by O.Reg. 156/84 and O.Reg. 645/86, and Ontario Regulation 714/82.

.4 Workers Safety & Insurance Board (WSIB) and municipal statutes and authorities.

1.1.3 In event of conflict between any provisions of above authorities, the most stringent provision governs.

1.1.4 The Contractor is designated “Constructor” as defined by law.

1.2 Special Protection and Precautions

1.2.1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials and regarding labelling and the provision of material safety data sheets (MSDS) acceptable to Labour Canada.

1.2.2 Conform to the Ministry of Labour requirements for work in hazardous locations. Establish and implement written procedures to assure compliance.

1.2.3 Comply with the Owner’s and Plant Operations Health and Safety Procedures.

1.2.4 Provide site specific health and safety training to all Contractor and Sub-Contractor staff on-site. To ensure all staff on site have attended site orientation and are accounted for in case of emergency, the Contractor is required to provide to the Owner a daily attendance sheet, listing individual’s names.

1.2.5 Submit all required training certificates related to performing the Work to the Owner prior to undertaking the Work, e.g. confined space training, fall arrest training, asbestos awareness training.

1.2.6 Contractor to obtain CAD rating and WSIB clearance certificates from each sub-contractor and to provide to Owner upon request.

1.2.7 Smoking is not permitted in hazardous areas or other areas as designated by the Owner. Post "No Smoking" signs as required.

1.3 Safety and First Aid Facilities

1.3.1 Provide and maintain on Site, in a clean orderly condition, completely equipped First-Aid kit or facilities readily accessible at all times to Contractor's employees and, the Engineer and the Owner.

1.3.2 Facilities and staffing to be in accordance with the Industrial First Aid Regulations of the WSIB and OSHA regulations.

1.3.3 Provide fire extinguishers, smoke and CO monitors for trailers.

1.3.4 Supply three additional hardhats and safety vests for visitors to site.

1.3.5 Provide and maintain on the site a completely equipped first aid kit, which shall be readily accessible at all times to all employees and the Owner.

1.3.6 Designate certain employees who are properly instructed to be in charge of first aid. At least one such employee is to be always available on the site while work is being carried out.

1.3.7 A telephone call list for summoning aid, such as doctors, ambulances, pulmotors and rescue squads from outside sources is to be conspicuously posted.

1.4 Safety Equipment and Hazardous Areas and Materials

1.4.1 Safety equipment such as gas detection equipment for explosive or toxic gases or oxygen deficiency, safety belts, ropes, etc., are to be made available to the Engineer as necessary for inspection.

1.4.2 Construction personnel requiring use of respiratory equipment are to be clean shaven.

1.4.3 Post warning signs at hazardous areas or where hazardous materials are stored, and install protective barriers. Instruct personnel in proper safety procedures. Inform the Owner of the location of these materials. The Contractor shall ensure that these materials are not kept stored or used on site without the Owner's prior consent or approval

1.4.4 Identify all areas considered to be hazardous locations and comply with all requirements of the Ministry of Labour.

1.4.5 Ensure compliance with CSA B149.6 – 15 and applicable safety codes when working on or in the area of natural and digester gas lines. Purge all gas lines with nitrogen prior to proceeding with work. Note that certain gas lines passing through the work area will continue in service during this construction. Take suitable safety precautions at all times.

1.5 Site Conditions

1.5.1 Work at site may involve contact with:

.1 Ammonia Sulphate (41%) Solution

.2 Chlorine gas canisters

.3 Dry/wet polymer

.4 Raw water residual solids

.5 Actiflo microsand

.6 High voltage electrical connections

END OF SECTION

1 GENERAL

1.1 Waste Management Objectives

1.1.1 The Owner has established that the Contract shall generate the least amount of waste possible and that processes shall be employed that ensure the generation of as little waste as possible including prevention of damage due to mishandling, improper storage, contamination, inadequate protection or other factors as well as minimizing over packaging and poor quantity estimating.

1.1.2 Of the inevitable waste that is generated, the waste materials designated in this specification shall be salvaged for recycling. Waste disposal in landfills or incinerators shall be minimized. This means careful recycling of job site waste.

1.1.3 The Contractor shall:

.1 Institute construction waste reduction practices.

.2 Effect optimum control of construction waste.

.3 Implement a site recycling program that includes source separation of solid waste materials.

.4 Be responsible for final implementation of site recycling program by disposal of recyclable solid waste at appropriate recycling centres.

.5 Transport and dispose of waste materials that are not identified to be recycled at permitted landfill facilities.

1.2 Waste Management Plan

1.2.1 The Contractor shall submit to the Engineer a Waste Management Plan. The Plan shall contain the following:

.1 Analysis of the proposed job site waste to be generated, including the types of recyclable and waste materials generated (by volume or weight).

.2 Alternatives to Landfilling: The Contractor shall designate responsibility for preparing a list of each material proposed to be recycled during the course of the Project.

.3 List of compulsory materials to be recycled, shall include, at minimum, the following designated materials:

.1 Old corrugated cardboard, paper and packaging.
.2 Clean dimensional wood, palette wood.
.3 Concrete/Concrete Block/Asphalt.
.4 Scrap metals.
.5 Unpainted gypsum wallboard.
.6 Glass and plastics.
.7 Beverage containers.
.8 Land clearing debris.
.9 Paint (to be returned to Paint Depot).

1.2.2 Materials Handling Procedures: The Contractor shall prevent contamination of materials to be recycled source and handle materials consistent with requirements for acceptance by designated facilities.

1.2.3 Waste Bins: The Contractor shall provide individual waste bins for each recyclable solid waste material and shall clearly designate recycling bins by colour coding and/or large identification signs. (Example: orange bin for wood only, green bin for trash).

1.2.4 Source Separation: The Contractor shall educate and monitor Sub Contractors about the acceptable methods of source separation.

1.2.5 Location: The Contractor shall place the recycling bins in convenient locations that are out of the way of construction traffic and shall designate this recycling area on site to prevent misuse or contamination of bins.

1.2.6 Contamination: When the recycling program is first started, and during construction operations the Contractor shall remind workers to keep trash out of the recyclable material bins. Coffee cups, caulking tubes, etc. must not be deposited into recycling bins.

1.2.7 Handling: Recyclable materials shall be free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process. The Contractor shall monitor source separation and ensure workers clean materials that are contaminated prior to placing in collection containers.

1.2.8 Collection: The Contractor shall arrange and pay for collection by or delivery of recyclable materials to the appropriate recycling company that accepts construction waste for purpose of recycling. The Contractor shall coordinate regular or “when-called” pick-up or delivery to eliminate overflowing bins.

1.2.9 Waste Management Plan Implementation:

.1 Manager: The Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and recording results of the Waste Management Plan for the Project.

.2 Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Sub Contractor, and the Engineer.

.3 Instruction: The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling to be used by all parties at the appropriate stages of the Project.

.4 Separation Facilities: The Contractor shall layout and label a specific area to facilitate separation of materials for recycling. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

.5 Hazardous Wastes: Any hazardous wastes shall be separated, stored, and disposed of in accordance with the requirements of the authorities having jurisdiction including the Ontario Regulation 542/06 Municipal Hazardous or Special Waste.

.6 The Contractor shall submit monthly to the Engineer a summary of waste materials, recycled, and disposed of using the form appended to this section or a form generated by the Contractor containing the same information. The Summary shall contain the amount (in metric tonnes) of material landfilled or incinerated from the Project, and the

identity of the landfill or transfer station. For each material recycled from the Project, include the amount (in tonnes) and the destination (i.e. the material recovery facility, transfer station, landfill, incinerator or used materials yard). The Summary shall include copies of logs, manifests, weight tickets and receipts.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

Sample Waste Management Tracking Sheet

Name of Company	Contact Person	Telephone No.
Project Site/Location	Project Size (in square metres)	Project Type/Construction

For Period:				To:
Material	Total Weight Produced	Recycled/Salvaged/Diverted	Disposed	Facility
Totals				
Signature	Title	Date		

Explanatory Note:

Column 1 – "Material" – Enter materials targeted for recycling and include a category for waste materials requiring disposal.

Column 2 – "Total Weight Produced" – enter quantities in metric tonnes of recyclable and waste materials generated.

Column 3 - "Recycled/ Salvaged/Diverted" – enter quantities metric tonnes of materials recycled, salvaged and diverted.

Column 4 - Disposed" – enter quantities metric tonnes of materials disposed.

Column 5 - "Facility" – enter end destination of recycled and disposed materials

END OF SECTION

1 GENERAL

1.1 Intent

1.1.1 This Section covers the work for the protection of the environment during construction.

1.1.2 The requirements of this Section are in addition to the requirements of any other Section of this specification and are not meant to limit in any way regulations, guidelines, laws or by-laws in effect at time of construction.

1.1.3 In all cases the most stringent requirements for environmental protection shall govern.

1.2 General Provisions

1.2.1 Be responsible for the protection of the natural environment of the site and surrounding areas, both land and water. Protection of the environment must start with avoidance and prevention, and then control/mitigation, compensation, or enhancement (in order of descending preference).

1.2.2 Prime consideration must be given to protecting the environment during all phases of construction. Co-operate fully with the Engineer, Owner, operating personnel and local authorities to protect the natural environment.

1.2.3 Obtain the Engineer's approval of planned work and storage areas and proposed access roads. Submit a written proposal prior to starting construction.

1.2.4 Project construction activities must be carried out in compliance with all applicable environmental laws and regulations.

1.2.5 All materials (hazardous and non-hazardous) shall be handled so as to protect human health and the environment.

1.2.6 Activities shall be planned and implemented, and equipment shall be managed and maintained in a manner that minimizes air emissions.

1.2.7 Prevent the accidental discharge of containments into soils, surface water and/or groundwater. Any accidental contamination shall be reported to the Ministry of Environment, Conservation and Parks immediately and cleaned up as per provincial requirements.

1.2.8 Erosion control measures shall be designed, implemented and maintained to ensure that there is no increased sediment loading to surface waters leaving the Project site. The Contractor is responsible for ensuring that the erosion control measures are implemented and maintained throughout the duration of the Project.

1.3 Inspection

1.3.1 Be advised that inspectors from the Owner, MOE, Conservation Authority and other authorities having jurisdiction may make periodic visits to the Site during construction. They have the authority to order the Contractor to stop work if in their opinion the Work is not being completed so as to ensure compliance with the environmental objectives. Acceptance of the Work by the Engineer may be withheld until the Owner and other authorities have issued their approval.

1.4 Limits of the Site

1.4.1 The limits of the site working area are shown on the Contract Drawings and described in the specifications. Confine operations within these limits, unless written approval is obtained from the Engineer and from the property owners concerned.

1.4.2 Install snow fencing stakes or other barriers suitable to the Engineer and other authorities to clearly define the working limits of the Site, parking areas, storage areas, maintenance areas and haul routes within the site and confine activities to these areas. Submit drawings of the Site showing areas outlined above for review by the Engineer.

1.5 Noise Control

1.5.1 If machinery, motors, pumps and other similar equipment must be operated beyond the normal working hours, keep the noise below a level acceptable to the Engineer by housing the equipment at no additional cost to the Contract.

1.5.2 Establish and maintain site procedures such that noise levels from construction areas are minimized. Use vehicles and equipment equipped with efficient muffling devices. Provide and use devices that will minimize noise levels in the construction area. Adhere to all local noise bylaws.

1.6 Dust Control

1.6.1 Prevent dust nuisance resulting from construction operations at all locations on site. Provide water for dust control as directed by the Engineer.

1.6.2 Use appropriate covers on trucks hauling fine or dusty material.

1.6.3 Use watertight vehicles to haul wet materials.

1.6.4 Employ only wet type equipment for saw cutting, or concrete grinding to control dust nuisance.

1.6.5 All trenches and areas disturbed by construction works that will produce dust shall be maintained dust free by an application of water.

1.6.6 Obtain Engineer’s approval before chemicals are used for dust control. Under no circumstances is sodium chloride permitted for dust control.

1.6.7 Do not use calcium chloride on access roads.

1.7 Mud Control

1.7.1 Keep plant and public roadways clean and free from mud.

1.7.2 Provide mud mats and/or wash stations to prevent tracking of mud from any portion of the contract limits onto any paved roadway.

1.7.3 Obtain and pay for the services of clean outside roads into the site with a street sweeper vehicle as required; or as directed by the Engineer. The street sweeper should be capable of wet and dry cleaning. Ensure that dust is controlled during cleaning operations. Mud, dust and other debris from the construction site will not permitted on the main roads leaving the

site. The Contractor will be responsible for street cleaning as required for the duration of construction until Substantial Performance.

1.8 Cleaning Equipment

1.8.1 Clean construction equipment prior to entering roadways. Do not clean equipment in locations where debris can gain access to sewers or watercourses.

1.9 Contingency and Emergency Response Plans

1.9.1 To fulfil its commitment to protecting public and worker health and safety, and the environment, the Contractor is required to adopt a preventive strategy. Through this strategy, the potential issues and emergency events that can be anticipated will be identified and procedures put in place to minimize their potential occurrence.

1.9.2 To address unanticipated events, the Contractor is required to develop Contingency and Emergency Response Plans and implement these plans as part of its contract with the Owner for undertaking the Project.

1.10 Spills

1.10.1 Submit procedures for interception, rapid clean up and disposal of spillages that may occur for Engineer's review prior to commencing work. Be prepared at all times to intercept, clean up and dispose of any spillage that may occur. Keep all materials required for clean-up of spillages readily accessible on site.

1.10.2 Report immediately any spills causing damage to environment to:

.1 Spills Action Centre of the Ministry of the Environment, Conservation and Parks Tel. 1 (800) 268-6060 and (416) 325-3000.

.2 The Municipality in which the spill occurred and the operating authority of the supply system water plant.

.3 Any other authority having jurisdiction or an interest in the spill including any Conservation Authority, water supply authorities, drainage authority, road authority, fire department, etc.

.4 The Owner of the pollutant, if known.

.5 The person having control over the pollutant if known.

.6 The Engineer.

1.10.3 Contact the manufacturer of the pollutant, if known, and ascertain the hazards involved, precautions required and best measures to be used in any clean up or mitigating action.

1.10.4 Take immediate action using any available resources to contain and mitigate the effects on the environment from any accidental spill.

1.11 Removal and Disposal

1.11.1 Remove surplus materials and temporary facilities and controls from the Site.

1.11.2 Dispose of all non-contaminated waste materials, litter, debris and rubbish off-Site.

1.11.3 Do not burn or bury rubbish and waste materials on the Site.

1.11.4 Do not dispose of volatile or hazardous wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

1.11.5 Do not discharge wastes into streams or waterways.

1.11.6 Dispose of debris including excess construction material, non-contaminated litter and rubbish at an appropriate off-Site facility identified by Contractor and approved by Owner.

1.12 Environmental Awareness Training

1.12.1 The Contractor is responsible for developing and implementing environmental awareness training to ensure that all on-site personnel are aware of environmental sensitivities associated with their actions; their roles and responsibilities in protecting the environment; and the mechanisms available for them to carry out their environmental protection responsibilities. The training program must include specific environmental awareness programs for the Contingency and Emergency Response Plans developed for the project.

1.12.2 The Contractor is responsible for submitting the training program for the Engineer's review and approval. The appropriate changes are to be made based on Engineer's review comments

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 Requirements Included

1.1.1 Regulations affecting the Work imposed by the most recent editions of

.1 American Water Works Association

.2 Ontario Building Code.

.3 Occupational Health and Safety Act Regulations for Construction projects, covering safety, hazardous materials, Workplace Hazardous Material Information Ontario.

.4 Ministry of the Environment, Conservation and Parks (MECP)

.5 Municipal by-laws and servicing standards.

.6 Municipal utilities.

.7 Ontario Fire Code (OFC)

.8 Boilers & Pressure Vessels Act Ontario (MCCR, TSSA, etc.)

.9 Energy Act Ontario

.10 Ontario Electrical Safety Code (OESC), latest edition and ESA bulletins

.11 Environmental Protection Act, Ontario Regulation 309

.12 Environment – Air, Ontario Regulation 346

.13 Environment – Noise, Ontario Regulation NPC 205

.14 Codes & Standards for National Fire Protection Association (NFPA)

.15 Ontario Reduce, Reuse and Recycle Regulations O.Reg. 101/94-105/94

.16 CSA Certificate Standards and Electrical Bulletins

.17 OSHA Standards for equipment

.18 CSA 2462-08 Safety in Workplace for Arc Flash Hazard

.19 Local Conservation Authority

.20 Municipal by-Laws and Regulations

1.2 Compliance with Regulations

1.2.1 Ascertain requirements and regulations of authorities listed above.

1.2.2 Comply with all such requirements and regulations as applicable to the Work.

1.2.3 Requirements set out in this Section are for guidance and information and are not necessarily complete.

1.3 Codes and Standards

1.3.1 The Contractor will:

.1 Perform work in accordance with the latest named published editions of codes and standards.

.2 Provide material and workmanship, which meet or exceed the specifically named code or standard.

.3 Execute Work in accordance with the applicable Federal, Provincial, Territorial and Municipal statutes, laws, regulations to the location of the Work to be performed.

.4 In the event of conflict of above statutes, laws, regulations and codes execute work in accordance with the requirements of the Authority having jurisdiction.

.5 Enforce all safety measures in accordance with the Ontario Occupational Health and Safety Act and applicable local Construction Safety.

.6 Enforce all safety measures in accordance with the Workplace Hazardous Materials Information System (WHMIS).

.7 For the purpose of the Occupational Health and Safety Act, the Contractor for the Works will be designated “Constructor” and will assume the responsibility of the Constructor as set out in the Act and its regulations. The Engineer will monitor the quality and quantity of work, undertake progress payment inspections and inspections for compliance with specifications and plans. The Owner will NOT be a “Constructor” by reason thereof.

.8 Provide the Director of Construction Health and Safety Branch of the Ministry of Labour with the information required under the Occupational Health and Safety Act prior to commencing work.

1.4 Permits

1.4.1 The Owner will apply for, obtain and pay for permits required prior to the Works commencing, including:

.1 All utilities approvals.

.2 Ministry of the Environment, Conservation and Parks

.3 Ministry of Consumers and Commercial Relations.

.4 Ministry of Labour.

.5 Ministry of Environment

.6 Local Region Conservation Authority

1.4.2 The Owner will secure the approval from the Ontario Ministry of Environment, Conservation and Parks.

1.4.3 The Contractor will apply for, obtain and pay for permits required after commencement of the Works.

1.4.4 The Contractor will apply for, obtain and pay for a demolition permit if required for the Works.

1.4.5 The Contractor will arrange for and inform the Engineer of inspections required by building permits, TSSA, ESA or any other Regulatory body requiring inspection.

1.4.6 The Contractor will arrange for and inform the Engineer of all other regular and final inspections required.

1.4.7 The Contractor will be responsible for all payments for the inspections as required for the permits.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 Intent of Section

1.1.1 This section provides a list of references, standards and organizations that may be referred to throughout these documents by an abbreviation. The abbreviations and details on the organization and contact information are provided in this section.

1.2 References

1.2.1 AA Aluminum Association, 900 19th Street N.W., Washington, D.C., U.S.A. 20006 http://www.aluminum.org.

1.2.2 AASHTO American Association of State Highway and Transportation Officials, 444 N Capitol Street N.W., Suite 249, Washington, D.C., U.S.A. 20001 http://www.aashto.org.

1.2.3 ACI American Concrete Institute, P.O. Box 9094, Farmington Hills, Michigan U.S.A. 48333

1.2.4 AHA American Hardboard Association, 887 B Wilmette Road, Palatine, Illinois, U.S.A. 60067

1.2.5 AITC American Institute of Timber Construction, 7012 S. Revere Parkway, Suite 140, Englewood, Colorado, U.S.A. 80112

1.2.6 AMCA Air Movement and Control Association Inc., 30 West University Drive, Arlington Heights, Illinois, U.S.A. 60004 1893 http://www.amca.org

1.2.7 ANSI American National Standards Institute, 11 West 42nd Street, New York, New York, U.S.A. 10036 http://www.ansi.org

1.2.8 API American Petroleum Institute,1220 L St. Northwest, Washington, D.C., U.S.A. 20005 4070 http://www.api.org

1.2.9 ARI Air Conditioning and Refrigeration Institute, 1815 North Fort Myer Drive, Arlington, Virginia, U.S.A. 22209 http://www.ari.org

1.2.10 ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, Georgia, U.S.A. 30329 http://www.ashrae.org

1.2.11 ASME American Society of Mechanical Engineers, United Engineering Centre, 345 East 47th Street, New York, New York, U.S.A. 10017 2392 http://www.asme.org

1.2.12 ASTM American Society for Testing and Materials, 100 Barr Harbor Drive West, Conshohocken, Pennsylvania 19428 2959 http://www.astm.org

1.2.13 AWCI Association of the Wall and Ceiling Industries, 1711 Connecticut Avenue N.W., Washington, D.C. U.S.A. 20009 http://www.awci.org

1.2.14 AWMAC Architectural Woodwork Manufacturers Association of Canada, 516 4 Street West, High River, Alberta T1V 1B6 http://www.awmac.com

1.2.15 AWS American Welding Society, 550 N.W. LeJeune Road, Miami, Florida U.S.A. 33126 http://www.amweld.org

1.2.16 AWWA American Water Works Association, 6666 W. Quincy Avenue, Denver, Colorado, U.S.A. 80235 http://www.awwa.org

1.2.17 CFFM Canadian Forces Fire Marshal, 101 Colonel By Drive, 8NT MGen George R. Pearkes Bldg., Ottawa, Ontario K1A 0K2

1.2.18 CGA Canadian Gas Association, 243 Consumers Road, Suite 1200, North York, Ontario M2J 5E3 http://www.cga.ca

1.2.19 CGSB Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 http://w3.pwgsc.gc.ca/cgsb

1.2.20 CISC Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, Ontario M2J 4G8

1.2.21 CITC Canadian Institute of Timber Construction, 200 Cooper Street, Ottawa, Ontario K2P 0G1

1.2.22 CMB Construction Materials Board, 101 Colonel By Drive, 8NT MGen George R. Pearkes Bldg., Ottawa, Ontario K1A 0K2

1.2.23 COFI Council of Forest Industries, 555 Burrard, Suite 1200, Vancouver, B.C. V7X 1S7 http://www.cofi.org

1.2.24 CRCA Canadian Roofing Contractors Association, 151 Slater Street, Suite 606, Ottawa, Ontario K1P 5H3

1.2.25 CSA Canadian Standards Association, 178 Rexdale Blvd., Etobicoke, Ontario M9W 1R3 http://www.csa.ca

1.2.26 CSC Construction Specifications Canada, 100 Lombard Street, Suite 200, Toronto, Ontario M5C 1M3

1.2.27 CSDFMA Canadian Steel Door and Frame Manufacturing Association One Yonge Street, Suite 1400, Toronto, Ontario M5E 1J9

1.2.28 CSPI Corrugated Steel Pipe Institute, 201 Consumers Road, Suite 306, Willowdale, Ontario M2J 4G8

1.2.29 CSSBI Canadian Sheet Steel Building Institute, 201 Consumers Road, Suite 305, Willowdale, Ontario M2J 4G8 http://www.cssbi.ca

1.2.30 CWC Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, Ontario K1J 9B8 http://www.cwc.ca

1.2.31 EEMAC Electrical and Electronic Manufacturers' Association of Canada, 1 Yonge Street, Suite 1608, Toronto, Ontario M5E 1R1 http://www.electro.ca

1.2.32 FCC Fire Commissioner of Canada, Place du Portage, Phase II, 165 rue Hotel de Ville, Hull Quebec K1A 0J2

1.2.33 ICPI Interlocking Concrete Pavement Institute, P.O. Box 23053, Milton, Ontario L9T 2M0 http://www.icpi.org/icpi

1.2.34 IEEE Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York U.S.A. 10017

1.2.35 MTO - Ministry of Transportation Ontario.

1.2.36 MECP – Ministry of the Environment, Conservation and Parks. https://www.ontario.ca/page/ministry-environment-conservation-parks

1.2.37 MSS Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, Virginia U.S.A.22180

1.2.38 NAAMM National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, Illinois U.S.A. 60603 http://www.naamm.org

1.2.39 NBC – National Building Code.

1.2.40 NFC – National Fire Code.

1.2.41 NEMA National Electrical Manufacturers Association, 1300 N. 17th Street, Suite 1847, Rosslyn, Virginia 22209 http://www.nema.org

1.2.42 NFPA National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts, U.S.A. 02269 9101 http://www.nfpa.org

1.2.43 NFSA National Fire Sprinkler Association, P.O. Box 1000, Patterson, New York, U.S.A. 12563 http://www.nfsa.org

1.2.44 NHLA National Hardwood Lumber Association, P.O. Box 34518, Memphis, Tennessee, U.S.A 38184 0518 http://www.natlhardwood.org

1.2.45 NLGA National Lumber Grades Authority, 260 1055 West Hastings, Vancouver, B.C. V6E 2E9

1.2.46 NRC National Research Council, Montreal Road, Ottawa, Ontario K1A 0S2

1.2.47 NSF International – P.O. Box 130140, 789 North Dixboro Road, Ann Arbor, Michigan 48105, USA http://www.nsf.org

1.2.48 OBC – Ontario Building Code.

1.2.49 PCI Prestressed Concrete Institute, 175 W. Jackson Blvd., Suite 1859, Chicago, Illinois, U.S.A. 60604 http://www.pci.org

1.2.50 QPL Qualification Program List, c/o Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 http://w3.pwgsc.gc.ca/cgsb

1.2.51 SAE Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, Pennsylvania 15096 0001 http://www.sae.org

1.2.52 SCC Standards Council of Canada, 1200 45 O'Connor Street, Ottawa, Ontario K1P 6N7 http://www.scc.ca

1.2.53 SMACNA Sheet Metal and Air Conditioning Contractors' National Association, 4201 Lafayette Center Drive, Chantilly, Virginia 20151 1209 http://www.smacna.org

1.2.54 SSPC Steel Structures Painting Council, 40 24th Street, Pittsburgh, Pennsylvania 15222 4656 http://www.sspc.org

1.2.55 The Technical Standards and Safety Authority (TSSA), 345 Carlingview Drive, Toronto, Ontario M9W 6N9 http://www.tssa.org

1.2.56 TTMAC Terrazzo, Tile and Marble Association of Canada, 30 Capston Gate, Unit 5 Concord, Ontario L4K 3E8 http://www.ttmac.com

1.2.57 UL Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, Illinois, U.S.A. 60062 http://www.ul.com

1.2.58 ULC Underwriters' Laboratories of Canada, 7 Crouse Road, Scarborough, Ontario M1R 3A9 http://www.ulc.ca

1.2.59 USACE United States Army Corps Engineers, Huntsville, Alabama http://www.hnd.usace.army.mil

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1.1 Inspection and testing, by the Owner, is not intended to relieve Contractor of responsibility but is a precaution against errors. Defective materials or workmanship, if found at any time prior to final acceptance of work, shall be rejected regardless of previous inspection.

1.2 Inspection

1.2.1 Allow the Engineer access to the Works at all times. If part of Work is prepared at locations other than the job site, allow access to such work whenever it is in progress.

1.2.2 Give timely notice requesting inspection if work is designated for special tests, inspections or approvals by the Engineer instructions.

1.2.3 If the Contractor covers or permits to be covered, work that has been designated for special tests, inspections or approvals before such is made, uncover such work, have inspections or tests satisfactorily completed and make good such work.

1.2.4 The Engineer may order any part of the Works to be examined if work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such work and pay cost of examination and correction. If such work is found in accordance with Contract Documents, the Owner will pay the cost of examination.

1.3 Independent Inspection Agencies

1.3.1 The Owner and/or Engineer may engage a Testing Laboratory or Independent Inspection/Testing Agencies for the purpose of inspecting and/or testing portions of Work. The cost of such services will be borne by the Owner.

1.3.2 Provide equipment required for executing inspection and testing by appointed agencies.

1.3.3 Employment of inspection/testing agencies does not relieve the Contractor from responsibility to perform work in accordance with the Contract Documents.

1.3.4 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by the Engineer at no cost to the Owner. The Contractor is to pay costs for retesting and re-inspection.

1.4 Liquid Leakage Tests

1.4.1 Before backfill has been placed against walls or any other activity that would prevent proper testing, test all liquid holding structures for leakage. Liquid retaining structures include:

.1 Reservoirs

.2 Clear wells

.3 Basins

.4 Tanks

.5 Channels

.6 Troughs and launders

.7 Digesters

.8 Wet wells

1.4.2 The Works and leakage testing shall conform to all requirements of ACI 350.1-10 published by the American Concrete Institute, Farmington Hills, Michigan, except as modified by these Contract Documents.

1.4.3 The test method in Clause 1.4.2 shall also apply for testing of:

.1 Secondary containment structures

.2 Precast concrete structures

.3 Prefabricated structures made up of any material that are not governed by any other leakage test requirements.

1.4.4 Each cell of multi-cell containment structures shall be considered a single containment structure.

1.4.5 A leakage test is also required for any existing structures that the Contractor has performed Work on, unless instructed otherwise by the Engineer.

1.4.6 Leakage test shall commence on a Monday.

1.4.7 Leakage test shall be conducted prior to installation of any coating or waterproofing.

1.4.8 Test all liquid holding structures for leakage by filling with water. The test water level shall be at the maximum liquid level indicated on the Contract Drawings.

1.4.9 Provide temporary plugs and barriers where necessary to facilitate the test. All containment structure penetrations and inlet/outlets shall be securely sealed to prevent the loss of water from the containment structure during the test.

1.4.10 Repair all visible damage prior to filling the structure with water.

1.4.11 The Contractor shall be responsible for coordinating the supply of water for the leakage tests and for transferring water from one structure to the next for leakage test purposes. The Contractor shall also be responsible for final disposal of the water used for leakage testing.

1.4.12 Fill with water and repair any visible leaks and measure leakage.

1.4.13 Repeat test until leakage is less than the permitted amount.

1.4.14 Complete leakage tests and reduce leakage to the specified limit before applying waterproofing.

1.4.15 After installation of the connecting pipe work the Owner will supply sufficient water from the existing system to carry out the first test. Should any subsequent tests be required, water will be supplied, but at the Contractor's expense.

1.5 Access to Work

1.5.1 Allow inspection/testing agencies access to the Works, off-site manufacturing and fabrication plants. Cooperate to provide reasonable facilities for such access.

1.5.2 Provide confined space access as required for inspection of the works.

1.6 Procedures

1.6.1 Notify appropriate agency and the Engineer in advance of requirement for tests, in order that attendance arrangements can be made.

1.6.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in work.

1.6.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 Rejected Work

1.7.1 Remove defective work, whether a result of poor workmanship, use of defective products or damage and whether incorporated in work or not, which has been rejected by the Engineer as failing to conform to Contract Documents. Replace or re execute in accordance with Contract Documents.

1.7.2 Make good other contractor's work damaged by such removals or replacements promptly.

1.7.3 If it is the opinion of the Engineer that it is not expedient to correct defective work or work not performed in accordance with the Contract Documents, the Owner may deduct from Contract Price difference in value between work performed and that called for by Contract Documents, amount of which shall be determined by the Engineer.

1.8 Tests and Mix Designs

1.8.1 Furnish test results and mix designs as may be requested. The cost of tests and mix designs beyond those called for in Contract Documents shall be appraised by the Engineer and may be authorized as recoverable.

1.9 Layout of Work

1.9.1 Where systems, piping and/or equipment are concentrated in a small work area, prepare interference drawings, per Section 1330, of the work to define potential conflicts or challenges in work sequencing, as requested by the Engineer.

1.9.2 Plan the total installation by preparing a minimum 1:50 scale reproduceable interference drawing detailing the location and identifying each system to the Engineer for review. Include for work of all disciplines on drawing.

1.9.3 Install systems and products to provide the maximum headroom, clearances for access, specified floor to ceiling heights, and to minimize offsets in pipes, conduit, ducts and structural framing.

1.9.4 Run pipes, ducts, tubing and conduit plumb or level (except where specific slope is required for proper function) and parallel with building surfaces.

1.9.5 Notify the Engineer and request clarification if locations of fixtures, fittings, equipment and services to these items interfere with interior finishes and use of the work.

1.10 Mill Tests

1.10.1 Submit mill test certificates as required of Specifications Sections or as requested by the Engineer.

1.11 Equipment and Systems

1.11.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

1.12 Minimum Standard

1.12.1 The Specifications and the Contract Drawings define a minimum standard of Workmanship. The Contractor shall include in the Tender, the cost of any additional work or improvements in the quality of the Works that the Contractor considers necessary to unconditionally guarantee the performance of the completed work in conformity with the Contract through the Warranty Period.

1.13 Workmanship

1.13.1 The quality of the workmanship and finished product shall present a neat and attractive appearance when finished.

1.13.2 If ordered by the Engineer, the Contractor shall make enough openings in the Works and/or materials as are necessary to inspect the works.

1.13.3 Should the Engineer find the work and/or materials so opened up to be faulty in any respect, the Contractor shall remove and make good all defective work and/or materials and shall bear the expense of all such opening, inspecting, and making good.

1.13.4 Should the Engineer find the work and/or materials so opened up to be in acceptable condition, the expense of such opening and closing will be borne by the Owner.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 Section Includes

1.1.1 Temporary utilities for the work including power, water, heating, ventilation, telephone and internet communication to be used during construction.

1.1.2 The Contractor shall install and pay for all temporary utilities.

1.2 Installation and Removal

1.2.1 Provide temporary utilities and controls in order to execute work properly, safely and expeditiously.

1.2.2 Remove all temporary works from site after use, unless otherwise directed by the Engineer or specified in this specification. Work for the Engineer's site office will not be removed.

1.2.3 Make all necessary applications, obtain permits and pay for all hook-ups, fees, charges for service and use.

1.3 Temporary Water Supply

1.3.1 The Contractor shall make arrangements with the Owner for a continuous supply of potable water for construction use. The Contractor shall connect to water supply and meter this supply for record and billing purposes. The Contractor must employ all reasonable steps and precautions to conserve water supplied. The connection point and method of connection will be subject to the approval of the Engineer and the Owner. A backflow prevention device meeting applicable code requirements must be supplied and installed at the point of connection by the Contractor.

1.3.2 Enough water will be provided once only by the Owner for the purpose of pressure testing the following items:

.1 Newly installed process piping

1.3.3 Should the initial attempt at pressure testing not pass all testing requirements as stipulated by the Contract Documents and additional water for pressure testing purposes will be provided by the Owner at the Contractor's sole expense.

1.4 Temporary Heating and Ventilation

1.4.1 Any construction heaters used inside a building must be vented to the outside or be flameless type. Solid fuel salamanders are not permitted.

1.4.2 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of the Works.

.2 Protect the Works and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment.

1.4.3 Maintain inside temperatures above a minimum of 13°C in areas and adjacent to areas where construction is in progress or ongoing.

1.4.4 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in a manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

1.4.5 The Contractor shall provide its own temporary heating and ventilation system to facilitate construction of the Works. If permitted by the Owner, the Contractor may use the permanent heating and ventilation system of the Facility. Be responsible for damage to heating and ventilation system if use is permitted. If the permanent heating and ventilation system is used, then all maintenance requirements for the system shall be performed by the Contractor. The Contractor shall perform maintenance as recommended by the system manufacturer and required by the Owner. All maintenance activities performed by the Contractor shall be documented and submitted to the Engineer and Owner.

1.4.6 Substantial Performance will not be issued until the entire system is as near original condition as possible and is certified by the Engineer.

1.4.7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

1.4.8 Be responsible for damage to the Works due to failure in providing adequate heat and protection during construction.

1.5 Temporary Power

1.5.1 The Contractor shall provide electric power distribution equipment, cabling and panels for both construction of the Work and feed the temporary construction trailers. The Contractor shall determine the type and amount of power required and provide both a power source and/or connections for obtaining temporary electric power service and metering equipment, and pay all costs for the electric power used during the Contract Time, except for the portions of the Work, if any, which have been designated in writing by the Engineer as being substantially performed and which have been assumed by the Owner.

1.5.2 The Contractor shall notify and make arrangements with the Utility Company for the supply of electric power for construction of the Works.

1.5.3 The Contractor shall replace any blown fuses or damaged breakers and repair any other damage caused. The Contractor shall provide extension cords as required. The Contractor shall not overload circuits beyond their rated capacities.

1.5.4 The Contractor shall provide ground fault protection for all electrical equipment.

1.5.5 The Contractor shall be responsible for payment of direct charges to the Utility Company for the provision of electric power for construction of the Works.

1.5.6 The Contractor may provide their own portable generators for power generation, inclusive of fuel, operation and maintenance, size appropriately for the intended work. The generator must be noise attenuated to 45 dB units from at least five metres distance under any operating condition.

1.6 Temporary Lighting

1.6.1 The Contractor shall provide temporary lighting to meet all applicable safety requirements to allow for erection, application, or installation of materials and equipment, and observation or inspection of the Work.

1.6.2 The existing lighting systems may be used at no cost and to the extent possible during construction. The Contractor shall provide additional lighting as required. When the Work is complete, the Contractor shall clean all permanent fixtures and lamps that have become soiled by the performance of the Work.

1.6.3 The Contractor shall secure all temporary lighting and wiring from damage, falling or tripping hazards.

1.7 Temporary Communication Facilities

1.7.1 The Contractor will provide and pay for telephone hook up equipment necessary for the Contractor’s own use.

1.7.2 The Contractor will provide and pay for a high-speed internet service and related equipment necessary for the Contractor’s and Engineer’s own uses and to facilitate on-line project collaboration.

1.8 Temporary Pumping for Leaks

1.8.1 The Contractor shall assume all existing gates and valves leak at a rate such that two 1/2 HP sump pumps are required to continuously dispose the leaking water to the nearest wastewater discharge location approved by the Engineer. Installation and removal of the pumps and associated piping, electrical, controls and generation shall be provided and paid for by the Contractor.

1.9 Fire Protection

1.9.1 Provide and maintain temporary fire protection equipment during performance of the Works required by governing codes, regulations and bylaws.

1.9.2 Burning rubbish and construction waste materials is not permitted on site.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 Submittals

1.1.1 Informational Submittals:

.1 Copies of permits and approvals for construction as required by all applicable laws, regulations and governing agencies.

.2 Temporary Utility Submittals:

.1 Electric power supply.

.2 Water supply.

.3 Temporary Construction Submittals:

.1 Parking area plans.

.2 Contractor's field offices locations, location of storage yard, and storage building plans, including gravel surfaced area.

.3 Fencing and protective barrier locations and details.

.4 Designated Work Areas - Fencing and protective barrier locations and details inside existing facilities to isolate New Work from ongoing Operations.

.4 Temporary Control Submittals:

.1 Noise control plan.

.2 Plan for disposal of waste materials and intended haul routes.

1.1.2 The Engineer has the right to modify the proposal for temporary works or connections at no additional cost to the Owner.

1.2 Mobilization

1.2.1 Mobilization of construction facilities shall include, but not be limited to, these principal items:

.1 Obtaining all required permits.

.2 Moving the Contractor's field office and equipment required for the first month of operations onto the Site.

.3 Moving Owner and Engineer's Field office and equipment onto site

.4 Installing temporary construction power, wiring, and lighting facilities.

.5 Providing on Site communication facilities.

.6 Providing on Site sanitary facilities and potable water facilities as specified in the Contract Documents and as required by all applicable laws, regulations, and governing agencies.

.7 Providing sedimentation and erosion control measures, including silt fencing and straw bale flow checks and the maintenance and repair (if necessary) of these facilities.

.8 Arranging for and erection of the Contractor's work and storage yard.

.9 Posting of the Occupational Health and Safety Act required notices and establishing safety programs and procedures.

.10 Having the Contractor's superintendent at the Site full time.

1.2.2 Use the area designated for the Contractor's temporary facilities as shown on the Drawings.

1.3 Temporary Utilities

1.3.1 Provide temporary utilities and controls in order to execute work expeditiously.

1.3.2 Remove all temporary works from site after use.

1.3.3 Co-ordinate all required utilities with the utility company. Provide details of the proposed temporary service connection and metering provisions prior to installation.

1.3.4 Make all necessary applications, obtain permits and pay for all fees, charges for service and use.

1.3.5 Contractor shall be responsible to all water, power and consumables that are required to carry out the Work.

2 PRODUCT

2.1 Temporary Buildings

2.1.1 Provide temporary buildings that meet the requirements of the Occupational Health and Safety Act.

2.1.2 Maintain temporary buildings clean and free from nuisances so as to avoid danger to Owner's personnel, property or structures, prevent complaints from the Engineer and prohibit interference with the operation of the existing Facility.

2.1.3 Prior to erection of temporary buildings to be used for construction purposes determine the extent of space required by Contractor for storage, temporary buildings, construction roads and parking, and submit a proposed layout of Contractor's compound including details of the type and proposed location of the temporary buildings.

2.1.4 Locate construction trailers and temporary buildings within the limits of the construction area or property boundaries as agreed with the Engineer.

2.1.5 Provide and maintain on the site such substantially constructed, weather-tight structures as will adequately house and service personnel of the Contractor working on the project. In

addition, furnish and maintain satisfactory weather-tight enclosures with raised floors as may be required to adequately protect materials and equipment stored on the site.

2.1.6 When temporary building facilities are no longer required, promptly dismantle and remove from the site, unless otherwise specified or directed. Restore areas damaged to conditions at start of Contract to the satisfaction of the Engineers.

2.1.7 Furnish and maintain all apparatus and equipment, such as ladders, scaffolds, ramps, runways, temporary stairs, derricks, hoists, elevators, chutes, etc., as required for the proper execution and progress of the Work. Such facilities shall be strong and substantial and safe for the purpose for which they are intended and shall meet all applicable requirements of governing regulations and authorities.

2.2 Site Facilities

2.2.1 Contractor shall not use Owner or Engineer washroom facilities. Contractor shall maintain Engineer field office facilities in acceptable sanitary conditions, cleaned & disinfected weekly, and consumables replenished as required.

2.2.2 Provide and maintain on the site in a clean orderly condition, completely equipped first aid facilities which shall be readily accessible at all times to all Contractor personnel. Designate certain employees who are properly instructed to be in charge of first aid. At least one such employee shall always be available on the site while work is being carried on. Post in conspicuous locations a telephone call list for summoning aid, such as doctors, ambulances, pull motors, and rescue squads from outside sources.

2.2.3 The facilities shall be furnished as required by the Workers Compensation Act and the Ministry of Labour.

2.2.4 Contractor is to verify that the site facilities meet all the obligations and to provide temporary facilities as required.

2.2.5 Maintain facilities with all required toilet room supplies in a clean and sanitary condition and disinfect frequently.

2.2.6 Leave site in a clean sanitary condition.

2.3 Contractor’s Field Office

2.3.1 Provide temporary buildings and hygienic facilities which meet the requirements of Ontario Reg. 659/79.

2.3.2 Provide a separate and dedicated room within the Contractor’s field office to store concrete test cylinders. Provide proper facilities for the storage of concrete specimens at the correct temperature, free from vibration or damage in accordance with the instruction of the inspection and testing agent and the concrete standard. Provide six minimum/maximum concrete thermometers for the exclusive use of the resident inspection staff. Provide boxes for storing and curing and crates for transporting concrete cylinders

2.3.3 Maintain all temporary buildings clean and free from nuisances so as to avoid danger to plant property or structures, and to prevent complaints from plant personnel and prohibit interferences with the operation of the existing plant.

2.3.4 Subcontractors may provide their own Site offices as necessary. Locate Site offices where directed by the Owner and the Engineer.

3 EXECUTION

3.1 Security

3.1.1 The Contractor shall assume overall responsibility for security of the site, during construction. Security deemed necessary for protection against loss or damage of any equipment on site in relation to the project shall be the sole responsibility of the Contractor.

3.1.2 Confine work and operations of employees as required by Contract Documents. Do not unreasonably encumber premises with products.

3.1.3 Prohibit the committing of nuisance on the site and any employee found violating such a provision shall be promptly discharged.

3.1.4 Positive visual identification shall be worn at all times and be monitored by the Engineer. Any person without valid identification will be removed from the site. No additional cost shall be incurred by the Owner for persons removed from site.

3.2 Access to the Site for Construction Deliveries

3.2.1 Access to the site for deliveries and equipment is also used by other contractors.

3.2.2 The Engineer will not accept deliveries of any Construction materials.

3.3 Cleaning

3.3.1 Provide professional weekly cleaning services for the field offices as follows:

.1 Waste paper baskets to be emptied twice per week.

.2 Washrooms to be cleaned three times per week

.3 Floors to be swept clean at end of every workday.

.4 Floors to be washed once per week.

3.3.2 Be responsible for maintenance of all electrical, mechanical and general maintenance and upkeep of the Field office for the duration of the Contract.

3.4 Electrical and Temporary Power

3.4.1 The Contractor shall arrange with the local power utility firm for an electrical power service to his field office and for all location that power is required to carry out construction activities. Contractor shall be responsible for installing all temporary wiring and provide all necessary means to covey the power to the location where it is required.

3.4.2 Temporary power in the form of overhead lines or portable generators shall be provided by the Contractor at no additional cost to the Owner.

3.4.3 Contractor shall pay for metered power consumption to the local hydro company at a rate set in the contract between the Contractor and the local hydro company.

3.4.4 To minimize the duration of shutdowns and to keep the plant operational, the Contractor shall maintain the existing electrical system in operation while all new electrical components required for the final electrical system are constructed.

3.4.5 Power will NOT be provided by the Owner for any temporary works and construction activity. Power by the Owner will only be provided for Functional Testing, Commissioning and Performance Testing.

3.5 Construction Parking

3.5.1 Access to the site for construction personnel is also used by other Contractors, consultants, the Engineer and the Owner.

3.5.2 Contractor’s personnel are to park vehicles as directed by the Engineer. If sufficient space is not available in the parking lot, arrange for parking elsewhere at no additional cost to the Owner. Do not park construction vehicles, equipment or cars on grass areas within the site.

3.5.3 Provide and maintain adequate access to project site.

3.5.4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

3.5.5 When site space is not adequate, arrange for and/or maintain additional off-site parking at no extra cost to the Owner.

3.6 Hoisting

3.6.1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment.

3.6.2 All hoists and cranes shall be operated by qualified operators.

3.7 Temporary Barriers and Enclosures

3.7.1 Provide temporary barriers to prevent unauthorized entry to construction, site office and on-site parking areas, and to protect existing facilities and adjacent properties from damage from the Contractor’s operations.

3.7.2 Where appropriate, equipment barriers with vehicular and pedestrian gates with locks.

3.7.3 Provide security and facilities to protect the Work and the Site from unauthorized entry, vandalism and theft.

3.7.4 Maintain a log of workers and visitors and make the log available to the Engineer upon request. Include the date, name, address and company employed by, company/ person invited, time in and time out for each person, and record deliveries and security incidents.

3.8 Removal of Temporary Facilities and Controls

3.8.1 At Final Completion of the Contract, remove all temporary field offices, storage facilities, etc., and restore the areas to pre-construction conditions.

END OF SECTION

1 GENERAL

1.1 Description

1.1.1 This section provides the general equipment stipulations that apply to all products, materials and equipment provided for this contract. These requirements are in addition to the detailed requirements that may be covered under individual equipment specification or manufacturer specific requirements.

1.2 Reference Standards

1.2.1 Conform to standards, in whole or in part as requested in each of the specifications.

1.2.2 If there is a question as to whether any product or system is in conformance with applicable standards, the Engineer reserves the right to have such products or systems tested to prove or disprove conformance.

1.2.3 The cost for such testing will be borne by the Owner in the event of conformance with Contract Documents or by the Contractor in the event of non-conformance.

1.2.4 Conform to the latest date of issue of referenced standards in effect on date of submission of Tender, except where specific date or issue is specifically noted.

1.3 Quality

1.3.1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in the Works shall be new, not damaged or defective, and of best quality (compatible with specifications) for purposes intended. If requested, furnish evidence as to type, source and quality of products provided.

1.3.2 Defective products identified prior to completion of the Work will be rejected regardless of previous inspections. Inspection by the Engineer or any agent of the Owner at no time relieves the Contractor from responsibility for the supply of acceptable quality products.

1.3.3 Remove and replace defective products at own expense and be responsible for delays and expenses caused by the rejection of defective products.

1.3.4 Should any dispute arise as to the quality or fitness of any products, the decision to accept the product(s) rests strictly with the Engineer based upon the requirements of the Contract Documents.

1.3.5 Unless otherwise indicated in the Specifications, maintain uniformity of manufacture for any particular or like item throughout the Works.

1.3.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.4 Availability

1.4.1 Immediately upon signing the Contract, review the product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are

foreseeable, notify the Engineer of such, in order that substitutions or other remedial action may be considered and authorized in ample time to prevent delay in performance of the work.

1.4.2 In the event of failure to notify the Engineer at commencement of the Works and, should it subsequently appear that the Works may be delayed for such reason, the Engineer reserves the right to substitute more readily available products of similar character, at no increase in the Contract Price or at no change to the Contract Time.

1.5 Storage, Handling and Protection

1.5.1 Handle and store products in a manner so as to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions.

1.5.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until they are to be incorporated in the Works.

1.5.3 Store products subject to damage from weather in weatherproof enclosures.

1.5.4 Store cementitious products clear of earth or concrete floors, and away from walls.

1.5.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

1.5.6 Store and mix paints in heated and ventilated areas. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

1.5.7 The Contractor shall protect existing materials that are being modified as part of the Work and shall ensure that all existing materials being modified remain in the same condition as they were prior to the modifications.

1.5.8 Remove and replace damaged products at own expense and to the satisfaction of the Engineer.

1.5.9 Touch-up damaged factory finished surfaces to the Engineer's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.6 Transportation

1.6.1 Pay the costs of transportation of products required in performance of the Works.

1.6.2 Transportation cost of products supplied by the Owner will be paid for by the Owner.

1.6.3 Unload, handle and store products supplied by the Owner at the Works.

1.7 Manufacturer's Instructions

1.7.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

1.7.2 Notify the Engineer in writing of conflicts between Specifications and manufacturer's instructions. The Engineer will clarify or establish the most appropriate solution to the conflict.

1.7.3 Improper installation or erection of products, due to failure in complying with manufacturer's instructions, authorizes the Engineer to require removal and re-installation at no increase in the Contract Price or at no change to the Contract Time.

1.8 Quality of Work

1.8.1 Ensure Quality of the Works is of the highest standard and is executed by workers experienced and skilled in their respective duties for which they are employed. Immediately notify the Engineer if the nature of the work is such as to make it impractical to produce required results.

1.8.2 Do not employ anyone unskilled in their required duties. The Engineer reserves the right to require dismissal from the Works of any workers deemed incompetent or careless.

1.8.3 Decisions as to standard or fitness or the Quality of Work, in cases of dispute, rest solely with the Engineer, whose decision is final.

1.9 Coordination

1.9.1 Ensure the cooperation of all work in the layout of the Works. Maintain efficient and continuous supervision over the entire works.

1.9.2 Be responsible for construction and placement of openings, sleeves, accessories and any materials or work necessary to fully coordinate all of the Works outlined in the Specifications.

1.9.3 Before installation, inform the Engineer of all potential interferences and complete installation as directed by the Engineer.

1.10 Concealment

1.10.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings or as indicated on drawings and specifications.

1.11 Remedial Work

1.11.1 Perform remedial work required to repair or replace parts or portions of the Works identified as defective or unacceptable. Coordinate adjacent affected work as required.

1.11.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of the Works.

1.12 Locations of Fixtures

1.12.1 Consider location of fixtures, outlets and mechanical and electrical items indicated as approximate. Fully coordinate their final placement and positioning.

1.12.2 Where in doubt, or in the case of potential interferences, inform the Engineer and install as directed.

1.13 Material Fasteners

1.13.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless otherwise indicated.

1.13.2 Prevent electrolytic action between dissimilar metals and materials by providing isolation kits, gaskets or some other manner of isolation as directed by Engineer.

1.13.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other materials are specifically requested in the affected Specifications.

1.13.4 Space anchors within the individual load limit or shear capacity and ensure that they provide positive permanent anchorage. Wood or any other organic material plugs are not acceptable.

1.13.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

1.13.6 Fastenings that cause spalling or cracking of material to which anchorage is made, are not acceptable.

1.14 Equipment Guards

1.14.1 Provide approved securely mounted equipment guards suitably reinforced and neatly formed of at least 12 gauge steel perforated sheet or expanded sheet metal for couplings, belts, chain drives, extended shafts and around all moving parts.

1.14.2 Eliminate sharp edges with suitable borders neatly welded to perforated sheet.

1.14.3 Provide guards hot-dip galvanized after fabrication.

1.15 Base Plates

1.15.1 Mount equipment and driver on a common base plate in a compact arrangement.

1.15.2 Provide equipment base plates complying with the OSHA of heavy cast iron or of welded structural steel section at least 13 mm thick. Provide mounting plates at least 19 mm thick for mounting equipment and driver. Machine surfaces for mounting equipment and driver to an arithmetical average roughness height of less than 2.8 mm

1.15.3 Provide closed base plates suitable for grouting. Provide grout holes, vent holes and anchor bolt holes in the base plates.

1.15.4 For equipment where leakage or condensation may occur, provide base plates with a drip lip and drain connections to the exterior of the base. Provide bossed connections to drip lips below the gutter invert and at least, 25 mm N.P.T. Provide piping from the drain connections to the building drainage system.

1.16 Nuts and Bolts

1.16.1 Unless specified otherwise, use U.S. standard hexagonal nuts and bolts for bolted connections. Project bolt ends beyond the nut faces at least 3 mm but not more than 1 bolt diameter. Use 316L SS nuts, washers and bolts.

1.17 Equipment Anchorage

1.17.1 Provide stainless steel anchor bolts conforming to ASTM A320.

1.17.2 For rotating equipment over 35kW, provide anchor bolts with sleeves and washers to permit adjustment during installation of the equipment.

1.17.3 Do not use drilled expansion or adhesive anchors for anchor bolts unless submitted and reviewed by the Engineer.

1.17.4 Design anchor bolts for lateral forces for both pullout and shear in accordance with the requirements of Division 5.

1.17.5 Use 316 Stainless Steel for all areas unless indicated otherwise on the Contract Document or affected specifications.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 Reference

1.1.1 Section 01000 applies to and governs the work under this Section.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION

3.1 Cleaning

3.1.1 Clean all areas prior to contract closeout, as required, to the satisfaction of the Engineer.

3.1.2 Use only cleaning materials recommended by the manufacturer on surfaces to be cleaned, and as recommended by cleaning material manufacturer.

3.1.3 Remove waste materials and rubbish from the project site.

3.1.4 Vacuum all MCC and control or instrumentation units.

3.1.5 In preparation for completion or occupancy, conduct final inspection of exposed interior and exterior surfaces, and of concealed spaces.

3.1.6 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from interior and exterior finished surfaces open to view including glass and other polished surfaces, and mechanical and electrical fixtures.

3.1.7 Broom clean paved surfaces. Rake clean other surfaces or grounds.

3.1.8 Remove debris and materials from roof areas, tanks, filters, etc.

3.1.9 Replace heating, ventilating and air conditioning filters if such units were operated during construction.

3.2 Removal of Temporary Facilities

3.2.1 Remove temporary facilities from site on completion of the works, in accordance with the Contract.

3.3 Project Record Documents

3.3.1 Refer to Section 01000 for requirements for maintenance of as-constructed documents on site.

3.3.2 At completion of project and in advance of final inspection, neatly transfer as-constructed notations to the second set of white prints and submit both sets to the Engineer.

3.4 Operating and Maintenance Data

3.4.1 The Contractor shall submit one (1) electronic copy of the preliminary draft Operations and Maintenance Manuals no later than 45 working days prior to commencement of training on the equipment. Provide one (1) electronic copy and two (2) individually bound copies of completed Operations and Maintenance Manuals with all working hyperlinks to operations and maintenance information (in pdf format) and corrections incorporated in final form, no later than 10 working days prior to the first instruction of Owner's Operations Contractor.

3.4.2 Submittals for operation and maintenance manuals, information and data are to be accompanied by a properly completed Form 01700-A, Operation and Maintenance Transmittal Form included at the end of this Section.

3.4.3 Have the manuals bound in expanding barlock binders – Grand & Toy Catalogue No. L21-P5436E with dividers and drawing pockets. Emboss the front and the spine of each binder with the following information.

.1 Owner's name.

.2 Project name.

.3 Year of completion.

.4 Volume number (e.g. 1 of 3)

.5 Set number (e.g. 1 of 6)

3.4.4 Refer to Section 01300 and Section 01999 for additional submittal requirements.

3.4.5 The manuals will include the following information:

.1 All equipment and materials information, instructions and catalogues must be provided in both hard (paper) and soft (electronic) versions.

.2 Manufacturer's data on operation, maintenance, replacement parts lists, lubrication charts and recommended inspection intervals for all equipment covered by the Specifications as well as mechanically and/or electrically operated items of equipment, including, but not limited to, valves, plumbing fixtures, electrical lighting, controls, cranes, switches, heating and ventilating equipment, etc. Ensure that the manufacturer's data includes a maintenance schedule for the equipment including a list of required activities as well as the recommended frequency for each activity.

.3 Instructions for the care and maintenance of the building components, including, but not limited to, the care of tiled and other types of floor finishes, wall finishes or other surfaces, as well as manufacturers' data with suppliers' names and addresses for, finishing hardware, doors, etc.

.4 Contact persons, companies, names, mail and e-mail addresses and telephone and facsimile numbers of sub-contractors and suppliers.

.5 Copy of hardware and paint schedules.

.6 Guarantee commencement date, and duration of guarantee. Copies of various product and/or equipment guarantees.

.7 A final, reviewed copy of shop drawings and products data sheets. Provide as-built drawings of the Motor Control Centres (MCC) and Control Panels.

.8 A complete list of instructions and names of products to be used for the cleaning of and the maintaining of finished building surfaces.

.9 Complete explanation of operation principles and sequences of each process and/or equipment.

.10 Instructions for installation, adjustment and operation, lubrication and maintenance of each item of equipment.

.11 Complete parts list with catalogue numbers, as well as equipment, valve and hardware schedules.

.12 Copies of signed inspection/installation reports.

.13 Balancing reports, vibration studies, coordination studies, electrical wire resistance test reports, etc.

.14 A final version of the Process Control Narrative.

.15 CD's of Instrument Ladder Logic drawings.

.16 Certificates and Instructions for Equipment as specified.

.17 As-constructed room finishing/paint schedule.

.18 Guarantees and Warranties.

3.5 Certificates and Instructions for Equipment

3.5.1 Submit to the Engineer two (2) weeks prior to the start of the initial plant operation the following:

.1 Complete inspection reports of tests done and results signed by the manufacturers of the equipment incorporated into the works, or by their accredited agents, stating that their qualified representatives have tested the equipment which they supplied and have found it to be satisfactorily installed in all respects, and in proper working order.

.2 An electrical inspection certificate from the Electrical Safety Authority having jurisdiction, stating that its representative has inspected the electrical installations in the works and is satisfied that they are in accordance with the code requirements.

.3 Certificates of special tests and balancing of heating, ventilating and air conditioning systems.

.4 Provide one (1) copy of the report of rotating equipment vibration analysis, carried out per Section 11000, including graphical vibration signatures of all rotating equipment.

3.5.2 Submit to the Engineer, before the end of the warranty, one (1) copy of a second report of rotating equipment vibration, per Section 11000, showing that the equipment remains in proper operating condition.

3.6 Touch-Up and Repair

3.6.1 Perform touch up of paint on buildings, equipment, piping, conduits, etc. All touch up and repairs must be completed by the corresponding subcontractor. If the work is performed by the General Contractor or other parties it must follow the recommendations of the original applicators. In the event the touch ups do not blend with the overall finish, repairs must be undertaken to the Owner's satisfaction.

3.6.2 Repair construction damage to the buildings, equipment and furnishings.

3.6.3 Repair damage to yard areas.

3.7 Warranty and Maintenance

3.7.1 The Warranty periods commence upon the date of completion.

3.7.2 Provide a two (2) years warranty for all components of the work from the date of substantial performance.

3.7.3 Promptly correct any defects during the Warranty Period.

3.7.4 Be responsible for extended warranties and/or guarantees as detailed in the various sections of the specifications.

3.7.5 Submit the required guarantee/warranty certificates and/or written documentation as specified.

See Form 01700-A Operation and Maintenance Transmittal Form on the next page which forms part of Section 01700.

01700 – A OPERATION AND MAINTENANCE TRANSMITTAL FORM:

Date:		Submittal No:[1]	
To:		Contract No:	
		Spec. Section:	
		Submittal Description:	
		From:	
Attention:			

Checklist		Contractor			
		Satisfactory	N/A		
1.	Table of contents				
2.	Equipment record forms				
3.	Manufacturer information				
4.	Vendor information				
5.	Safety precautions				
6.	Operator prestart				
7.	Start-up, shutdown, and post-shutdown procedures				
8.	Normal operations				
9.	Emergency operations				
10.	Operator service requirements				
11.	Environmental conditions				
12.	Lubrication data				
13.	Preventive maintenance plan and schedule				
14.	Troubleshooting guides and diagnostic techniques				
15.	Wiring diagrams and control diagrams				
16.	Maintenance and repair procedures				
17.	Removal and replacement instructions				
18.	Spare parts and supply list				
19.	Corrective maintenance man-hours				
20.	Parts identification				
21.	Warranty information				
22.	Personnel training requirements				
23.	Testing equipment and special tool information				

[1] See Section 01300, Transmittal Procedure for Submittals.

Remarks:_____ Contractor's Signature_____

END OF SECTION

1 GENERAL

1.1 Description

1.1.1 This section describes the cleaning requirements for existing facilities and the project site.

1.2 Cleaning of Existing Facilities

.1 Deep River Water Treatment Plant within the vicinity where constructions works occurred.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION

3.1 Project Cleanliness

3.1.1 Maintain the Works in tidy condition, free from accumulation of waste products and debris, other than that caused by the Owner or other contractors.

3.1.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by the Engineer. Do not burn waste materials on site.

3.1.3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

3.1.4 Provide onsite drum containers for collection of waste materials and debris.

3.1.5 Provide and use clearly marked separate bins for recycling.

3.1.6 Remove waste material and debris from site and deposit in waste container at end of each working day.

3.1.7 Dispose of waste materials and debris off site.

3.1.8 Clean interior areas prior to the start of finish work and maintain areas free of dust and other contaminants during finishing operations.

3.1.9 Store volatile waste in covered metal containers and remove from premises at the end of each working day.

3.1.10 Provide adequate ventilation while using volatile or noxious substances. The use of building ventilation systems is not permitted for this purpose.

3.1.11 Use only cleaning materials recommended by the manufacturer of the surface to be cleaned, and as recommended by the cleaning material manufacturer.

3.1.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces and will not contaminate building systems or electrical or control panels.

3.2 Final Cleaning

3.2.1 Prior to Substantial Performance or Completion, remove surplus products, tools, construction machinery and equipment not required for performance of remaining work.

3.2.2 Remove waste products and debris other than that caused by others, and leave the Works clean and suitable for occupancy.

3.2.3 Remove waste products and debris other than that caused by the Owner or other contractors.

3.2.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

3.2.5 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

3.2.6 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.

3.2.7 Clean lighting reflectors, lenses, and other lighting surfaces.

3.2.8 Vacuum clean and dust building interiors, behind grilles, louvres, screens and electrical control panels.

3.2.9 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

3.2.10 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

3.2.11 Remove dirt and other disfiguration from exterior surfaces.

3.2.12 Clean and sweep roofs, gutters, areaways.

3.2.13 Sweep and wash clean paved areas.

3.2.14 Clean equipment and fixtures to a sanitary condition and clean or replace filters of mechanical equipment.

3.2.15 Ensure downspouts, and drainage systems have not become blocked by construction activities. Clean and remove blockages if required.

3.2.16 Remove debris and surplus materials from crawl areas and other accessible concealed spaces

END OF SECTION

1 GENERAL

1.1 Intent of Section

1.1.1 This section covers the flushing and disinfection of water retaining structures, and in-plant potable water process piping.

1.1.2 The Contractor shall be responsible to flush, test and sterilize all structures and pipework in such lengths or sections as the Engineer shall direct, and provide all labour, water, chemicals and chemical metering equipment, pumps, gauges, caps, stoppers, air release cocks, pipework and other apparatus required to complete the tests. The Contractor shall employ qualified specialists if necessary.

1.2 Acceptable Specialist Sub-contractor

1.2.1 The specialists shall be fully experienced in providing disinfection services of water retaining structures, and potable water process piping and shall provide references of disinfection work completed for other water treatment plants and elevated water tower projects in Ontario if requested. Should the Contractor intend on completing the disinfection work themselves, they shall provide references of their experience to the Engineer for review and approval. The Engineer reserves the right to reject the Contractors experience, and the Contractor shall use one of the acceptable specialist sub-contractors listed below at no extra cost to the Owner.

1.2.2 Acceptable Specialist Sub-contractors include:

.1 Jackson-Tkach Inc.

.2 Tarpon Contracting and Restoration

.3 IQ Environmental Inc.

.4 Canadian Pipeline Cleaning Inc.

.5 Engineer approved equal.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION

3.1 Disinfection Standards

3.1.1 Infrastructure in continuous contact with potable water shall be disinfected in accordance with the requirements of the following ANSI/AWWA Standards:

ANSI/AWWA Standard	Standard Name
C651-14	AWWA Standard for Disinfecting Water Mains

ANSI/AWWA Standard	Standard Name
C652-19	AWWA Standard for Disinfection of Water-Storage Facilities
C654-13	AWWA Standard for Disinfection of Water-Water Treatment Plants

3.1.2 Should there be conflicts between the above-noted standards or with the specifications, the more stringent provisions shall apply between the two.

3.2 Disinfection of Water Retaining Structures

3.2.1 The Contractor shall submit a disinfection plan and methodology for all piping and water retaining structures for review by the Owner and the Engineer, at least 15 working days before disinfection is proposed to be carried out.

3.2.2 Prior to placing water retaining structures into service, the Contractor shall disinfect water retaining structures per this specification. All disinfection operations shall be supervised by the Engineer.

3.2.3 Disinfection of water retaining structures shall be carried out in accordance with the requirements of the appropriate standard referenced in the table above. There are three disinfection methods provided in the Standard, however, only Method 2 or Method 3 shall be used by the Contractor unless otherwise noted or agreed to by the Engineer and Owner.

3.2.4 Disinfection shall not commence until components have been cleaned and thoroughly flushed.

3.2.5 After the disinfection procedure is completed and before the facilities are placed in service, water shall be sampled and tested for chlorine residual and coliform organisms in accordance with the relevant standard.

3.3 Bacteriological Sampling and Testing

3.3.1 Before a water storage facility or treatment facility is placed in service, bacteriological sampling and testing shall be performed in accordance with the above-noted respective AWWA Standard, and Ontario Regulation 170/03.

3.3.2 The water samples for bacteriological testing shall be taken by the Operating Authority for the existing facility only.

3.3.3 The Operating Authority shall be responsible for sending the samples to a registered laboratory for testing.

3.3.4 Analytical fees for the initial round of sampling will be absorbed by the Operating Authority. The Contractor will be responsible for fees related to additional samples submitted due to failed results plus any costs associated with providing additional water.

3.4 Discharge of Chlorinated Water

3.4.1 Safely dispose of all chlorinated water from draining operations or used for testing, flushing or disinfecting waterworks.

3.4.2 Do not discharge any untreated chlorinated water into any storm sewer, watercourse or sanitary sewer.

3.4.3 A reducing agent to neutralize residual chlorine shall be applied to the chlorinated water used for the disinfection of treatment facilities and water retaining structures and piping prior to discharge to the environment, in accordance with the requirements of the appropriate above-noted AWWA Standard or MECP regulation. The Contractor will bear all associated costs with the materials and labour required for dechlorination and discharge of chlorinated water.

3.4.4 Approved dechlorinating agents:

.1 Hydrogen Peroxide

.2 Sulphur Dioxide.

.3 Sodium Bisulphate.

.4 Sodium Metabisulphate.

3.4.5 In all cases, the wasted water must be neutralized to provide a total chlorine residual of less than 0.002 mg/L at the outfall where detrimental effects may be suffered by plants and/or animals in the natural environment. The Contractor is responsible for monitoring and testing the discharge of all wastewater in the presence of the Engineer. Should test results show a residual of greater than 0.002 mg/L, the discharge shall be ceased immediately and the procedure modified to meet the requirement of less than 0.002 mg/L of total chlorine.

3.4.6 Notify the following authorities regarding the method to be used to dechlorinate potable water and obtain approval from the Engineer prior to discharge of any chlorinated water to the environment:

.1 For drainage ditches and storm sewers, notify the Owner.

END OF SECTION

1 GENERAL

1.1 Description

1.1.1 This Section specifies requirements for work during the Warranty Period.

1.2 General

1.2.1 Provide all warranties outlined in the Contract Documents from the time of Substantial Performance or Completion of the Works.

1.2.2 Perform warranty work required during progress of the work and during the Warranty Period. Reference section 01770 Closeout Procedures, 01780 Closeout Documents and the General Conditions.

1.2.3 Extend warranties on any component of the work that is required to be placed in operation prior to Substantial Performance for the purpose of complying with the sequence of construction.

1.3 Submittals

1.3.1 Inform the Engineer in writing of the arrangements made for carrying out warranty work during the Warranty Period.

1.3.2 Provide a telephone number and address for receipt of notices relating to matters requiring action by the Contractor during the Warranty Period.

1.4 Inspection and Declaration of Final Completion

1.4.1 Request inspection for Final Completion no later than 10 working days before the expiry of the Warranty Period.

1.4.2 Participate in a joint inspection of the Works for the purpose of establishing Final Completion. Arrange for, coordinate and pay for any special access required to inspect the Works, such as the draining of tanks.

1.4.3 Review the status of all Warranty items carried out during the Warranty Period with the Engineer.

1.4.4 Complete all outstanding deficiencies, repair noted defects, complete all outstanding warranty items and obtain the Engineer’s written agreement that all works are complete in accordance with the Contract Documents.

1.4.5 Apply for Final Completion.

1.5 Work during Warranty Period

1.5.1 Perform all warranty work required upon receipt of verbal or written notices from the Engineer.

1.6 Repair by Owner

1.6.1 The Owner may, without giving notice to the Contractor, repair defects that are dangerous in nature, that constitute an emergency or that affect the operation of the Works. The Contractor will be notified prior to work being performed, when possible.

1.6.2 The Engineer will notify the Contractor of emergency work performed by the Owner.

1.6.3 The cost of labour, equipment and material to perform emergency work will be deducted from the Maintenance Security where work is not performed by the Contractor.

END OF SECTION

1 GENERAL

1.1 Section Includes

1.1.1 Procedures for the purpose of issuance of Substantial Performance and Completion of the Works.

1.2 Final Cleaning

1.2.1 Execute final cleaning per Section 01740 prior to Substantial Performance of the Work.

1.2.2 Clean debris from drainage systems or swales.

1.2.3 Clean the Site; sweep paved areas and rake clean landscaped surfaces.

1.2.4 Maintain cleaning until acceptance by the Owner.

1.3 Restoration

1.3.1 As a minimum, restoration shall mean replacement, repairs, or reconstruction to a condition at least as good as or better than the condition prior to commencement of the Work.

1.3.2 Except where specifically required otherwise by other Sections, restore areas of the Work and areas affected by the performance of the Work to conditions that existed prior to commencement of the Work and to match condition of similar adjacent, undisturbed areas.

1.3.3 Ensure that restored areas match existing grade and surface drainage characteristics, except as otherwise specified, and ensure a smooth transition from restored surfaces to existing surfaces.

1.3.4 Do not alter original conditions without prior written approval from the Engineer.

1.3.5 Without limiting the generality of the foregoing or other requirements of the Contract Documents, preserve and protect existing features encountered at the Site during performance of the Work including, but not limited to buildings, wells, yard hydrants, structures, fences, utilities, access roads, grassed areas, trees and other graded or improved areas.

1.3.6 Utilize construction methods and procedures during performance of the Work which keeps disturbance and damage of whatever nature to existing conditions to the practical minimum. Where work necessitates root or branch cutting, do not proceed without the Engineer's prior approval.

1.3.7 Restoration Material: New, except as otherwise specified, not damaged or defective, and of the best quality for the purpose intended. Furnish evidence as to type, source, and quality of materials or products furnished when requested by the Engineer or specified in other Sections.

1.3.8 Should any dispute arise as to the quality or fitness of materials, whether obtained on or off Site, whether previously inspected by the Engineer prior to use or not, the decision to use any material or product in the finished Works will rest solely with the Engineer.

1.3.9 Remove from the Site clean material not approved for reuse.

1.3.10 Handle and store products and materials in a manner to prevent damage, adulteration, deterioration, and soiling and in accordance with manufacturers' instructions when applicable.

1.3.11 Prior to commencement of restoration work, inform the Engineer of proposed material, methods, and procedures to repair, replace, or reconstruct disturbed, damaged, or suspected damage to the Work.

1.3.12 Perform cutting, fitting, remedial, and coordination work to make the several parts of the Work fit together.

1.3.13 Except as specified otherwise, dismantle and salvage materials for reuse where practicable.

1.3.14 Exercise due care when removing material for salvage. Repair or replace materials damaged through improper handling or through loss after removal.

1.3.15 Store and protect removed material approved for reuse in approved locations. Beginning of restoration work means acceptance of existing conditions.

1.3.16 Repair pavement, roads, sod, and all other areas affected by construction operations and restore them to original condition or to minimum condition specified.

1.4 Inspection and Declaration of Substantial Performance

1.4.1 Contractor's Inspection: The Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects, and repair as required to conform to the Contract Documents.

1.4.2 Notify the Engineer in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made and request the Engineer's Inspection no later than 10 working days before the expected Substantial Performance date.

1.4.3 Owner staff to attend inspection with Engineer and Contractor.

1.4.4 Substantial Performance: Submit a written certificate that the following has been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed to a dollar value per the General Conditions of the Contract.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Electrical inspections and approvals are complete and submitted.

.5 All required documentation has been submitted per Section 01780.

.6 Operation of systems has been demonstrated to the Owner’s personnel.

.7 All required training has been delivered.

.8 Work is complete and ready to be used for the purposes intended.

1.4.5 Agree to a list of outstanding work and deficiencies that do not affect Substantial Performance with the Engineer.

1.4.6 Apply for Substantial Performance.

1.5 Total Completion

1.5.1 Complete all remaining outstanding work and deficiencies within the timeframe stipulated in the Form of Tender or within the dollar value per the General Conditions of the Contract.

1.5.2 Final Inspection: When all the outstanding items and deficiencies that did not affect Substantial Performance have been completed, request final inspection of the Works by the Engineer and the Owner.

1.5.3 Complete any outstanding work or deficiencies arising out of the final inspection that are deemed to affect issuance of the Completion Payment Certificate.

2 PRODUCTS – NOT APPLICABLE

3 EXECUTION – NOT APPLICABLE

END OF SECTION

1 GENERAL

1.1 Section Includes

1.1.1 Redline drawings, samples, and specifications.

1.1.2 Equipment and systems.

1.1.3 Product data, materials and finishes, and related information.

1.1.4 Operation and maintenance data.

1.1.5 Spare parts, special tools and maintenance materials.

1.1.6 Warranties and bonds.

1.1.7 Final site survey.

1.2 Submission

1.2.1 Prepare closeout submittals as detailed with in this section and submit to the Engineer for review. Submittals shall be as detailed herein and shall also confirm to section 01330 Submittals.

1.3 Operation and Maintenance Data

1.3.1 Prepare draft Operations and Maintenance (O&M) Manuals and submit to the Engineer for review.

1.3.2 One copy will be returned with comments and one copy will be retained to assist the Engineer and will be returned after delivery of the final copies.

1.3.3 Revise the content of documents as required prior to final submittal.

1.3.1 Manual

.1 An organized compilation of operating and maintenance data including detailed technical information, documents and records describing operation and maintenance of individual products or systems as specified in individual Sections of Divisions 02 to 16.

.2 The number of draft and final hard copy submissions is identified in Section 01330 – Submittals.

1.3.2 General

.1 Provide copies of documentation including as-constructed shop drawings to instruct the Owner’s operations and maintenance staff in the operation and associated maintenance of each piece of equipment and system as supplied and installed. The following description is provided to the Contractor to describe the general requirements of the O&M Manuals. All information may not apply in all cases.

Similarly, the Contractor may be required to provide additional information to adequately describe the equipment.

.2 The Contractor will prepare a skeleton of the O&M Manuals including table of contents, section tabs and scale mock-up of printing proposed. The Contractor shall submit the draft O&M manual at least twenty (20) working days prior to the start of training specified in Section 01820.

.3 In construction projects where work is carried out in distinct stages, the relevant portion of the manual will be required for that section of the work prior to equipment start-up.

.4 Payment for closeout submittals shall be per Section 01025 – Measurement and Payment.

1.3.3 Contents

.1 Provide the material in sections organized by specification section. It is not necessary that each Division be in a separate binder. However, the arrangement must be approved by the Engineer.

.1 The manual content in Volume 1 will be prepared by the Engineer. Documentation for all other Volumes is the responsibility of the Contractor.

.2 Provide the following information for each system and major piece of equipment. Refer to each piece of equipment by its name and tag number. Where manufacturer's literature covers several models or options, highlight the applicable information and cross out redundant information.

.1 Index of information in that section in order of appearance.

.2 Description of system, components and technical data. Include interfaces, sequences, operations, characteristics changes for seasonal operation.

.3 Maintenance and operating instructions, including:

.1 Installation instructions

.2 Procedure for starting

.3 Proper adjustment

.4 Test procedures

.5 Procedure for operating

.6 Procedure for shutdown

.7 Safety precautions

.8 List of electrical relay settings and control and alarm contact settings.

.1 Troubleshooting data

.2 Preventative maintenance program complete with:

.3 Suggested check list sheets

.4 List of points to be greased or oiled

.5 Recommended type, grade and temperature range of lubricants

.6 List of wear points to be inspected and/or adjusted regularly

.7 Suggested schedule of lubrication and inspection

.9 Schematic, single line and wiring diagrams

.10 Valve tag list

.11 Recommended spare parts list

.12 Certification, guarantee, warranty

.13 Service representatives – name, address and telephone number

.14 Suppliers for replacement parts – name, address and telephone numbers

.15 Test results; witness testing and commissioning, reports

.16 Test data for piping systems (degreasing, flushing, disinfection)

.17 Hydrostatic or air tests performance

.18 Equipment alignment certificates

.19 Balancing data for air and water systems

.20 Inspection approval certificates for all types of systems; plumbing and piping, hot air and ventilating, electrical supervisory, etc.

1.3.4 The material submitted in accordance with the contractual requirements for “As-Constructed Shop Drawings” is generally bulky and difficult to file in a binder. If requested by the Engineer, provide copies of all “As-Constructed Shop Drawing” material in a single drawer legal size cardboard file cabinet. Arrange in accordance with the Construction Specifications Institute. Identify any material located in the file cabinet as such in the appropriate location in the binders.

1.3.5 All schematic/control, equipment, and wiring changes made during construction shall be reflected in the final shop drawings. The Owner shall have the right to determine whether the scope of such changes requires a complete re-issue of shop drawings or may be

submitted on a page page-for-page replacement basis. No extra payment will be made for any such requests.

1.3.6 Provide a tabulated report for all motors and other equipment on the contract outlining the description, nameplate data, measured current and voltage type, size, setting of overload heaters (thermal/electronic) installed, setting of motor circuit protectors, breaker trip settings, fuse relays and fuse sizes in the control circuits, equipment name, horsepower. Indicate feeder conductor size and length of conduit.

1.3.7 At the Engineer's discretion, provide the information in plastic map pockets in appropriate sections in the binders.

.1 Binders

.1 Binders shall be large capacity, expanding/catalogue type for 11 x 8-1/2 sheets with expanding, lockable posts, 2" to 4", or 3" to 5" capacity, having fully hinged (metal, piano type) hard covers bound in heavyweight black leather-grain cover with custom embossed gold lettering. Allow minimum 1/4" empty space inside each binder. Binders: ACCO 50505-05426, 50505-05436, or equal.

.2 The custom embossed gold lettering on the front cover and spine must include: the name of the Owner, Contract No., Contract Title, Owner Logo, "Operation & Maintenance Manual" title, Volume x of y number, Divisions included, and Set x of y number. Template for spine and cover page attached.

.3 Binder accessories – Sections will be separated with the divider pages with labelled printed indexes (side tabs) and reinforces with a rip-proof, three hold punched strip, or similar protection. Drawings will be folded and inserted in labelled clear plastic binder type pockets/sleeves (page protectors). CDs, DVDs, and other electronic media will be placed in labelled, clear plastic, static free binder type holder sheets.

.2 Provide one complete electronic copy on USB. The electronic copy shall be in PDF format.

.1 Files are to be exact duplicates of the hard copy submission. Arrange by Specification number and name.

.2 Files are to be fully functional and viewable in the most recent version of Adobe Acrobat.

.3 The single PDF file shall include bookmarks for each section and subsection, be properly indexed, and fully searchable.

1.4 Redline Drawings and Samples

1.4.1 The Owner will supply a set of contract drawings. Mark thereon all revisions in red ink as the job progresses to produce a set of redline drawings.

1.4.2 Dimension locations (vertically and horizontally) of buried or concealed work, especially piping and conduit, with reference to exposed structures. Dimension the installed locations of concealed service lines on the site or within the structure by reference from the centre

line of the service to the structure column lines or other main finished faces or other structural point easily identified and located in the finished work.

1.4.3 Update these drawings and make available for monthly review. Payment against the Progress Payment line item for updated drawings will be withheld if drawings have not been maintained up-to-date.

1.4.4 Submit redline drawings for electrical schematic and instrument control diagrams. Submit operation and maintenance instruction manuals with updated as-built control diagrams, revised to show construction revisions.

1.4.5 Submit redline drawings in SI metric units.

1.4.6 Record on the white prints on a daily basis, work constructed differently than shown on the Contract Documents. Record all changes in the work caused by site conditions, or originated by the Owner, the Engineer, the Contractor, or a sub-contractor and by addenda, supplemental drawings, site instructions, supplementary instructions, change orders, correspondence, and directions of regulatory authorities. Accurately record the location of concealed mechanical services and electrical main feeders, junction boxes and pull boxes. Do not conceal critical work until its location has been recorded.

1.4.7 Do not use these drawings for daily working purposes and make the set available for periodic inspection by the Engineer.

1.4.8 Make records in a neat and legibly printed manner with non-smudging medium.

1.4.9 The Contractor shall scan the complete set of redline drawings to PDF (full resolution) and upload progress redline drawings onto the CIMA FTP site and transmit to the Engineer at the end of the project.

1.4.10 Submit all marked up redline drawings to the Engineer at the conclusion of the contract. Substantial Performance will not be issued until redline drawings are complete and submitted.

1.5 Recording Actual Site Conditions

1.5.1 Record information on set of drawing prints provided by the Engineer.

1.5.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

1.5.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

1.5.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimensions and details.

.5 Changes made by Contract Change Directives.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

1.5.5 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and Contract Change Directives.

1.5.6 Other Documents: maintain manufacturers' certifications, inspection certifications, field test records, required by individual specifications sections.

1.6 Final Survey

1.6.1 The Owner will check the 'As-Recorded' survey elevations.

1.7 Equipment and Systems

1.7.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

1.7.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications, final as-constructed diagram.

1.7.3 Include as-constructed installed colour coded wiring diagrams in the manual and also provide an electronic copy in AutoCAD.

1.7.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

1.7.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

1.7.6 Provide servicing and lubrication schedule, and list of lubricants required.

1.7.7 Include manufacturer's printed operation and maintenance instructions.

1.7.8 Include sequence of operation by controls manufacturer where appropriate.

1.7.9 Provide original manufacturers' parts list, illustrations, assembly drawings, and diagrams required for maintenance.

1.7.10 Provide installed control diagrams by controls manufacturer where appropriate. Include copies in the manuals and provide an electronic version in AutoCAD.

1.7.11 Provide coordination drawings, with installed colour coded piping diagrams.

1.7.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

1.7.13 Provide list of original manufacturers' spare parts, current prices, and recommended quantities to be maintained in storage.

1.7.14 Include test and balancing reports.

1.7.15 Additional requirements: As specified in individual specification sections.

1.7.16 Provide Engineer-reviewed Single Line Diagram in its final version. Single Line Diagram shall be of size 24-inch by 36-inch, laminated, mounted on wood board and be installed by GC in respective electrical room.

1.8 Spare Parts

1.8.1 Provide spare parts, in quantities specified in individual specification sections.

1.8.2 Provide items of same manufacture and quality as items in Work.

1.8.3 Deliver to site location and place in storage as directed by the Owner.

1.8.4 Obtain receipt for all delivered products from the Owner or Engineer and submit these receipts prior to Substantial Performance.

1.8.5 Where spare parts are not specified, provide the Engineer and Owner with a list of all spare parts recommended by the equipment manufacturer for all major pieces of equipment, valves, and instruments, including model or part numbers, and costs for individual items.

1.9 Maintenance Materials

1.9.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

1.9.2 Provide items of same manufacture and quality as items in Work.

1.9.3 Deliver to site location and place in storage as directed by the Owner.

1.9.4 Obtain receipt for all delivered products from the Owner or Engineer and submit these receipts prior to Substantial Performance.

1.10 Storage Handling and Protection

1.10.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

1.10.2 Store in original and undamaged condition with manufacturers' seal and labels intact.

1.10.3 Store components subject to damage from weather in weatherproof enclosures.

1.10.4 Store paints and freezable materials in a heated and ventilated room.

1.10.5 Remove and replace damaged products at the Contractor’s own expense and to the satisfaction of the Engineer.

1.10.6 Exercise all equipment in strict conformance with the equipment manufacturers written instructions during storage and following installation. Provide all equipment exercise logs to the Engineer for review.

1.11 Warranties and Bonds

1.11.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

1.11.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

1.11.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers.

1.11.4 No warranty will commence until issuance of Substantial Performance on respective work components. The warranty on items used during construction, with the Owner’s permission, for the safe and orderly completion of the works will not commence until Substantial Performance.

1.11.5 Verify that documents are in proper form, contain full information, and are notarized.

1.11.6 Co-execute submittals when required.

1.11.7 Retain warranties and bonds until time specified for submittal.

2 PRODUCTS – NOT APPLICABLE

3 EXECUTION – NOT APPLICABLE

END OF SECTION

1 GENERAL

1.1 Intent

1.1.1 Testing is implemented to minimize commissioning time and to provide a smooth transition when bringing the system on-line.

1.1.2 The Contractor is responsible for coordinating the implementation and testing to ensure that the facility remains operational at all times.

1.1.1 The Section includes:

.1 Pre-commissioning checks on each component.

.2 Commissioning and adjustment of each component and system and all specified testing.

.3 Performance testing for all systems.

.4 In the event of any conflicts between this Section and the General Conditions, more stringent requirements shall govern.

1.2 General

1.2.1 The Contractor shall construct, test, commission and turn over to the Owner a complete operating facility.

1.2.2 Cooperate with testing organization services under provisions specified in Section 01450 - Quality Control.

.1 Comply with applicable procedures and standards of the certification sponsoring association.

.2 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

.3 The Contractor shall ensure that there are no visible leaks on water retaining structures and shall repair all visible leaks.

1.2.3 The following requirements shall be met:

.1 All components shall be fully protected against damage prior to start-up. All temporary protection measures are the responsibility of the Contractor.

.2 The Contractor shall notify the Supplier(s) and the Engineer that the Project is ready for start-up testing and operation.

.3 The Contractor shall supply all labour and equipment for testing and commissioning.

.4 Within 90 days of commencement of the Contract the Contractor shall meet with the Engineer and Owner to discuss the Testing and Commissioning program and requirements of this specification. Prior to this meeting, the Contractor shall identify information required from the Engineer and Owner, necessary for completion of the draft

Start-up and Commissioning Plan. Provide a written draft Start-up and Commissioning Plan a minimum of 100 working days prior to the commencement of Start-up and Commissioning. The finalized Start-up and Commissioning Plan incorporating all the Engineer and Owner comments shall be submitted by the Contractor a minimum of 40 days prior to the commencement of Start-up and Commissioning.

1.2.4 Testing and commissioning shall proceed as follows:

.1 Off-site system programming factory acceptance testing (FAT);

.2 Off-site control panel factory acceptance testing (Panel FAT);

.3 Off-site equipment factory acceptance testing (Equipment FAT);

.4 Complete pre-commissioning checks, start-up commissioning and performance testing of individual pieces of equipment and equipment sub-systems;

.5 On-site control system site acceptance testing (SAT);

.6 Continuous operation testing, as detailed within this document, demonstrating that the work of this contract has been commissioned in its entirety and that the Contract is substantially complete, and;

.7 Turn over the work to the Owner.

1.2.5 Testing and commissioning shall be performed by the Contractor in the presence of the Engineer and the Owner.

1.3 Quality Assurance Testing Program

1.3.1 The Contractor shall appoint an engineer or qualified operations specialist as Testing Manager to manage, coordinate and supervise the Contractor's Quality Assurance Program. The Testing Manager shall have at least 5 years' experience in managing start-up and commissioning of mechanical, electrical, instrumentation, HVAC and piping systems. The Contractor shall forward a copy of the Testing Manager's resume to the Engineer prior to the commencement of the testing program.

1.3.2 The Quality Assurance Testing Program for this project shall include:

.1 A calibration program for all instruments, gauges and meters used for determining the performance of equipment and systems installed under the Contract.

.2 A calibration program for all instruments, gauges and meters installed under the Contract.

.3 A testing program for all mechanical, electrical, instrumentation and HVAC equipment and process systems installed under the Contract. The testing program shall be divided into two phases: performance testing and operational testing.

.4 A comprehensive testing plan detailing the procedure of the testing program of all works required under this QA. The test plan shall include all equipment and process systems.

.5 The test plan shall include procedures for the evaluation of the performance of the equipment and process system, including the required specified performance criteria.

.6 A schedule providing date, time, sequence and duration of the performance and operational testing for each equipment and process system. The Critical Path Method shall be used for the scheduling of the test plan and shall be updated as required to reflect changes.

.7 A documentation program to record the results of all equipment and system tests.

1.3.3 All test equipment, gauges, thermometers, meters, analysis instruments and other equipment used for calibrating or verifying the performance of equipment installed under this Contract shall be calibrated to within ± 2% of actual value at full scale. Test equipment employed for individual test runs shall be selected so that expected values as indicated by the detailed performance specifications will fall between 60 and 85 percent of full scale.

1.3.4 Pressure gauges shall be calibrated in accordance with ANSI/ASME B40.1.

1.3.5 Thermometers shall be calibrated in accordance with ASTM E77 and shall be furnished with a calibration curve.

1.3.6 Liquid flowmeters installed in pipelines with diameters greater than 50mm shall be calibrated in-situ using the pitot tube velocity averaging method. Calibration tests for flow metering systems shall be performed over a range of not less than 10% to at least 75% of system full scale. At least five confirmed valid data points shall be obtained within this range. Confirmed data points shall be validated by not less than three (3) test runs with results which are in agreement within ± 2%.

1.3.7 The following documents referred to in this Quality Assurance Program take precedence over requirements that may be listed in other parts of the Contract. In case of a conflict between the requirements of this QA Program and that of the Contract Document, the QA Program shall take precedence:

.1 ANSI/ASME B40.1 Gauges Pressure Indicating Dial Type – Elastic Element

.2 ASTM E77 Method for Verification and Calibration of Liquid-in-Glass Thermometers

.3 ASHRAE 41.8 Standard Methods of Measurement of Flow of Gas

.4 Flow Measurement in Open Channels and Closed Conduits, Vo. 1, US Dept. of Commerce, National Bureau of Standards, pg. 361

.5 Techniques of Water Resources Investigation of the US Geological Survey, Chapter 16, Measurements of Discharge Using Tracers

.6 Other standards as applicable

.7 If the above listed standards are revised, the most recent version will be applicable

1.4 Submittals

1.4.1 Submittal material shall consist of the following:

.1 Detailed testing plans, setting forth step-by-step descriptions of the procedures proposed by the Contractor for the systematic testing of all equipment and systems installed under this contract.

.2 Sample test acceptance forms for documenting the results of testing, for each test to be performed, that shall be submitted as Shop Drawings as per these specifications.

.3 The credentials and certification of the testing laboratory proposed by the Contractor for calibration of all test equipment.

.4 A testing and commissioning schedule.

.5 Test forms documenting the results of testing and commissioning completed to the satisfaction of the Engineer.

1.4.2 Prepare and submit test plan for the Engineer's review and approval at least 15 working days prior to commencing pre-commissioning checks.

1.4.3 Submit reports on testing, adjusting, balancing and performance tests promptly after execution of those services.

1.5 Test Plan

1.5.1 All testing and commissioning work shall be covered by a test plan to be prepared by the Contractor, which shall take into consideration the sequence of construction and the necessity to sequentially commission certain components and place them in operation prior to completion of other components.

1.5.2 Meet with the Engineer and the Owner as necessary to review the testing and commissioning sequence and to establish responsibilities of each party during testing and commissioning. The test plan must be approved by the Engineer and the Owner.

1.5.3 Approval to proceed with pre-commissioning checks shall be contingent upon approval of the test plan. Coordinate all construction and testing activities as generally outlined in Section 01120 Coordination with Existing Operations and Sequence of Construction.

1.5.4 The test plan shall include:

.1 The name and contact arrangements for the person assigned by the Contractor to have managerial responsibility for coordination of the entire testing and commissioning period.

.2 The names and contact arrangements for the persons in charge of particular disciplines and manufacturer representatives.

.3 Confirmation that all persons involved in the testing and commissioning are suitably qualified, including a licensed operator.

.4 A list of all tests to be performed; the nature of the test; test objectives and required results.

1.5.5 A written description of the methods to be used to test and commission each component and system and to conduct the overall performance and reliability run.

1.5.6 A written description of the methods to be used to test and commission all instrumentation and control equipment.

1.5.7 Copies of all site testing and commissioning report sheets to be used for each component. All report sheets must be approved by the Engineer and the Owner.

1.5.8 Copies of all factory test reports to be used for components where factory testing is required.

1.5.9 A schedule for all testing and commissioning work.

2 PRODUCTS

2.1 Documentation

2.1.1 The Contractor shall develop and implement a record keeping system to document compliance with the requirements of this Section.

2.1.2 Test acceptance forms as a minimum shall include date of test, equipment number or system name, nature of test (performance or operational), test objectives, test results, test instruments employed for the test and signature spaces for the Engineer's witness and the Contractor's Testing Manager. A file shall be established for each system and item of equipment. It is suggested that files be maintained separately for pipe pressure testing, mechanical equipment performance testing, instrumentation equipment performance testing (loops), and electrical equipment.

2.1.3 It shall be the requirement of this Contract that the Contractor shall produce test documentation forms specific for each system and associated equipment items installed under this Contract. Acceptable documentation forms for all systems and items of equipment shall be produced for review by the Engineer a minimum of four weeks prior to any performance testing. Once the Engineer has reviewed and taken no exception to the forms proposed by the Contractor, the Contractor shall produce sufficient forms, at his expense, to provide documentation of all testing work to be conducted as a part of this Contract.

2.1.4 The Contractor shall develop test plans detailing the coordinated, sequential testing of each item of equipment and system installed under this contract. The test plans shall also be specific as to support systems required to complete the test work, temporary systems required during the test work, subcontractors' and manufacturers' representatives to be present and expected test duration. The test plans shall include the following features:

.1 FAT(s);

.2 Panel FAT(s);

.3 Equipment FAT(s);

.4 Performance testing including but not limited to:

.1 Pressure and/or leak tests.

.2 Functional checkout of all electrical tests.

.3 Electrical circuit ringouts.

.4 Resistance tests of all electrical equipment and electrical systems.

.5 Instrument calibration, loop test, loop commissioning and tuning.

.6 Preoperational check out for all mechanical and HVAC equipment.

.7 Functional tests of all mechanical, electrical, HVAC and instrumentation equipment and systems to demonstrate compliance with the performance requirements.

.8 Control network testing.

.5 In general, performance tests for any individual system shall be performed in the order listed above. The order may be altered as authorized by the Engineer in writing after receipt of a written request, complete with justification of the need for the change in sequence.

.6 SAT(s);

.7 Continuous performance test.

2.1.5 Test plans shall contain a complete description of the procedures to be employed to achieve the desired test environment.

2.1.6 Four weeks in advance of the date the Contractor wishes to begin performance testing of equipment and/or systems (whichever occurs earliest in the project schedule), the Contractor shall have submitted the test plan(s) required for the systematic field performance tests for the equipment and/or system installed under this contract. Once the Engineer has reviewed and taken no exception to the Contractor's test plan(s), the Contractor shall reproduce the plan(s) in sufficient number for the Contractor's purposes and an additional three copies for delivery to the Engineer. No test work for the equipment, system or facility shall begin until the Contractor has delivered the specified number of approved final test plans to the Engineer.

2.1.7 The Contractor shall produce a testing schedule setting forth the sequence contemplated for performing the test work. The schedule shall be in bar chart form, plotted against calendar time, and shall detail the equipment and/or systems to be tested. The schedule shall show the contemplated start date, duration of the test and completion of each test. The test schedule shall be submitted no later than four weeks in advance of the date testing is to begin. The Engineer will not witness any testing work for the purpose of acceptance until the Contractor has submitted a schedule to which the Engineer takes no exception. The test schedule shall be updated weekly, showing actual dates of test work, indicating systems and equipment testing completed satisfactorily.

2.2 Equipment and System Performance Tests

2.2.1 Each item of process, mechanical, electrical, instrumentation, and HVAC equipment installed under this contract shall be tested to demonstrate compliance with the performance requirements of this project manual. Each electrical, instrumentation, mechanical, piping, and HVAC system installed or modified under this contract shall be tested in accordance with the specified requirements.

3 EXECUTION

3.1 Testing

3.1.1 The completed works shall be subject to testing and trial operation to determine whether works function as required for the intended purpose. The Contractor shall give the Engineer at least four days prior notice of the testing program. The Contractor shall conduct tests only in the presence of the Engineer or Engineer's appointed representative and under his general direction. The Contractor shall provide all equipment, gauges, materials, water and labour required to conduct the tests.

3.1.2 Testing and commissioning shall be completed in accordance with the manufacturer's recommendations and the Contract Documents.

3.1.3 Test results shall be within the tolerances set forth in the detailed specification sections. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory installed test, any doubt, dispute, or difference should arise between the Engineer and the Contractor regarding the test results or the methods or equipment used in the performance of such test, and then the Engineer may order the test to be repeated.

3.1.4 If under test, any portion of the work should fail to fulfill the contract requirements and is adjusted, altered, renewed, or replaced, tests on that portion when so adjusted, altered, removed, or replaced, together with all other portions of the work as are affected thereby, shall, unless otherwise directed by the Engineer, be repeated within reasonable time and in accordance with the specified conditions. The Contractor shall pay to the Owner all reasonable expenses incurred by the Owner, as a result of repeating such tests.

3.2 Pre-commissioning Checks

3.2.1 Obtain all approvals and clearances from authorities prior to energizing any components of the work.

3.2.2 Ensure that relevant operations and maintenance instructions are on site.

3.2.3 Obtain the Engineer's approval to proceed with Pre-commissioning checks of relevant systems in accordance with the test plan. The Engineer will make all necessary arrangements for the Owner's personnel to be present at tests.

3.2.4 Perform all necessary Pre-commissioning checks and tests prior to commissioning any components of the work in accordance with the test plan, including:

.1 Check installations are in accordance with manufacturer instructions.

.2 Check all piping connections and related piping systems are complete and pressure tested.

.3 Check all electrical, instrumentation and control cable connections and related power and control panels are complete and tested.

.4 Check and calibrate all related protective devices.

.5 Check all pre-run maintenance and installation conditions have been completed such as oil and grease addition.

.6 Clean and flush all related piping systems.

.7 Disinfect all related piping systems.

.8 Check rotation of all rotating equipment.

.9 Obtain written clearance from manufacturers/suppliers to place equipment or systems in operation. Each manufacturer/supplier must allow one fall day for pre-commissioning.

3.2.5 Resolve all installation and pre-commissioning test discrepancies and retest as necessary to the satisfaction of the Engineer.

3.2.6 Submit two copies of all Pre-commissioning check sheets and reports to the Engineer including all initial test reports containing discrepancies and final test reports where components are retested. This is in addition to the copies incorporated into the Maintenance Manual.

3.2.7 Obtain the Engineer's approval to proceed with commissioning of relevant systems in accordance with the test plan, after successfully pre-commissioning.

3.2.8 Arrange for the Owner to open valves or connect to existing systems where applicable. Do not operate any of the Owner's equipment or valves, unless directed by the Engineer or the Owner.

3.2.9 Conform to requirements of all suppliers.

3.2.10 The intent of the pre-commissioning checks is to test and demonstrate all equipment and controls to the Engineer, and resolve and correct all deficiencies prior to final commissioning with the Owner.

3.3 Off-Site Testing

3.3.1 Perform all necessary off-site testing as required by the specifications. A FAT test for the ICP panel is required.

3.3.2 Notify the Engineer at least 15 working days in advance of any planned off-site tests and confirm the test at least 72 hours in advance.

3.3.3 Provide a copy of the planned test procedure and test result form to be used to the Engineer at least 15 working days in advance of any off-site test.

3.3.4 Do not pay any costs associated with travel and accommodation for the Engineer or the Owner's personnel to attend any off-site testing.

3.3.5 Where off-site testing is not successful, and the Engineer and/or the Owner is required to witness repeat testing, the Owner reserves the right to deduct all fair and reasonable charges and expenses incurred by the Owner in respect of this retesting from monies owed to the Contractor under this Contract.

3.3.6 Submit two copies of all off-site testing reports to the Engineer in addition to the copies incorporated into the Maintenance Manual.

3.4 On-Site Testing Procedure

3.4.1 Blower Testing

.1 In accordance with Section 11367 – Odour Control Systems and as per the Manufacturer's recommendations.

.2 In accordance with Section 13100 – Control and Instrumentation and 13560 – Instrumentation General Requirements.

.3 Comply with ISO 5389:2005, PTC 10-1997, IS 1940/1, ASME PTC 10-997, ASME PTC 19.5 and ISO 5801 First Edition 1997-06-01.

.4 Complete a factory performance, overspeed spin, balance and vibration tests and submit the test reports.

.5 On-site vibration test

.1 The standard tests shall be carried out on a combination of blower (s) and associated valves and fittings at the final site installation.

.2 Submit the test records or reports with the vibration limits/levels and noise levels.

3.4.2 Fan Testing

.1 Refer to Section 11367 – Odour Control Systems, 15500 – Heating, Ventilation and Air Conditioning and 15750 – Air Handling Units.

.2 Comply with AMCA Publication 211, AMCA Publication 311 and AMCA 204-05.

.3 Dynamic balancing shall be used on the rotors and static balancing would be redundant.

.4 Vibration limits for testing

.1 Comply with ANSI S2.19, Balance Quality of Rigid Bodies to confirm the fan application category and balance quality grade.

.2 Vibration limits for tests may be in the range of 0.2 to 0.1 in./sec depending on the fan application category.

.3 A tri-axial accelerometer may be used to measure the vibration in the horizontal, vertical and axial directions.

3.5 Pre-commissioning Procedures

3.5.1 General Requirements

.1 All pipe leak testing shall be complete. Verify all auto valve operation and normal open or closed position of manual valves.

.2 Operate the aeration blowers in the auto mode.

.3 One (1) train shall be preliminary commissioned at a time. The second train shall be preliminary commissioned after the first train commissioning is approved the Owner.

.4 Refer to all process equipment specifications to comply with the detailed performance test procedure.

3.5.2 Chemical Dosing System

.1 Complete the independent testing for chemical dosing systems.

3.5.3 Test Failure

.1 Before starting corrective work, the Manufacturer shall submit to the Engineer for review any analysis of the cause of the failure and details of the proposed corrective work.

.2 The Manufacturer shall make repairs acceptable to the Engineer at all points where failures are observed.

.3 If the repair works do not correct the system, a qualified and independent third party shall perform the inspection and testing services. The Contractor shall pay for the services.

3.6 Commissioning

3.6.1 The roles and responsibilities during commissioning are defined as follows:

.1 Contractor:

.1 The Contractor will make all arrangements for testing, coordinate all personnel involved, issue all required notifications, perform all commissioning tests, record results, make all necessary adjustments and retest as necessary until equipment and systems perform as intended. The Contractor will sign and submit all test results.

.2 The Contractor will coordinate all the work required by suppliers.

.3 The Contractor shall supply and pay for all required chemicals for the construction and commissioning of the works.

.4 The Contractor shall coordinate all testing and commissioning with the Engineer and the Owner, and co-operate fully with the System Programmer for testing and commissioning.

.5 The Contractor will ensure that the facility is cleaned and ready for commissioning per Section 01740 Cleaning.

.2 The Engineer:

.1 The Engineer will witness all tests and sign test reports as a witness.

.2 The Engineer will assist the Contractor is resolving deficiencies.

.3 The Owner:

.1 The Owner will assign relevant staff to witness all tests and will operate existing equipment, valves and systems.

.2 The Owner will supply water once to fill the tank for testing and commissioning of the Works. Any subsequent fills will be the responsibility of the Contractor. The Contractor will meter this supply and reimburse the Owner for subsequent fills at the completion of the works.

.4 System Programmer:

.1 The System Programmer will witness all relevant control panel tests, (FAT, loop checks, SAT, etc.). The System Programmer will be responsible for all SCADA and RPU programming, and will work within the Contractors' schedule for pre-commissioning and commissioning checks.

.2 Perform all necessary commissioning of the works in accordance with the test plan including:

.1 Run equipment and systems as intended sufficiently to make all necessary adjustments and balancing and to obtain all necessary test readings.

.2 Provide all equipment and instruments to perform tests and obtain all necessary readings.

.3 Check all related instruments and control devices and perform all necessary adjustments and calibrations.

.4 Confirm and test all control set points.

.5 Confirm operation under normal operating conditions; by-pass conditions; emergency conditions and under power failure remote, control system, communications system and key component failure.

.6 Confirm operation of all protective devices.

.7 Cooperate with and permit system programmer to perform all necessary tests on control systems.

.8 Allow ten working days for control system commissioning.

.9 Arrange for and pay all costs for equipment manufacturer services as necessary to complete commissioning work.

.10 Arrange for all temporary diversions of flow and other utilities necessary to complete commissioning of individual systems.

.11 Arrange for disposal of all wastes resulting from commissioning works.

3.6.2 Co-ordinate requirements for commissioning in accordance with the test plan.

3.6.3 Make available all required supervisory personnel, mechanics, electricians, plumbers and other trades, as well as manufacturer personnel to attend to any adjustments, corrections or repairs that may be required during pre-commissioning.

3.6.4 The commissioning period for each component shall be of sufficient duration to ensure that the equipment is ready for full time operation.

3.6.5 Provide ten working days notice of all commissioning tests where these tests are in accordance with the test plan.

3.6.6 Provide a request 15 working days in advance for all commissioning tests where these tests are not in accordance with the test plan.

3.6.7 Allow five working days for input-output checks by the Engineer and System Programmer.

3.6.8 Check oil and grease and maintain equipment and instruments at completion of commissioning prior to commencing performance and reliability run.

3.6.9 Resolve all commissioning test discrepancies and retest as necessary to the satisfaction of the Engineer.

3.6.10 Submit two copies of all commissioning test reports to the Engineer, including all initial test reports containing discrepancies and final test reports where components are retested, in addition to the copies to be incorporated into the Maintenance Manual.

3.6.11 Obtain the Engineer's approval to proceed with Performance and Reliability Run.

3.7 14 Day Performance and Reliability Run

3.7.1 Once equipment and/or systems have been tested individually, the Contractor shall co-ordinate the continuous operation test with the Engineer and Owner.

3.7.2 The performance test shall not start on a Monday or Friday.

3.7.3 The test shall be either live i.e. supplying potable water or off-line in recirculation mode or discharge-to-waste mode. The Owner will dictate whether the test shall be live or off-line, based on system demands and the need to keep the system in-service.

.1 For live testing, the Contractor shall ensure that the system has been properly disinfected or cleaned, as applicable.

.2 For off-line testing, the Contractor shall install temporary connections, bulk heads, and other provisions as required to affect the testing and simulate anticipated operating conditions.

3.7.4 The Contractor shall provide continuous site supervision for the duration of this test.

3.7.5 During the period of continuous performance testing, the Contractor shall coordinate, mechanics, electricians, and other maintenance personnel to attend to any adjustments, corrections or operations which may be required.

3.7.6 During this test, the Contractor's Testing Manager and testing team shall monitor the characteristics of each piece of equipment, instrumentation and each control device according to the Manufacturer's specifications and report any unusual conditions to the Engineer.

3.7.7 The continuous operation test shall run for minimum 14 day calendar period. Should the Engineer deem that the test needs to be stopped as a result of the non-performance of any work completed under this Contract, the Contractor shall make good the non-performing component and restart the test at time zero. Should the Engineer or Owner stop the test for any other reason, the test will be restarted and run for the remaining balance of this period.

1.9.1 The Contractor recognizes and agrees that the Performance and Reliability Run is for the purpose of establishing that the works can be operated as intended and that it shall be successfully completed prior to Substantial Performance.

1.9.2 Meet with the Engineer and the Owner to finalize the test plan for the performance and reliability run.

1.9.3 Modify the test plan to suit prevailing operating conditions if necessary.

1.9.4 Provide all instruments and test devices necessary to record operating parameters where they are not part of the works.

1.9.5 The roles and responsibilities during the Performance and Reliability Run are defined as follows:

.1 The Contractor:

.1 The Contractor will place all systems on-line ready for continuous operation and complete all cleaning, disinfection and preparatory works to permit the works to be operated as intended.

.2 The Contractor will provide supervisory personnel, tradesmen and manufacturer representatives as necessary during the test period to support the Owner's operations staff in maintaining the works in full time operation.

.2 The Engineer:

.1 The Engineer will monitor the performance and reliability run on behalf of the Owner. The Engineer will assess whether any abnormalities affect the integrity of the test during the test period. The Engineer will assess the results of the test run and determine whether additional testing is required.

.3 The Owner:

.1 The Owner will operate the works as intended and record all required operating parameters. The Owner's staff will report any abnormalities to the Engineer promptly throughout the test period.

.4 System Programmer

.1 The programmer of the control system will ensure that the control programs are placed on line ready for continuous operation and will provide support to operations staff throughout the test as required to maintain the control systems in full time operation.

.2 The Contractor will be required to coordinate with the SCADA programmer throughout the test period as required.

.3 The Contractor agrees to accept the Owner or agents of the Owner as the operating authority for the performance and reliability run. The Owner will provide the qualifications of staff or agents appointed to conduct tests to the Contractor upon request.

.4 The works will perform as outlined below for a continuous period of 14 calendar days.

.5 The performance and reliability run requirements will be provided by the Engineer.

.6 The performance and reliability run will commence on a Tuesday unless otherwise approved by the Engineer.

.7 Abnormalities and/or component failures during the performance and reliability run may result in the entire test being repeated or extended or components being repeated or extended at the discretion of the Engineer.

.8 Investigate the cause of all abnormalities such as vibration overloading, overheating, unexpected operating results and provide reports as necessary to the Engineer to demonstrate that the abnormalities have been resolved and eliminated.

.9 The Scope of Work of this Contract includes the performance and reliability run and Substantial Performance is conditional on completion of this test to the satisfaction of the Engineer.

3.8 Test Forms

3.8.1 It is a condition of acceptance for commissioning by the Owner that all equipment test forms be signed by the Contractor, Engineer, and the Owner indicating acceptance.

3.8.2 Prepare all test forms for use in advance of system performance and operational testing.

3.9 Equipment and System Performance Tests

3.9.1 Each item of process, mechanical, electrical, and instrumentation equipment installed under this contract shall be tested to demonstrate compliance with the performance requirements of this project manual. Each electrical, instrumentation, mechanical, and piping system installed or modified under this contract shall be tested in accordance with the specified requirements.

3.10 Cleaning

3.10.1 Following completion of the continuous operational testing period, the Contractor shall replace all HVAC filters; dewater and clean all sumps; dewater all process units for the deficiency inspection, and other tasks as required to return the installation to an as new condition. The system shall be completely cleaned to the satisfaction of the Engineer and the Owner prior to turning over to the Owner.

3.11 Utilities and Consumables

3.11.1 The Contractor is required to provide and pay for all services, water, electricity and any other temporary services required during the construction and commissioning period. The Owner

shall pay for all electricity costs following the date of commencement of operation of the Works.

3.11.2 Prior to the commencement of operation and at the end of the start-up operation period the Contractor shall ensure that all the equipment has been thoroughly greased and oiled with materials approved by the manufacturer and in accordance with the manufacturer's written instructions.

3.11.3 At the end of the start-up operation period, all manuals, parts and supplies which are required by the Contract shall be turned over to the Owner.

3.11.4 During the period of operation, the Contractor shall have at the site supervisory personnel, mechanics, electricians, and other maintenance personnel to attend to any adjustments, corrections or operations which may be required.

3.11.5 Before the Owner takes over the station from the Contractor or issues the Certificate of Substantial Performance, the Contractor's period of operation shall have been successfully completed and the certificates required by the Contract Documents shall have been submitted.

3.12 Documentation

3.12.1 It is a condition of acceptance for commissioning by the Owner that all equipment test forms be signed by the Contractor, Engineer, and the Owner indicating acceptance.

3.12.2 At the end of the continuous performance test period, all manuals, parts and supplies which are required by the Contract shall be turned over to the Owner.

3.12.3 Before the Owner takes over the station from the Contractor or issues the Certificate of Substantial Performance, the Contractor's period of operation shall have been successfully completed and the certificates required by the Contract Documents shall have been submitted.

3.12.4 All tasks noted within Section 01810-S2 Handover Checklist shall be completed and tracked by Contractor prior to Owner taking over the system.

END OF SECTION

1 GENERAL

1.1 Intent

1.1.1 The specification outlines the requirements for demonstration, training and instruction in the operation and maintenance of equipment and systems to the Owner and plant personnel.

1.1.2 The Contractor shall provide demonstration, training and instruction for all pieces of equipment specified to be installed under the Contract.

1.2 Qualified Trainer

1.3 The Contractor shall provide the specified on-the-job training of the Owner's operating or maintenance staff for the maintenance of equipment. The training sessions shall be conducted by qualified, experienced (3 years minimum) factory-trained representatives from the various equipment manufacturers. Training shall include instruction of operation personnel in equipment operation and preventative maintenance and instruct plant mechanics, electricians and electronics technicians in normal maintenance up to major repair.

1.4 Submittals and Schedule

1.4.1 Submit outline of all demonstration and training sessions 20 working days in advance of the planned start date.

1.4.2 Submit schedule of time and date for all demonstration and training sessions 20 working days prior to the planned start dates for the Engineer's approval.

1.4.3 Maintain a record of all attendees for demonstration and training sessions and submit to the Engineer, along with a report on all sessions prior to Substantial Performance.

1.4.4 Allow sufficient time in the construction schedule and test plan for completion of demonstration and training.

1.4.5 Coordinate attendance of demonstration and training specialists with availability of Owner and plant personnel.

1.4.6 Where the same personnel are used for testing and commissioning and for demonstration and training, ensure that the testing and commissioning work is completed to the satisfaction of the Engineer before the demonstration and training commences and that sufficient time is set aside to complete the demonstration and training.

1.4.7 All training shall occur on site. Contractor to coordinate and pay for all cost associated with brining qualified trainers to the site.

1.4.8 All training programs shall be completed prior to the start of commissioning.

1.4.9 All field training programs shall be fully co-ordinated with construction, testing and commissioning. Where projects are phased, training for each phase shall be completed before acceptance of that work. Separate training sessions shall be conducted for each phase as required. Separate training sessions may be required as a result of shift work by operations staff, customize to suit.

1.4.10 All training sessions will be conducted Monday to Friday between 8 a.m. to 3 p.m.

1.5 Pre-Conditions for Demonstrations and Training

1.5.1 Where appropriate, components shall be pre-commissioned and ready for final testing and commissioning. Equipment and Instruments shall be capable of operating as intended, during demonstration and training sessions.

1.5.2 Training materials will be approved by the Engineer and available to trainees.

1.5.3 Final Operation and Maintenance Manual shall be complete.

1.6 Required Demonstration and Training Sessions

1.6.1 Provide the following demonstration and training sessions:

1.6.2 Provide sufficient demonstration to cover start-up, operation, control, adjustment, calibration, trouble-shooting, servicing, maintenance and shut down of all components of the works.

1.6.3 As a minimum, the following trainings should be provided with one (1) week break between sessions for each equipment:

.1 Two (2) software training sessions

.2 Two (2) training sessions for Operation staff, scheduled at different times to accommodate for all work hours shifts

2 TRAINING SESSIONS

2.1.1 General:

.1 The Contractor shall be responsible to set up the training sessions with the manufacturer.

2.1.2 Lesson Plan: prepare for each required course, containing the following minimum information:

.1 Title and objectives.

.2 Recommended types of attendees (e.g., managers, Engineers, operators, maintenance).

.3 Course description and outline of course content.

.4 Format (e.g., lecture, self-study, demonstration, hands-on).

.5 Instruction materials and equipment requirements.

.6 Resumes of instructors providing the training.

2.1.3 Training Schedule

.1 List specified equipment and systems that require training services and show:

.1 Name of manufacturer.

.2 Estimated dates for installation completion.

.3 Estimated training dates.

.2 Allow for multiple sessions when several shifts are involved.

.3 Adjust schedule to ensure training of appropriate personnel as deemed necessary by Operation manager and to allow full participation by manufacturers' representatives. Adjust schedule for interruptions in operability of equipment.

.4 Coordinate with Section 01330 - Submittals and Section 01810 – Testing and Commissioning.

2.2 Training Requirements

2.2.1 The Contractor shall conduct training sessions for the Owner's staff to instruct on the proper operation, care and maintenance of the equipment and systems installed under this contract. Training shall take place at the site of the work and under the conditions as specified.

2.2.2 Field training session shall take place at the site of the equipment.

2.2.3 Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan shall contain a time allocation for each subject. One complete set of the originals of the lesson plans; training manuals, handouts, visual aids and reference material shall be the property of the Owner and shall be properly bound and organized for easy reproduction of any section as required. The Contractor shall furnish ten (10) copies of training manuals, handouts, visual aids and reference materials at least one week prior for each training session.

2.2.4 Each training session shall be comprised of time spent both in the classroom and training session shall cover the following topics for each item of equipment or system:

.1 Familiarization

.2 Safety

.3 Operation

.4 Troubleshooting

.5 Preventive maintenance

.6 Corrective maintenance

.7 Parts

.8 Local representatives

.9 Operation and maintenance manuals

2.2.5 The Consultant shall specify the time required for the proper training of Owner's Operating and Maintenance staff that is required for each equipment or process system. To permit shift Operators to attend training sessions, the Contractor shall provide for off-hours and multiple sessions.

2.3 Classroom Equipment Training – Operating Staff

.1 As a minimum, the Contractor shall provide classroom equipment training for operating staff and shall include the following:

.1 Videos, slides and or drawings, for discussion of the specific equipment, its location in the plant and an operation overview.

.2 Purpose and function of the equipment.

.3 A working knowledge of the operating theory of the equipment.

.4 Start-up, shutdown, normal operation, and emergency operation procedures, including a discussion on system integration and electrical interlocks, if any.

.5 Identify and discuss safety items and procedures.

.6 Routine preventative maintenance, including specific details on lubrications and maintenance of corrosive protection of the equipment and ancillary components.

.7 Operator detection, without test instruments, of specific equipment trouble symptoms.

.8 Required equipment exercise procedures and intervals.

.9 Routine disassembly and assembly of equipment, if applicable, (as judged by the Owner on a case-by-case basis) for purposes such as operator inspection of equipment.

2.4 Hands on Training for Operating Staff

.1 Hands-on training of equipment shall include:

.1 Location of the equipment in the facility and review its function.

.2 Identify piping and flow options.

.3 Identify valves and its function.

.4 Identify field instrumentation, particularly with respect to:

.1 Location of primary element.

.2 Location of instrument readout.

.3 Discuss purpose, basic operation and interpretation of operating data.

.5 Discuss, demonstrate, and perform standard operating procedures and outline checks.

.6 Discuss and perform the preventative maintenance activities.

.7 Discuss and perform start-up and shutdown procedure.

.8 Perform routine equipment exercise procedure.

.9 Perform disassembly and assembly of equipment if applicable.

.2 Identify and review hazardous operation and demonstrate safety procedures, where applicable.

.3 Contractor must be able to turn on equipment and demonstrate operation of the equipment for training session to be considered complete.

2.5 Classroom Equipment Training – Maintenance Staff

.1 Classroom equipment training for the maintenance and repair personnel will include:

.1 Theory of operation.

.2 Description and function of equipment.

.3 Start-up and shutdown procedures.

.4 Normal and major repair procedures.

.5 Equipment inspection and trouble shooting procedure including the use of applicable test instruments and the “pass” and “no pass” test instrument readings.

.6 Routine and long-term calibration procedures.

.7 Safety procedures.

.8 Preventative maintenance such as lubrication; normal maintenance such as belt, seal, and bearing replacement; and up to major repairs such as replacement of major equipment part(s) with the use of special tools, welding jigs, etc.

2.6 Hands on Training for Maintenance Staff

.1 Hands-on equipment maintenance and repair training for Maintenance staff shall include:

.1 Locate and identify equipment components.

.2 Review the equipment function and theory of operation.

.3 Review normal repair procedures.

.4 Perform start-up and shutdown procedures.

.5 Review and perform the safety procedures.

.6 Perform Owner's-approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and trouble shooting equipment problems.

.7 Review and use equipment manufacturer's manual in the hands-on training.

END OF SECTION

DIVISION 2 – SITE WORKS

Section No.	Title
02061	Tank Draining and Cleaning

1 GENERAL

1.1 Scope of Work

1.1.1 The Contractor will supply all equipment, labour, material and consumables necessary to enter the existing Actiflo Tanks #1, #2, and #3 and complete all required works in the tank. Discharge liquid from the tanks to the backwash surge tank. The contents of the tanks consist of raw river water with microsand, polymer, and coagulant. Settled solids will be present at the bottom of the tanks and are to be removed with the liquid.

1.2 Submittals

1.2.1 Provide copies of Confined Space Entry Plans and a copy of each Entry Permit to the Contract Administrator prior to entering into any confined space.

1.2.2 Complete list of all controlled products, hazardous materials, products containing hazardous materials, and all biological or chemical agents or devices or equipment producing or emitting a physical agent and any substance, compound, product or physical agent that is deemed to be or contains a designated substance as defined under the Act and the Regulations, which will be or may be used for the work, prior to the commencement of the work.

1.2.3 Provide appropriate information and Material Safety Data Sheets, where required, for the substances used in the performance of the work.

1.2.4 Provide a Spills Contingency Plan, outlining the notification requirements and procedures for rapid clean-up of spills that may occur.

1.3 Permits, Fees and Inspection

1.3.1 The Contractor shall apply for, obtain and pay for all permits, licenses, inspection, examination testing and fees required.

1.3.2 Any work rejected or requiring correction shall be rectified at the Contractor’s expense and any additional inspection caused by the deficient work shall also be paid by the Contractor.

1.4 Protection of Utilities, Structures and Property

1.4.1 The Contractor shall ensure that his/her operations do not interfere with or damage existing utilities, equipment, structures and property. The Contractor will be held fully responsible for any damage to utilities, properties and/or structures adjacent or in the general area of the work through settlement of ground, vibration or shock resulting from any cause relating to work carried under this contract.

1.4.2 The Contractor shall support and protect from direct or indirect damage existing utilities, equipment, structures and property which occur within or over contractor’s operations, or adjacent to the work. The methods of protecting and temporary supporting utilities, structures and other items, where required, shall be satisfactory to the Owner and or utility owner concerned. Such work and costs shall be included in and considered to be part of payment under this contract.

1.4.3 Prevent dust, water, and dirt from entering buildings or areas where equipment is stored or operating.

1.5 Records

1.5.1 The Contractor shall maintain accurate minutes of all meetings, records, memos, site inspection reports and other relevant documents.

1.5.2 A daily log, hard cover book with permanent pages, shall be kept on site and maintained by the Contractor. The daily logbook shall be available at any time and submitted to the Owner at upon completion of work under this contract.

1.6 WHMIS – Workplace Hazardous Materials Information System

1.6.1 The Contractor shall provide a complete list of all controlled products, hazardous materials, products containing hazardous materials, and all biological or chemical agents or devices or equipment producing or emitting a physical agent and any substance, compound, product or physical agent that is deemed to be or contains a designated substance as defined under the Act and the Regulations, which will be or may be used for the work, prior to the commencement of the work. The Contractor shall provide appropriate information and Material Safety Data Sheets, where required, for the substances used in the performance of the work.

1.6.2 Where hazardous materials, biological or chemical agents and/or designated substances are used in the performance of the work, the Contractor shall ensure that the requirements to train workers, provide appropriate labels and Material Safety Data Sheets or to implement a control program.

1.6.3 The Contractor shall take steps to inform the Owner of the location of these materials and to ensure that these materials are not kept stored or used at a location where an employee of the Owner could be working with or exposed to the substance, without the Owner's prior consent or approval.

1.7 Spills

1.7.1 The Contractor shall submit procedures for inspection and rapid clean up of spills that may occur. Be prepared at all times to intercept, clean up and dispose of any spill that may occur. Keep all materials required for clean-up of spills readily accessible on the site.

1.7.2 Report immediately any spills causing damage to environment to:

.1 Spills Action Centre of the Ministry of Environment

.2 Town of Deep River

.3 OCWA

.4 CIMA+

.5 Any other authority having jurisdiction or an interest in the spill including any Conservation Authority, water supply authority, drainage authority, road authority, fire department.

1.7.3 Take immediate action using any available resource to contain and mitigate the effects on the environment from any accidental spill.

1.8 Volume of Actiflo Tank Content

1.8.1 Each Actiflo Tank has a volume of approximately 72 m^3. The contractor shall provide a portable pump to drain the liquid portion of each Actiflo tank to the backwash surge tank.

1.9 Supply of Water

1.9.1 Refer to Section 01510 Clause 1.5.

1.10 Actiflo Tank Cleaning

1.10.1 The Contractor shall cooperate with OCWA personnel to minimize interference with the plant operation.

1.10.2 The Contractor shall provide proper pumping equipment, temporary piping and all other required equipment in order to remove the liquid from the tank.

1.10.3 Before commencing work and while working in areas which may contain an explosive, toxic, or oxygen deficient atmosphere, the Contractor shall test for explosive or toxic gases, or oxygen deficiency in accordance with applicable statutes and acceptable practice. If a hazardous condition is found, the Contractor shall make the work area safe before commencing or continuing work.

1.10.4 The Contractor upon removal of all waste material shall hose down tank interior including all piping, fittings, pipe hangers and brackets. Remove all rags, debris, sand, solid waste and any other matter from all fittings and piping.

1.10.5 The tank cleaning shop drawing and report shall be reviewed by the Engineer. No machinery (mini backhoe, excavator, skid steer, etc.) shall be allowed in the tank. The contractor shall repair damage caused by improper cleaning at no additional cost.

1.11 Disposal Method

1.11.1 Haul or pump the liquid phase of the dewatering contents to the backwash surge tank.

1.11.2 The remaining heavy solids shall be slurried by the contractor to allow pumping to temporary portable dewatering equipment. Contractor to include mobilization, demobilization, dewatering equipment and operator, polymer equipment and supply costs, temporary power supply costs and loading, transportation and disposal costs of dewatered solids at a licensed landfill.

1.11.3 The Contractor shall submit to the Owner prior to commencement a detailed work plan schedule of the proposed works.

1.11.4 The Contractor is deemed to have taken into consideration variation of the quality and composition of the tank contents.

1.11.5 All costs associated with tank cleanout are deemed to be included in the total lump sum tender price.

1.12 Disposal Sites

1.12.1 Secure waste disposal sites and provide certification documents for all sites receiving the tanks' solids content.

1.12.2 Provide proof of agreements with landfill sites, selected for acceptance of the tank contents.

1.13 Waste Haulage

1.13.1 The Contractor is responsible for providing all labour, equipment, and transfer vehicles necessary to undertake the services outlined in this Contract.

1.13.2 The contractor is fully responsible for determining the number of complete transfer trailer/truck cab units required to perform the work. In the event of an equipment breakdown, the Contractor shall readily supply a replacement vehicle to properly carry out the provisions of the Contract.

1.13.3 Transfer trailers must be sufficiently tarped or covered to prevent loss or spillage of the materials and to prevent the escape of fugitive odours during transport. Trailers shall be watertight to ensure that no spillage of liquid occurs during transport. The Contractor shall transfer only full loads to minimize haulage requirements unless authorized by the Contract Administer to do otherwise. The Contractor shall not overfill transfer trailers.

1.13.4 The Contractor shall ensure that all transfer trailers are clean and free of contamination prior to use. The Owner is not responsible for any additional disposal or clean-up costs should the liquid/material become unacceptable to disposal due to contamination from the transfer trailer.

1.14 Equipment

1.14.1 The use of the Owner's machinery, equipment or services will not be permitted.

1.14.2 All electrical devices and wiring used inside the tanks shall be explosion proof and carry appropriate C.S.A. approval. All lighting and wiring shall be made secure from damage or falling. All electrical installation and equipment shall comply with electrical codes.

1.14.3 In hazardous areas, provide intrinsically safe mechanical devices and equipment such as non-sparking aluminum wheels for fans, pneumatic operators for dampers and aluminum clappers for check valves on pipelines conveying gaseous fuels.

1.14.4 Designate an area within the working limits to be used exclusively for fueling of construction equipment. Submit for review a plan for the interception and rapid clean up of fuel spills should they occur. Maintain the apparatus for cleaning up fuel spills.

1.14.5 Keep equipment clean so that no debris is deposited on the plant roadways or any public roadway. Contain debris in a designated area within the working limits. Dispose of debris off-site as specified.

1.14.6 Use only vehicles and equipment equipped with effective muffling devices. Provide noise barriers on stationary engines and compressors.

1.14.7 Provide, mount and maintain signs warning all of the hazards and of the proper procedures required for working in the hazardous areas.

1.14.8 Refer to Section 01510 Clause 1.7.

1.15 Damage and Contamination

1.15.1 The Contractor shall be liable for any damage or contamination done due to spills or improper waste disposal. The Contractor shall make good and restore the site at no additional cost to the Owner.

1.15.2 In the event of improper disposal or accidental spillage, the Contractor shall immediately clean the area affected to the satisfaction of the Owner and all other authorities having jurisdiction.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

DIVISION 3 – CONCRETE

Section No.	Title
03800	Crack Injection
03902	Rust Spot Repair
03903	Spalls Repair

1 GENERAL

1.1 Scope of Work

1.1.1 Furnish all labour, materials, tools and equipment and perform all operations necessary for the repair of leaking construction joints or cracks in concrete using injection resin.

1.2 Related Sections

1.2.1 Section 01330 - Submittals

1.2.2 Section 01450 - Quality Control

1.3 References

1.3.1 Ontario Building Code (OBC)

1.3.2 CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction

1.3.3 CSA S478 – Guideline on Durability in Buildings

1.3.4 Ontario Ministry of the Environment, Conservation and Parks (MECP) Guidelines for Potable Water Reservoirs

1.4 Quality Assurance

1.4.1 In addition to the requirements of Section 01450 – Quality Control, the following measures are required:

.1 The applicator shall have a minimum of three (3) years of experience performing similar work and be authorized by the supplier for performing resin injection of the nature specified. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.

.2 A technical specialist representing the product manufacturer shall visit the site to examine site specific conditions and to make recommendations regarding material selection, injection equipment and application techniques.

.3 Contractor must arrange for a field visit with the manufacturer’s technical specialist to review and approve all surface preparation prior to applying the product.

.4 Install materials in accordance with all safety and weather conditions required by the manufacturer. Consult Material Safety Data Sheets for complete handling recommendations.

1.5 Submittals

1.5.1 General:

.1 Applicator shall submit certificate authorized by the supplier for performing resin injection of the nature specified.

.2 Prior to start of work, discuss with engineer the type and location of crack repairs.

.3 Submit a work plan indicating the type and location of repairs, and materials and method of preparation, repair, and clean up.

1.5.2 Product Data:

.1 Submit manufacturer's data and application instructions for each product specified.

1.6 Delivery, Storage and Handling

1.6.1 All materials shall be delivered to the site in undamaged, unopened containers bearing the supplier's original labels. Store materials in protected location prior to use, in accordance with manufacturer's directions.

1.6.2 Condition the specified product as recommended by the manufacturer.

1.7 Environmental and Site Conditions

1.7.1 Environmental Conditions:

.1 Workplace Hazardous Materials Information System (WHMIS) labels on all containers shall conform to Canadian regulations, proper chemical name, shipping class, packing group and UN number.

.2 Material Safety Data Sheets (MSDS) for all materials shall conform to Canadian regulations.

.3 No materials shall be used that are manufactured from or contain toluene diisocyanate (TDI), toluene, acetone or methyl ethyl ketone.

.4 No materials shall be used that are flammable or that display shipping Class 3 Red warning labels.

.5 Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature to be 40ºF (5ºC) and rising.

1.7.2 Workplace Safety:

.1 Supply workers with appropriate safety equipment for performing injection of resins and associated tasks.

.2 Supply safety devices, traffic control barriers, drop sheets and other items to protect the site, other contents and other personnel from contact with the Contractor's material or equipment.

1.8 Site Services

1.8.1 The Contractor shall attend the site and evaluate the present electrical supply that is available for their use. The Contractor will be responsible to modify those services, if required, without affecting the pumping operations and to restore those services after the work is complete. As an alternative, the Contractor can supply their own power source but must control the noise to the satisfaction of the Owner.

1.8.2 All construction debris and empty containers are to be removed from the site by the Contractor and disposed of in accordance with applicable regulations.

1.9 Measurement and Payment

1.9.1 Repair of cracks in new concrete placed under this contract will not be measured but considered incidental to the work. Engineer approval must be obtained prior to using crack injection to new concrete containing crystalline waterproofing admixture.

1.9.2 Repair of all cracks in existing concrete will be paid under lump sum tender and provisional items as described in the contract.

2 PRODUCTS

2.1 Approved Manufacturers

2.1.1 Sika Canada Inc., 6915 Davand Drive, Mississauga, Ontario, L5T 1L5 Toll free: 1-800-933-4758, URL: www.sika.ca

2.1.2 Aquafin, 505 Blue Ball Rd., #160, Elkton, MD 21921, Phone: 410-392-2300, URL: https://www.aquafin.net/us/enEuclid Chemical, 19215 Redwood Road, Cleveland, OH, 44110, Phone: (800) 321-7628, URL: https://www.euclidchemical.com/

2.1.3 Simpson Strong-Tie, 5 Kenview Blvd., Brampton, Ontario L6T 5G5, Phone: (905) 458-5538, URL: https://www.strongtie.com/

2.1.4 Avanti International, 822 Bay Star Blvd., Webster, TX 77598, Phone: 281.486.5600, URL: https://www.avantigrout.com/

2.1.5 MAPEI Inc., 2900 Francis-Hughes Avenue, Laval, Quebec, H7L 3J5 Toll free: 1-800-426-2734, URL: https://www.mapei.com/ca/en-ca/home

2.1.6 Or Agency Approved Equal

2.2 Materials

All products applied on facing water side shall be approved by NSF/ANSI 61.

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2.2.1 Damp Cracks (wall cracks):

.1 Polyurethane Injection, with the following specifications:

.1 Water activated type

.2 Flexible foam end product

.3 Hydrophobic

.4 Solvent-free and non-flammable

.5 Fast-acting with variable cure rate

.6 Cured product shall not shrink

.7 MDI-based polyurethane pre-polymer with accelerator

.8 Suitable for cold temperature use above 4°C

.9 Viscosity – 600 cps at 20°C

.10 Resistant to chlorine concentration up to 3 mg/L

.11 Acceptable products meeting this specification:

.1 SikaFix HH LV

.2 BASF MasterRoc MP 355 1K

.3 MAPEI Resfoam HB45

.4 Or Agency Approved Equivalent

2.2.2 Non-Leaking Cracks (roof/ceiling cracks in dry areas):

.1 Epoxy injection resins for dry cracks shall conform with the following specifications:

.1 Non-shrink

.2 Compressive Strength: 50MPa at 7 days at 5°C

.3 Suitable for cold temperature use above 5°C

.4 Minimum bond strength: 14 MPa at 5°C

.5 Acceptable product meeting this specification:

.1 Sika Sikadur 55 SLV injection resin, with Sikadur 31 crack sealant

.2 Simpson Strong-Tie CI-LV injection resin, with CIP crack sealant

.3 Euclid Dural Injection Gel

.4 Or Agency Approved Equal

3 EXECUTION

3.1 General

3.1.1 Injection to be completed as per injection resin supplier's requirements.

3.1.2 If unusually large quantities of injection material are required, there may be honeycomb or other structural issues present, contact the engineer immediately before proceeding.

3.1.3 Avoid the use of excessive injection pressures. Pressures shall be as per manufacturer's recommendations.

3.1.4 Continue injection until a permanent watertight seal has been created.

3.2 Mixing and Handling of Injection Resins

3.2.1 Follow recommended guidelines as per supplier's product data sheets.

3.2.2 Measure all materials using graduated containers and in appropriate quantities to suit site requirements.

3.3 Cleaning Cracks Prior to Injection

3.3.1 Use compressed air to clean and prepare cracks for epoxy injection.

3.4 Polyurethane Injection

3.4.1 Surface Preparation

.1 If the cracks become difficult to flush with water, Contractor shall contact the manufacturer immediately and arrange a site visit with the manufacturer to provide a recommendation.

.2 Manufacturer may recommend routing out the cracks and installing hydraulic cement to retain the material prior to injection.

.3 Follow strictly manufacturer's recommendations.

3.4.2 Drilling Injection Holes

.1 Drill 9 mm injection holes at a distance from the crack equal to half the thickness of the slab, at an angle of 45 degrees to intersect cracks beyond the mid-point of the wall or slab being injected.

.2 Drill hole spacing shall not exceed 300mm under any condition.

.3 All drill holes shall be flushed with copious quantities of water to remove all dust and drilling debris from the hole prior to installing the injection packers.

3.4.3 Installation of Injection Packers

.1 Install 9.5mm plastic injection packers, complete with metal fittings, in accordance with supplier's instructions.

3.4.4 Installation of Sealing Materials

.1 Install appropriate sealing materials along the crack or joint to be injected, where required, to minimize the loss of injection resin.

.2 Suitable sealing materials may include hydraulic cement, epoxy bonders, polyester bonders, wooden shims, grout pads or backer rod, depending on site conditions.

3.4.5 Injection Equipment

.1 Use an electrically-operated airless pump, modified specifically for resin injection.

.2 The pump shall be equipped with gravity feed suction containers.

.3 The pump controls shall feature an adjustable pressure and to provide automatic on/off pump operation.

.4 A multiple grout header shall be used to control the flow of injection resin and shall include a 0-2 MPa pressure gauge, flow control valves and a bypass pressure relief valve.

3.4.6 Injection of Polyurethane Resins

.1 Follow recommended guidelines as per supplier's product data sheets and technical literature.

.2 Start injection procedure from the bottom of a crack and inject until resin can be seen in the next port above, then move to that port and inject.

.3 Inject sufficient resin at each location to completely fill all cracks, and injection material can be seen in the adjacent port.

3.5 Epoxy Injection

3.5.1 Surface preparation

.1 Prepare surface area around crack by abrasive blasting or other mechanical means to remove all surface laitance.

.2 Thoroughly clean all dust and debris from surface with compressed air.

3.5.2 Installing porting device

.1 Set porting devices by drilling as required by the manufacturer. Spacing of the porting devices should not exceed the thickness of the substrate or 300mm c/c whichever is less.

.2 On structures open on both sides, provide porting devices on opposite sides at staggered elevations.

3.5.3 Installation of Sealing Materials

.1 Apply the epoxy resin adhesive over the cracks and around each porting device to provide an adequate seal to prevent the escape of the epoxy resin adhesive for the injection grouting.

.2 Do not begin injection until epoxy adhesive has fully cured.

3.5.4 Injection of Epoxy Resins

.1 Dispense the epoxy resin adhesive for grouting under constant pressure in accordance with procedures recommended by the equipment manufacturer as required to achieve maximum filling and penetration of the prepared cracks without the inclusion of air pockets or voids in the epoxy resin adhesive.

3.6 Clean-up

3.6.1 Remove all injection resin and adhesive material on the surface of the concrete.

3.6.2 Remove all injection packers, plug and repair openings with manufacturer approved products. Grind surface smooth after repair material has completely cured.

3.6.3 Clean the substrate and produce a finish to match surrounding concrete surfaces.

END OF SECTION

1 GENERAL

1.1 Scope of Work

1.1.1 This work comprises:

.1 The preparation of concrete surfaces, including patching of spalled concrete and damaged concrete edges.

.2 Removal of the rust of corroded reinforcement.

.3 Removal of the deteriorated surface of concrete, and disposal of all wastes off site.

1.2 Related Sections

1.2.1 Section 01330 - Submittals

1.2.2 Section 01450 - Quality Control

1.2.3 Section 03903 - Spall Repair

1.3 References

1.3.1 Ontario Building Code (OBC)

1.3.2 CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction

1.3.3 CSA S478 – Guideline on Durability in Buildings

1.3.4 Ontario Ministry of the Environment, Conservation and Parks (MECP) Guidelines for Potable Water Reservoirs

1.4 Basis of Payment

1.4.1 Payment of this item shall be based on the lump sum price bid.

1.4.2 Include in the price all costs of labour, stages, materials, equipment, etc. to:

.1 Remove deteriorated surface material

.2 Prepare the specified surfaces using hand-chipping tools for the removal of loose, soft, flaked or otherwise defective material and carrying out repairs of spalls.

1.5 Quality Assurance

1.5.1 Pre-Repair Meeting; hold a meeting prior to start of work to discuss the work plan. Attendants must include but not be limited to Engineer, repair foreman, general contractor and manufacturer’s representative.

1.6 Submittals

1.6.1 Make all submittals in accordance with Section 01330.

1.6.2 Work plan: Prior to the start of work, submit the methods of preparation, repair, and curing and a list of repair locations.

1.6.3 Technical Data Sheet (TDS) for each material applied.

1.7 Warranty

1.7.1 10-year leak free, combined manufacturers and contractor's warranty

2 PRODUCTS

2.1 Materials

All products applied on facing water side shall be approved by NSF/ANSI 61.

2.1.1 Spall Repair (for isolated rust spots)

.1 Polymer-modified, cementitious, trowel grade mortar:

.1 SikaTop 122 Plus

.2 Or approved equivalent

.2 Self-consolidating, cement-based concrete:

.1 Sikacrete-08 SCC

.2 Or approved equivalent

2.1.2 Resurfacing Mortar (for isolated rust spots)

.1 SikaTop - 122 Plus for floor

.2 SikaTop - 123 Plus for ceiling and wall

.3 Or approved equivalent

2.1.3 Bonding Agent (for isolated rust spots)

.1 SikaTop Armatec110 EpoCem

.2 Or approved equivalent

2.1.4 Fine Concrete (for large area corroded reinforcement)

The recommended fine concrete mix for repair work shall comply with Ontario Building Code s.9.3.1.7 and be:

1. Type of cement: Type GU or equivalent
2. Water-to-cement ratio (w/c): 0.45
3. Fine aggregates: clean, well-graded sand, max size 2 mm
4. Coarse aggregate: milled, smaller crushed stone (max 10 - 14 mm)
5. Optional additives (recommended):
   - Shrinkage compensator for crack control

3 EXECUTION

3.1 General

3.1.1 All preparation and repair techniques should be in accordance with the International Concrete Repair Institute (ICRI).

3.2 For Large Area Corroded Reinforcement

3.2.1 Surface Preparation

All exposed and corroded reinforcing steel shall be cleaned in accordance with SSPC-SP2 (Hand Tool Cleaning) or SSPC-SP3 (Power Tool Cleaning) standards to remove rust, scale, and other contaminants prior to repair. Repair documents will include details on how to repair corroded reinforcement.

3.2.2 Reinforcement and Structural Repair

- For reinforcement with section loss < 20%, remove the surrounding concrete, clean the reinforcement to remove rust, and fill the area using fine concrete with compressive strength of 45 MPa.
- For reinforcement with section loss ≥ 20%, remove the surrounding concrete, clean the affected reinforcement, and provide a splice using new reinforcement of Grade 400 MPa. Fill the area using fine concrete with compressive strength of 45 MPa.

3.2.3 Waterproofing and Protection

- Apply a cementitious crystalline waterproofing coating to the entire interior face of the wall to prevent future water ingress and protect reinforcement.
- Ensure compatibility with wastewater exposure as per Ontario Ministry of the Environment, Conservation and Parks (MECP) and CSA B128.3, if applicable.

3.3 For Isolated Rust Spots

3.3.1 Surface Investigation and Removal

- Mechanically remove surface rust stains using wire brushing, light grinding, or appropriate chemical cleaners. Take care not to damage sound concrete during surface treatment.

- If rust originates from active corrosion of embedded steel, the affected concrete should be removed to expose the corroded reinforcement.

3.3.2 Assessment of Embedded Reinforcement

- Inspect the exposed reinforcement for section loss or advanced corrosion.
- Clean all corroded steel in accordance with SSPC-SP2 (hand tool cleaning) or SSPC-SP3 (power tool cleaning) standards to remove rust and loose scale.
- If significant section loss is present, consult a licensed structural engineer to determine whether supplemental reinforcement is required.

3.3.3 Concrete Repair

- Following reinforcement preparation, restore the removed concrete using a compatible non-shrink, sulfate-resistant, polymer-modified repair mortar or epoxy-based repair system, as appropriate for wastewater exposure conditions.
- Ensure proper substrate preparation and curing as per CSA A23.1 standards and the manufacturer's guidelines.

3.3.4 Surface Protection

Upon completion of repairs, apply a protective surface treatment such as a cementitious crystalline waterproofing coating or elastomeric barrier system to enhance durability and prevent further moisture ingress.

3.4 Environmental Conditions

3.4.1 Patching shall only be applied in sufficient quantity to allow complete filling of the spalled or honeycombed areas in accordance with the manufacturer’s requirements.

3.4.2 Ambient, substrate temperature and rising temperature at time of application to follow the requirements of the manufacturer.

3.4.3 Cover all floor drains to prevent grit and debris from entering the drain.

3.5 Application

3.5.1 At time of application, surfaces shall be saturated surface dry without glistening water.

3.5.2 Mortar must be scrubbed into the substrate filling all pores and voids. Alternatively, bonding agent can be applied.

3.5.3 Apply mortar by hand patching:

.1 Follow manufacturer’s requirements for minimum and maximum lifts. Mortar layer greater than 38mm up to maximum of 100mm can be applied with extended aggregates.

3.5.4 Apply concrete by forming and pouring:

.1 Follow manufacturer’s requirements for minimum and maximum application thicknesses.

3.5.5 Allow mortar to reach initial set then finish using a steel trowel to obtain a uniform, consistent, smooth and even profile.

3.5.6 Cover with poly sheet and cure according to the requirements of the manufacturer.

3.6 Field Quality Control

3.6.1 Substrate shall be inspected by Engineer prior to application of repair mortar.

3.6.2 Repair mortar shall be mixed so that it does not sag or flow when applied on vertical surfaces.

3.6.3 Surfacing mortar shall be mixed in accordance with the manufacturer's requirements.

3.6.4 Repair mortar to be placed with respect to the maximum and minimum thicknesses as per the manufacturers written instruction.

3.6.5 Excess mortar surfacing thickness remaining on the concrete surface after patching the spalls shall be removed.

3.6.6 The manufacturer shall be represented during the preparation and the application of the patch repair.

3.6.7 Manufacturer to provide a letter stating that the repair mortar has been used following manufacturer's quality procedures to complete the repair.

END OF SECTION

1 GENERAL

1.1 Scope of Work

1.1.1 This work comprises:

.1 The preparation of concrete surfaces, including patching of spalled concrete and damaged concrete edges.

.2 Removal of the deteriorated surface of concrete, and disposal of all wastes off site.

1.2 Related Sections

1.2.1 Section 01330 - Submittals

1.2.2 Section 01450 - Quality Control

1.2.3 Section 03800 - Crack Injection (Polyurethane).

1.3 References

1.3.1 Ontario Building Code (OBC)

1.3.2 CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction

1.3.3 CSA S478 – Guideline on Durability in Buildings

1.3.4 Ontario Ministry of the Environment, Conservation and Parks (MECP) Guidelines for Potable Water Reservoirs

1.4 Basis of Payment

1.4.1 Payment of this item shall be based on the lump sum price bid.

1.4.2 Include in the price all costs of labour, stages, materials, equipment, etc. to:

.1 Remove deteriorated surface material

.2 Prepare the specified surfaces using hand-chipping tools for the removal of loose, soft, flaked or otherwise defective material and carrying out repairs of spalls.

1.5 Quality Assurance

1.5.1 Pre-Repair Meeting; hold a meeting prior to start of work to discuss the work plan. Attendants must include but not be limited to Engineer, repair foreman, general contractor and manufacturer’s representative.

1.6 Submittals

1.6.1 Make all submittals in accordance with Section 01330.

1.6.2 Work plan: Prior to the start of work, submit the methods of preparation, repair, and curing and a list of repair locations.

1.6.3 Technical Data Sheet (TDS) for each material applied.

1.7 Warranty

1.7.1 10-year leak free, combined manufacturers and contractor's warranty

2 PRODUCTS

2.1 Materials

All products applied on facing water side shall be approved by NSF/ANSI 61.

2.1.1 Spall Repair

.1 Polymer-modified, cementitious, trowel grade mortar:

.1 SikaTop 122 Plus

.2 Or approved equivalent

.2 Self-consolidating, cement-based concrete:

.1 Sikacrete-08 SCC

.2 Or approved equivalent

2.1.2 Resurfacing Mortar

.1 SikaTop - 122 Plus for floor

.2 SikaTop - 123 Plus for ceiling and wall

.3 Or approved equivalent

2.1.3 Bonding Agent

.1 SikaTop Armatec110 EpoCem

.2 Or approved equivalent

3 EXECUTION

3.1 General

3.1.1 All preparation and repair techniques should be in accordance with the International Concrete Repair Institute (ICRI).

3.2 Surface Preparation

3.2.1 Remove deteriorated concrete, dirt, grease, oil and other bond inhibiting materials from surface.

3.2.2 Prepare surface by chipping and/or other appropriate mechanical means.

3.2.3 Obtain a minimum profile of ±3mm (CSP 6 to 9) on the substrate to be patched.

3.2.4 Sawcut repair area edges to provide a vertical edge.

3.2.5 Dampen surface to be repaired with clean water.

3.2.6 Substrate should be saturated surface dry with no standing water during application using a sponge or air pressure for larger areas.

3.3 Environmental Conditions

3.3.1 Patching shall only be applied in sufficient quantity to allow complete filling of the spalled or honeycombed areas in accordance with the manufacturer's requirements.

3.3.2 Ambient, substrate temperature and rising temperature at time of application to follow the requirements of the manufacturer.

3.3.3 Cover all floor drains to prevent grit and debris from entering the drain.

3.4 Application

3.4.1 At time of application, surfaces shall be saturated surface dry without glistening water.

3.4.2 Mortar must be scrubbed into the substrate filling all pores and voids. Alternatively, bonding agent can be applied.

3.4.3 Apply mortar by hand patching:

.1 Follow manufacturer's requirements for minimum and maximum lifts. Mortar layer greater than 38mm up to maximum of 100mm can be applied with extended aggregates.

3.4.4 Apply concrete by forming and pouring:

.1 Follow manufacturer's requirements for minimum and maximum application thicknesses.

3.4.5 Allow mortar to reach initial set then finish using a steel trowel to obtain a uniform, consistent, smooth and even profile.

3.4.6 Cover with poly sheet and cure according to the requirements of the manufacturer.

3.5 Field Quality Control

3.5.1 Substrate shall be inspected by Engineer prior to application of repair mortar.

3.5.2 Repair mortar shall be mixed so that it does not sag or flow when applied on vertical surfaces.

3.5.3 Surfacing mortar shall be mixed in accordance with the manufacturer's requirements.

3.5.4 Repair mortar to be placed with respect to the maximum and minimum thicknesses as per the manufacturers written instruction.

3.5.5 Excess mortar surfacing thickness remaining on the concrete surface after patching the spalls shall be removed.

3.5.6 The manufacturer shall be represented during the preparation and the application of the patch repair.

3.5.7 Manufacturer to provide a letter stating that the repair mortar has been used following manufacturer's quality procedures to complete the repair.

END OF SECTION

DIVISION 9 – FINISHES

Section No.	Title
09967	Fluid Applied Insulative Coating

1 GENERAL

1.1 Scope

1.1.1 This section includes spray-applied insulative coating systems including primer, insulative coating and topcoat, for the purpose of condensation reduction on WTP stainless steel process piping, including all nuts and bolts, in the Deep River WTP Treatment Room.

.1 Field surface preparation, application of primers, insulative coating and finishes are specified in this Section.

1.2 References

1.2.1 ASTM International

.1 ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus

.2 ASTM D870 – Standard Practice for Testing Water Resistance of Coatings

.3 ASTM D4541 – Standard Practice for Pull-Off Strength of Coatings Using Portable Adhesion Testers

.4 ASTM D4585 – Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation

.5 ASTM D4587– Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings

.6 ASTM D5894 – Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet).

1.2.2 The Society of Protective Coatings (SSPC)

.1 SSPC-SP 2 - Hand Tool Cleaning

.2 SSPC-SP3 - Power Tool Cleaning Standard.

.3 SSPC-SP 6/NACE No. 3: Commercial Blast Cleaning Standard.

.4 SSPC-PA1: Shop, Field, and Maintenance Painting of Steel.

.5 SSPC-PA2: Procedure for Determining Conformance to Dry Coating Thickness Requirements.

1.3 Submittals

1.3.1 Make submittals in accordance with Section 01330 – Submittal Procedures.

1.3.2 Submit full records of all products used. List each product in relation to finish formula and include the following:

.1 Finish formula designation

.2 Product type and use

.3 Manufacturer's product number

.4 Colour number

.5 Manufacturer's Material Safety Data Sheets (MSDS)

.6 Maximum VOC classification

.7 Eco-Logo certification.

.8 Submit manufacturer's application instructions for each product specified.

1.3.3 Product Data: Submit product data including manufacturers technical data indicating product performance characteristics, performance and limitation criteria.

1.3.4 Manufacturer's Instructions: Submit manufacturer written installation instructions.

1.3.5 Submit manufacturer's representative's written approval of surface preparation methods and any specific recommendations for alternative methods.

1.4 Quality Assurance

1.4.1 Execute work of this Section by a firm which has adequate plant, equipment and skilled workers to perform work expeditiously and which is known to have been responsible, during immediate past 5 years, for installations similar to the scope of work contained herein. Ensure firm is fully conversant with applicable laws, bylaws, codes, fire, health and safety regulations and other regulations which govern.

1.4.2 Provide work of this Section executed by competent applicators with membership in good standing in OPCA and/or PDCA and have a minimum of 5 years experience in application of Products, systems, coatings and assemblies specified and with approval and training of Product manufacturers.

1.4.3 Retain purchase orders, invoices and other documents to prove that all materials utilized in this contract meet requirements of the specifications. Produce documents when requested by engineer.

1.4.4 Pre-installation meetings: Prior to the commencement of painting operations meet at the Site with the material supplier's representative and with the Engineer to review this Section, the painting Work to be done and the following related items:

.1 Equipment use and servicing

.2 Material storage and application techniques

.1 Surface preparation and ambient temperature

.2 Inspection requirements

.3 Inspection reports

.4 Hold points or check points

.5 Safety requirements during application

.6 Mock ups or samples of coatings in highly corrosive environments

1.4.5 Manufacturer:

.1 Company specializing in manufacturing product in this section with a minimum of 3 years documented experience in manufacturing insulative technology.

1.4.6 Mock-up:

.1 Minimum thirty (30) days prior to application in any area, provide mock-up Samples of Fluid Applied Insulative Coating system in accordance with the following requirements:

.1 Provide minimum two square feet (.18 square meter) on representative substrate, where directed by the Engineer, for each different thickness and finish of required for the work.

.2 Provide mock-up areas that comply with thickness, density application, finish texture, and color.

.3 Inspect mock-up areas within one hour of application for variance due to shrinkage, temperature, and humidity.

.4 Where shrinkage and cracking are evident, adjust mixture and method of application as necessary to meet required installation, finish, and color requirements.

.5 Continue to provide mock-up areas until acceptable areas are produced.

.6 Acceptable areas shall constitute standard of acceptance for method of application, thickness, finish texture, and color requirements, for Fluid Applied Insulative material applications.

1.5 Delivery, Storage and Handling

1.5.1 Deliver products to site in sealed and labelled containers.

1.5.2 Storage: Materials shall be stored in strict accordance with manufacturers documented instructions.

1.5.3 Documentation: All batch number, product identification and quantities shall be recorded on appropriate QC documents. A copy of the transport document and manufacturers conformance certificate shall be attached to the material delivery on site.

1.6 Field Conditions

1.6.1 Project Environmental Requirements: Substrate and air temperature shall be in accordance with the manufacturers' requirements.

.1 Protect work area from windblown dust and rain. Protect adjacent areas from over spray of material.

.2 Provide ventilation in areas to receive work of this section during application and minimum 24 hours after application.

1.6.2 Temperature and Humidity Requirements: Maintain air temperature and relative humidity in areas where products will be applied for a time period before during and after application as recommended by manufacturer.

.1 Do not apply Fluid Applied Insulative Coating when temperature of substrate and/or surrounding ambient air temperature is below 7°C. Temporary protection and heat shall be maintained at this minimum temperature for 24 hours before, during and 24 hours after material application.

.2 Steel substrate temperature shall be a minimum of 3°C above the dew point of the surrounding air for a period of 24 hours prior, during the application of the material and 24 hour cure period.

.3 If necessary for job schedule, the General Contractor shall provide enclosures and heat to maintain proper temperatures and humidity levels in the application areas.

.4 The relative humidity of the application area shall not exceed a maximum of 85% 24 hours prior, during and 24 hours after the application of the material. The relative humidity shall not exceed 75% throughout the application and curing of the decorative top coat finish.

1.7 Warranty

1.7.1 Warrant work of this Section for a period of 24 months against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which became apparent within warranty period, to satisfaction of the Engineer and at no expense to the Owner. Defects include but are not limited to material and workmanship defects such as:

.1 Improper cleaning and preparation of surfaces.

.2 Entrapped dust and dirt.

.3 Material shrinkage, cracking, splitting and defective workmanship.

2 PRODUCTS

2.1 General

2.1.1 Contractor to prepare, repair, prime, coat, and seal stainless steel process piping as noted on the Contract Drawings per coating manufacturer’s recommendations.

2.2 Materials Compatibility

2.2.1 Provide shop and field primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.2.2 Provide products of same manufacturer for each coat in a coating system.

2.3 Approved Manufacturer

2.3.1 Products specified are manufactured by Tnemec Company Inc., 6800 Corporate Drive, Kansas City, Missouri 64120, 816-483-3400, www.tnemec.com, ist@tnemec.com, and are specified as a standard of quality.

2.4 Primers

2.4.1 Inorganic Hybrid Water-Based Epoxy:

.1 Tnemec Series 1224 Tnemec Epoxy

.1 Recommended DFT: 4.0 to 8.0 mils

2.5 Thermal Insulative Coating

2.5.1 Fluid-Applied Acrylic Insulative Coating

.1 Tnemec Series 971 Aerolon Acrylic

.1 Requirements:

.1 Abrasion (ASTM D4060): No more than 50.2 mg loss after 1,000 cycles.

.2 Cyclic Salt Fog/UV Exposure (ASTM D5894): No blistering, cracking, rusting or delamination of film after 5,000 hours.

.3 Humidity Resistance (ASTM D4585): No blistering, cracking, rusting, or delamination after 2,000 hours.

.4 Immersion (ASTM D870): No blistering, cracking, rusting, or delamination after six months continuous tap water immersion.

.5 Thermal Conductivity (ASTM C518): No greater than 0.0356 W/m-°K or 0.2468 BTU-in/ft2-hr-°F.

.6 NORSOK M-501 ISO 20340: Passed 25 cycles.

2.6 Topcoat

2.6.1 Aliphatic Acrylic Polyurethane

.1 Tnemec Series 1095 Endura-Shield

3 EXECUTION

3.1 Examination

3.1.1 Do not begin installation until substrates have been properly prepared.

3.1.2 If substrate preparation is the responsibility of another installer, notify Owner of unsatisfactory preparation before proceeding.

3.1.3 All surfaces to receive the specified Tnemec Series 971 Aerolon shall follow the manufacturer's printed instructions and be clean, dry and free of oil, grease, loose mill scale, dirt, dust or other foreign substances which would impair bond of the material to the substrate.

3.1.4 Verify that substrate and workspace temperature and humidity conditions are in accordance with manufacturers recommendations.

3.2 Surface Preparation

3.2.1 Prepare surfaces in accordance with manufacturer's instructions.

3.2.2 Provide masking, drop cloths or other suitable coverings to prevent overspray onto surfaces not intended to be coated with insulative coating.

3.2.3 Weld spatter and other defects shall be ground smooth prior to commencement of primer and fluid applied insulative coating.

3.2.4 Primer shall not be applied to prepared substrate until the area has been adequately vented to remove all airborne dust. Prior to the application of any coating material, the surface preparation by-products, dust and debris shall be removed by vacuuming.

3.2.5 Stainless Steel Substrates:

.1 Fabrication defects:

.1 Correct fabrication defects.

.2 Round sharp edges and corners of welds to a smooth contour.

.3 Smooth weld undercuts and recesses.

.4 Grind down porous welds to pinhole-free metal.

.5 Remove weld flux from surface.

.2 Pressure wash surfaces to remove visible oil, grease, dirt, dust, and loose corrosion products.

.3 Ensure surfaces are dry.

.4 Remove rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 2 or SP3.

3.3 Coating Application

3.3.1 Apply coatings in accordance with manufacturer's instructions.

.1 Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.

.2 Keep containers closed when not in use to avoid contamination.

.3 Do not use mixed coatings beyond pot life limits.

.4 Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

3.3.2 Uniformly apply coatings at spreading rate required to achieve specified Dry Film Thickness (DFT).

3.3.3 Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.3.4 Apply primer coat of Series 1224 at 4.0 to 8.0 mils DFT.

3.3.5 Apply Series 971 Aerolon Thermal Insulative Coating at a minimum 100 mils thickness with 2 or more coats of 40.0 to 50.0 mils DFT per coat using approved spray equipment.

3.3.6 Apply topcoat of Series 1095 in 1 or 2 coats, at 2.0 to 3.0 mils DFT per coat, to provide a sealed and continuous film.

3.3.7 Final DFT shall be measured with a dry film thickness gauge.

3.4 Coating Schedule

3.4.1 Condensation Reduction System for Treatment Plant Piping, Ferrous Substrates:

.1 Liquid Applied Insulative Coating System

.1 Surface Preparation: SSPC-SP2 or SP3 Hand and Power Tool Cleaning

.2 Primer: Tnemec Series 1224 at 4 to 8 mils (100 to 200 um)

.3 Insulation Coating: Tnemec Series 971 Aerolon Acrylic at 100 mils minimum DFT.

.4 Topcoat: Tnemec Series 1095 Endura-Shield at 2.0 to 3.0 mils DFT per coat in 1 coat minimum.

3.5 Repair

3.5.1 Materials and Surfaces Not Scheduled to Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

3.5.2 Damaged Coatings: All patching and repair to material, due to damage by other trades, shall be performed under this section and paid for by the trade responsible for the damage. Patching shall be performed by applicators certified by the manufacturer and applied in accordance with the manufacturer application instructions.

3.5.3 Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.6 Field Quality Control

3.6.1 Contractor's Required Field Quality Control:

.1 Verify coatings and other materials are as specified.

.2 Verify surface preparation and application are as specified.

.3 Verify DFT of each coat and total DFT of each coating system specified using wet film and dry film gauges.

.4 Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.

.5 Report:

.1 Submit written reports describing inspections made and actions taken to correct nonconforming work.

.2 Report nonconforming work not corrected.

.3 Submit copies of report to Engineer.

3.6.2 Manufacturer's Technical Services:

.1 Coordinate with coating manufacturer's technical service department or independent sales representative for current technical data and instructions.

.2 Arrange to have paint manufacturer's representative review work of this Section on a regular basis and prepare weekly reports. Submit a copy of the reports to the Engineer.

3.6.3 Field inspection of painting operations to be carried out by independent inspection firm as designated by Engineer.

3.6.4 Advise Engineer when each applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

3.6.5 Cooperate with inspection firm and provide access to all areas of the work.

3.6.6 Non-Conforming Work:

.1 Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction to Consultant at no cost to the Owner. Touch-up small affected areas, repaint large affected areas or areas without sufficient DFT of paint. Remove runs, sags, of damaged paint by scraper or by sanding prior to application of paint.

.2 Lack of uniformity – the following are considered non-conforming qualities:

.1 Streaks, laps, runs, sags, drips, hiding or shadowing by inefficient application methods, skipped or missed areas and foreign materials in paint coatings.

.2 Evidence of poor coverage at bolt heads, plated edges, lap joints, crevices, pockets, corners and re-entrant angles.

.3 Damage due to touching before paint is sufficiently dry or any other contributory cause.

.4 Damage due to application on moist surfaces or caused by inadequate protection from weather.

.5 Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.)

3.7 Cleaning

3.7.1 Remove temporary coverings and protection of surrounding areas and surfaces.

3.7.2 Clean and re-install all hardware items that were removed before undertaking painting operations.

3.7.3 Remove overspray and splatter, if any.

3.8 Protection of Coating Systems

3.8.1 Protect surfaces of coating systems from damage during construction.

3.8.2 Touch-up, or repair damaged products before Substantial Completion.

3.9 Disposal

3.9.1 Be responsible for removal and disposal of material and waste generated.

3.9.2 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

3.10 Warranty Inspection

3.10.1 Owner will set date for warranty inspection of coating systems prior to the expiration of the 24-month warranty period.

3.10.2 Inspection shall be attended by Owner, Contractor, and manufacturer's representative.

3.10.3 Repair deficiencies in coating systems as determined by Owner in accordance with manufacturer’s instructions.

END OF SECTION

DIVISION 11 – EQUIPMENT

Section No.	Title
11010	Equipment General Requirements
11010A	Equipment Schedule
11015	Installation of Pre-Purchased Equipment
11100	Miscellaneous Piping and Accessories Installation
11101	Piping, Valves and Fittings
11101S1	Valve Schedule
11170	Pipeline Pressure and Leakage Testing
11190	Pipe and Valve Supports
11530	Chemical Metering System and Storage
11540	Chemical Pipes, Valves and Fittings

1 GENERAL

1.1 Description

1.1.1 The work of this section covers the general requirements for the supply and installation of all process equipment and other works as specified herein and/or indicated on the Drawings.

1.2 Related Sections

1.2.1 Division 1 – General Requirements

1.2.2 Division 3 – Concrete

1.2.3 All Sections In Division 11

1.2.4 Division 13 - Instrumentation, Control & Scada

1.2.5 Specifications on M-101

1.2.6 Division 16 - Electrical

1.3 References, Standards and Codes

1.3.1 Wherever standards and regulations are mentioned, refer to the latest issues thereof at time of Tender.

1.3.2 The materials and workmanship employed in the manufacture of all equipment shall conform to the applicable standards established by the ASTM, AWWA, CEC, COSB and CSA. Canadian Standards shall take precedence over American Standards in the case of duplication or conflicting requirements.

1.3.3 All electrical motors and equipment shall be built to EEMCA (Electrical and Electronic Manufacturers' Association of Canada) standards with Canadian threads and bearings throughout and all motorized and electrical equipment shall be CSA approved or supplied in accordance with the rules and regulations of the local inspection authority and subject to its approval.

1.3.4 In case of conflicting specification requirements, the more stringent provisions shall apply.

1.3.5 Other references/standards as applicable:

.1 OSHA - Occupational Safety and Health Act

.2 Materials - conform to ASTM (American Society for Testing and Materials) and CSA (Canadian Standards Association) unless specified otherwise.

.3 Equipment - conform to ASME (American Society of mechanical Engineers) unless specified otherwise.

.4 Welding - conform to CSA (Canadian Standards Association). See, also, Part 3 herein for weld test examination requirements.

.5 CSA (Canadian Standards Association).

.6 Ontario Building Code.

.7 City and Provincial Codes/Standards.

.8 Others as may be applicable and as part of good engineering, design, fabrication practice.

1.4 General

1.4.1 Equipment installed under this section shall be erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

1.4.2 When pumping units are being installed, hydraulic considerations and definition of terms shall be as set forth in the Hydraulic Institute Standards.

1.4.3 Any equipment identified as being provided by others will be furnished complete for installation by the Contractor. Technical specifications under which the equipment will be purchased will be made available.

1.4.4 Any existing equipment that is to be removed shall be handled as specified and indicated on the contract drawings or within the specifications.

1.4.5 Provide all labour and materials, obtain all necessary permits and pay all fees as may be required.

1.4.6 If there is a discrepancy between the process, mechanical, electrical, instrumentation drawings and piping and instrumentation drawings (P&IDs), the P&ID shall take precedence for piping and valves design. If any items, cables or connections are missing, provide them at no extra costs as per the P&IDs. The electrical drawings shall dictate for the panel design. Any deviations from the Specifications or piping locations shown on the Contract Drawings require prior review and approval by the Engineer.

1.4.7 Small piping and valves, such as less than 80mm, may not be presented on the Contract Drawings. The Contractor shall provide all small piping and valves with supports as per P&IDs. No extra costs are allowed for those piping and valves shown on the P&IDs as the Contractor shall verify the size, location and length.

1.4.8 The equipment manufacturers shall provide anti corrosive coating on the system or equipment if those are not specified to be stainless steel products.

1.4.9 Flange connections shall be provided for different pipe materials.

1.4.10 The Manufacturer shall be assigned unit responsibility for coordinating, supplying, testing and commissioning of the individual equipment and their respective accessories as a complete package.

1.4.11 In case of conflicting specification or drawing requirements, the more stringent clause shall apply.

1.5 Coordination

1.5.1 The Contractor shall coordinate with the system and equipment manufacturers, the Vendor's installation and supply scope or work because the Contractor shall be responsible for the entire installation and commissioning.

1.5.2 If there is a discrepancy for the Vendor's supply scope or work shown on the process drawings, the Contractor shall provide all required piping, power cables and communication cables for the complete commissioning and controls.

1.5.3 Fully coordinate the work with all other specification sections. Use equipment specifications together with all electrical and controls specifications as necessary in order to produce a fully coordinated product meeting all necessary specifications.

1.5.4 When manufacturers field services are provided by the equipment manufacturer, the Contractor shall coordinate the services with the equipment manufacturer. The Contractor shall give the Engineer written notice at least 30 days prior to the need for manufacturer's field services furnished by others.

1.6 Submittals

1.6.1 In accordance with Section 01330 - Submittal Procedures.

1.6.2 Submit Shop Drawings for all electric motors together with respective equipment indicating motor dimensions and characteristics, including efficiency, power factor, insulation class and details of winding protection.

1.6.3 Submit Shop Drawings for all equipment in this Division, including relevant installation and fabrication details.

1.6.4 In addition to the requirements of Section 01330, submit the following specific information with shop drawings for each item of equipment specified in Division 11.

.1 Assembly drawings showing details of connections and terminations of equipment for connection by others.

.2 List of materials of construction, detailing the component parts and reference specifications (ASTM, CSA, ANSI, etc.).

.3 Motor operating data, including motor and insulation ratings, start-up and operating current ratings, operating voltage and amperage tolerances, and description of construction, complete with illustrative drawings.

.4 Gearbox and drive data, including AGMA/ABFMA ratings for components, materials of construction, tolerances, and description of construction.

.5 Control schematics, text, and wiring diagrams as required to describe control operations.

.6 Required ancillary services including, but not limited to electrical, non-potable water and drains.

.7 Installation instructions indicating assembly and mounting requirements, alignment and assembly tolerances, and point of connection for ancillary services.

.8 Start-up instructions including lubricant requirements, electrical requirements, etc.

.9 Details of coating systems to be applied.

.10 Details of insulation provided to prevent galvanic corrosion between mating surfaces constructed of dissimilar metals.

.11 A copy of the Contract Document mechanical layout drawings, control diagrams, and process and instrumentation diagrams, with addenda updates, that apply to the equipment marked to indicate special changes necessary for the supplied equipment. If no changes are required, mark the drawing(s) "no changes required".

.12 A copy of the related specification section with addenda updates, and all referenced sections with addenda updates, with each paragraph check-marked to show specification compliance or marked to show deviations.

1.6.5 Submit Operating and Maintenance Data for all equipment in this Division, in accordance with Section 01780 - Closeout Submittals.

1.7 Handling And Storage

1.7.1 Provide all necessary equipment, materials and labour to off-load equipment at the site. The methods employed for off-loading and handling must be to the satisfaction of the Engineer.

1.7.2 Before taking delivery of equipment, examine the equipment for any damage. Rectify damage to the equipment to the satisfaction of the Engineer or remove damaged material from the site.

1.7.3 If not required for immediate use, adequately store and protect all equipment against weather damage and theft. Store mechanical and electrical equipment as recommended by the manufacturer and to the satisfaction of the Engineer.

1.8 Factory Testing

1.8.1 Where witnessed factory testing is specified, the Supplier is to give 10 working days' notice of the date when equipment will be ready for testing. Confirmation of the test date and time is to be provided a minimum of five working days in advance of the tests. Equipment is not to be delivered to the site until factory testing has been satisfactorily completed.

1.8.2 When certified factory testing of the equipment or any component is specified, the supplier shall provide the Engineer with two copies of required certified test reports showing that the equipment complies with the Specification, before the equipment is delivered to site. Additional copies are required for the Maintenance Data Manuals.

1.9 Sleeves

1.9.1 Install pipe sleeves at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated on drawings.

1.9.2 Use schedule 40 steel pipe or approved equal for all sleeves.

1.9.3 Sleeves shall have puddle flange when they are installed in foundation walls and/or floor slabs on grade. The puddle flange material shall be same as the pipeline and welded directly to the pipe.

1.9.4 Provide a maximum 6 mm clearance all around between sleeve and uninsulated pipe or between sleeve and insulation.

1.9.5 Terminate sleeves flush with surface of concrete and masonry walls and concrete floors on grade and 25 mm above all other floors.

1.9.6 Fill voids around pipes as follows:

.1 Caulk between sleeve and pipe in foundations walls and below grade with waterproof, fire retardant non-hardening mastic or approved equal.

.2 Where sleeves pass through walls or floors provide space for fireproofing. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rated integrity.

.3 Ensure no contact between copper piping and ferrous sleeve.

1.10 Escutcheons

1.10.1 Install escutcheons on pipes passing through walls, partitions, floors and ceilings.

1.10.2 Use chrome, plated brass or stainless steel two piece type escutcheons mechanically secured to adjacent surface.

1.10.3 Outside diameter of escutcheons shall cover the opening of the sleeve.

1.10.4 The inside diameter of the escutcheon shall fit around the finished pipe.

1.11 Trial Usage

1.11.1 The Engineer and Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material and instruments required for testing.

1.12 Protection Of Openings

1.12.1 Protect equipment and systems from dirt, dust and other foreign materials with materials appropriate to the system.

1.13 Valve End Joints

1.13.1 Unless otherwise specified, valves 100 mm and larger in size shall be furnished with flange ends, faced and drilled to ANSI Standards for class 125 flanges with bolt holes straddling the vertical centerline.

1.14 Special Tools

1.14.1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01780 - Closeout Submittals.

1.15 Cleaning

1.15.1 Clean interior and exterior of all systems including piping, valves and strainers. Vacuum interior of ductwork and air handling units.

1.16 Spare Parts

1.16.1 Furnish all spare parts in accordance with Section 01330 -Submittals.

1.17 As-Built Information

1.17.1 Submit as-built information as per Section 01330 -Submittals.

1.18 Warranties And Bonds

1.18.1 Guarantee all equipment in accordance with Section 01780 - Closeout Submittals.

1.19 Measurement And Payment

1.19.1 The lump sums included in the Bid Form for each equipment section shall be deemed to include the cost of all equipment general requirements.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION

3.1 Delivery, Receiving and Storage of Equipment

3.1.1 Arrange with the suppliers for delivery of all items of equipment to the site of the work as required to meet the schedule.

3.1.2 Arrange for delivery of all anchor bolts, templates, embedded metals, and other materials required during the concreting placement and assembly of equipment.

3.1.3 Receive equipment at the site, unload and examine it upon arrival for damage or defects and be responsible for its safekeeping, storage and installation. Immediately notify the Engineer and the supplier of any damages or defects in the equipment delivered.

3.1.4 Special measures shall be taken to ensure that electrical motors do not suffer from moisture, dust, dirt or mechanical damage if stored or installed and inactive

3.1.5 Equipment storage, safekeeping and relocation of equipment from one area of the site to another, for whatever reason, shall be the sole responsibility of the Contractor from the time of initial off-loading at the site until the date of completion and acceptance by the Owner.

3.2 Time Of Completion

3.2.1 Delay in delivery of equipment or installation materials does not relieve the Contractor of the responsibility to complete the Contract within the agreed date for contract completion.

3.3 Manufacturers Services and Certification Of Installation

3.3.1 Provide for all necessary services and expenses of trained personnel representing the manufacturers of various pieces of specified equipment, to ensure correctness of installation and include any start-up costs required by suppliers necessary to ensure satisfactory installation, testing and commissioning of the equipment.

3.3.2 Provide all materials, labour and equipment necessary to make any adjustments to the installation as required by the manufacturer or the Engineer until the equipment is fully tested and commissioned.

3.3.3 On completion of installation and testing, obtain from the suppliers or the manufacturers concerned, certification that the equipment is installed correctly, is in full operational condition, and is operating in accordance with its design rating. Submit the original certificate to the Engineer and all copies necessary to comply with other submitted requirements. Certificates are to include a statement to the effect that any adjoining pipe is properly and independently supported and does not cause undue stress that would be detrimental to the equipment performance.

3.3.4 Co-ordinate the work of all equipment suppliers, fully commission all equipment and provide representatives from various manufacturers during plant testing and commissioning as required by the Engineer.

3.4 Acquaintance With Work

3.4.1 The Contractor shall be fully acquainted with all work involved in the complete installation of all equipment. At no time shall the Contractor make any claim that any misunderstanding existed in regard to the nature or amount of work to be done in relation to the installation, testing and commissioning of all specified equipment.

3.4.2 Obtain all necessary details from Equipment suppliers including dimensions and other information pertinent to the Work of this Contract.

3.5 Materials And Workmanship

3.5.1 Material and equipment is to conform to the latest edition of applicable standards in force at the time of tendering. In the case of any conflict between the Specifications with any standards, the more stringent of the two applies.

3.5.2 Provide materials and equipment in conformance with the following:

.1 First class in every respect.

.2 Constructed and finished in a workmanlike manner.

.3 Fully suitable for the service intended.

.4 Selected and fabricated to best engineering practice.

3.5.3 Furnish safety devices, including shear pins, flexible coupling guards, beltguards and other pertinent items with the equipment.

3.5.4 Install machinery such that working parts are readily accessible for inspection and repair, and each part is suitable for the service required.

3.5.5 Carefully pack and crate equipment for shipment. Protect polished and machined metal surfaces from corrosion and damage during shipment. Specially pack electrical equipment to prevent damage by moisture. Cover equipment having exposed bearings and glands to exclude foreign matter.

3.5.6 Equipment shall be designed by the manufacturer to have adequate strength, power and capacity for both continuous and intermittent service and have motors and other parts capable of starting and operating under any conditions or loading likely to occur under normal operating conditions.

3.5.7 Mechanical and electrical equipment and particularly gearings, contacts and other wearing parts shall be designed by the manufacturer to satisfy the need for long periods of operation without frequent maintenance or attention.

3.5.8 The manufacturer shall provide adequate and, as far as practicable, authentic means of lubrication for working parts. Arrange lubrication grease nipples, grease boxes and other lubrication devices so that they are readily accessible for routine greasing.

3.5.9 Indicate on the working Drawings submitted, the type of lubricants to be used (readily available in Canada). Use grease nipples of a consistent type (Alemite button head type or equivalent).

3.5.10 Make lubrication points readily accessible using grease nipples and Type 316 stainless steel extensions where required. Secure the nipples and tubing to the equipment at appropriate locations.

3.6 Special Tools and Accessories

3.6.1 Furnish a set of any special tools, wrenches and accessories required for removing worn parts, for carrying out maintenance and for making adjustments. Special tools are those tools which, because of their limited use or purpose-made design, are not normally readily available, but which are necessary for maintaining the equipment.

3.7 Temporary Supports

3.7.1 The design floor live loads are shown on the drawings. These loads shall not be exceeded.

3.7.2 Provide all necessary temporary supports and bracing to prevent the overloading of all floors and walls, while equipment is being installed. Ascertain the weights of all pieces of equipment from the manufacturer and move equipment into position in a manner and at a time approved by the Engineer.

3.7.3 Provide eye bolts or hooks for the safe handling of the equipment during installation. Eyebolts are to be left in place.

3.8 Lubricants, Grease, Oil and Fuel

3.8.1 Provide the complete initial lubrication of all equipment in accordance with the manufacturer's recommendations. Provide a complete schedule of all manufacturer's recommended lubricants. Fill grease, oil and fuel tanks, as required for the initial operation of the equipment.

3.8.2 All lubricants coming in contact with water (potable and non-potable) shall be NSF certified.

3.9 Small Piping

3.9.1 Supply and install all small connecting pipework, fittings and valves whether shown on the Drawings or not. Perform all such Work strictly in accordance with the instructions of the manufacturer whose equipment is being installed or connected.

3.10 Anchor Bolts

3.10.1 Unless otherwise specified, supply all stainless steel anchor bolts, such anchor bolts being of a diameter and size as recommended by the manufacturers of the equipment and machinery being installed. Generally use expansive type anchorages in setting small equipment. Set large equipment by means of bolts with sleeves cast into the concrete to a minimum depth of 150 mm. Elsewhere, cast in place anchor bolts may be used subject to the approval of the Engineer; these must be properly positioned by means of substantial templates.

3.11 Field Welding and Fabrication

3.11.1 Ascertain details of field welding and fabrication to be carried out for the erection and installation of the various items of equipment.

3.11.2 Fabricate the equipment in accordance with CSA Standard S16, Steel Structures for buildings and the manufacturer's instructions.

3.11.3 Have the welding shielded, conforming to CSA Standard W59.0, General Specifications.

3.12 Equipment Guards

3.12.1 Provide removable protective guards for all open rotating equipment including pulleys, belts, drives, shafts and couplings, etc.

3.12.2 Ascertain the extent of the work for the installation and/or the supply etc., of equipment guards by direct contact with the equipment suppliers.

3.13 Protection Of Equipment

3.13.1 After the equipment has been installed and prior to final acceptance, protect the equipment from damage. Ensure that protection measures are to the satisfaction of the manufacturer and the Engineer.

3.14 Testing And Commissioning

3.14.1 Unless otherwise specified, provide commissioning and start-up in accordance with Section 01810 - Testing and Commissioning.

3.14.2 Unless otherwise specified, furnish a certificate of final inspection and approvals from the electrical inspection authority to the Engineer.

3.15 Training

3.15.1 Unless otherwise specified, provide Demonstration and Training in accordance with Section 01820 - Demonstration and Training.

END OF SECTION

Item	Tag Number	Description	Process Function	Design Capacity / Footprint	Design Flow	Dynamic Head	Power Support (VAC/ph/Hz)	Specification Section	Drawing No.	Remarks
1	TBC by Veolia	HydraSand Mini	Microsand Feeding System	751 mm x 682 mm	9.6 m3/hr inlet domestic service water	85 PSIG for domestic service water	120V / 1 ph	11015	D-601	Supplied by Veolia
2	AB303	AERSHAFT Blower	Lamella plate air scour system process blower	10 HP, 1000 mm x 1100 mm	TBC by Veolia	TBC by Veolia	600V / 3 ph / 60 Hz	11015	D-601	Supplied by Veolia
3	TBC by Veolia	Hydrapol	Actiflo® Automated Polymer Mixing System	2328 mm (L) x 1512 mm (W) x 2517 mm (H)	TBC by Veolia	TBC by Veolia	600V / 3 ph / 60 Hz	11015	D-604	Supplied by Veolia
4	CL-101	Chlorinator #1	Chlorine gas addition to water for disinfection	100 lb/day, 2.0 kg/h rotameter	TBC	TBC	120V / 1 ph	11530	D-605	Supplied by Contractor
5	CL-301	Chlorinator #3	Chlorine gas addition to water for disinfection	100 lb/day, 2.0 kg/h rotameter	TBC	TBC	120V / 1 ph	11530	D-605	Supplied by Contractor
6	AMP01	Ammonium Sulphate Pump #1	Ammonium Sulphate Dosing	Min = 0.14 L/h, Max = 4.0 L/h	0.70 L/h	110 PSI	120V / 1 ph / 60 Hz	11530	D-606	Supplied by Contractor
7	AMP02	Ammonium Sulphate Pump #2	Ammonium Sulphate Dosing	Min = 0.14 L/h, Max = 4.0 L/h	0.70 L/h	110 PSI	120V / 1 ph / 60 Hz	11530	D-606	Supplied by Contractor
8	AMT01	Ammonium Sulphate Tank	Ammonium Sulphate Storage	1250 L (min)	N/A	N/A	N/A	11530	D-606	Supplied by Contractor
9	AMP03	Ammonium Sulphate IBC Transfer Pump	Ammonium Sulphate Storage Transfer Pump	1/2 HP	64 L/min	3 m	120V / 1 ph	11530	D-606	Supplied by Contractor

1 GENERAL

1.1 Scope

.1 The scope of this section includes the supply, delivery, unloading, storage, handling, installation, testing, start-up and commissioning, and warranty of the following pre-purchased equipment for the Deep River Water Treatment Plant (WTP):

.1 Lamella plates for each of the three (3) Actiflo® clarifiers.

.2 Lamella plate air scour system (AERSHAFT).

.3 Microsand Feeding System (HydraSand Mini).

.4 Actiflo® Automated Polymer Mixing System (Hydrapol).

.5 Programmable Logic Control (PLC) Actiflo® Control Panel.

.2 The Owner has entered into a separate contract with the equipment supplier for purchase of the pre-purchased equipment. The contract obligations are to be assumed by the Contractor, with execution of the respective novation agreements. The Contractor is to follow all manufacturer instructions.

.3 In general, the equipment supplier will provide the following work:

.1 Design, fabrication, supply, and delivery of the pre-purchased equipment.

.2 Inspection of installation and supervision of testing and commissioning of the pre-purchased equipment.

.4 In general, the Contractor shall provide the following work:

.1 Accepting and offloading of pre-purchased equipment at the Deep River WTP.

.2 Storing the equipment in accordance with manufacturer's instructions and assuming responsibility of relevant insurance for the pre-purchased equipment until the completion of this Contract.

.3 Installation of the pre-purchased equipment, including removal of existing equipment for equipment replacements (ex. lamella plates, Actiflo® Control Panel, polymer day tank).

.4 Service water, electrical, discharge piping connections for new equipment.

.5 Assume or ensure the performance bonding of the equipment suppliers is maintained.

.6 Assistance with initial operation, testing, and commissioning of the pre-purchased equipment.

.5 Review in detail the pre-purchased documents to determine the extent of responsibility of the equipment supplier.

.6 All work outside the requirements of pre-purchased equipment supply that is required for successful installation and operation of the pre-purchased equipment is the full responsibility of the Contractor.

.7 Consult with the equipment suppliers during the tender period regarding the intricacies of installation, the extent of work required, coordination requirements, etc., of all of the suppliers' equipment.

1.2 Submittals

.1 Shop drawings submitted by the equipment suppliers for the pre-purchased equipment were reviewed by the Engineer. Copies of the approved shop drawings are appended to the Contract Documents.

1.3 Storage of Equipment

.1 Assume the costs incurred from the date that the pre-purchased equipment is delivered to the Deep River WTP and maintain the equipment in proper storage, including insurance, for all the suppliers' equipment.

.2 After delivery, provide routine maintenance on all the suppliers' equipment as required by the equipment supplier from the date of earliest delivery to the time of initial start-up of the equipment.

1.4 Receiving Suppliers' Equipment into Storage

.1 If required, place suppliers' equipment into secure on-site storage or offsite storage in a bonded warehouse.

.2 Examine all shipments during offloading for damage and check against shipping papers to ensure that all parts, boxes, crates, bundles or items have been received. Do not unpack if not installed for use immediately.

.3 Unloading of the equipment shall be performed by the Contractor, at his expense, in accordance with the equipment manufacturers' written instructions and utilizing methods which will not damage the equipment. Contractor shall furnish all rigging necessary to unload the equipment.

.4 File a written claim for any damage or shortage immediately with the equipment supplier.

.5 Repair or replace all damage or shortages that may occur during the period of storage.

.6 Provide all necessary equipment and labour to move all items supplied by the equipment suppliers and stored at the Deep River WTP when equipment is ready for installation.

.7 Move equipment only according to the equipment suppliers' instructions and under the equipment suppliers' direct supervision.

.8 Provide surveillance to ensure no equipment is removed by other than the Contractor's forces nor damaged by vandalism.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION

3.1 Coordination of Pre-Purchased Equipment Contracts

.1 Review the contracts for supply of the pre-purchased equipment and coordinate all requirements with the requirements of this Contract.

3.2 Installation of Equipment

.1 Install equipment in accordance with the equipment manufacturers' written instructions and approved shop drawings.

.2 Provide all labour for installation of the equipment.

.3 Provide all necessary external piping, pneumatic and/or electrical connections and panels, where not supplied, to all the suppliers' equipment. Piping connections to be made to permit ready disconnection of equipment with minimum disturbance of adjoining piping and equipment and in accordance with manufacturer's instructions.

.4 Where instruments, ancillary equipment, control panels, receptacles, switches or other devices are supplied by the equipment suppliers, provide all piping, electrical and instrument wiring and connections required for the devices.

.5 Install equipment in accordance with the applicable Specification sections and Drawings of this Contract.

.6 Locate, level, and align all equipment and set all lines and levels of equipment to the accuracy required.

.7 Set, align and assemble equipment in conformance with the manufacturer's drawings or instructions. Runout tolerance by dial indicator method of alignment or other approved method shall be plus or minus 0.002 inches or as directed by the manufacturer, whichever is more stringent.

.8 Furnish all blocking, wedges, shims, filling pieces, or other materials required for the proper support and leveling of equipment during installation. Grind as required to bring parts to proper bearing after erection.

.9 Provide all anchor bolts required for installation of the equipment if such anchor bolts are not furnished by the equipment supplier. Anchor bolts and nuts shall be Type 316 stainless steel unless specified otherwise.

.10 Rotate rotating assemblies and all other moving parts a minimum of once per week to ensure proper lubrication and prevent "flat-spotting" of bearings.

.11 Apply an anti-seize compound to all threads in mechanical connections such as bolts, studs, cap screws, tubing, etc.

.12 Coating: Touch up all damage to finish paint caused during unloading, storage, handling, and installation of the equipment. Obtain matching coatings from manufacturer.

3.3 Workmanship

.1 Use proper tools for assembly of equipment and materials to prevent marring the surface of shafts, nuts or other parts.

.2 Tighten all connections requiring gaskets evenly all around to ensure uniform stress over the entire gasket area.

.3 Do not weld or burn any parts with machined surfaces except upon written permission of the Engineer.

3.4 Lubrication

.1 Lubricate equipment in accordance with the lubrication specifications and instructions provided by the manufacturer.

3.5 Start-Up, Operation and Commissioning

.1 Coordinate with the equipment suppliers for start-up, operation and commissioning services of the pre-purchased equipment in accordance with Section 01810, Commissioning, and Section 01820, Demonstration and Training.

3.6 Manufacturer's Services

.1 Manufacturer's representative shall provide onsite services as required to provide Manufacturer's Report and assist the Contractor in the equipment delivery, storage, installation, performance of all testing requirements, startup, and commissioning of the equipment as specified in the pre-purchased equipment tenders.

END OF SECTION

1 GENERAL

1.1 Scope

1.1.1 This section covers the installation of miscellaneous piping, miscellaneous steel, stainless steel, miscellaneous plastic, cast iron soil pipe, copper tubing, and accessories, located above grade or within building structures, including wall penetrations below grade to appoint 1.00 m beyond the exterior face of the structure, all as indicated on the drawings. Contractor shall furnish all necessary jointing materials, coatings, and accessories that are specified herein.

1.1.2 Pipe supports and anchors shall be furnished by Contractor and are covered in the pipe supports sections.

1.2 General

1.2.1 Materials installed under this section shall be installed in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the manufacturer, unless exceptions are noted by Engineer.

1.3 Submittals

1.3.1 Drawings and Data. Complete specifications, data, and catalogue cuts or drawings shall be submitted in accordance with the submittals section.

1.4 Quality Assurance

1.4.1 Tolerances. These tolerances apply to in-line items and connections for other lines.

.1 The general dimension, such as face-to-face, face or end-to-end, face- or end-to center, and center-to-center shall be 3 mm (1/8 inch).

.2 The inclination of flange face from true in any direction shall not exceed 4 mm per meter (3/64 inch per foot).

.3 Rotation of flange bolt holes shall not exceed 1.5 mm (1/16 inch).

1.5 Delivery, Storage, And Handling

1.5.1 Shipping shall be in accordance with the shipping section. Handling and storage shall be in accordance with the handling and storage section. All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.

1.5.2 Plastic pipe, tubing, and fittings shall be stored between 4°C and 32°C (40°F and 90°F).

1.5.3 Coated Pipe. Handling methods and equipment used shall prevent damage to the protective coating and shall include the use of end hooks, padded calipers, and nylon or similar fabric slings with spreader bars. Bare cables, chains, or metal bars shall not be used. Coated pipe shall be stored off the ground on wide, padded skids. Plastic-coated pipe shall be covered or otherwise protected from exposure to sunlight.

2 PRODUCTS

2.1 Service Conditions

2.1.1 Pipe, tubing, and fittings covered herein shall be installed in the services indicated in the various pipe sections.

2.1.2 Materials

Solder	Solid wire, ASTM B32, ANSI/NSF 61 certified, Alloy Grade Sb5, (95-5).
Soldering Flux	Paste type, ASTM B813.
Brazing Filler Metal	AWS A5.8, BCuP-5; Engelhard "Silvaloy 15", Goldsmith "GB-15", or Handy & Harman "Sil-Fos".
Brazing Flux	Paste type, Fed Spec O-F-499, Type B.
Insulating Fittings:	
Threaded	Dielectric steel pipe nipple, ASTM A53, Schedule 40, polypropylene lined, zinc plated; Perfection Corp. “Clearflow Fittings”.
Flanged	Epco “Dielectric Flange Unions” or Central Plastics “Insulating Flange Unions”.
Pipe Insulation	N/A
Watertight/Dust tight Pipe Sleeves	O-Z Electrical Manufacturing “Thruwall” and “Floor Seals”, or Thunderline “Link-Seals”; with modular rubber sealing elements, 2on-metallic pressure plates, and galvanized bolts.
Pipe Sleeve Sealant	Polysulfide or urethane, as specified in the Section 7900, Sealants
Anti-Seize Thread Lubricant	Jet-Lube “Nikal”, John Crane “Thred Gard Nickel”, Never-Seez “Pure Nickel Special”, or Permatex “Nickel Anti-Seize”.
Teflon Thread Sealer	Paste type; Hercules “Real-tuff”, John Crane “JC-30”, or Permatex “Thread Sealant with Teflon”.
Teflon Thread Tape	Hercules “Tape Dope” or John Crane “Thread-Tape”.
Solvent Cement:	
PVC Systems	ASTM D2564.
CPVC Systems	ASTM F493.
Primer, PVC Systems	ASTM F656.
Protective Coatings:	
Tape Wrap	ANSI/AWWA C209, except single ply tape thickness shall not be less than 30 mils [760 µm]; Protecto Wrap "200" or Tapecoat "CT".
Primer	As recommended by the tape manufacturer.
Coal Tar Coating	Medium consistency; Carboline "Bitumastic Super Service Black" or Tnemec "46-465 H.B. Tnemecol".

3 EXECUTION

3.1 Inspection

3.1.1 All piping components shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and recleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

3.2 Preparation

3.2.1 Field Measurement. Pipe shall be cut to measurements taken at the site, not from the drawings. All necessary provisions shall be made in laying out piping to allow for expansion and contraction. Piping shall not obstruct openings or passageways. Pipes shall be held free of contact with building construction to avoid transmission of noise resulting from expansion.

3.3 Installation

3.3.1 General. All instruments and specialty items shall be installed according to the manufacturer's instructions and with sufficient clearance and access for ease of operation and maintenance.

.1 Flat faced wrenches and vises shall be used for copper tubing systems. Pipe wrenches and vises with toothed jaws will damage copper materials and shall not be used. Bends in soft temper tubing shall be shaped with bending tools.

3.3.2 Pipe Sleeves. Piping passing through concrete or masonry shall be installed through sleeves that have been installed before the concrete is placed or when masonry is laid. Pipe sleeves installed through floors with a special finish, such as ceramic or vinyl composition tile, shall be flush with the finished floor surface and shall be provided with nickel or chromium plated floor plates. Unless otherwise indicated on the drawings, in all other locations where pipes pass through floors, pipe sleeves shall project not less than 25 mm [1 inch] nor more than 50 mm [2 inches] above the floor surface, with the projections uniform within each area. In the case of insulated pipes, the insulation shall extend through pipe sleeves. Where the drawings indicate future installation of pipe, sleeves fitted with suitable plastic caps or plugs shall be provided.

.1 Holes drilled with a suitable rotary drill will be considered instead of sleeves for piping which passes through interior walls and through floors with a special finish.

.2 Unless otherwise indicated on the drawings, all pipes passing through walls or slabs which have one side in contact with earth or exposed to the weather shall be sealed watertight with special rubber-gasketed sleeve and joint assemblies, or with sleeves and modular rubber sealing elements.

.3 Piping passing through locations as required shall be made dust tight and gastight with special rubber-gasketed sleeve and joint assemblies; with sleeves sealed with modular rubber sealing elements; or by caulking with oakum and polysulfide or urethane sealant.

3.3.3 Pipe Joints. Pipe joints shall be carefully and neatly made in accordance with the indicated requirements.

.1 Threaded. Pipe threads shall conform to ANSI/ASME B1.20.1, NPT, and shall be fully and cleanly cut with sharp dies. Not more than three threads at each pipe connection shall remain exposed after installation. Ends of pipe shall be reamed after threading and before assembly to remove all burrs.

.1 Threaded joints in plastic piping shall be made up with teflon thread tape applied to all male threads. Threaded joints in stainless steel piping shall be made up with teflon thread sealer and teflon thread tape applied to all male threads.

.2 Threaded joints in steel piping for chlorine service shall be made up with teflon thread tape or litharge and glycerine paste applied to all male threads.

.3 At the option of Contractor, threaded joints in other piping may be made up with teflon thread tape, thread sealer, or a suitable joint compound.

3.3.4 Compression. Ends of tubing shall be cut square and all burrs shall be removed. The tubing end shall be fully inserted into the compression fitting and the nut shall be tightened not less than 1 1/4 turns and not more than 1 1/2 turns past fingertight, or as recommended by the fitting manufacturer, to produce a leaktight, torque free connection.

3.3.5 Soldered and Brazed. Where solder fittings are specified for lines smaller than 50 mm [2 inches], joints may be soldered or brazed at the option of Contractor. Joints in 50 mm (2 inch) and larger copper tubing shall be brazed. Joints in copper chlorine tubing and refrigerant piping shall be brazed; solder will not be acceptable. Brazing alloy shall contain no tin.

.1 Surfaces to be joined shall be thoroughly cleaned with flint paper and coated with a thin film of flux. At each joint, tubing shall enter to the full depth of the fitting socket.

.2 Care shall be taken to avoid overheating the metal or flux. Each joint shall be uniformly heated to the extent that filler metal will melt on contact. While the joint is still hot, surplus filler metal and flux shall be removed with a rag or brush.

3.3.6 Solvent Welded. Solvent welded connections shall only be used for PVC or CPVC pipe. All joint preparation, cutting, and jointing procedures shall comply with the pipe manufacturer's recommendations and ASTM D2855. Pipe ends shall be beveled or chamfered to the dimensions recommended by the manufacturer. Newly assembled joints shall be suitably blocked or restrained to prevent movement during the setting time recommended by the manufacturer. Pressure testing of solvent welded piping systems shall not be performed until the applicable curing time, as set forth in Table X2.1 of ASTM D2855, has elapsed.

3.3.7 Flanged. Flange bolts shall be tightened sufficiently to slightly compress the gasket and effect a seal, but shall not be torqued less than the minimum value required by the gasket manufacturer. Flange bolts shall not be so tight as to fracture or distort the flanges. A plain washer shall be installed under the head and nut of bolts connecting plastic pipe flanges.

Anti-seize thread lubricant shall be applied to the threaded portion of all stainless steel bolts during assembly.

.1 Flange bolt holes shall be oriented as follows, unless otherwise indicated on the spool drawings:

.1 Vertical flange face: Bolt holes to straddle the vertical centerlines.

.2 Horizontal flange face: Bolt holes to straddle plant north-south centerlines.

.3 Pipe sealants, thread compounds, or other coatings shall not be applied to flange gaskets unless recommended by the gasket manufacturer for the specified service and approved by Engineer.

.4 Welds at orifice flanges shall have internal surfaces ground smooth to the pipe wall.

.5 Slip-on flanges shall be welded inside and outside. There shall be a distance of approximately 1.5 to 3 mm (1/16 to 1/8 inch) between the edge of the fillet weld and the face of the flange. The seal weld shall be applied so that the flange face shall be free of weld spatter and does not require refacing.

.6 Flat-faced flanges shall be used when mating to Class 125 flanges. Full face gaskets shall be used with flat-faced flanges and ring gaskets shall be used with raised faced flanges.

.7 Weld neck flanges shall be used with butt-weld fittings. The bore of weld neck flanges shall match the pipe wall thickness.

.8 Insulating joints connecting submerged (buried) piping to exposed piping shall be installed above the maximum water surface elevation and before the first pipe support not having coated anchor bolts or adhesive-bonded concrete anchors. All submerged (buried) metallic piping shall be isolated from the concrete reinforcement. Insulating flanges shall be tested for electrical isolation after installation and bolt-up but prior to introduction of conducting fluid.

3.3.8 Welded. Welding shall conform to the specifications and recommendations contained in the "Code for Pressure Piping", ANSI B31.1.

.1 Weld cross-sections shall be equal to or greater than the pipe wall thickness. Welds shall be smooth and continuous and shall have interior projections no greater than 1.5 mm [1/16 inch]. Backing strips or rings shall not be used except with specific prior review by Engineer as to use, material, and design. Root gap inserts that are completely melted and consumed in the weld bead are acceptable only when reviewed in advance by Engineer.

.2 Stainless steel welding shall be inert gas tungsten arc (TIG) or the direct current, straight polarity, inert gas metal arc process (MIG).

3.3.9 Grooved Couplings. Grooves for grooved couplings shall be cut with a specially designed grooving tool. Grooves cut in steel pipe shall conform to flexible grooving dimensions, as set forth in AWWA C606, and shall be clean and sharp without burrs or check marks.

3.3.10 Push on. Gasket installation and other jointing procedures shall be in accordance with the recommendations of the manufacturer. Each spigot end shall be suitably beveled to facilitate assembly. All joint surfaces shall be lubricated with a heavy vegetable soap solution immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean.

3.3.11 Rubber-Gasketed. Rubber-gasketed joints for hub and spigot type cast iron soil pipe shall have plain spigot ends, without beads. Cut ends of all pipe shall be cut square, beveled, and all burrs shall be removed. Spigot ends shall be coated with a lubricant recommended by the gasket manufacturer and fully seated in the gasket. Clamps for hubless cast iron soil pipe shall be installed in accordance with the manufacturer's recommendations.

3.3.12 Pipe. Pipe shall be installed as specified, as indicated on the drawings, or, in the absence of detail piping arrangement, in a manner acceptable to Engineer.

.1 Piping shall be installed without springing or forcing the pipe in a manner which would induce stresses in the pipe, valves, or connecting equipment.

.2 Piping shall be supported in conformance with the pipe supports section.

.3 Piping shall be connected to equipment by flanges or unions as specified in the pipe procurement sections. Piping connecting to equipment shall be supported by a pipe support and not by the equipment.

.4 A union shall be provided within 600 mm (2 feet) of each threaded-end valve unless there are other connections which will permit easy removal of the valve. Unions shall also be provided in piping adjacent to devices or equipment which may require removal in the future and where required by the drawings or the specifications.

.5 Water supply piping within structures shall be arranged, and facilities provided, for complete drainage. All piping serving metering equipment shall be uniformly graded so that air traps are eliminated, and complete venting is provided.

.6 Taps for pressure gauge connections on the discharge of pumping units shall be provided with a nipple and a ball type shutoff valve.

.7 Drilling and tapping of pipe walls for installation of pressure gauges or switches will not be permitted.

.8 In all piping except air and gas piping, insulating fittings shall be provided to prevent contact of dissimilar metals, including but not limited to, contact of copper, brass, or bronze pipe, tubing, fittings, valves, or appurtenances, or stainless steel pipe, tubing, fittings, valves, or appurtenances with iron or steel pipe, fittings, valves, or appurtenances. Insulating fittings shall also be provided to prevent contact of copper, brass, or bronze pipe, tubing, fittings, valves or appurtenances with stainless steel pipe, tubing, fittings, valves, or appurtenances.

.9 Piping adjacent to flow sensors shall be installed in accordance with the requirements of the manufacturer of the flow sensor and commonly accepted design practices of the appropriate straight pipe runs both upstream and downstream.

.10 Vents at all high points and drains at all low points in the piping that are required for complete draining for pressure test may not be shown on these drawings. Contractor

shall add such items as found to be necessary during detail piping design and/or piping installation.

3.3.13 Valves. Prior to soldering or brazing valves, teflon and elastomer seats and seals shall be removed to prevent damage.

.1 Isolation valves provided with equipment and instruments shall be located in a manner which will allow ease of access and removal of the items to be isolated.

3.4 Piping Assembly

3.4.1 General. Contractor shall only use labour that has been qualified by training and experience to capably perform the specified activities required to accomplish the work in a satisfactory manner

.1 If there is a conflict between the mechanical drawings and piping and instrumentation drawings (P&IDs), the P&ID shall take precedence. Any deviations from the Specifications or piping locations shown on the drawings require prior review and approval by Engineer.

3.4.2 Buttwelded Piping. The specification and qualification of weld joints and welders for buttwelded piping shall be in accordance with ASME Boiler Pressure Vessel Code, Section IX, Welding and Brazing. Weld procedure specifications (WPS) and procedure qualification reports (PQR) shall be submitted to Engineer for review and validation of joint design, efficiencies and strength before installation begins.

.1 Nondestructive examination (NDE) shall be in accordance with the ASME Boiler and Pressure Vessel Code, Section V, Nondestructive Examination. The minimum level of NDE shall be as follows:

.1 100 percent visual examination of welds by a qualified examiner (per ASME B31.1).

.2 Radiographic testing (RT) of 5 percent random sampling of welds.

.2 If the Contractor wants to use alternative techniques or intends to apply alternative methods considered equivalent to those indicated herein, a proposal on such techniques or methods shall be submitted in writing to Engineer for review and approval at least 14 days before intended date of use.

.3 Welding shall not begin until weld joint and welder qualification submittals have been reviewed and approved. NDE shall be performed before the pressure and leakage testing of the piping. Weld acceptance standards shall be in accordance with ASME B31.1, Chapter VI. If a weld fails the NDE, it shall be repaired, and the test repeated at no additional cost to the Owner.

3.5 Cleaning

3.5.1 The interior of all pipe, valves, and fittings shall be smooth, clean, and free of blisters, loose mill scale, sand, dirt, and other foreign matter when installed. Before being placed in service, the interior of all lines shall be thoroughly cleaned, to the satisfaction of Engineer.

3.6 Acceptance

3.6.1 OWNER reserves the right to have any section of the piping system which he suspects may be faulty cut out of the system by Contractor for inspection and testing. Should the joint prove to be sound, Owner will reimburse Contractor on a time and material basis as specified in the Contract. Should the joint prove to be faulty, the destructive test will continue joint by joint in all directions until sound joints are found. Costs for replacement of faulty work and/or materials shall be the responsibility of Contractor.

END OF SECTION

1 GENERAL

1.1 Intention of Section

1.1.1 This section covers the supply, delivery, and supervision of installation and commissioning of process valves, piping and fittings.

1.1.2 The term "Process Piping" includes pipes within or outside structures., used to convey water or air.

1.1.3 These systems are included in other sections of the Specifications.

1.1.4 The plans and specifications are intended to set the acceptable minimum and shall not be construed to relieve this Contractor of the responsibility of:

.1 Installing a complete and trouble-free system

.2 Good workmanship

1.1.5 All materials, coatings and lubricants shall be suitable for use with potable water.

1.2 References

1.2.1 ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.

1.2.2 ANSI B16.5, Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.

1.2.3 ANSI B16.20, Ring-Joint Gaskets and Grooves for Steel Pipe Flanges.

1.2.4 ANSI B18.2.1, Square and Hex Bolts and Screws.

1.2.5 ASTM A53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

1.2.6 ASTM A47M, Specification for Ferritic Malleable iron Castings.

1.2.7 ASTM A536, Specification for Ductile Iron Castings.

1.2.8 ASTM A120, Specification for Pipe, Steel, Black, and Hot-Dipped Zinc Coated, (Galvanized) Welded and Seamless, for Ordinary uses.

1.2.9 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

1.2.10 CSA B242, Groove and Shoulder type Mechanical Pipe Couplings.

1.2.11 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

1.2.12 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

1.2.13 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

1.2.14 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.2.15 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2.16 ANSI 150, ASTM D-1784, all PVC valves with classification 12454A.

1.2.17 AWWA C500, Metal Seated Gate Valves for Water Supply Service

1.2.18 AWWA C504, Rubber Seated Butterfly Valves.

1.2.19 AWWA C508, Swing Check Valves for Waterworks Service, 2 in. to 24 in. NPS

1.2.20 AWWA C509, Resilient Seated Gate Valves for Water Supply Service.

1.2.21 AWWA C510, Double Check Valve, Backflow Preventer Assembly.

1.2.22 AWWA C511, Reduced Pressure Principle Backflow Prevention Assembly.

1.2.23 AWWA C512, Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service

1.2.24 AWWA C542, Electric Motor Actuators for Valves and Slide Gates.

1.2.25 AWWA C550, Protective Epoxy Interior Coatings for Valves and Hydrants

1.2.26 AWWA C606, Grooved and Shouldered Joints

1.2.27 AWWA C800, Underground Service Line Valves and Fittings

1.3 Operating Conditions

1.3.1 The following site operating, and water quality conditions shall be assumed for all design calculations:

.1 40°C maximum/5°C minimum ambient air temperature.

.2 25°C maximum/1°C minimum water temperature.

.3 95% maximum relative humidity (non-condensing).

.4 7.5 - 9 water pH.

.5 Elevation ±118 meters above sea level.

.6 Chlorinated water to contain nominal chlorine residual at 1 to 2 mg/L.

.7 Disinfection of piping and valves prior start-up in this project and prior start-up of other possible future upgrade projects would require chlorine concentrations from 50 mg/L to 200 mg/L according to AWWA C653 procedures.

1.3.2 Refer to the Contract Drawings for further details.

1.4 Shop Drawings

1.4.1 Submit Shop Drawings, Samples and catalogue data to the Consultant for approval.

1.4.2 The shop drawing submission shall include, but not be limited to, the following:

.1 General dimensioned layout and materials list for all valves.

.2 Valve list showing valve torque requirements corresponding motorized operator torque capability.

.3 Summary list showing valve tag numbers, size type of operator, valve class, location, motorized operator number, pipe system including pipe schedule, materials.

.4 Submit Manufacture's catalogue literature indicating the bends, couplings, cocks, fittings, pipes, gaskets and other required materials.

.5 Grooved joint couplings and fitting shall be referred to on drawings and product submittals, and be identified by the manufacturer's listed model or series designation.

.6 Descriptive material in sufficient detail to show the general construction pertinent to the proper review.

.7 The Supplier shall indicate a list of spare parts, which would be recommended to purchase and individual prices for each item.

.8 All ancillary equipment to be provided by the Supplier shall be listed.

.9 Special accessories or tools for the adjustment or removal of parts required for any piece of equipment shall be listed and furnished as part of the supply.

1.4.3 Fabrication shall not commence until review of these drawings and data has been completed.

1.4.4 Provide maintenance data for incorporation into maintenance manual specified in Section 01780 - Closeout Submittals.

1.5 Measurement And Payment

1.5.1 Work outlined in this section is included in the lump sum tender price.

1.6 Shipment, Protection and Storage

1.6.1 Deliver valves and fittings to site using loading methods, which do not damage casings or coatings.

1.6.2 Clearly tag valves stating size, type, coatings, and mating parts.

1.6.3 Store on-site and inside protected from weather until ready for incorporation in the work using methods recommended by the manufacturer to prevent damage, undue stresses, or weathering.

2 PRODUCTS

2.1 Pipe - General

2.1.1 Supply all pipes and fittings of the materials, size, classes and types as shown on the Contract Drawings and as specified herein.

2.1.2 As the Contract Drawings may not present flange or coupling connections except for expansion joints, the Contractor shall determine the location of flange or coupling connections. Submit the shop drawing to present the connection type and locations.

2.1.3 The Contractor shall have the coupling and pipe suppliers review the entire pipeline and configuration with pipe supports and submit its review for the Engineer's approval. As per the coupling and pipe suppliers' recommendations, the pipe support locations and coupling/expansion joint type may be changed, but no extra cost to the Owner shall be permitted.

2.1.4 The Contractor shall install piping and valves as per P&IDs if the Process Design Drawings do not present any installation details or connections. No extra cost to the Owner shall be permitted.

2.2 Piping And Tubing

2.2.1 For all piping, tubing and accessories, design for operating pressures appropriate to the system at given locations. Select appropriate pipe classes and pressure/vacuum ratings.

2.2.2 Pipe shall be designed for 785 kPa (115 psi) working pressure not including any additional allowances for transient/surge pressures. Pipe design and reinforcement shall be provided in accordance with AWWA standards.

2.3 Stainless Steel Piping and Fittings

2.3.1 The stainless steel pipe and fittings to be applied to water main shall be Type 316L stainless steel ASTM A312, conforming to ANSI B36.19, Schedule 10S.

2.3.2 The wall thickness of piping system (including tees, elbows, flanges, lateral fittings, specials, couplings, etc.) shall be designed to withstand full vacuum and a working pressure of 785 kPa at 20°C. The pipe shall be carefully die-formed or rolled true to dimension and round within a tolerance plus or minus 1.5 mm. Ends of the pipe and fittings are to be perpendicular to the longitudinal axis.

2.3.3 All joints shall be welded by either Tungsten Inert Gas or Metal Inert Gas method. Pipe surfaces shall be smooth and even and the interior weld bead shall not be higher than 1.5 mm. The pipes shall be pickled by immersion in acid bath for removal of weld discoloration and iron pick-up. After pickling, the pipe and fittings shall be thoroughly washed with fresh clean water. All pipes shall be properly secured for shipment and marked in the shop for identification at job site. The exterior finish of the pipework shall be in accordance with the Manufacturer's recommendation unless otherwise noted herein.

2.3.4 Flanges for all pipe sizes - rolled type Van-Stones or rolled angle, thickness not less than thickness of pipe, with galvanized mild steel backing flanges to ANSI B16.5 Class 150 or Class 300. Place true and perpendicular to the axis. Fasten with bolts and nuts. Gaskets - 5 mm thick red rubber, cloth insert, full faced.

2.3.5 All grooved couplings and fittings shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

2.3.6 After the piping system has been installed and tested, the Contractor shall pickle wash the stainless steel piping system to remove weld discoloration and iron pickup. After pickling, the pipe and fittings shall be thoroughly washed with fresh clean water and inspected by the Engineer if deemed necessary by the Engineer, the Contractor may be instructed to repeat the entire pickle wash procedure.

2.3.7 Pipe couplings shall be provided as deemed necessary for expansion and/or maintenance purposes. Apply flexible coupling and fittings to the expansion loops to absorb thermal expansion/contraction within the couplings at the elbows.

2.3.8 Main anchors shall be installed at terminal points, major branch connections or changes of piping direction. Use anchors to direct movement away from or to protect critical changes in direction, bend, branch connections and structure. Spacing and types of supports shall be considered in accommodating anticipated axial movements.

2.3.9 The expansion joint design for all piping shall be provided by the Contractor. Submit shop drawings stamped by a Professional Engineer for the Engineer's review.

2.3.10 Provide 316L SS couplings, joints and other components where possible if the pipe material is of SS316L. Otherwise, provide epoxy coated components. Provide NSF 61 approved gaskets and 316L SS hardware.

2.3.11 Victaulic Style couplings shall be provided as shown in Contract Drawings.

2.3.12 Stainless steel bolts and nuts shall be used for flange connection between dissimilar material pipes.

2.3.13 The use of stainless steel piping is subject to the following:

.1 That all welding be done by certified welders.

.2 That the alignment of welds be true to prevent any bending stresses in the welds from the pipe joining.

.3 That minimum welding work is performed in the field.

.4 That shop drawings for the various pipe work systems are submitted for review.

.5 That all necessary joints shown on the Contract Drawings be included or as determined by the Engineer.

2.4 Drainage Pipe and Fittings

2.4.1 Provide work in accordance with requirements of Regulatory Agencies and conform to:

.1 Local and district by-laws, regulations and published engineering standards.

.2 The Ontario Building Code which includes Part 7 Plumbing.

2.4.2 Schedule 40 solvent weld rigid PVC drain, waste and vent pipe and fittings in accordance with CSA B181.2. PVC injection moulded fittings, solvent weld type ends.

2.5 Fasteners

2.5.1 Studs, nuts, and washers shall be best quality Type 304 stainless steel ASTM A193 Grade B-8, Class 2.

2.6 Stainless Steel Tubing

2.6.1 Stainless steel tubing shall be used for all process water piping unless otherwise shown on the drawings. The following piping systems shall be from stainless steel tubing:

.1 Instrumentation connections and sample lines.

.2 Water piping less than 50mm shown on the process drawings (samples, isolation piping of air release).

2.6.2 Stainless steel tubing shall be fully annealed Type 316 seamless hydraulic tubing to ASTM A269, A213 or equivalent. Tubing to be free of scratches and suitable for bending and flaring. Fittings must withstand a working pressure same as pipes, without leakage.

2.6.3 Approved Manufacturers:

.1 Swagelock

.2 Approved Equivalent.

2.7 Interior Finishes

2.7.1 General

.1 Provide products with factory applied coatings and finishes unless otherwise noted. Fittings and pipe of any one pipe system to be lined by the same manufacturer.

.2 Do not shop coat the internal surface of stainless steel or plastic piping.

.3 Provide standard mill finish for stainless steel pipe.

.4 Unless otherwise specified, finish fittings in the same manner as the pipe run.

2.8 Flanges

2.8.1 General requirements for flanges are as follows:

.1 Compatible flanges for mating to equipment or valves.

.2 Contractor will be responsible for ensuring compatible flanges.

2.8.2 Do not use slip-on flanges that are attached to a pipe by means of set screws and gaskets (uni-flange, etc.).

2.9 Gaskets

2.9.1 For flat faced flanges, use full-face gaskets. For raised-face flanges, use ring type gaskets. Conform to ASTM B16.21 and NSF60/61 for use in potable water systems.

2.9.2 Use gasket materials for flanged connections suitable for the temperature, pressure, and corrosiveness of the fluid conveyed in the pipeline.

2.9.3 Unless otherwise specified, minimum Gasket Material Thickness for full face gaskets:

.1 Greater than 75 mm pipe diameter, 3.2 mm thick.

2.10 Piping Schedule

2.10.1 The Pipe Schedule is included to assist the Tenderer. The schedule does not purport to be fully complete and the Tenderer is to refer to the Contract.

2.10.2 Process piping schedule is provided in the following table:

Service	Nominal Sizes (mm)	Exposure	Pipe Material	Operating Pressure (kPa)	Working Temp (°C)	Test Pressure (kPa)	PVC Insulation
Air Scour Piping	100mm	Exposed	316L SS	80	5 to 100	Per Section 11170	N/A
Microsand Feeding Piping	80mm	Exposed	316L SS	650	1 to 25	Per Section 11170	N/A
Discharge Treated Water Header Piping	450mm	Exposed	316L SS	620-750	1 to 25	Per Section 11170	N/A
Note: For pressure test, H = hydraulic test; P = pneumatic test.							

2.11 Valves

2.11.1 All potable water valves to be ANSI/NSF61 and NSF 372 approved and labelled.

2.11.2 All lubricants, epoxies, grease, etc. to conform to ANSI/NSF61.

2.11.3 Where there is an applicable AWWA recommended standard for the design, construction, and testing of a valve and/or actuator, equipment supplied under this section shall meet this standard in all regards unless otherwise specified herein. Where specifically requested, provide certificates of compliance with the applicable standards.

2.11.4 All valves 75mm or greater must have flanges as specified for the line into which they are to be installed, unless otherwise indicated by the Contract Drawings.

2.11.5 Ensure each valve and operator is of suitable construction and rating for the long term service with the fluid being conveyed and at the pressure and operating frequencies required by the relevant service.

2.11.6 Maximum required pull on a manual operator to open or close the valve must not exceed 356 N (80 lb force) as per AWWA C504. Manual operators must operate in a clockwise motion to close the valve.

2.11.7 Unless specified otherwise, supply all ferrous metal valves with a protective interior epoxy coating conforming to AWWA Standard C550 for Protective Interior Coatings for Valves and Hydrants and certified by the National Sanitation Foundation (NSF) to Standard 61. Provide the following additional information as identified in AWWA C550.

.1 Affidavit of compliance.

.2 Measurement of coating thickness.

2.11.8 Mark valves with size, pressure rating and manufacturer on a corrosion resistant nameplate mounted on the body.

2.11.9 Equip valves with a disc position indicator and a direction of flow indicator.

2.11.10 Provide tee wrench of steel pipe and tubing with socket for 50 mm square operating nut.

2.11.11 Operators must be capable of seating and unseating the valves and gates under the specified Design Water, Oil, Gas (WOG) pressure or unbalanced head.

2.11.12 Coating Application: 2 coats, 6 mils minimum dry film thickness per coat to manufacturer's instructions.

.1 Acceptable Coating Material:

.1 Carboline 891

.2 Approved equivalent

2.12 Valve Operators

2.12.1 General

.1 All valves shall be equipped with operators.

.2 The valve operator types, as specified herein, describe only the general characteristics of the operator.

.3 The operator shall be compatible with the valve with which it will be used and shall be of the same manufacturer, or a product that is recommended by the valve manufacturer.

.4 The operator shall be sized to operate the valve for the full range of pressures and velocities imposed by the service.

.5 All valve operators shall be opened by turning counter-clockwise

2.12.2 Manual Operators:

.1 Manual handwheel operators shall be provided unless otherwise shown or specified. Ferrous handwheels shall be galvanized and painted the same colour as the valve and

associated pipeline. Lever operators may be supplied on quarter-turn type valves 100mm and smaller, if recommended by the manufacturer; however, operator force shall not exceed initial breakaway.

.2 When the maximum force required to operate a valve under full operating head exceeds 175N (40 pounds), gear reduction operations shall be provided. Gear operators shall be totally enclosed and lubricated.

.3 On quarter-turn valves, the valve operators shall be of the self-locking type to prevent the disc or plug from creeping and shall be provided with position indicators to show the position of the valve disc or plug. Operators of the worm and gear type shall have self-locking worm gears, one-piece design, of bronze material, and accurately machine cut. The worm shall be hardened alloy steel, with thread ground and polished. Operators of the geared travelling nut type shall have threaded steel reach rods with an internally threaded bronze or ductile iron nut and equipped with adjustable stops.

.4 Valves located more than 1.8m (6 feet) above finish floor elevation shall be fitted with chain wheels and guides. Chain wheels and guides shall be galvanized or cadmium-plated. Chains shall be of the size recommended by the valve manufacturer and shall extend to within 1.2m (4 feet) of the operating floor. Where chains hang in normally travelled areas, appropriate "L" type tie-back anchors shall be provided and located as approved by the Engineer. Level type operators shall have some means of being fixed in any given position to prevent accidental movement; shall be of rugged, noncorrosive construction; and shall be fully compatible with the valve.

.5 Provide sufficient lubrication of all bearing gears and other moving parts. Lubricants shall be suitable for potable water.

.6 Cast an arrow with the word "OPEN" in a prominent location, readily visible to the operator, indicating the correct rotation of the handwheel to open (clockwise).

.7 Provide properly sized handwheels to suit the size of the valve, having a diameter of not less than 250 mm in diameter. Provide larger handwheels on valves greater than 1050 mm in diameter.

.8 Provide operators designed to withstand a force of up to 4000 N on the rim without damage.

.9 Provide carbon steel epoxy coated valve stem extension where additional clearance is required for pipe insulation, where valve operation without the extension is difficult, and in manholes.

.10 All stem extensions are sized for the maximum valve operating torque and deflection calculated to at less than 0.75 degrees.

2.12.3 Electrical Actuators:

.1 Refer to Section 11290 - Valve Electrical Actuator if applicable.

2.13 Butterfly Valves

2.13.1 Supply and install all butterfly valves as shown on the drawings and/or as specified herein.

2.13.2 Butterfly valves shall be of the short body rubber seated type, confirming to the latest revision of AWWA C504. Valves shall be bubble tight at the rated pressure and shall be suitable for both throttling and on/off isolation service. Provide an affidavit of compliance with applicable provisions of AWWA Standard C504 and with the supplementary specifications of this section.

2.13.3 Design butterfly valves for installation in any orientation and with valve stem either horizontal or vertical.

2.13.4 Shop Testing: Certified copies of reports describing the procedures and results of the performance test, leakage test and hydrostatic test for each unit must be submitted to the Consultant.

2.13.5 Provide butterfly valves manufactured to AWWA C504 - Class 150B Standards.

2.13.6 Valve body shall be of ductile iron construction, ASTM A536 Gr. 65-45-12.

2.13.7 Valve discs shall be of ductile iron, ASTM A536, Gr. 65-45-12.

2.13.8 Valve shall be rated for bi-directional shutoff up to 1034 kPa (150 psi).

2.13.9 Valve shafts shall be of solid 304 stainless steel corresponding to the design requirements of the latest revision of AWWA C504. The shafts shall be fastened to the disc by stainless steel designed to provide vibration-proof connection.

2.13.10 Seats and shaft packing shall be of Buna-N. Design valve seats to provide tight shut off at a pressure differential across the valve equal to the rated pressure. Valve seats can be installed on the body or on the disc. For valve sizes 600mm and larger, valve seats shall be adjustable as per AWWA C504 standards. The mating seat surface to be of ANSI 304 or 316 stainless steel. Valve seats must be suitable for end of line installation. Alternately, provide retaining flanges.

2.13.11 Shaft bearings shall be of the self-lubricating corrosion resistant sleeve type designed for both horizontal and vertical shaft loading.

2.13.12 Valve ends must have flanged ends conforming in dimension to ANSI B16.5, Class 150 ductile iron flanges and must be flat faced.

2.13.13 Valves shall be hydrostatically tested for bubble tight shutoff in accordance with the latest revision of AWWA C504.

2.13.14 Interior and exterior surfaces of all butterfly valves shall be fusion bonded epoxy coating or two-part liquid epoxy coating meeting NSF 61.

2.13.15 Unless otherwise indicated, valves shall be provided with handwheel operated manual gear actuators suitably selected for the torque requirements outlined in Table 4 of AWWA C504.

2.13.16 Provide gear ratios in the operator so that the force exerted on the rim of the wheel does not exceed 356 N as per AWWA C504 except for seating and unseating the butterfly valve

2.13.17 Acceptable Suppliers

.1 Val-Matic

.2 DeZurik

.3 Pratt

.4 Approved Equivalent.

2.14 Silent Globe Check Valve

2.14.1 Supply and install silent globe check valves as shown on the drawings and/or as specified herein. The sizes and locations are as shown on the Contract Drawings.

2.14.2 The Silent Globe Check Valve shall be of the silent operating type that begins to close as the forward flow diminishes and fully closes at zero velocity preventing flow reversal and resultant water hammer.

2.14.3 Design valves in accordance with the following:

.1 Ductile Iron - ASTM 536 65-45-12.

.2 Disc and seat: 304 Stainless Steel - SS ASTM A276 T304.

.3 Spring: 316 Stainless Steel; stone tumbled and stress relieved - SS ASTM A276 T16.

.4 EPDM seat and helical, stone-tumbled stainless steel center-guided spring

.5 Valve disc shall be centre guided at both ends with an integral shaft and shall be spring loaded for silent operation

.6 The seat and disc shall be replaceable in the field

.7 Valve to close drip-tight preventing flow reversals

.8 Fusion bonded epoxy coating or two-part epoxy coating lined interior and exterior meeting NSF61.

.9 Acceptable manufacturer:

.1 Pratt

.2 Cla-Val

.3 Approved Equivalent.

2.15 Ball Valve (On Water Lines)

2.15.1 Supply and install ball valves as shown on the Contract Drawings and/or as specified herein. Ball valves are used for drain valves, sampling valves, isolation valves of air release and tap water valves.

2.15.2 Valves

.1 Stainless steel 3-piece, full port threaded ball valves, pressure rating 150 psi.

.2 Shop Testing: Certified copies of reports describing the procedures and results of the performance test, leakage test and hydrostatic test for each unit must be submitted to the Consultant.

.3 Valve must be suitable for potable water application.

.4 Materials:

.1 Valve body: stainless steel to ASTM A351-CF8M

.2 Seats and seals: RPTFE

.3 Ball: Type 316 stainless steel

2.15.3 Acceptable Manufacturers:

.1 Apollo 85R-100 Series

.2 Trueline

.3 Pinnacle

.4 Approved Equivalent.

3 EXECUTION

3.1 Preparation

3.1.1 Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.

3.1.2 Make all minor modifications to suit installed equipment and structural element locations and elevations.

3.1.3 Piping arrangements indicated on the drawings have been established on the basis of the "Design Standard" listed in the specific process equipment sections. If the equipment to be provided is not the Design Standard, at no additional expense to the Town, modify the piping arrangement as necessary.

3.1.4 Advise the Engineer of all modifications. Do not commence work on the related piping until all modifications have been reviewed by the Engineer.

3.1.5 Include any piping modifications in the shop drawings submitted prior to fabrication or installation.

3.2 Handling

3.2.1 Inspect each pipe and fitting prior to installation. Do not install damaged pipe or pipe with damaged protective coatings.

3.2.2 Remove all foreign matter from inside of pipe prior to installation.

3.2.3 Repair pipe with damaged protective coatings with material similar to the original in accordance with the manufacturer's directions and to the satisfaction of the Engineer.

3.2.4 Use proper implements, tools, and facilities for the proper protection of the pipe. Exercise care in the installation so as to avoid damage to pipe or coatings.

3.3 Installation

3.3.1 Fabricate and install pressure piping in accordance with the ASME B31.1 pressure vessel code and the Ontario Power Engineers and Boiler and Pressure Vessel Safety Act and Regulations.

3.3.2 Make adequate provisions in piping and pipe support systems for proper slope and anchorage.

3.3.3 Install pipe support system to adequately secure the pipe and to prevent undue vibration, sag or stress.

3.3.4 Provide temporary supports as necessary during construction to prevent overstressing of equipment, valves or pipe.

3.3.5 Accurately cut all piping for fabrication to field measurements.

3.3.6 Install pipes in straight alignment. Do not exceed 10 mm in 10 m variance from the true alignment, in any direction. Fabricate and assemble pipe runs so that the pipework is not stressed to achieve the desired alignment and that no stresses are transferred to equipment or equipment flanges. The "springing" of pipework to ensure alignment is not permitted. Undo and subsequently remake all pipework connections to ensure that springing does not occur. Take care not to damage equipment, valves or flanges.

3.3.7 Slope instrument air piping to condensate traps. Provide condensate traps as recommended by the manufacturer of the instrument air compressor.

3.3.8 Do not cut or weaken the building structure to facilitate installation.

3.3.9 In parallel pipe runs, offset flanges and/or grooved joint fittings by a minimum of 200 mm.

3.4 Sizing

3.4.1 Supply and install pipes, valves and other fittings according to the sizes and pressure ratings as indicated in this specification and on drawings. Where sizes are not clearly indicated, obtain sizes from the Consultant before proceeding with the work.

3.5 Stainless Steel Welding

3.5.1 Conform to reviewed stainless steel pipe welding procedures, which have been stamped and signed by a Professional Engineer registered in the Province of Ontario, hired by the Contractor.

3.5.2 For all stainless steel pipe intended to convey liquids, use inert gas backing for field and shop welds. For these services, solar flux will not be allowed.

3.6 Passivation

3.6.1 Passivate all stainless steel welds after completion.

3.6.2 Use acid pickling. A pickling paste may be used with the Engineer's approval.

3.6.3 As appropriate, neutralize and/or rinse the joint after passivation.

3.7 Pressure Testing

3.7.1 Give 24 hour written notice of date of tests.

3.7.2 Do not insulate or conceal work until piping systems are tested and accepted.

3.7.3 Conduct all tests in the presence of the Consultant.

3.7.4 Bear all costs of testing including retesting and making good.

3.7.5 Maintain test pressures for at least 4 hours unless otherwise specified.

3.7.6 Piping to be tested to specified test pressure. Leakage from pipes will be zero. No loss of pressure will be accepted.

3.7.7 If leaks are detected in the pipe or any of the appurtenances connected thereto, make any necessary repairs and retest.

3.7.8 Prior to tests, isolate all equipment or other parts that are not designed to withstand test pressures.

3.8 Flushing And Disinfection

3.8.1 Flush process pipe work with clean water when installation work is completed. Repeat this procedure as necessary to ensure removal of all unwanted matter from the system.

3.8.2 Disinfect lines intended for potable water service after testing in accordance with AWWA C651 and C653.

3.9 Storage

3.9.1 Prior to the installation the piping, valves, fittings and accessories shall be protected and stored indoors in a dry area, in accordance with the Manufacturer's recommendations.

END OF SECTION

Item	Equipment Tag	Description	Valve Type (1)	Size (mm)	Service (2)	Specification Sections	Actuator Type (3)	SCADA Monitored?	Drawing No.	Remarks
1	BV-101	Actiflo #1 Microsand Feeding Isolation Valve	BV	80	ISV	11101	HW	No	D-601	Supplied by Contractor
2	BV-201	Actiflo #2 Microsand Feeding Isolation Valve	BV	80	ISV	11101	HW	No	D-601	Supplied by Contractor
3	BV-301	Actiflo #3 Microsand Feeding Isolation Valve	BV	80	ISV	11101	HW	No	D-601	Supplied by Contractor
4	CV-101	Microsand Feeding Discharge Check Valve	CV	80	CV	11101	N/A	No	D-601	Supplied by Contractor
5	BFV-102	Actiflo #1 Air Scour Actuated Isolation Valve	BFV	100	ISV	11101	SE	No	D-601	Supplied by Veolia
6	BFV-103	Actiflo #1 Air Scour Manual Isolation Valve	BFV	100	ISV	11101	HW	No	D-601	Supplied by Veolia
7	BFV-202	Actiflo #2 Air Scour Actuated Isolation Valve	BFV	100	ISV	11101	SE	No	D-601	Supplied by Veolia
8	BFV-203	Actiflo #2 Air Scour Manual Isolation Valve	BFV	100	ISV	11101	HW	No	D-601	Supplied by Veolia
9	BFV-302	Actiflo #3 Air Scour Actuated Isolation Valve	BFV	100	ISV	11101	SE	No	D-601	Supplied by Veolia
10	BFV-303	Actiflo #3 Air Scour Manual Isolation Valve	BFV	100	ISV	11101	HW	No	D-601	Supplied by Veolia
11	BFV-530	Treated Water Discharge Isolation Valve	BFV	450	ISV	11101	HW	No	D-603	Supplied by Contractor
12	AMT01_VLV01	Ammonium Sulphate Storage Tank Discharge Isolation Valve	BV	50	ISV	11540	HW	No	D-606	Supplied by Contractor
13	AMP01_INV01	Ammonium Sulphate Pump #1 Suction Isolation Valve	BV	50	ISV	11540	HW	No	D-606	Supplied by Contractor
14	AMP01_DSV01	Ammonium Sulphate Pump #1 Discharge Isolation Valve	BV	50	ISV	11540	HW	No	D-606	Supplied by Contractor
15	AMP02_INV01	Ammonium Sulphate Pump #2 Suction Isolation Valve	BV	50	ISV	11540	HW	No	D-606	Supplied by Contractor
16	AMP02_DSV01	Ammonium Sulphate Pump #2 Discharge Isolation Valve	BV	50	ISV	11540	HW	No	D-606	Supplied by Contractor
17	AMP00_PSV01	Ammonium Sulphate Pump Discharge Pressure Sustaining Valve	PSV	15	PSV	11540	N/A	No	D-606	Supplied by Contractor
18	AMP00_DRV01	Ammonium Sulphate System Drain Valve	BV	15	DV	11540	HW	No	D-606	Supplied by Contractor

Notes:

1) Valve type:

BV	Ball Valve
BFV	Butterfly Valve
CV	Check Valve
KGV	Knife Gate Valve
GV	Gate Valve
PRV	Pressure Relief Valve
ARV	Air Relief Valve
PSV	Pressure Sustaining Valve

2) Service:

ISV	Isolation Valve
CV	Check Valve
MOV	Motorized Valve
RV	Relief Valve
PSV	Pressure Sustaining Valve
DV	Drain Valve

3) Actuator: **Related Section 11290 for Electric**

HW	Hand Wheel Actuator
SE	Standard Electric Actuator
ME	Modulating Electric Actuator

1 GENERAL

1.1 Scope

1.1.1 This section covers field hydrostatic pressure and leakage testing of all process piping. The term "piping" shall be used in this section to refer to piping systems, pipelines, or sections thereof.

1.1.2 Testing of other piping is covered in the miscellaneous piping section.

1.2 General

1.2.1 Contractor shall contact applicable regulatory agencies to determine if any special procedures or permits are required for disposal of water used for pressure and leakage testing and to identify acceptable locations for disposal of the water. All requirements and costs associated with notifications and obtaining any discharge permit or approvals shall be responsibility of Contractor.

1.2.2 Engineer or Engineer's representative shall be present during testing and shall be notified of the time and place of testing at least three (3) days prior to commencement of the work. All work shall be performed to the satisfaction of Engineer.

1.2.3 Testing Schedule and Procedure. A testing schedule and test procedure shall be submitted to Engineer for review and acceptance not less than 21 days prior to commencement of testing. The schedule shall indicate the proposed time and sequence of testing of the piping. The testing procedure shall establish the limits of the piping to be tested, the positions of all valves during testing, the locations of temporary bulkheads, and all procedures to be followed in performing the testing.

1.2.4 Special Testing Requirements. Special testing requirements shall be as follows:

.1 Unless otherwise acceptable, during testing of the pipeline, all valves shall be in the open position.

.2 Unless otherwise acceptable, temporary bulkheads shall be provided during testing so that the test pressures are not applied to existing or new valves and hydrants, or to existing water lines, or to any portion of water lines installed under this Contract that have already been put into service.

1.2.5 Water for testing shall be furnished as stipulated in the temporary utilities section. Following completion of testing, the water shall be disposed of in a manner acceptable to Engineer. Unless otherwise permitted, the water shall be kept out of the remainder of the piping.

2 PRODUCTS

2.1 Test Equipment

2.1.1 All necessary connections between the piping to be tested and the water source, together with pumping equipment, flow meter, pressure gauges, and all other equipment, materials, and facilities required to perform the specified tests, shall be provided. All required flanges, valves, bulkheads, bracing, blocking, and other sectionalizing devices shall also be provided.

All temporary sectionalizing devices shall be removed upon completion of testing. Vents shall be provided in test bulkheads where necessary to expel air from the piping to be tested.

2.1.2 Test pressures shall be applied by means of a force pump sized to produce and maintain the required pressure without interruption during the test.

2.1.3 Flow meters and pressure gauges shall be accurately calibrated and shall be subject to review and acceptance by Engineer.

2.1.4 Permanent gauge connections shall be installed at each location where test gauges are connected to the piping during the required tests. Drilling and tapping of pipe walls will be permitted as required. Upon completion of testing, each gauge connection shall be fitted with a removable plug or cap acceptable to Engineer.

3 EXECUTION

3.1 Filling And Venting

3.1.1 Before filling the piping with water, care shall be taken to ensure that all air release valves and other venting devices are properly installed and in the open position. Hand operated vent valves shall not be closed until an uninterrupted stream of water is flowing from each valve. The rate of filling the piping with water must not exceed the venting capacity of the installed air vent valves and devices.

3.2 Station Piping Leakage

3.2.1 All station piping shall be watertight and free from leaks. Each leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

3.3 Blocking

3.3.1 Piping shall be adequately blocked, anchored, and supported before the test pressure is applied.

3.4 Pressure Testing

3.4.1 After the piping to be tested has been filled with water, the test pressure shall be applied and maintained without interruption within plus or minus five (5) percent of test pressure for two (4) hours plus any additional time required for Engineer to examine all piping being tested and for Contractor to locate any defective joints and pipe materials

3.4.2 The test pressure shall be in accordance with the requirements specified for pipeline or plant piping.

.1 Pipeline Test Pressure. Unless otherwise noted, piping shall be subjected to a hydrostatic test pressure as indicated in the specific piping sections, or as indicated below.

.1 The test pressure, expressed in metres (ft) of water, to be applied at any point in the piping shall be equivalent to the arithmetic difference between the specified test pressure plane elevation and the elevation of the horizontal centre line of the piping at the selected location.

.2 The value obtained shall be multiplied by 1.423 to obtain psi [9.806 to obtain kPa].

3.4.3 Plant Piping Test Pressure. Unless otherwise noted, piping shall be subjected to the test pressure as indicated in the specific piping sections, as indicated in the piping schedule at the end of this section, or 1.5 times the rated working pressure

3.4.4 All specified tests shall be made by and at the expense of the Contractor in the presence, and to the satisfaction, of the Engineer. Piping shall be tested at the following pressures:

Service	Pipe Material	Test Medium	Test Pressure (kPa)
Microsand Feeding Piping	SS	Water	1035 (150 psi)
Service Water	SS	Water	1035 (150 psi)
Air Scour Piping	SS	Air	345 kPa (50 psi)

3.4.5 Compressed air or pressurized gas shall not be used for testing plastic piping.

3.4.6 Leakage may be determined by loss-of-pressure, soap solution, chemical indicator, or positive and accurate method acceptable to the Engineer.

3.4.7 All fixtures, devices, or accessories which are to be connected to the lines and which would be damaged if subjected to the specified test pressure shall be disconnected and the ends of the branch lines plugged or capped as required during the testing.

3.4.8 Unless otherwise required by the applicable codes, drainage and venting systems shall be tested with compressed air. Openings shall be plugged as necessary, and the system shall be charged with air to a minimum pressure of 35 kPa [5 psi]. To be considered free of leaks, the system shall hold the air for 30 minutes without any drop-in pressure.

3.4.9 All necessary testing equipment and materials, including tools, appliances and devices, shall be furnished and all tests shall be made by and at the expense of the Contractor and at the time directed by the Engineer.

3.4.10 All joints in piping shall be tight and free of leaks. All joints which are found to leak, by observation or during any specified test, shall be repaired, and the tests repeated.

3.4.11 After pipeline pressure and leakage testing, water inside the pipeline shall be completely drained.

3.5 Pipeline Leakage Testing

3.5.1 Following completion of pressure testing and acceptance by Engineer, the pipeline piping shall be subjected to a leakage test. The duration of the leakage test shall be two (2) hours.

3.5.2 Leakage Test Pressure. The hydrostatic pressure during the leakage test shall be maintained between 100 and 105 percent of the pressure specified for pressure testing of the piping, for the entire duration of the leakage test.

3.5.3 No visible leakage will be accepted.

END OF SECTION

1 GENERAL

1.1 Scope

1.1.1 This section covers the furnishing and installation of pipe hangers, brackets, and supports. Pipe supports shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, and other accessories.

1.1.2 This section also covers the spacing of expansion joints in piping systems. Expansion joint products and materials are covered in the respective piping sections.

1.1.3 Concrete and fabricated steel supports shall be as indicated on the drawings, as specified in other sections, or, in the absence of such requirements, as permitted by Engineer.

1.2 General

1.2.1 In certain locations, pipe supports, anchors, and expansion joints have been indicated on the drawings, but no attempt has been made to indicate every pipe/valve support, anchor, and expansion joint. It shall be Contractor's responsibility to provide a complete system of the supports, to provide expansion joints, and to anchor all piping, in accordance with the requirements specified herein. Additional pipe supports may be required adjacent to expansion joints, couplings, valves and scum piping.

1.2.2 There may not be instrument supports indicated on the contract drawings, but the Contractor shall provide all required stainless steel supports for the instruments. Submit the shop drawings for the Engineer's review and approval.

1.2.3 The pipe supports shown on the Contract Drawings are typical details. The Contractor may propose alternative pipe supports or hangers, but no extra cost shall be allowed for the changes. The alternative shall be reviewed by the Engineer.

1.2.4 Piping support system components shall comply with specified piping code requirements.

1.2.5 Abbreviations: Reference to standards and organizations in this section shall be as indicated by the following designations:

.1 AISI American Iron and Steel Institute

.2 ANSI American National Standards Institute

.3 ASTM American Society for Testing and Materials

.4 MSS Manufacturers Standardization Society of Valve and Fitting Industry

1.2.6 General Equipment Requirements: The General Equipment Requirements shall apply to all equipment provided under this section.

1.2.7 Pipe hanger or guide shall not be used for a fixed point pipe support.

1.2.8 The Contractor shall provide the detailed piping layout as the shop drawings stamped by a professional engineer licensed to practice in Ontario who shall coordinate with the expansion

manufacturer coupling installation with the coupling manufacturer. Present the fixed and sliding pipe supports locations with couplings on the layout.

1.3 Submittals

1.3.1 Complete data and catalog cuts or drawings covering fabricated pipe supports, fabricated inserts, and stainless steel, galvanized, and copper and plastic coated pipe supports shall be submitted in accordance with the submittals section.

1.3.2 Data shall include a listing of the intended use and general location of each item submitted.

2 PRODUCTS

2.1 Materials

2.1.1 Unless otherwise indicated, all pipe supports shall comply with ANSI/MSS SP 58 and MSS SP 69. Materials of construction for fabricated steel supports are covered in the structural and miscellaneous metals section. All pipe support materials shall be packaged as necessary to ensure delivery in satisfactory condition.

2.1.2 Unless otherwise specified or indicated on the drawings, pipe supports shall be fabricated of manufacturer's standard materials and provided with manufacturer's standard finish.

2.1.3 Design loads for inserts, brackets, clamps, and other support items shall not exceed the manufacturer's recommended loads.

2.1.4 Pipe supports shall be manufactured for the sizes and types of pipe to which they are applied. Strap hangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item. Continuously threaded rod is not acceptable for hanger rods over 12 inches [300 mm] in length.

2.1.5 Unless otherwise acceptable to Engineer, the use of supports which rely on stressed thermoplastic components to support the pipe will not be acceptable.

2.1.6 Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Supports for brass or copper pipe or tubing shall be copper plated. Portions of pipe supports which come into contact with other metals that are dissimilar shall be rubber or vinyl coated.

2.1.7 Stainless steel supports shall be furnished unless otherwise specified, and shall be AISI Type 316 stainless steel. Stainless steel supports fabricated by welding shall be AISI Type 316L.

2.1.8 A base of stainless steel tee or bend shall be provided where a support is required for the tee or bend. It may be a manufacturer's standard base or a stainless steel pipe to be welded to the support and fittings as per the process details.

3 EXECUTION

3.1 Application

3.1.1 Concrete inserts or anchor bolts shall be used to support piping from new cast in place concrete. Expansion anchors shall be used to fasten supports to existing concrete and masonry.

3.1.2 Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead-ending. Anchors shall be located as specified to force expansion and contraction movement to occur at expansion joints, loops, or elbows, and as needed to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints. Anchorage for bellows type expansion joints may be located adjacent to the joint.

3.1.3 When expansion joints are required, pipe guides shall be provided adjacent to expansion joints. Guides will not be required where mechanical couplings are permitted as expansion joints. Guides shall be located on both sides of expansion joints, except where anchors are adjacent to the joint. Unless otherwise indicated on the drawings, one guide shall be within four pipe diameters from the joint and a second guide within 14 pipe diameters from the first guide. Pipe supports shall allow adequate movement; pipe guides shall not be used for support. Pipe guides shall be provided at locations as recommended by the manufacturer.

3.2 Types of Supports

3.2.1 Typical pipe supports and hangers are shown on the Contract Drawings.

3.2.2 The specific products for pipe supports shall be provided in accordance with ANSI/MSS SP-58-2018: Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.

3.2.3 Comply with MSS SP-127 for bracing for piping systems: Seismic – Wind – Dynamic Design, Selection, and Application.

3.2.4 Provide the pipe supports and hangers as shown on the Contract Drawings. Otherwise, maximum pipe support spacing at standard temperatures and services shall be as follows:

Maximum Pipe Support Spacings

Type of Pipe		Pipe Support Max Spacing (m)	Max Run Without Expansion Joint, Loop, or Bend (m)	Expansion Joint Max Spacing (m)
Stainless steel and Carbon Steel based on Schedule 10 or 10S				
	50 mm and smaller	3.4	9.1	24.4
	80 to 100 mm	4.0	9.1	24.4
	125 to 250 mm	4.9	24.4	24.4
	300 to 450 mm	6.0	24.4	24.4
	500 to 600 mm	6.5	24.4	24.4
	750 mm and larger	7.5	24.4	24.4

Notes:
1. The Contractor may apply 1.2 times to the above maximum spacing if the pipes are for air or odour control line application.
2. ASME B31.1, Table 121.5-1 Suggested Steel Pipe Support Spacing is for Schedule 40 standard steel pipe.
3. The Contractor shall submit the maximum spacing calculations for different Schedules such as Schedule 5, 40 and 80 for the steel pipes.

Maximum Pipe Support Spacings				
Type of Pipe		Pipe Support Max Spacing (m)	Max Run Without Expansion Joint, Loop, or Bend (m)	Expansion Joint Max Spacing (m)
PVC, Schedule 80 at a maximum temperature of 38°C (100°F).				
	25 mm and smaller	1.5	6.1	18.3
	32 mm to 50 mm	1.8	6.1	18.3
	64 to 80 mm	2.1	6.1	18.3
	100 to 150 mm	2.5	6.1	18.3
	200 to 250 mm	2.7	6.1	18.3
	300 mm and larger	3.0	6.1	18.3
PVC, Schedule 40 at a maximum temperature of 38°C (100°F).				
	25 mm and smaller	1.2	6.1	18.3
	32 mm to 50 mm	1.5	6.1	18.3
`	64 to 80 mm	1.8	6.1	18.3
	100 to 150 mm	2.1	6.1	18.3
	200 to 250 mm	2.4	6.1	18.3
	300 mm and larger	2.9	6.1	18.3
PVC Pipe Notes: 1. Contractor shall provide the pipe support maximum spacing as per the manufacturer's recommendations with calculations if the temperature is higher than 38°C (100°F). 2. The calculations shall include the input data with the pipe type, maximum deflection, max temperature, wind/seismic effects, specific gravity and correction factors, etc.				
FRP Pipe Maximum Spacings: 1. Contractor shall provide the pipe support maximum spacing as per the manufacturer's recommendations with calculations. 2. The calculations shall include the input data with the pipe type, maximum deflection, max temperature, wind/seismic effects, specific gravity and correction factors, etc.				

3.2.5 Expansion joint fittings are specified in the respective piping procurement sections or acceptable by Engineer's approval. The expansion joint design shall be provided by the Contractor. Submit shop drawings stamped by a Professional Engineer for review.

3.2.6 Provide the pipe expansion joint with two pipe supports on both side of expansion joints above every structural expansion joints. The spacing between two supports shall not be more than 1.0 m.

3.2.7 One of sliding supports between fixed supports shall be a pipe guide as per Process Details in the Contract Drawings.

3.2.8 Provide a one (1) Victaulic Style 77S flexible coupling at every 90 degree bends to allow for deflection.

3.3 Installation

3.3.1 General: All piping shall be supported in a manner which will prevent undue stress on any valve, fitting, or piece of equipment. In addition, pipe supports shall be provided at changes in direction or elevation, adjacent to flexible couplings, and where otherwise shown. Pipe supports and hangers shall not be installed in equipment access areas:

.1 Where horizontal piping is arranged with two or more parallel lines, trapeze hangers may be used in lieu of individual hangers. Trapeze assembly shall consist of structure attachments as previously specified with rod size dependent upon total weight supported. Spacing of assemblies shall be determined by the minimum pipe size included in the group supported. Trapeze horizontal assemblies shall be structural angle or channel section of sufficient size to prevent measurable sag between rods. All lines shall be attached to the horizontal with intermediate pipe guides and U-bolts or one-hole clamps. Pre-engineered support equipment may be used when selected and installed in accordance with the manufacturer's recommendations.

.2 No copper pipe shall contact a pipe support or hanger of dissimilar metal. Hangers and supports for copper pipe shall be copper-plated, plastic coated, or copper pipe shall be galvanically isolated using Neoprene strips or other material as approved.

.3 No piping shall be supported from the pipe above.

.4 Horizontal piping hanger support rods shall attach to steel beams with center-loading I clamps, or welded beam clips. Hanger support rods shall attach to concrete slabs or beams with inserts.

.5 Anchorage shall be provided to resist both lateral and longitudinal seismic forces. Seismic forces shall be calculated assuming the pipes are full.

3.3.2 Inserts: Reference building structural concrete drawings for concrete inserts. When not provided as part of the building concrete structure, provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams:

.1 Where concrete slabs form finished ceilings, provide inserts flush with the slab surface.

.2 Where inserts are omitted, drill through concrete slab from below and provide thru bolt with recessed square steel plate and nut recessed into and grouted flush with slab. X ray locate existing reinforcing rods before drilling.

.3 Pipe Hangers and Supports. Hanger rod sizing for copper pipe and plastic pipe shall be same as for steel pipe. Install hangers to provide a minimum 1/2 inch [13 mm] space between finished covering and adjacent work.

.4 A hanger shall be placed with 450 mm [18 inches] of each horizontal elbow, and on both sides of all piping accessories and valves weighing 9 kg [20 lbs] or more.

.5 Hangers shall have 38 mm [1 1/2 inches] minimum vertical adjustment.

.6 Support vertical piping at every floor using riser clamps.

.7 Support riser piping independently of connected horizontal piping.

.8 Hanger and hanger components shall be sized specifically for the pipe size it is to be used on.

3.4 Placement

3.4.1 Unless closer spacing is indicated on the drawings, the maximum spacing for pipe supports and expansion joints shall be as indicated in Clause 3.2.4.

3.4.2 Rubber hose and flexible tubing shall be provided with continuous angle or channel support.

3.4.3 Unless otherwise indicated on the drawings or acceptable to Engineer, piping shall be supported approximately 38 mm [1 1/2 inches] out from the face of walls and at least 75 mm [3 inches] below ceilings.

END OF SECTION

1 GENERAL

1.1 Scope

.1 This Section covers the Work associated with supply, installation, commissioning, and warranty of the following equipment for the Deep River Water Treatment Plant (WTP).

.1 One complete pre-packaged, self-contained, and fully assembled and tested feed equipment skid package for Ammonium Sulphate chemical including two (2) dosing pumps, including secondary containment.

.2 Injection quill and static mixer for ammonium sulphate injection.

.3 One (1) Ammonium Sulphate storage tank, including secondary containment.

.4 One (1) Ammonium Sulphate IBC tote electric chemical transfer pump.

.5 Two (2) Chlorinators.

1.2 Related Sections

.1 Division 1 - General Requirements

.2 Division 11 - Equipment

.3 Division 13 - Instrumentation and Control

.4 Specifications on M-101

.5 Division 16 - Electrical

1.3 References, Codes and Standards

.1 American Society of Testing Materials (ASTM).

D638	Tensile Properties of Plastics
D883	Standard Definitions of Terms Relating to Plastics
D1505	Density of Plastics by the Density-Gradient Technique
D1525	Test Method for Vicat Softening Temperature of Plastics
D1693	ESCR Specification Thickness 0.125" F50-10% Igepal
F412	Standard Terminology Relating to Plastic Piping Systems

.2 ANSI Standards: B-16.5, Pipe Flanges and Flanged Fittings

.3 ARM: Low Temperature Impact Resistance (Falling Dart Test Procedure).

.4 NSF/ANSI Standard 61, AWWA – Drinking Water System Components

.5 ASTM D-1998, Standard Specification for Polyethylene Upright Storage Tanks

1.4 Site Conditions

.1 The following site operating and water quality conditions shall be assumed for all design calculations:

.1 40°C maximum/+5°C minimum ambient air temperature

.2 30°C maximum/0°C minimum chemical temperature

.3 95% maximum relative humidity (non-condensing)

.2 Refer to the Contract Drawings for further details.

1.5 Conditions of Service

.1 Provide equipment and appurtenances suitable for handling 41% Ammonium Sulphate with specific gravity 1.23 at 21°C in solution with pH between 3 and 6.

1.6 Appurtenances Fittings and Accessories

.1 All appurtenances, fittings, and accessories necessary for the proper functioning of all the equipment or reasonably inferable from the drawings shall be supplied and installed with the equipment, whether indicated on the drawings or specified herein, or not.

1.7 Submittals

.1 In accordance with Section 01330 - Submittals

.2 The shop drawing submission shall include, but not be limited to, the following:

.1 Dimensional chemical system panel layout.

.2 Provide pump output curves for each pump.

.3 Provide basic design details for each piece of equipment, including sizing calculations, control panel layout, control schematics and wiring diagram(s).

.4 Detailed engineering drawings of each tank with port sizes, connections and locations.

.5 Data confirming that the material of equipment is resistant to the chemicals used.

.6 For each major component include the name of Manufacturer, type and model of equipment and net weight.

.7 Descriptions of the materials of construction of the major components. Provide sufficient detail to show the general construction pertinent to the proper review of the equipment.

.8 A precise list of all electrical requirements for the equipment including all controls, monitoring equipment and instruments shall be given including all power characteristics and materials of construction.

.9 The Supplier shall indicate a list of spare parts, which they would recommend be purchased and individual prices for each item.

.10 All ancillary equipment to be provided by the Supplier shall be listed.

.11 Special accessories or tools for the adjustment or removal of parts required for any piece of equipment shall be listed and furnished as part of the supply.

1.8 Maintenance Data

.1 Refer to Section 01780 - Closeout Submittals

1.9 Measurement and Payment

.1 Work outlined in this section is included in the lump sum tender price.

2 PRODUCTS

2.1 General

.1 Provide and install ammonium sulphate chemical metering system and storage tank as indicated on the Drawings.

.2 Provide one (1) chemical feed system (c/w two pumps) for ammonium sulphate that is capable of operating 24 hours per day 365 days per year. The input power for the chemical feed system shall be 120 Vac, 1-phase via wall- mounted 120 Vac receptacles as per the supplier's requirements.

.3 One (1) high density polyethylene piping panel with fiberglass supports, pre-mounted, pre-piped, pre-wired and 24-hours pressure tested with local and remote control.

.4 Chemical piping, chemical carrier piping and injection quills for the injection of ammonium sulphate.

.5 Provide one (1) double wall storage tank suitable for 41% Ammonium Sulphate liquid solution.

.6 Provide secondary containment for 110% capacity of an IBC tote of Ammonium Sulphate.

.7 Provide Ammonium Sulphate IBC tote electric chemical transfer pump.

.8 Provide (2) chlorinators.

2.2 Metering Pumps

.1 The following table lists the conditions of service, the number of pumps required, flow and head conditions control and additional features.

Pump Tag No.	Pump Qty.	Capacity (L/min) Per pump	Discharge Pressure (psi)	Location of Pumps	Control Feature
AMP01 AMP02	2 (1 duty, 1 standby)	4.0	110	Chemical Room	4-20mA control from SCADA, 4-20mA feedback to SCADA

.2 The diaphragm metering pumps will include, but not limited to the following:

.1 Chemical metering pumps shall be Mechanically Actuated Diaphragm, positive displacement, motor driven, metering pump.

.2 Chemical metering pump shall be driven by a microprocessor controlled stepper motor providing a minimum of 1000:1 turndown ratio. The stepper motor is to be coupled to a flat, PTFE diaphragm via a gear assembly. The drive assembly shall be a maintenance free design.

.3 The pump shall operate at 100% stroke length throughout the pumps entire capacity range.

.4 Solenoid-driven pumps, hydraulically actuated diaphragm pumps and those with a lost motion spring return will not be accepted.

.5 The liquid end & valve design shall provide for ease of maintenance. Ball checks shall be cartridge type design.

.6 The pump shall be able to measure actual flow through the head to monitor the dosing process without need for additional measuring equipment.

.7 The pump shall be able to compensate automatically for pressure fluctuations on the injecting point, maintaining the flow rate constant.

.3 The enclosure will include, but not limited to the following:

.1 Drive mechanism and microprocessor shall be housed in a corrosion resistant, plastic UV stabilized enclosure.

.2 The pump design shall include provisions for optional positioning of the control interface/display, for right/left side and front mounting.

.3 Pump enclosure rating shall be to IP65 and NEMA 4X standards.

.4 The pump design shall include an integral removable click stop mounting plate, to allow for flat base or wall mounting.

.4 The pump drive will include, but not limited to the following:

.1 The pump's stroke length will always be 100%. No adjustment to the stroke length, to regulate flow, or for other reasons, is acceptable.

.2 An integral variable speed stepper motor shall be used to ensure the pump discharge phase extends throughout the full period between suction intervals.

.3 Variable frequency drives shall not be accepted.

.4 The motor shall be integral, supplied with power cord and plug.

.5 The drive mechanism shall not require regular field service or external lubrication.

.5 The interface will include, but not limited to the following:

.1 User interface/display shall be backlit LCD with selectable on-site positioning for either side or front mounting.

.2 The interface shall provide a selection of metered output to be displayed in litres per hour (l/h) or gallons per hour (gph). Pumps displaying percent (%) of output only will not be accepted.

.3 The interface should include a turn and push knob (click wheel) for easy navigation.

.4 The interface menu shall include 25 language selections and provide easy navigation of all configuration and operational functions.

.5 The interface shall include a lock function to protect against unauthorized changes.

.6 A built in counter shall be included to provide a running total of, accumulated strokes, cumulative hours of operation and dosing flow.

.7 A priming button shall be provided on the interface. The priming button shall initiate a time selectable prime cycle operating at full capacity without need of attenuating the pumps output setpoint.

.8 A system of white, red, yellow and green LCD shall indicate pump status and alarm conditions.

.6 The liquid end will include, but not limited to the following:

.1 The process diaphragm shall be PTFE, PTFE coated diaphragms are not acceptable.

.2 Head and valves body material shall be (PVDF) with (Ceramic) ball material.

.1 Wetted gasket material shall be EPDM.

.2 Suction and discharge valve design shall incorporate double ball arrangement. Spring-loaded valves shall be available as an option. Direction of flow shall be clearly marked on each check valve to ensure correct installation.

.3 Head design shall incorporate integral priming valve.

.4 A back-plate with separation chamber shall have a safety lip seal and drain hole.

.5 Metering Pump Control

.1 Analog: Pump shall include direct interface provisions for analog control. Both direct and reverse acting 0/4-20mA input configurations are to be acceptable inputs. The menu configuration shall permit pump maximum output multipoint scaling. The pump shall include a local alarm for loss of input signal.

.2 Pulse: The pump shall include direct interface provisions for pulse output devices. In pulse control mode, the pump shall be configured to deliver a volume of product per incoming pulse. The pump speed shall attenuate the delivery rate based on the frequency of pulses generated by the external device.

.3 Batch: In batch mode the pump shall respond to deliver a menu configurable quantity of liquid after receiving a remotely provided contact input.

.4 Cycle timer: The configuration menu of the cycle timer shall permit the user to prescribe batch volume, timed sequence start point and the time between each successive timed delivery cycle.

.5 Week timer: The pump shall be equipped with a real-time clock and a seven-day internal week timer. The configuration menu shall permit the user to prescribe up to 16 procedures with batch volume, dosing time, start time and weekdays.

.7 Acceptable suppliers are as follows: Grundfos DDA FCM Series, Prominent GammaX, or pre-approved equal.

2.3 Ammonium Sulphate System

.1 General

.1 The feed systems shall be provided as a complete system by a supplier with at least five (5) years experience in Municipal chemical dosing systems.

.2 Contractor shall provide all chemical piping, fitting, and valves between chemical system and the identified dosage locations as indicated on the Contract Drawings.

.3 The Contract Process Drawings may not present all chemical piping.

.4 Where the chemical pipe is located outside the concrete containments, it shall be dual containment using clear PVC piping as second containment.

.5 Provide one ammonium sulphate system, including two (2) metering pumps and accessories pre-mounted on the HDPE chemical panel with fiberglass supports with pump skid and instruments. If bolts are used, stainless steel SS316 must be used. The Contractor shall provide the supports and anchorage in the shop drawing.

.6 Pump accessories pre-mounted on each panel shall include, but not be limited to the following:

.1 One (1) back pressure valve

.2 One (1) pressure relief valve (multifunctional valve from Grundfos)

.3 Isolation ball valves for the pump panel, quantity as per drawings.

.4 One (1) lot of PVC isolation ball valves, tubing and fittings

.7 Accessories supplied loose shall include:

.1 The Manufacturer shall coordinate with the Contractor, the required length for input & output signal cables which shall be supplied by the Manufacturer.

.8 The Contractor shall provide secondary containment to suit the size of the chemical pump panel and feed system.

2.4 Ammonium Sulphate Injection and Static Mixing Unit

.1 Provide one (1) 450mm diameter static mixer with two (2) 50mm injection quill ports for ammonium sulphate chemical piping connection.

.2 PVC injection quills shall be retractable-type with SS isolation ball check valve and SS chains. Proposed injection quill length to be suitable for 450mm pipe diameter and 90-110 psi header pressure, which shall be included in the shop drawings to be reviewed by the Engineer.

.3 Acceptable manufacturer is Westfall Model 2800, 0.7 BETA ratio, or pre-approved equal.

2.5 Storage Tank

.1 Provide one (1) tank for ammonium sulphate. The tank should be vertical flat bottom.

.2 Chemical Storage Tank shall be designed in accordance to ASME D638 Specifications, ANSI Standards B-16.5 Pipe Flanges and Flanged Fittings, and UBS Code: Uniform Building Code.

.3 The tank shall apply to NSF/ANSI Standard 61, AWWA - Drinking Water System Components.

.4 Design requirements:

Parameter	**Ammonium Sulphate**
Number of Tanks	1
Minimum Capacity	1250 L
Maximum Diameter	1.2 m
Maximum Overall Height	1.3 m
Tank Material	High-Density Crosslinked Polyethylene
Construction	Rotationally molded in one piece
Ball Valves	Standard PVC, true union ends, EPDM seals

.5 Tank to include the connections listed below.

Tank Port	Number of Ports	Type/Location	Size	Connection Details
Chemical suction	1	IMFO/Bottom of the Tank	2” NPT	Provide flexible style fitting with expansion joint
Chemical filling	1	Flanged/Top of the Tank	50mm	Provide a cam lock fitting.
Vent	1	Flanged/Top of the Tank	100mm	As per Contract Drawings
Overflow	1	Flanged/Lateral Top of Tank (above 100% level)	100mm	As per Contract Drawings
Ultrasonic Level Sensor	1	Flanged/Top of the Tank	100mm	Riser with flange for ultrasonic level control

.6 The ports should accommodate the pipe sizes shown in the Contract Drawings. All connections should be airtight.

.7 Tank to include molded-in clear strips (entire tank height), graduated in “Litres”; the strips should be positioned to monitor tank content.

.8 Tank to be double-walled or provided with secondary containment with 110% capacity of the tank.

.9 Acceptable manufacturers: RTS Plastics, Polyprocessing, ACO Containers or pre-approved equal.

2.6 Ammonium Sulphate IBC Tote Electric Chemical Transfer Pump

.1 Provide one (1) chemical transfer pump suitable for transferring Ammonium Sulphate 41% solution from IBC totes to the Chemical Storage Tank, as described in Clause 2.5.

.2 Minimum pump flow rate: 100 L/min at 5 m TDH.

.3 Pump material: 316SS.

.4 Provide one (1) commutator Motor FEM 4070, 120V, 1Ph, 60Hz, 500W to power the chemical transfer pump.

.5 Provide a minimum of 5 m length of flexible PVC 80 mm diameter discharge tubing suitable for connection to the IBC tote chemical transfer pump.

.6 Acceptable manufacturer: FLUX, Model: MINIFLUX 10-430 20 003, or pre-approved equal.

2.7 Chlorinators

.1 Provide two (2) V10K Automatic wall mounted chlorinators, Model V10K1C5A2T1 with dual scale 100 lb/day, 2.0 kg/h rotameter, to replace existing chlorinator units, as noted on the Contract Drawings.

.2 Each chlorinator to be panel mounted with Rivo controller suitable for 4-20 mA flow proportional control.

.3 Each chlorinator unit shall be provided with ¾" injectors for remote mounting including 120F throat & tailway.

.4 Acceptable manufacturer: Xylem (Evoqua Water Technologies Ltd.).

.1 Supplier Contact Information: Kelly Brett, 416-452-2686, Kelly.Brett@xylem.com

2.8 Caustic Soda, Fluoride, and Spare Injection Quills

.1 Provide three (3) 13mm injection quills for caustic soda, fluoride, and spare chemical piping connections as shown on the Contract Drawings.

.2 PVC injection quills shall be retractable-type with SS isolation ball check valve and SS chains. Proposed injection quill length to be suitable for 450mm pipe diameter and 90-110 psi header pressure, which shall be included in the shop drawings to be reviewed by the Engineer.

.3 Acceptable Suppliers: SCG Process, SPD Sales, or pre-approved equal.

3 EXECUTION

3.1 Installation and Inspection

.1 The chemical dosing pumps, storage tanks and other chemical equipment shall be installed as indicated on the Contract Drawings, in accordance with the Manufacturer's recommendations and as approved by the Engineer.

.2 The Contractor shall provide a dual containment clear PVC pipe where the pipe runs outside the containment in the building.

.3 Refer to Section 01850 - Demonstration and Training.

.4 Provide the services of a factory trained representative to inspect, operate, test, adjust, and troubleshoot the installation.

.5 Prior to start-up, a factory trained service representative employed directly by the Manufacturer shall inspect, operate, test, adjust and troubleshoot the installation. This work will ensure that the equipment has been installed properly, lubricated adequately, checked for soundness and ready to be started.

.6 The factory trained representative, mentioned above, will certify that the equipment is ready for operation before use.

.7 In addition, the factory trained representative shall instruct the owner's operation personnel in the proper operation and maintenance of the equipment supplied.

.8 Provide for additional supervision of installation by equipment Supplier as required.

.9 Arrange with the Engineer a mutually agreeable date when the representative should be on site.

.10 Submit a report, signed by the Manufacturer's representative, describing in detail the inspection, tests, and adjustments made, quantitative results and suggestions for precautions to be taken to ensure proper maintenance. The report must verify that the equipment conforms to all specifications.

.11 Inspection to include checking for:

.1 Cracks and other damaged or defective parts.

.2 Completeness of installation as specified and as recommended by the Manufacturer.

.3 Correctness of setting, alignment and relative arrangement of various parts of the system.

3.2 Mechanical Testing and Certification

.1 After start-up and prior to final acceptance, the Contractor shall conduct Engineer-witnessed performance tests on the equipment.

.1 Prepare calibration curves for each of the pumps at 8 mA through 20 mA flow signals using a minimum of 16 different data points.

.2 Prepare tables to record the test results for each calibration curve. Have table reviewed by the Engineer prior to testing. Submit the results to the Engineer for review.

.3 Conduct the calibration curve testing using the intended design flow rates.

.2 A field service representative will start the chemical dosing pumps to perform all mechanical functions that the pump is designed to perform. Tests will be scheduled with the Engineer at least two (2) weeks prior to the planned test date.

.3 The factory trained representative shall submit to the Engineer a written report stating that the equipment has been checked and is suitable for operation.

.4 Hydrostatic test: Following installation of storage tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 24 hour and inspected for leaks.

3.3 Supervision of Installation and Commissioning

.1 Test and commission the equipment in accordance with section 01800 - Start-up and Commissioning.

.2 At the completion of satisfactory installation, each unit shall be started by the General Contractor under the supervision of the Supplier and in cooperation with the plant operations staff. All controls and alarms shall be checked and tested to ensure proper control and equipment protection.

.3 Equipment will only be accepted after receipt of a satisfactory report submitted by the Manufacturer's representative(s).

.4 When the installation and operation is satisfactory, the Supplier shall certify in writing to the General Contractor that the unit is available for operation.

.5 Modify or replace equipment or materials failing required tests.

.6 Perform additional testing required due to changes of materials, and/or failure of materials or construction to meet specifications at no extra cost to the Owner.

.7 As a minimum, allow the following:

.1	Installation Inspection	1 trip, 1 day
.2	Startup/Commissioning	1 trip, 2 days

3.4 Storage

.1 Prior to the installation, the chemical dosing pumps and systems and accessories should be protected and stored indoors in a dry area, in accordance with the Manufacturers recommendations.

3.5 Maintenance

.1 Provide maintenance on Supplier's equipment as required by the Supplier from the date of delivery to the initial start-up.

3.6 Training

.1 The manufacturer of the chemical systems shall furnish the services of a competent and experienced operator of the equipment, who is directly employed by the manufacturer, to instruct the Owner's operating personnel in the proper operation and maintenance of the equipment. In accordance with Section 01850 - Demonstration and Training.

3.7 Warranty

.1 Each unit shall be new and shall carry the full Manufacturer's warranty on parts, service, and performance. The warranty shall include replacement of all defective equipment and shall extend two (2) years beyond date of completion.

.2 Corrective Work. Any location where corrosion is evident shall be considered a failure of the material or the protection system. Before starting corrective work, the Manufacturer shall submit to the Engineer for review an analysis of the cause of the failure and details of the proposed corrective work. The Manufacturer shall make repairs acceptable to the Engineer at all points where failures are observed within the Warranty Period.

.3 Inspection. Each unit shall be inspected at the end of the warranty period by representatives of the Owner, the Engineer, and the Manufacturer to identify any failures that may have occurred. The Manufacturer shall establish the date of each inspection and shall notify the Owner at least 30 days in advance. The scheduled inspection shall not relieve the Manufacturer from the obligation to perform corrective work whenever needed.

.4 The Manufacturer shall prepare and deliver to the Owner an inspection report covering each inspection, indicating the number and type of failures observed, material and part where materials have failed, the percentage of the surface area where corrosion

protection system failure has occurred, and the names of the persons making the inspection. Colour photographs illustrating each type of failure shall be included in the report.

END OF SECTION

1 GENERAL

1.1 Intent of Section

1.1.1 This section covers the supply, delivery, supervision of installation and commissioning of chemical feed piping and accessories for the Deep River Water Treatment Plant Upgrades complete as specified herein and as shown on the Contract Drawings. The work includes, but is not limited to, the following:

.1 Ammonium Sulphate Lines

.2 Polymer Pump Suction Lines

1.1.2 The Contractor is responsible for overall coordination of pipes, valves and fittings to ensure their compatibility with the proposed works.

1.2 Related Sections

1.2.1 Division 1 - General Requirements

1.2.2 Section 11000 - Equipment General Requirements

1.2.3 Section 11190 - Piping and Valve Supports

1.2.4 Division 16 - Electrical

1.3 Site Conditions

1.3.1 The following site operating and water quality conditions shall be assumed for all design calculations:

.1 40°C maximum/+5°C minimum ambient air temperature.

.2 30°C maximum/0°C minimum chemical temperature.

.3 95% maximum relative humidity (non-condensing).

1.3.2 Refer to the Contract Drawings for further details.

1.4 Dimensions

1.4.1 Prior to ordering materials and proceeding with the work, check and confirm that the dimensions indicated on the Contract Drawings agree with the dimensions of equipment specified.

1.4.2 Notify the Engineer of any discrepancy in dimensions and obtain clarification. Correct the dimensions as instructed.

1.5 Shop Drawings

1.5.1 Submit the Shop Drawings for review in accordance with Section 01330 - Submittals.

1.5.2 The shop drawing submission shall include, but not be limited to, the following:

.1 General dimensioned layout and materials list for all valves.

.2 Summary list showing valve tag numbers, size type of operator, valve class, location, motorized operator number, pipe system including pipe schedule, materials.

.3 Submit Manufacturer's catalogue literature indicting the valves, bends, couplings, cocks, fittings, pipes, gaskets and other required materials.

.4 Descriptive material in sufficient detail to show the general construction pertinent to the proper review of the equipment.

.5 The Supplier shall indicate a list of spare parts, which he/she would recommend be purchased and individual prices for each item.

.6 All ancillary equipment to be provided by the Contractor shall be listed.

.7 Special accessories or tools for the adjustment or removal of parts required for any piece of equipment shall be listed and furnished as part of the supply.

1.6 Maintenance Data

1.6.1 Refer to section 01780 - Closeout Procedures.

1.7 Measurement And Payment

1.7.1 Work outlined in this section is included in the lump sum tender price.

2 PRODUCTS

2.1 General

2.1.1 Provide equipment that is capable of operating 24 hours per day, 365 days per year.

2.1.2 Supply all pipes, valves and fittings of the materials, size, classes and types as shown on the Contract Drawings and as specified herein. All piping, cables, valves and accessories shall be compatible with the chemical being conveyed, and shall be panel-board mounted.

2.1.3 All piping, valves and fittings shall be assembled and mounted on site as per the contract drawings within the designated facility, chemical containments areas and tunnels. The assembled system shall be tested on site by the Contractor.

2.1.4 Chemical pipes shall be labelled with the name of the chemical.

2.1.5 Provide a written confirmation from the supplier that the materials used in the fabrication of pipes, valves and accessories are suitable for the specific conditions of service.

2.2 Chemical Feed Pipe and Fittings for Ammonium Sulphate

2.2.1 General - Supply all pipes, valves and fittings of the materials, size, classes and types as shown on the Contract Drawings and as specified herein. All piping, cables, valves and accessories shall be compatible with the chemical being conveyed:

.1 Trade 41% ammonium sulphate with specific gravity of 1.05 to 1.23.

.2 Polymer solution concentration of 0.1% to 0.5% with viscosity <1,000 cPs

2.2.2 PFA Piping and Fittings:

.1 The Contractor shall supply and install PFA piping for ammonium sulphate lines as shown on the Contract Drawings and as specified herein.

.2 Solvent welding shall be avoided in PFA pipe fittings.

.3 Flexible Perfluoroalkoxy (PFA) Teflon tubing containment in Schedule 80 PVC piping should be employed as shown on the contact drawing detail.

.4 Teflon PFA tube and fitting shall conform to ASTM D6867-03.

.5 Service temperature range: -184°C to 260°

.6 Flammability: UL 94 VO rated. PFA tubing shall resist combustion and not promote flame spread.

.7 Connection method: Tight flare method.

.8 All piping and fittings shall be pre-assembled and pre-tested by the manufacturer.

.9 Acceptable Teflon PFA tubing and fitting supplier: Chemline Plastics Limited (Chemflare Line) or Engineer approved equal.

2.2.3 PVC Pipes and Fittings:

.1 The Contractor shall supply and install PVC piping for ammonium sulphate lines as shown on the Contract Drawings and as specified herein.

.2 PVC piping and fittings indicated on the Drawings shall conform to CSA B137.3 and shall be Schedule 80. Fittings shall be socket type and the socket ends are to conform to ASTM D-2467. Provide all the fittings and other ancillary items as required in order to fabricate the pipe systems to the intent of the Drawings.

.3 Solvent welding shall be avoided in PVC pipe fittings.

.4 All PVC pipe and fitting joints to be flanged.

.5 Threaded fittings to be accepted by Engineer before assembly.

.6 Piping system shall be provided with suitable drains and vents, and be designed to provide complete drainage of primary systems through valve ports.

.7 Acceptable PVC pipe and fittings suppliers are:

.1 IPEX Inc.

.2 George Fischer

.3 Chemline Plastics Ltd.

2.2.4 Clear PVC Piping:

.1 Containment

.1 Supply and install clear flexible PVC piping for the outer containment for inner 13 mm Teflon tube for service exterior to the containment area, as shown on the drawings and/or as specified herein. The material should be resistant to the chemicals used in this application.

.2 Containment piping shall be supported by tube clamps and fixed to the wall at intervals sufficient to prevent sagging. Piping shall be sloped to allow for gravity drainage.

.2 Acceptable clear PVC pipe and fittings suppliers are:

.1 IPEX Inc.

.2 Georg Fischer (GF)

.3 Chemline Plastics Ltd.

.4 Grainger

.5 Pre-approved equal.

2.3 Valves

2.3.1 Valving for the chemical suction/discharge piping shall be as follows:

.1 Ball valves shall be PVC compound, true union ball valves with EPDM seals, Teflon ball seats with socket weld type 21 ends.

.2 Acceptable suppliers:

.1 Chemline

.2 Georg Fisher (GF)

2.3.2 The following schedule is to establish a quality basis and product type. The schedule is based on Chemline products but equivalents such as those supplied by Georg Fisher, are also acceptable:

.1	PVC Ball Valves	: Chemline Type 21
.2	PVC Diaphragm Valves	: Chemline Series DVA
.3	PVC Elbows	: Proprietary Item
.4	PVC Tees	: Proprietary Item
.5	PVC Y-Strainers	: Chemline Series YST

.6 PVC Foot Valves : Chemline Series FVA

.7 PVC Gate Valves : Chemline Series CGA

.8 PVC Swing Check Valves : Chemline Series SCA

.9 PVC Ball Check Valves : Chemline Series BCA

.10 PVC Globe Valves : Chemline Series GVA

.11 PVC Pressure Relief Valves : Chemline Series PRA

.12 Gauge Isolators : Chemline Series GI

.13 Electric Actuators : Chemline Series Q, A and V

.14 Plastic Pneumatic Actuators : Chemline Series PP

.15 Plastic Butterfly Valves : Chemline Series Type 57

2.3.3 Seats and seals shall be as recommended by the valve manufacturer and are to be compatible with the medium in the pipe.

2.4 Backpressure Valves

2.4.1 Provide backpressure valves for each chemical system as shown on the drawings, with the following features:

.1 Constructed of materials suitable for the chemical conditions of service.

.2 Each individually tagged with reference to the chemical service.

.3 Screwed end, PVC body, PTFE or EPDM seals.

.4 Acceptable Suppliers

.1 Chemline

.2 Pre-approved Equal

2.5 Pressure Relief Valves

2.5.1 Provide pressure relief valves for each chemical metering pump with the following features:

.1 Constructed of materials suitable for the chemical conditions of service.

.2 Each individually tagged with reference to the chemical service.

.3 Adjustable pressure settings.

.4 Screwed end, PVC body, PTFE or EPDM seals.

.5 Acceptable Suppliers:

.1 Chemline

.2 Pre-approved Equal

3 EXECUTION

3.1 Installation And Inspection

3.1.1 The piping, valves, fittings and accessories, shall be installed as indicated on the Contract Drawings, in accordance with the Manufacturer's recommendations and as approved by the Engineer.

3.1.2 Refer to Section 01820 - Demonstration and Training.

3.1.3 Provide the services of a factory trained representative(s) to inspect, operate, test, adjust, and troubleshoot the installation.

3.1.4 The factory trained representative(s), mentioned above, will certify that the equipment is ready for operation before use. In addition, the factory trained representative(s) shall instruct the owner's operation personnel in the proper operation and maintenance of the equipment supplied.

3.1.5 Provide for additional supervision of installation by Equipment Supplier as required.

3.1.6 Arrange with the Engineer a mutually agreeable date when the representative should be on site.

3.1.7 Submit a report, signed by the Manufacturer's representative, describing in detail the inspection, tests, and adjustments made, quantitative results and suggestions for precautions to be taken to ensure proper maintenance. The report must verify that the equipment conforms to all specifications.

3.1.8 Inspection to include checking for:

.1 Cracks and other damaged or defective parts. The equipment must be undamaged, without cracks and free of defective parts.

.2 Completeness of installation as specified and as recommended by the Manufacturer.

.3 Correctness of setting, alignment and relative arrangement of various parts of the system.

3.2 Handling

3.2.1 Provide proper equipment and tools for safe and convenient handling and installation of pipes, fittings, valves and other accessories.

3.2.2 Exercise particular care to prevent abrasion of pipe coating.

3.3 Sizing

3.3.1 Supply and install pipes, valves and other fittings according to the sizes indicated on drawings. Where sizes are not clearly indicated, obtain sizes from the Engineer before proceeding with the work.

3.4 Mechanical Testing and Certification

3.4.1 After start-up and prior to final acceptance, the Contractor shall conduct Engineer-witnessed performance tests on the equipment.

3.4.2 The field service representative will cause the chemical piping and valve system to perform all mechanical functions that it has been designed to perform. Tests will be scheduled with the Engineer at least two (2) weeks prior to the planned test date.

3.4.3 The field service representative shall submit to the Engineer a written report stating that the equipment has been checked and is suitable for operation.

3.5 Leakage Testing

3.5.1 Pressure test complete installation of all piping to a minimum of 150 psi for a two (2) hour period following installation. Testing shall be completed on both the primary (carrier) and secondary (containment) piping. If any leaks are present, Contractor shall repair leaks and retest piping until no leaks are present.

3.6 Supervision Of Installation and Commissioning

3.6.1 Test and commission the equipment in accordance with Section 01810 - Testing and Commissioning.

3.6.2 At the completion of satisfactory installation, each unit shall be started by the General Contractor under the supervision of the Supplier and with cooperation of the plant operating staff. All controls and alarms shall be checked and tested to ensure proper control and equipment protection.

3.6.3 Equipment installation shall only be accepted after receipt of a satisfactory report submitted by the Manufacturer's representatives.

3.6.4 Modify or replace equipment or materials failing required tests.

3.6.5 Perform additional testing required due to changes of materials and/or failure of materials or construction to meet specifications at no extra cost to the Owner.

3.7 Storage

3.7.1 Prior to the installation the piping, valves, fittings and accessories shall be protected and stored indoors in a dry area, in accordance with the Manufacturer's recommendations.

3.8 Maintenance

3.8.1 Provide maintenance on Supplier's equipment as required by the Supplier from the date of delivery to the initial start-up.

3.9 Warranty

3.9.1 Each unit shall be new and shall carry the full Manufacturer's warranty on parts, service, and performance. The warranty shall include replacement of all defective equipment and shall extend two (2) years beyond date of completion.

3.9.2 Corrective Work: Any location where corrosion is evident shall be considered a failure of the material or the protection system. Before starting corrective work, the Manufacturer shall submit to the Engineer for review an analysis of the cause of the failure and details of the proposed corrective work. The Manufacturer shall make repairs acceptable to the Engineer at all points where failures are observed within the Warranty Period.

3.9.3 Inspection: Each unit shall be inspected at the end of the warranty period by representatives of the Owner, the Engineer, and the Manufacturer to identify any failures that may have occurred. The Manufacturer shall establish the date of each inspection and shall notify the Owner at least 30 days in advance. The scheduled inspection shall not relieve the Manufacturer from the obligation to perform corrective work whenever needed.

3.9.4 The Manufacturer shall prepare and deliver to the Owner an inspection report covering each inspection, indicating the number and type of failures observed, material and part where materials have failed, the percentage of the surface area where corrosion protection system failure has occurred, and the names of the persons making the inspection. Colour photographs illustrating each type of failure shall be included in the report.

END OF SECTION

DIVISION 13
INSTRUMENTATION, CONTROL & SCADA

Section No.	Title
13100	Control and Instrumentation Systems
13110	SCADA Integration Services
13200	SCADA Hardware and Software
13560	Instrumentation General Requirements
13560S1	Instrument List
13563	Pressure and Level Instruments
13565	Turbidity Analyzers
13566	Magnetic Flow Meters
13567	Chlorine Residual Analyzer

1 GENERAL

1.1 Intent

1.1.1 It is the intent of this section to provide an industrial control system (i.e. SCADA) for the Deep River WTP comprised of a computer-based HMI, PLC and instrumentation to monitor and control process parameters and equipment to be supplied and installed under this contract, as shown on the drawings or specified.

1.1.2 The SCADA system shall be complete, fully functional system and designed and developed to meet the control requirements of the process design indicated on the contract drawings.

1.2 References

1.2.1 Comply with the requirements of Division 1. Be responsible for all the requirements of this Section and of Division 1. No additional cost will be considered for non-coordination between this Section and the other Sections in the Specification.

1.2.2 Refer to Section 16010 Electrical General Requirements, Section 16050 Electrical Material and Methods for instructions that apply to the Work of Section 16900.

1.2.3 Have the material, equipment, installation and workmanship also meet the latest edition and requirements of the following:

.1 Ontario Electrical Safety Code (OESC)

.2 Canadian Standards Association (CSA)

.3 Canadian Electrical Manufacturers Association (CEMA)

.4 National Electrical Manufacturers Association (NEMA), and NEMA ICS-1-109.60

.5 Electrical and Electronic Manufacturers Association of Canada (EEMAC)

.6 International Society for Measurement and Control (Formerly the Instrument Society of America. ISA)

.7 Electronic Industries Association / Telecommunications Industries Association (EIA/TIA 606)

.8 ANSI C37.90

1.3 Scope of Work

1.3.1 A Control System Supplier (CSS) has been pre-selected for this project and is responsible for the scope identified herein inclusive, to provide all SCADA system hardware including control panels, communication equipment, software and development tools. Refer to section 13200 for SCADA Hardware and Software. The pre-selected CSS for this project shall be one of the following:

.1 Veolia

.2 Capital Controls

.3 Stroma Automation Solutions

.4 Valley Integration Inc.

.5 Selog

.6 Selectra Inc.

.7 Approved equivalent

1.3.2 A Control System Integrator/Programmer (CSIP) has been pre-selected for this project and is responsible for the scope described herein and in section 13200 including programming of all non-packaged PLCs and development of graphical user interface for SCADA HMI computers and non-packaged OITs. The CSIP for this project shall be one of the following:

.1 Capital Controls

.2 Approved equivalent

1.3.3 The work consists of the supply and installation of all controls, SCADA system automation components specified herein and shown on the drawings, and commissioning by the Contractor to suit the Deep River WTP.

1.3.4 The CSIP, the CSS and the Contractor shall provide all labour, supervision, tools, equipment, materials, services and miscellaneous expenses necessary to complete the work as outlined in this Section. The word “provide” shall be defined to mean supply, install, start up, test and commission.

1.3.5 This specification is intended as a functional description of the systems required and shall serve as a guide to the approved controls system supplier in providing the complete system. The CSS will be required to submit complete control wiring and communications shop drawings, in addition to shop drawings of equipment. The CSS is responsible for the design of all the new control panels. The control panel layouts and dimensions identified on the drawings are based on minimum requirements. Provide additional control panel sections as required to suit the design of the respective control panel applications. The contractor will be responsible for coordination of shipping splits to ensure that multiple panel arrangements may be installed in respective areas.

1.3.6 The Contractor shall provide all instrumentation detailed in Section 13 and as shown on the drawings.

1.4 General Requirement

1.4.1 The Contractor shall supply and install all power, control, and communications wire interconnecting the control panels, and electrical and electronic pieces of the instrumentation equipment, under Division 16. Final wiring shall be as required by the reviewed shop drawings, (See Division 16).

1.4.2 Hydraulic and pneumatic control tubing, piping and appurtenances, interconnecting various pieces of the instrumentation equipment as required under Division 11, 13 and 15.

1.4.3 All functionality described in the Tender Documents and Process Narrative shall be fully implemented.

1.4.4 All control wiring shall be continuous and without splices. All control wiring is required to transition through or terminate to DIN rail mounted terminal blocks. No marrette connections of control wiring are permitted.

1.4.5 All equipment performance requirements shall be based upon worst case scenarios and/or to the maximum capabilities of the equipment.

1.4.6 Provide documentation in a timely manner and as specified.

1.4.7 The Contractor shall prevent the following from occurring:

.1 The use and/or implementation of problematic, unstable hardware that is a result of device driver conflicts, component substitutes that deviate from specifications or fail to meet performance criteria, including unauthorized tampering with computer operating system or application setup parameters, all of which create additional setup time.

.2 Deficient factory acceptance testing due to non-compliance in panel assembly, substandard workmanship or poor preparation prompting the Engineer to reject FAT and thereby having to reschedule further sessions.

.3 Scheduling of Commissioning & Site Inspection, prior to the completion of all site works including, loop checks, instrument calibration, wire or installation, resulting in delays and repeat site visits.

.4 Lack of maintenance works to suit field equipment/devices including instruments, control hardware, motor starters, valve actuators, and all essential process systems required for the facility to run in a safe and fully automated fashion.

1.4.8 The Contractor shall supply a communications & automation equipment schedule for review prior to submission of all shop drawings. The schedule shall be tabular in form and have a minimum of:

.1 Item number and system description

.2 Tag number as specified herein or as shown on the drawings and Process and Instrumentation diagrams.

.3 Reference the specification section/subsection, item number, drawing number and description

.4 Proposed submission date

.5 List of associated equipment. Note all equipment forming part of a system should be submitted at same time.

.6 List of all software as required to set-up/program field devices, including verification that all software is licensed in the name of the owner

1.5 Related Work Specified in other Divisions

1.5.1 Division 1 – General Requirements

1.5.2 Division 11 – Process

1.5.3 Division 13 – Instrumentation, Control & SCADA

1.5.4 Division 15 – Mechanical

1.5.5 Division 16 – Electrical

1.6 Quality Assurance

1.6.1 The materials, design, and workmanship employed in the manufacture of all equipment shall conform to the applicable standards established by the A.S.T.M. (American Society for Testing Materials), A.S.A. (American Standards Association), C.E.C. (Canadian Electrical Code) including the Ontario Supplement, C.G.S.B. (Canadian Government Specifications Board), C.S.A. (Canadian Standards Association), and the I.S.A. (The Instrumentation, Systems, and Automation Society). Canadian Standards shall take precedence over American Standards in the case of duplication or conflict.

1.7 Submittals

1.7.1 Submittals to be in accordance with Section 01330 – Submittals and 01780 – Closeout Submittals

1.7.2 Drawing Index: Prepare a clear, typed index listing the number and title of all proposed purpose-made drawings and submit for review.

1.7.3 Wherever there is a discrepancy between information provided in this document and on a drawing, the drawing shall take precedence.

1.7.4 A detailed submittal package identifying the equipment to be supplied and its operation shall be furnished. The intent of the submittal is to ensure complete project scope coverage and does not relieve the supplier from fulfilling any specified requirements. The submittal shall consist of legible printed text and high quality CAD drawings bound in three-ring notebooks with index tabs that identify major sections of the document. The submittal shall address all hardware and software to be supplied. In addition:

.1 Identification of the respective responsibilities of each party to the project. Include what is provided by the system manufacturer, what is to be subcontracted, etc.

.2 SCADA/PLC Communications Architecture shop drawing detailing all communications links to suit the design drawing requirements, including equipment that is free issued and/or packaged equipment with automation control systems. Architecture drawings shall identify all automation and communications networks including all components and media associated with each type of communications networks. Identify all component model numbers and media types. Identify all unique addressing for each device that communicates on the respective networks

.3 Description of the major user related features and operating characteristics of the proposed system.

.4 Description of all site PLC Automation hardware and I/O modules.

.5 All significant equipment to be supplied shall be listed followed by descriptive data sheets. The equipment list shall include each component name, manufacturer, model number, a description of the operation, quantity supplied and any special set-up and operation and maintenance characteristics.

.6 In addition to data sheets, all shop drawings are to be provided in Adobe PDF format.

.7 Milestone Schedule: Prepare and submit a proposed schedule of instrumentation and control work per General Conditions, indicating the following major milestones as a minimum:

.1 Hardware shop drawings submission;

.2 Preliminary issue of operating and maintenance instruction manual;

.3 Panel inspection and factory acceptance testing (FAT);

.4 PLC and OIT test programming applications to suit FAT and SAT;

.5 Signed calibration sheet or report on each field instrument;

.6 Report on proper site installation, inspection, and loop check;

.7 Final submission and sign-off of Product Date Sheets as per this Section;

.8 Site acceptance testing (SAT);

.9 Maintenance training sessions on filed instruments;

.8 Application Specific Drawings:

.1 Prepare application specific drawings neatly and accurately by means of the latest version of AutoCAD or as otherwise advised. Do not use external references or customized file extensions. Provide fully portable electronic file copies of all drawings.

.2 Submission shall be complete with a title block containing the Engineer's E.O. number, your contract number and company logo, a drawing and Contract title as stated in the Contract drawings, and a referenced drawing number (related to a file name if applicable). Provide tabular columns to record the original submission date, a revision number, date and reason for subsequent revision s, and signature of authorized issuing staff member.

.3 Submit, as a minimum, the following application specific drawings:

.1 Scaled, reference, front of panel layouts, and general arrangements drawings;

.2 Scaled, referenced, internal panel layouts (may be combined with the above);

.3 Equipment and/or panel block wiring diagrams showing termination identification at each item of equipment, inter-wiring and cable numbering, all peripheral equipment, any PLC module DIP switch settings, pin assignments for D-shell connectors, plugs and jacks, and instrument/equipment tag numbers;

.4 Submit itemized instrument wiring drawings for all analog process loops and discrete connections, generally in accordance with ISA S5.4 format and as a minimum incorporating the following details: PLC terminal numbers, PLC I/O Address, PLC Slot & Rack identification, Control Cabinet terminal numbers,

field terminal numbers, wire numbers, contact orientation, power source identifications and equipment numbers. The “AutoCAD” files for these drawings are to be edited with “Record Drawing” detail and made accessible to the Engineer during the Contract. Include wiring by others that form part of the system or circuit.

.5 List of expendable materials and quantities;

.6 List of Instrument, Equipment and Panel Identification Nameplates.

.7 Factory test results.

.8 Project name and job numbers.

.9 Cable and wire requirements inclusive of specifications.

.10 Input and output signal ranges and calibrated ranges.

.11 Installation details including: material list, dimensions, process and electrical connection sizes and external wiring requirements.

.9 Vendor Equipment Shop Drawings:

.1 Submit Shop Drawings for all field and panel mounted instruments, controllers, gauges and similar products. Manufacturers’ documentation will be accepted only if the following information is clearly indicated and highlighted for the equipment proposed. Submit the following:

.1 An itemized quotation from the proposed instrument or equipment vendor, (prices removed), including tag numbers, quantities, options being provided and a full description and performance data;

.2 Installation details depicting mounting assemblies, physical dimensions, process connection size (e.g. flange ratings & styles);

.3 Termination details clearly indicating the type and lengths of external wiring required and electrical connections;

.4 Power supply rating input and output signal ranges, maximum measured process range and calibrated scale, physical, electrical and environmental requirements;

.5 Exact catalogue model numbers of each piece of equipment and its accessory options, and clearly referenced by the respective instrument or equipment tag name given in this document (improperly tagged items shall be rejected);

.6 A separate sheet with manufacturers’ recommended list of spare parts including individual pricing with the shop drawings;

.2 The Contractor shall note compliance and variance in writing or the specification shall have precedence over approved vendor drawings. Stamp the shop drawings submitted as either “COMPLIES EXACLTY WITH SPECIFICATION” or “DEVIATES FROM SPECIFICATION” as appropriate. In the latter case, describe

deviations exactly and indicate how they impact the specified duty of the component. The Engineer will assess acceptability of submission.

.10 Product Data Sheets:

.1 Product Data Sheets specifying instruments and equipment form part of this document. Complete the blank spaces on these sheets with the information noted below and any other data pertinent to the equipment and the application.

.2 Provide individual product data sheets for each instrument and control element bearing the tag designation, as indicated on the contract drawings, citing specific features for each product including the following as a minimum:

.1 Process Area

.2 P&ID Tag

.3 Process Media

.4 Input and Output range and span

.5 Scales, units

.6 Material of construction

.7 Configuration

.8 Alarm outputs

.9 Communications

.10 Power

.11 Sensing element

.3 Initial submission for review to accompany Shop Drawings:

.1 The product manufacturer and the supplier or representative;

.2 The complete model or catalogue number(s) including any special options;

.3 The available adjustment range(s) and the operating range(s).

.4 Second submission during pre-commissioning, testing and calibration period:

.1 Serial numbers, part numbers, dates of installation and calibration;

.2 Any special procedures required to duplicate calibration;

.3 This submission is for signature by the Contractor and the Engineer following acceptance of the operation of each instrument.

.5 Final Submission of signed-off Product Data Sheets included with Operating and Maintenance Instruction Manuals:

.1 All of the above information; and

.2 Phone and fax numbers of contact person for product support/service.

.6 Where there is any discrepancy, the description provided on the Product Data Sheet takes precedence over the model number given in the data sheet.

.7 Record Copies of Purpose-made Drawings & Electronic Files:

.1 Submit six white print “as-built” copies of each Purpose-made drawing and document specified above, as well as electronic copies (on USB media). Under certain circumstances during the course of the contract, instead of paper, drawing and document files may be exchanged with the Engineer to streamline coordination.

1.7.5 Submission Format:

.1 A complete set of Purpose-made Drawings, Shop Drawings, and the initial submission of the Product Data Sheets shall be bound into one volume and issued for approval before the commencement of work.

.2 Include a product data sheet for each instrument and/or device.

.3 The Contractor shall prepare a product description sheet for each item or package submitted for shop drawing approval.

.4 Each shop drawing submission by the Contractor must be accompanied by a submission overview sheet that lists the individual items described in the product description sheet.

.5 The product description sheet shall have the following format:

.1 Submission date: Project:

.2 Submission #: Prepared by:

.3 Quantity: Instrumentation P&ID Tag:

.4 Manufacturer: Model No.:

.5 Description: Contractor ID No.:

.6 The shop drawing overview submission sheet shall have the following format:

.1 Date of submission:

.2 Project:

.3 Prepared by:

.4 Equipment P&ID Tags: (summarize all P&ID Tags for equipment submitted for review)

1.8 Operation and Maintenance Manuals

1.8.1 Provide Operations and Maintenance (O&M) Manuals in accordance with Section 01780.

1.8.2 The following printed materials shall be provided a minimum:

.1 Detailed (O&M) manuals shall be provided with complete information concerning the operation of the system and support necessary with diagnostics.

.2 Data sheets shall be supplied for all equipment used in the system. The data shall include, as a minimum, the component name; manufacturer; model number, quantity and all special (O&M) characteristics.

.3 Final as-built drawings of equipment shall be provided and as a minimum include:

.1 Overall dimensions details for each equipment and all door mounted operator devices including nameplate designations.

.2 Interconnecting wiring diagrams of all control equipment, communications networks, and remote switchgear control panels.

1.9 Work Included

1.9.1 The Contractor shall be responsible for the:

.1 Supply, installation and commissioning of all Controls & Instrumentation equipment and devices specified herein and/or shown on drawings.

.2 Preparation of all descriptive data, schematic layout, interconnecting wiring diagrams, and communications architectures for submission and review as herein specified and in accordance with the requirements of the contract.

.3 Installation of the new Actiflow PLC Control Panel at the New Treatment Room as indicated on the drawings.

.4 The installation, wiring and point to point checkout of all communications cabling including;

.1 CAT6 Ethernet

.5 Installation of wiring and wiring terminations to suit connection of field devices as shown on contract drawings.

.6 Testing, calibration, and commissioning of each signal loop.

.7 Supply and installation of all Terminal Blocks, control wiring, and auxiliary relays as shown on the drawings.

.8 The installation, wiring and point by point checkout of proposed field devices and instrumentation.

.9 The installation and wiring of all control and instrumentation equipment supplied under this contract.

.10 Provide complete record drawings. Drawings to be produced using AutoCAD Version 2008 or newer, program and supplied to the customer on flash drive. Also provide one print set of reproducible record drawings (size A1). The Contractor shall also be responsible for providing detailed wiring diagrams, and equipment manual, upon satisfactory commissioning and certification of work.

.11 The installation, wiring and point by point checkout of proposed communications networks including status and control functions from remote control panels.

.12 Division 16 to provide power to all electrical equipment whether equipment supplied by this Division or by others, or pre-selected. Provide local disconnect switches (fused or un-fused) as required by code whether shown or not. Coordinate this equipment supply and wiring with the Electrical Contractor.

.13 Commissioning of all equipment to be by the manufacturer's representative.

.14 Testing, and commissioning of communications networks including verification of communications from the PLC's to all devices located on the respective remote networks.

1.10 Standards

1.10.1 Comply with the requirements of the latest edition of the applicable CSA Standards, the requirements of the Authorities, Federal, Provincial and Municipal Codes, the applicable standards of the Underwriter's Association and all other authorities having jurisdiction. These codes and regulations constitute an integral part of these Specifications. In case of conflict, the codes take precedence over the Contract Drawings.

1.11 Coordination

1.11.1 It will be the responsibility of the Contractor to coordinate work to be wired under this Division.

1.11.2 The Contractor will coordinate work with other Divisions where there is an impact or overlap of work with this Division.

1.11.3 Ensure that other Divisions provide all necessary material and work required by this Division for the installation of equipment and wire, which falls under the responsibility of this division.

1.11.4 Conform with Division 1.

1.12 Control System Supplier

1.12.1 The acceptable Control System Supplier (CSS) shall install complete controls, SCADA System Computer hardware, SCADA system software, PLC programming software, reporting software, alarm software, PLC automation and communications system.

1.12.2 The CSS is required to provide all hardware and software indicated in Division 13.

1.12.3 Equipment and software furnished under this section and under other related sections shall be designed with the exception of the vendor provided equipment, coordinated, and supplied by a single manufacturer or supplier, hereinafter referred to as the CSS. The Contractor shall utilize the services of the CSS to coordinate all control system related items, and to perform all testing, training, and startup activities specified to be provided.

1.12.4 Systems supplied under this section shall be designed and coordinated by the CSS for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications, under other contracts, and, where applicable, with related existing equipment.

1.12.5 All equipment shall be designed and installed in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the manufacturer, the manufacturer of the related equipment.

1.12.6 The drawings and specifications indicate the extent and general arrangement of the systems. If all departures from the drawings or specifications are deemed necessary by the CSS, details of such departures and the reasons shall be submitted to Engineer for review with or before the first stage submittal. No departures shall be made without prior written acceptance.

1.12.7 The specifications describe the minimum requirements for hardware and software. Where the CSS standard configuration includes additional items of equipment or software features not specifically described herein, such equipment or features shall be furnished as a part of the system and shall be warranted as specified herein.

1.12.8 Layout dimensions will vary between manufacturers and the layout area indicated on the drawings is based on typical values. The CSS shall review the contract drawings, the manufacturer's layout drawings and installation requirements, and make all modifications requisite for proper installation subject to acceptance by Engineer. At least 1100mm of clear access space shall be provided in front of all components of the computer control system components.

1.12.9 The CSS shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure.

1.12.10 The CSS shall be responsible for providing ventilation and/or dedicated cooling systems for all the control panels supplied by the CSS. Size the ventilation/cooling systems to provide sufficient air changes to dissipate excess heat generated by internal components. Maintain panel ambient temperature to suit the operating requirements of the internal components.

1.13 Control System Integrator/Programmer

1.13.1 The Contractor shall retain the pre-approved Control System Integrator/Programmer (CSIP) to provide all PLC/SCADA programming as stated in Division 13 and inclusive of the following:

.1 Prepare detailed control narratives based on existing and new process narratives.

.2 Modify the programs, re-configure software parameters, develop graphical user interface screens, etc., as required for all SCADA systems and local Ethernet Communications Network to integrate the new processes and new process equipment installed under this contract into the plant’s SCADA system and plant operations communications Network.

.3 Programming of all (new and existing) PLC’s SCADA Computers and local Ethernet Communications Network.

.4 Integration of auxiliary network systems that are installed and pre-configured by the Contractor.

.5 Development of graphical user interface applications to suit the SCADA Computers and related custom HMI SCADA application.

.6 Coordinate with the respective Control System Integrator/Programmers of the packaged equipment systems to ensure the vendor automation packages are integrated into the Deep River WTP SCADA HMI application in accordance with Township standards. Provide coordination with packaged vendor programmers for PLC logic and related messaging to facilitate integrated operation of all automation systems.

.7 Attend integration meetings with other Control System Integrator/Programmer's providing software development and automation logic for packaged equipment systems.

.8 Verification of all I/O on site.

.9 Assist with start-up & commissioning of all PLC/SCADA controlled equipment.

.10 Software Factory Acceptance Testing – Complete system automation and SCADA software application

.11 PLC/SCADA Programming documentation

.12 PLC/SCADA Manual

.13 PLC/SCADA Training – on site

.14 Start-up & commissioning of all PLC/SCADA controlled equipment.

.15 Factory Acceptance Testing and Site Acceptance Testing of all control panels provided by the CSS.

.16 Transportation of all hardware and insuring the equipment for transport and while in the possession of any 3rd parties or sub-contractors.

.17 Software Factory Acceptance testing is performed at the offices of the specified SCADA integrator.

1.13.2 Examine the contract documents in accordance with Instructions to Bidders.

1.13.3 The CSIP shall provide a "test" program for the new automation hardware to demonstrate the functionality of all the physical I/O, virtual I/O, located in the respective automation hardware and available via communications networks. The individual test programs shall demonstrate that the new PLC and automation hardware located in the new PLC panel specified in this section are able to monitor and control all local I/O.

1.14 Quality Assurance for Copper Cables

1.14.1 The materials, design, and workmanship employed in the manufacture of all equipment shall conform to the applicable standards for Copper cables.

1.14.2 The cable must meet the requirements of C (UL) CEC approved as communications cables meeting the requirements for the Bi-National Standard CSA C22.2 No. 214/UL 444 and

Section 60 of the Canadian Electrical Code, Part 1 (CEC). The C (UL) cable designation (and its meaning) would be one of the following:

.1 CMP – Cable meeting CSA FT6 or UL 910

.2 CMR – Cable meeting UL 1666

.3 CMG – Cable meeting CSA FT4

.4 CM – Cable meeting UL 1581, Section 1160 (Vertical Tray)

.5 CMX – Cable meeting UP 1581, Section 1080 (VW-1)

.6 CMH – Cable meeting CSA FTI

1.15 Quality Assurance for Ethernet Cables

1.15.1 The materials, design and workmanship employed in the manufacture of all equipment shall conform to the applicable standards for Ethernet Cables, Category 5e type:

.1 ANSI/TIA/569-A-1-2000 – Surface Raceways

.2 ANSI/EIA/TIA-569-A-2-2000 – Furniture Pathways and Spaces

.3 ANSI/EIA/TIA-569-A-3-2000 – Access Floors

.4 ANSI/EIA/TIAAAA-569-A-4-2000 – Poke Thru Fittings

.5 ANSI/EIA/TIA/569-A-7-2001 – Cable Trays and Wire ways

2 PRODUCTS

2.1 General Requirements

2.1.1 All line voltage powered instruments are to be suitable for a 120VAC power supply. All line voltage AC powered instrument not CSA certified must bear an ESA Special Approvals Branch label.

2.1.2 Normal instrument and control power supply for the Contract is 120VAC. Emergency power supply is from associated UPS. Provide all line powered instruments suitable for use on these supplies with appropriate CSA approval. All UPS power feeds are to be sourced from the treatment plant existing emergency generator electrical distribution system.

2.1.3 As applicable, instrument control output is to be from 4 to 20 mA, linear, isolated capable of driving a maximum load of 750ohms, unless otherwise specified.

2.1.4 Provide all the necessary mounting hardware, electrical connections, transducer junction boxes, power supplies, and all accessory items or options required to satisfy each application.

2.1.5 Provide corrosion resistant stainless steel or epoxy coated screws, bolts, fasteners, etc. in all applications.

2.1.6 Provide all special instrumentation communication cables, transducer cables, power cables, process sensing/sampling lines and capillary tubing in field measured lengths without joins as required by manufacturer. Allow adequate cable/capillary etc. to allow removal of instrument/transducer from process. Agree instrument-mounting locations with Engineer to ensure accurate field measurements.

2.1.7 Provide mechanical protection for capillaries and transducer cables and adequately secure to eliminate sagging.

2.1.8 All instruments shall be provided with process isolation valves. Valves must be utilized on all instrument lines for easy removal without disruption to the process.

2.1.9 All readouts, indicators, recorders, etc., shall be in metric units, whether shown or not and in engineering scales. All final units, ranges, set points, colours, etc., will be finalized on the shop drawings.

2.1.10 The Contractor shall be responsible for supplying all required communications setup and/or wiring, etc., and all other appurtenances which may be required, in order for the entire control and instrumentation system to operate as intended by this specification and as designed. Unless specifically stated otherwise, all control and readout signals, etc., shall be linear.

2.1.11 For wiring, see Division 16.

2.1.12 Equipment specified includes automation hardware, communications hardware and control equipment (including panels/enclosures) as specified herein and shown on drawings.

2.1.13 Without limitation to the following sections of this item, the equipment supplied shall be complete with all accessory items, whether specifically mentioned or not, so as to provide completeness of installation, and operation as intended.

2.1.14 The equipment specified shall generally be an "all electronic" control system, with linear isolated outputs from all instruments, 4-20 mA DC unless otherwise noted, and suitable for 115 volts, 60Hz, single phase operation.

2.1.15 No instruments shall be included in the design which utilize mercury or all other highly toxic substances, which through error or otherwise may enter and endanger the water supply.

2.1.16 All instruments and control elements shall be fully pre-wired and pre-piped in the factory and shall be equipped complete with terminal, terminal blocks and taps suitable for direct connection in the field.

2.1.17 Mounting brackets, hooks, plates, screws, bolts, anchors, etc., shall be stainless steel or epoxy coated and of sufficient size to permanently mount the equipment.

2.1.18 All process controls and instrumentation shall be complete with all necessary appurtenances to perform the functions indicated on the control schematics and electrical drawings with respect to inputs, outputs, etc.

2.1.19 Equipment specified includes instrumentation (including appropriate mounting hardware) and control equipment (including panels/enclosures) as specified herein and shown on drawings. Primary devices, transmitters, receivers, signal protection, conditioning equipment, indicators, switches (pressure/flow/temp.) etc. is to be included.

2.2 Service Conditions and Environmental Requirements

2.2.1 The equipment provided for the control system shall be suitable for the service conditions specified in the equipment sections.

2.2.2 All equipment shall be designed and selected to operate without degradation in performance throughout the environmental extremes specified. Equipment shall be designed to prevent the generation of electromagnetic and radio frequency interference and shall be in compliance with FCC Rules and Regulations, Part 15, for Class A computing devices.

2.2.3 All control system equipment located in air conditioned rooms shall be suitable for operation in ambient temperatures from 10°C to 35°C and a relative humidity of 10 to 80 per cent, noncondensing. All equipment located in non air conditioned indoor areas shall be suitable for an ambient temperature range of 0°C to 50°C and a relative humidity of 10 to 95 per cent, noncondensing. All equipment located outdoors shall be suitable for operation in an ambient temperature range -20°C to 60°C and a relative humidity of 5 to 100 per cent. Heaters and air conditioning/cooling equipment shall be provided where essential to maintain equipment within its manufacturer-recommended operating ranges.

2.2.4 All control system equipment will be installed in areas without anti-static floor construction and without any provisions for control of particulates or corrosive gases other than ordinary office-type HVAC filtering. System supplier shall furnish any additional air cleaning equipment, anti-static chair pads, or other protective measures necessary for proper operation of the system.

2.2.5 All input/output hardware shall meet or exceed, without false operation, all requirements of NEMA ICS-1-109.60, Electrical Noise Tests.

2.2.6 The equivalent "A" weighted sound level for all system equipment located in the BPS Electrical room, shall not exceed 35 dBA. Sound reduction enclosures shall be provided where necessary to comply with these limits.

2.3 PLC & Automation Equipment

2.3.1 The CSS is to supply, install, test, and commission new PLC components as indicated on contract drawings. Provide/retrofit control panels to suit the integration of the process system I/O and communications, including I/O required to suit future process applications.

2.4 System Software Configuration

2.4.1 The SCADA HMI and the system software will be configured by the CSIP as detailed in Division 13. The CSS shall be responsible for the following configuration support tasks:

.1 Furnish and install the necessary operating system software, utilities, and all standard software packages. All software provided shall be fully configured for use as specified herein and in related sections. This configuration should include but not be limited to, security access from the Administrator functionality to the Operator functions, printing functions (including graphics, reports, system documentation parameters, etc.), reporting functions and historical interface and historical data accessibility.

.2 Configure the hardware and provide any necessary firmware or software programming associated with the hardware, configuration such as DCU, PLC, and RTU device address assignments.

.3 Provide the services of an experienced applications engineer for two (2) 8-hour day visits, at Owner's facilities, to assist with the configuration. One of these visits shall be scheduled to coincide with the delivery of equipment for configuration. The remaining visits shall be scheduled with Engineer and Owner.

.4 Provide the services of the applications engineer for telephone consultation and trouble shooting from System Supplier's facility for twenty-four (24) hours.

.5 Provide early shipment of the terminal and hardware equipment for configuration of the system as defined herein. This equipment shall be delivered to Owner's offices, but not before submittal information and drawings for the equipment have been approved. System Supplier shall also be responsible for subsequent re-transport of this equipment to the project site.

.6 Provide complete startup, checkout, and calibration of all system hardware and I/O specified.

2.5 Software Documentation

2.5.1 CSS shall furnish complete documentation on all software supplied with the system specified herein and in Division 13. Operating systems, compilers, assemblers, and utility and diagnostic programs that are standard commercial products of third parties need not be included in the magnetic/optical media backup. Software documentation shall consist of the following principal items.

.1 One backup set of any integrated circuit or solid-state memory-based plug-in firmware used.

.2 Two complete backup copies of system and application software in installable/executable format on magnetic/optical media compatible with the system furnished.

.3 Two complete backup copies of all purpose made software c/w source code and optical/media.

.4 Three sets of user reference manuals for all standard system and application software.

.5 One set of user reference manuals for all operating system software.

.6 Three sets of printed as-built reference documentation for any special software provided specifically for this contract.

.7 One set of above on magnetic/optical media compatible with the system furnished.

.8 For each licensed software product, all documentation provided by the product manufacturer shall be provided. This includes all reference manuals and any other documents that were provided by the manufacturer. There should be one set of this documentation for each and every piece of equipment provided. Multiple pieces of similar equipment or software require multiple copies of this documentation.

2.6 Software License

2.6.1 All software programs supplied as a standard part of System Supplier's products for this project shall be licensed to the Owner for use on the system specified herein. Such license

shall not restrict Owner from using the software on the system provided hereunder or its replacement. Owner shall have the right to make copies of the software for use on the system provided. Specific requirements of System Supplier's software license are subject to review and approval by Owner and Engineer.

2.7 Communications Hardware

2.7.1 Ethernet Switch/Hub

.1 The CSS shall provide the ethernet switch types in the respective control panels as indicated on the drawings, to suit the required quantities

.2 The CSS is required to install all switches in the respective panels prior to control panel factory acceptance testing.

2.8 Instrumentation, Control, Communication, and Special Field Wiring

2.8.1 Conform to the requirements of Division 16.

2.8.2 Run all wiring in conduit or duct (underground wire) unless otherwise specified. Refer to this division and to the drawings for additional information, requirements and details.

2.8.3 Provide minimum 20 per cent spare wiring or two conductors (one pair) whichever is greater for each control conduit. Spare control wire shall be tagged as spare at both ends.

2.8.4 All wires must be tagged with pre-numbered slip-on markers. Allow for up to 10 characters per individual wire. No wrap around markers will be accepted.

2.8.5 Control Wiring (Field)

.1 All control wiring to be stranded, annealed copper conductors, 600V minimum rating 14 AWG, RW90 XLPE, 600V rated conductors to be provided.

.2 Where conductors to be buried in conduit 14 AWG, RWU90, XLPE, 600V rated conductors to be provided.

2.8.6 Instrumentation Cable (Field)

.1 Cable to be 300 V rated and meet CSA, C22.2 No. 239 standard with the following features:

.1 Seven strand copper conductor with TW75 (-40°C) 105°C dry PVC insulation formed into pairs or triads.

.2 Aluminum/polyester tape shield over individual pairs or triads.

.3 Individual shield, seven strand tinned copper drain wire.

.4 Aluminum/polyester tape shield over cable.

.5 Overall shield, seven strand tinned copper drain wire.

.6 Ripcord.

.7 90°C (-40°C) FRPVC jacket.

.2 Cable to be as manufactured by SHAWFLEX LTD. or BELDEN LTD.

2.8.7 Communication and Special Wire and Cable (Field)

.1 The Contractor shall provide all wiring and cable, including connectors, plugs and termination devices required for the wiring of the systems and equipment shown on the drawings, unless otherwise specified.

.2 Provide quantities and lengths of cable and wire type as recommended by the system equipment manufacturers. Do not de-rate any cabling and wire. No wire/cable to be sized less than 18 AWG unless approved by the Engineer or unless a specific requirement of the equipment manufacturer.

.3 Coordinate with the manufacturer and other sections of these specifications to ensure proper conduit type (i.e. metal) and sizes are provided.

.4 All cables and wire to be continuous runs.

.5 Provide, as part of shop drawing submittal, cable and wire specifications and data for each system. Include written proof that cable and wire meets requirements of equipment supplier.

.6 Any wire and cable installed that does not meet the wiring specifications of the equipment manufacturer shall be removed and replaced (including conduits, if necessary), at the Contractor's expense.

2.9 Field Devices and Control Equipment

2.9.1 Unless specified otherwise, transmitters shall be two-wire, suitable for operation on 24VDC, with 4-20 mA DC linear output, complete with direct reading local indicators in engineering scales.

2.9.2 Calibration and scale range data indicated may vary during shop drawing review.

2.9.3 Provide quantity and tagging to suit the drawings.

2.9.4 Acceptable manufacturers of control equipment transmitters shall be as specified for the respective field devices:

.1 Analyzers

.1 To be supplied and installed in accordance with Division 13.

.2 To be wired for 120V power supply and control wiring associated with alarm set point contacts by Division 16.

.3 Wiring to suit installation location as directed by the Engineer.

.4 Sensor cable length to be coordinated so that wiring between the sensor and controller is without splices.

.5 If meter is not CSA, then it will require special inspection by the Electrical Safety Authority (ESA).

.2 Flow Indicator Transmitter (FIT)

.1 To be supplied and installed in accordance with Section 13566.

.2 All power and control wiring by Division 16.

.3 Output: Isolated 4-20mA

.4 Sensor cable length to be coordinated so that wiring between the sensor and controller is without splices.

.5 If any instrument or device is not CSA, then it will require special inspection by the Electrical Safety Authority (ESA). The Contractor shall coordinate and pay for each inspection as required.

.3 Limit Switches - LS

.1 To be supplied and installed in accordance with Section 13563.

.4 Pressure Indicator Transmitter (PIT)

.1 To be supplied and installed in accordance with Section 13563.

2.10 Control Panel – General

2.10.1 General dimensions and arrangements are indicated on the drawings. System Supplier shall be responsible for coordinating the console and enclosure sizes and arrangements to accommodate the equipment provided.

2.10.2 Provide industrial type control panels to suit model and dimensions shown on the drawings. Dimension identified on the drawings are to be considered minimum. It is the responsibility of the CSS to increase the dimensions of the control panel, and/or provide additional control panel sections as required to accommodate the all components to be installed within the respective control panel applications. All control panel designs that require additional control sections shall include a full size door to suit each additional section.

2.10.3 All panels furnished by the Contractor shall carry CSA/ULC label to suit the custom fabricated application or be special inspected by the Electrical Safety Authority.

2.10.4 Provide wall mounted or free standing control panels to suit the respective applications as shown on the design drawings.

2.10.5 Control Panel wiring or instrument connections and all internal items to be identified with tagging per these Specifications.

2.10.6 Wire/conductor colour coding to be per these Specifications.

2.10.7 All panel mounted equipment including switches, relays, timers, analog equipment power suppliers, circuit breakers etc., shall be identified with individual lamacoid nameplates. Provide Engineer with nameplate data for review.

2.10.8 The Contractor shall provide the Engineer in writing with a proposed system of terminal wire numbering for approval prior to submitting shop drawings.

2.10.9 All wire and cable shall be run in continuous lengths between supply point and the load and/or device termination points. No splices will be allowed.

2.11 Control Panel Grounding and Power Distribution

2.11.1 Power shall be supplied to the all field devices and instruments from the respective control panels as indicated on the drawings.

3 EXECUTION

3.1 General Instructions

3.1.1 The Contractor shall supply a communications & automation equipment schedule for review prior to submission of any shop drawings. The schedule shall be tabular in form and have a minimum of:

.1 Item system description

.2 Tag number as herein specified or as shown on the drawings.

.3 Reference to specification item number, drawing number and description

.4 Proposed submission date

.5 List of associated equipment. Note all equipment forming part of a system should be submitted at same time.

.6 List of all software as required to set-up/program field devices, including verification that all software is licensed in the name of the owner.

3.2 Coordination

3.2.1 Carefully examine and monitor for compatibility, any instrumentation and control work provided as part of the work of Sections of the specification, other than the Sections governed by this Section and ensure that all trades involved are aware of any coordination problems or details.

3.2.2 Incompatible work, such as instrument process connections, mounting of equipment, analog, discrete or communication wiring, voltages, or inconsistencies resulting from insufficient coordination of other related work, is to be satisfactorily resolved at no additional cost to the Contract.

3.2.3 When scheduling site inspection, FAT, commissioning, or SAT with the Engineer, allow at least 10 working days advance notice.

3.3 Manufacturer’s Services and Certification of Installation

3.3.1 Comply with the requirement of Section 0100 – Clean Up, Commissioning, and Training.

3.3.2 Allow in the tender for all the necessary services and expenses of a trained, qualified manufacturer's representative for each device to ensure correctness of installation, testing, start-up commissioning and training. The qualified representative is to:

.1 Provide onsite supervision of installation for the initial and critical stages of the work as agreed to with the manufacturer/supplier and as require by the Engineer.

.2 Supervise testing of equipment. Supervise retesting of equipment at no additional cost.

.3 Provide written certification stating that the work has been completed satisfactorily.

.4 Provide a complete Installation, Start-up Checklist and sign off on the start-up work completed.

.5 Provide operation and maintenance instruction to the Township operating staff.

3.3.3 Provide supervision of installation as required by the manufacturers for all equipment in this Division.

3.3.4 Provide all materials, labour and equipment to make any adjustments to the installation as required by the manufacturer or the Engineer to effect performance.

3.3.5 On completion of installation and testing, obtain certification from the manufacturers that the equipment is installed correctly, is in full operating condition, and is operating in accordance with its design rating. Submit the original certificate to the Engineer.

3.3.6 Include the service of the trained personnel to inspect and commission the equipment when ready for starting and to instruct the operating personnel in the operation and maintenance of the equipment. Time spent on site by the trained personnel must be witnessed by the Engineer.

3.3.7 Include above services for all equipment specified in relation to this Section and as a minimum provide commissioning and training as follows:

.1 Major process equipment – See the list below. Split the specified time into three stages: inspection during installation, start up and commissioning, staff training.

.1 Automated polymer preparation system

.2 Ammonium sulphate pump skid

.2 Two eight hour days for all other process instrument, where not specially mentioned, of which 0.5 day minimum dedicated to training.

3.4 Panel Inspection & Factory Acceptance Testing (FAT)

3.4.1 Make all of the necessary arrangements with equipment suppliers for panel inspection and FAT prior to delivery.

3.4.2 Schedule the FAT sessions with the Engineer a minimum of 10 working days in advance. Allow enough time for thorough testing and corrections to take place. Provide written indication of the control panels to test as part of the FAT.

3.4.3 Panel inspection and FAT is to be performed in the presence and to the satisfaction of the Engineer, and is to include all devices necessary to simulate actual operating conditions.

3.4.4 Configure the PLC with a suitable “dummy” or shell program, establish communication, temporarily wire digital inputs to test switches and digital outputs to indicating lights, analog inputs to 4-20mA generators and analog outputs to panel meters to demonstrate functionality of all hardware and software. Exercise the hardware (i.e. I/O, communications, panel mounted instruments, etc.) with appropriate software in place to demonstrate/monitor operation of all connected equipment and wiring.

3.4.5 Configure and demonstrate all network connections to the respective control panels. Provide temporary network connections to “test devices” to demonstrate the operation of all PLC communications modules.

3.4.6 Make the necessary corrections as indicated by the tests, or as directed by the Engineer. Shipment of equipment to site is contingent on the Engineer’s approval.

3.5 Installing Instruments

3.5.1 Install, test, calibrate and commission instruments in accordance with this Specification, drawings for construction and any special details where they apply. Where installation details are not indicated, conform to the manufacturer’s instructions and/or API RP550 recommendations.

3.5.2 Unless otherwise shown or specified, all required mounting hardware, enclosures, terminations, junction boxes, etc. are to be provided. Refer to the tender drawings and the manufacturer’s documentation to confirm the necessary hardware and construction for specific mounting assemblies where such details are not specified herein.

3.5.3 Do not mount instruments on vibrating structures (e.g. handrails), or on piping or near equipment that induces vibration. Do not mount instruments below or directly adjacent to lines conveying corrosive chemicals or near sources of leakage or spillage.

3.5.4 Prepare metal surfaces and paint supports or frames the same colour as the member the complete assembly is mounted on.

3.5.5 Locate instruments and their associated sensors, local isolation valves, isolation switches and other related accessories so that they are readily accessible for operation, maintenance or removal. Ensure that instrument displays are properly oriented so as to be easily viewed. Unless otherwise shown or specified, mount instruments 1.4 m above finished floors, grade or platforms. Allow for cabinet floor-pad heights when locating panel instruments. Any instrument that is not easily accessible for operation or maintenance, or any indicator that is not easily and readily visible must be relocated as directed by the Engineer at no charge to the Contract.

3.5.6 When drilling or installing conduit entry points instruments, protect internally mounted equipment from vibration, shock and metal filings. Conduit entries must maintain the equipment or panel EEMAC rating.

3.5.7 Field measure lengths for transducer cables, and similar items prior to ordering. Mechanically protect cables and adequately secure in place without sagging.

3.5.8 For location, power, mounting and other related details, refer to the manufacturer’s installation details and to the instrument and electrical drawings issued for construction.

3.5.9 Provide isolation valves for all instruments.

3.5.10 Protect all instruments with capillaries throughout their length without sagging, by using painted/galvanized angle iron and clips. Avoid sharp bends in capillary and coil any excess close to the sensor end. Protect the coiled capillary by clipping to a steel plate or other safe method.

3.5.11 Sensing and sample lines are to be run in ½ inch stainless steel tubing with “Swagelok” compression type fittings.

3.5.12 Electrically heat trace all instrument sensing and sample lines liable to freezing.

3.5.13 Install process sample piping and sensing lines to avoid accumulation of vapour or gas (in liquid service) and of liquid or condensate (on vapour or gas service) as appropriate.

3.5.14 Position instruments so that they do not block or obstruct walkways or access points and provide adequate space around installation for removal of covers, etc.

3.5.15 Standard instrument process connections of ½” NPT female are to be provided (pressure gauges normally ½ inch NPT male).

3.5.16 Instrument support brackets may not be welded to process piping or equipment, but should generally be pedestal or wall mounted.

3.5.17 Run field cables for analog signals in separate conduit from 120VAC/24VDC control or 120VAC power supply cables.

3.5.18 Use field junction boxes suitable for the area classification to “marshal” groups of signals of the same type in an area and cable back to buildings and local control panel with multicore cables.

3.5.19 Junction boxes may be FRP (fibreglass reinforced plastic) or similar material suitable for the area and rust and weather resistant. Terminals inside field junction boxes are to be DIN rail mounted.

3.5.20 Provide the necessary mechanical shields, mounting plates to properly secure and protect transducers. Provide stilling wells wherever turbulence can adversely affect measurement.

3.5.21 Once an instrument has been inspected by the Engineer and initially calibrated, it is to remain powered up at all times unless servicing the instrument itself. Immediately install keepers on all panel circuit breakers powering instruments.

3.5.22 Instrument calibration, setpoints and other programmable parameters are to be confirmed with the Engineer during on-site inspection as soon as site conditions are sufficiently ready. Final calibration values may and will be different than nominal values specified in the Product Data Sheet at no extra cost to the Contract.

3.6 Identification and Tagging

3.6.1 Identify systems and equipment in accordance with the provisions of this specification. Systems and equipment include:

.1 All items furnished under this contract.

.2 Items defined in this contract that require identification;

.1 Identification of wiring and electrical equipment as specified and tagged in the PLC I/O list.

.2 Provide a Tag text list to Engineer for approval prior manufacturing.

.3 Provide tags of the following materials:

.1 Field instrument tags are 10 gauge, stainless steel with black lettering.

.2 Equipment tags are 10 gauge, stainless steel with green lettering.

.3 Control panels tags are to be Lamicoid, black background with white lettering.

.4 Size tags as 100 x 40 with maximum three lines, front height as 6.5mm.

.5 Use text with the following characteristics:

.1 Lettering – Uppercase

.2 Font – Times New Roman

.3 Style – Regular

.4 Size – Maximum to fit label width, minimum 3mm

.5 Character spacing – Normal

.6 Justification – Center lettering on each line

.6 Submit with the Shop Drawings, a typed list indicating all nameplates wording as well as proposed types, sizes and styles.

.7 Prior to installation of new items, apply identification nameplates to each instrument, panel, telemetry device and controller. Where existing instruments are re-used, or connected into the new system/control panel, provide identification nameplates for these instruments also.

.8 Lamacoid nameplates shall be provided for each piece of instrumentation equipment. (For interior or exterior panel mounted equipment).

.9 Mount tags so that they are readily apparent and legible. Place tags within a height range of 1200mm to 1650mm if possible. Do not obscure or mount over other nameplates, labels or tags.

.10 Nameplates shall be fastened with corrosion resistant screws.

.11 Nameplates on field equipment and external to control panels to be black background with white lettering. Internal panel labels to be black background and white lettering.

.12 Identify transducer and miscellaneous hardware with stainless steel labels denoting tag name only, permanently fastened to either the transducer housing or cable.

.13 Wiring:

.1 Identify all PLC I/O signals on field terminal rails with appropriate tag.

.2 Identify all wiring at both ends with appropriate, permanent wire markers.

3.7 Controller Application Program Installation, Testing & Control System Commissioning

3.7.1 When field pre-commissioning of the instrumentation and control system has been completed as specified above, the system is ready to load control application program.

3.7.2 Coordinate all commissioning activities. Supply all labour and materials required to coordinate instrument and controls commissioning with other trades.

3.7.3 Provide all labour and materials necessary to commission and operate the system for the duration of the run or period. During this time all equipment is expected to run in automatic mode.

3.7.4 Perform the commissioning activities associated with operation of the treatment plant process equipment under control by the software program, as directed by the programmer.

3.7.5 Take all necessary steps to ensure that all equipment or parts of the system successfully tested and deemed ready for their intended use stay in operation.

3.7.6 Provide clear signs/marking as to required status on the equipment that is to remain powered up, left in Auto, or remain Off, etc., during the commissioning period. Agree with the Engineer on the method for achieving this and ensure safe and compliant operation of the equipment at all times.

3.7.7 Adopt a recognized lock-out policy and agree to it with the Engineer. Coordinate the requirement for lock-out for safety reasons with the scheduled commissioning program so that all equipment needed to commission a process/area is available concurrently.

3.7.8 Make minor corrections/additions to wiring, terminations, instrument calibrations and settings as normally expected necessary to resolve operational problems during commissioning at no additional cost.

3.8 Site Acceptance Testing (SAT)

3.8.1 When initial site inspections and commissioning of the instrumentation and the control system is satisfactorily complete, schedule with the Engineer to demonstrate the entire system is ready to start control application program commissioning.

3.8.2 Include for the presence of qualified instrument technicians and equipment manufacturer's representatives to supervise the test if requested by the Engineer. Testing is to demonstrate the proper operation of all field physical input and output signals of the PLC system under actual operating conditions to the satisfaction of the Engineer. This includes proper operations between PLCs, and all peripheral devices. Supply all labour, instruments and materials to perform the testing.

3.8.3 The SAT must be satisfactorily complete prior to applying for a Certificate of Substantial Performance.

3.8.4 Deliver all testing software, panel keys etc. to the Engineer.

3.8.5 Provide test programming to suit all PLC applications, and provide the same I/O and communications demonstration performed during the FAT.

3.9 Training

3.9.1 Comply with the requirements of Section 01820 – Demonstration and Commissioning.

3.9.2 Supply a site training program for the plant operating personnel consisting of:

.1 Maintenance Training (8 hours) in two groups of four hours each by Instrument Supplier and/or appropriate equipment manufacturer's representatives.

.2 Operator training (8 hours) in two groups of four hours each by Instrument Supplier.

3.9.3 Dates personnel receiving training will be coordinated by the Township.

3.9.4 The training program is to be conducted by qualified instrument technicians and competent manufacturer's personnel experienced both with the product and with instruction, using system operation and maintenance manual data as the basis for demonstrations and instructions.

3.9.5 Training shall take place at the site or at the equipment itself. Operation and maintenance manuals shall be submitted to the Township a minimum of 30 days prior to the training occurring.

3.9.6 The training program is to include routine maintenance of the equipment.

3.9.7 The site training program must be complete prior to application for a Certificate of Substantial Performance of the work.

3.9.8 Pay all costs associated with the training program, with the sole exception of salaries associated with the operating personnel being trained.

3.10 Process Performance Operation

3.10.1 Provide all labour and materials necessary to support the process and the instrumentation and control system for the duration of the contract performance run. During this operation all equipment is expected to run in automatic mode.

3.11 Warranty and Guarantee Period Activities

3.11.1 During the warranty period, hardware service should be provided by a factory trained service representative who shall be on-site within 24 hours of a service request, seven days/week, including weekends and holidays. The service representative shall be equipped with all necessary tools, testing equipment, spare parts, and expertise to perform the service in one visit.

.1 For each service call submit a report giving the following information:

.1 Part numbers, description and prices for items replaced.

.2 Revised hard copy/soft copy listings of program changes.

.3 Hours worked by maintenance personnel.

.4 Reason for the service call, and whether preventative, unscheduled or corrective maintenance was carried out.

.5 Name of Township representative present during repairs. Explain the problem and solutions to the Township representatives.

.6 Description of problem as discovered on arrival at site and itemized report of activities performed to isolate and correct problem.

.7 Identification of any required actions to prevent similar future occurrence.

.8 Name of attending operations representative, time of call and time of arrival on site.

.2 A single contact point shall be provided for all hardware such that the Township representative need only call a single phone number irrespective of which piece of hardware has failed.

.3 Spare Components/Firmware & Software Upgrades:

.1 The supplier should have access to a dedicated spare parts inventory for each component provided. Parts shall be available within 24 hours of a service parts request, seven days/week.

.2 Include key spare parts that are not normally available immediately from stock, in the Recommended Spare Parts List.

3.12 Installation of Equipment

3.12.1 Provide all necessary labour, equipment, tools, anchor bolts, etc., for the complete installation of all equipment specified under this Division.

3.12.2 Install all equipment in a workmanlike manner and in accordance with the manufacturer's drawings, instructions and/or under the direction of his qualified technical representative unless otherwise specified or instructed by the Engineer.

3.12.3 All serial and Ethernet connections shall be tested and verified operational.

3.12.4 All communication cables, including serial and Ethernet shall be continuous, with no splices or junction points.

3.13 Data Communications Outlet Installation

3.13.1 Install all Ethernet cable in accordance with manufacturer's recommendations.

3.13.2 Ethernet cable runs in control rooms, offices or other rooms with drywall shall be concealed behind the walls and terminate in a wall mounted jack.

3.13.3 All other Ethernet cable runs shall be neatly dressed and terminated both ends with a flush or wall mounted jack.

3.13.4 All outlets shall be installed in the following manner:

.1 Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box eliminators are used, excess wire can be stored in the wall. No more than 300mm of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack may be neatly coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

3.13.5 In addition, each cable type shall be terminated as indicated below:

.1 Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturer's recommendations and/or best industry practices.

.2 Pair untwist at the termination shall not exceed one half an inch for Category 5e connecting hardware.

.3 Bend radius of the cable in the termination area shall not be less than four times the outside diameter of the cable.

.4 The cable jacket shall be maintained as close as possible to the termination point.

.5 Data jacks shall occupy the top positions on the faceplate. Data jacks in horizontally oriented faceplates shall occupy the left most positions.

3.14 Network Connections

3.14.1 Configure all patch panels, switches, media converters, PLC's, TVSS's, wall jacks, copper patch cords and other devices as required to provide a complete and functional communications systems as specified in this section.

3.15 LAN Commissioning

3.15.1 All IP addresses to be supplied by the Engineer.

3.15.2 Install and connect new Ethernet cables as shown on the drawings.

3.15.3 Configure, test and demonstrate to the Engineer the correct functioning of the PLC SCADA LAN by demonstrating communications between the each device and/or control panel connected to the LAN and a test device (i.e. a laptop provided by the Contractor and equipped with software to suit the communications demonstration).

3.16 Supervision and Commissioning

3.16.1 A supervision and commissioning period shall be allowed for by the Contractor for his supplier to thoroughly check the final installation and performance of each individual piece of equipment, to check each loop control, to start up the equipment and to instruct Operations Staff on the operation and maintenance of the system. The work shall also include site supervision of the installations where necessary, repair and/or adjustments to the supplier's equipment, and co-ordinate the field supervision by other suppliers and the Contractor within their areas of responsibility.

3.16.2 The start-up procedures will not be carried out without the co-operation and presence of the Engineer. The Contractor shall be responsible for co-ordinating the work, and for making his

supplier available to completely commission the entire control and instrumentation system so that it is in perfect running order. The cost of this supervision and commissioning by the supplier for the Contractor shall be total included for in the Contractor's tender. No extra accommodation or meal expenses will be paid. The Contractor remains responsible for a complete and working system, in full accordance with these documents, and at the price bid in his tender.

3.16.3 The Contractor shall obtain written approval from the Engineer, Owner, and Operator prior to modifying the existing system.

3.16.4 The commissioning will not be considered complete without a complete, final, and up-to-date test software listing being supplied.

3.16.5 Non-Operational Tests

.1 Verify and demonstrate the operation of all communications links including:

.1 Ethernet communications links to all digital metering devices, and packaged PLC control systems.

3.16.6 Operational Tests

.1 Demonstrate the operation of all communications systems.

.2 Demonstrate all remote I/O automation control functions.

3.16.7 The complete control system and instrumentation must be fully operational and without deviancies prior to implementation of the client supplied custom automation programming.

3.16.8 The Contractor shall provide the services of the installing electrician, on site for a period of not less than 15 non-consecutive days to assist in the testing of the client supplied custom automation applications. Any changes or adjustments to field wiring, setpoints, and system operation shall be at no cost.

END OF SECTION

1 GENERAL

1.1 Related Sections

1.1.1 Division 13 – Instrumentation, Control & SCADA

1.2 Intent

1.2.1 All work described in this section shall be performed by the Control System Integrator/Programmer (**CSIP**).

1.2.2 It is the intent of this section to provide an industrial control system (i.e. SCADA) for the Deep River WTP comprised of computer based HMI's, PLC's and instrumentation to monitor and control process parameters and equipment to be supplied and installed under this contract, as shown on the drawings or specified.

1.2.3 The SCADA system shall be complete, fully functional system and designed and developed to meet the control requirements of the process design indicated on the contract drawings.

1.3 Description

1.3.1 The CSIP shall coordinate, develop and implement all system parameters, data tables and programs within the SCADA system to make the SCADA function as intended and to suit the process and automation objectives outlined in the Process Control Narrative and the contract documents.

1.3.2 The CSIP is required to develop a detailed Process Control Narrative (PCN). CIMA will provide a control philosophy to reflect the intention for controls of the new equipment compared to the existing system. The PCN is to include but not be limited to the following information:

.1 Describe each process to be monitored and/or controlled by the Deep River WTP automation system.

.2 Provide a tag database for all real and virtual signals that will be included in the automation system. Identify the mode/type/units/range for each real or virtual signal.

.3 Identify all packaged automation systems to be integrated into the main plant HMI/SCADA application. Produce custom graphical HMI applications to match the full functionality of the status/control/alarm features provided by the respective package vendor OIT applications.

.4 Identify detailed control logic required in the operation of each process including, interlock logic, delay logic, adjustable variables, high/low limits, modes of operation, failure modes, and base conditions

1.3.3 The CSIP shall coordinate and implement the necessary configurations in the SCADA system to integrate and interface the SCADA system with the control systems provided by the suppliers of packaged equipment.

1.3.4 Develop a work plan with an itemized list of all deliverables.

1.3.5 SCADA tag name assignments will developed and confirmed during the integration meeting process.

1.3.6 The CSIP and the Contractor shall provide all labour, supervision, tools, equipment, materials, services and miscellaneous expenses necessary to complete the work as outlined in this Section. The word “provide” shall be defined to mean supply, install, start up, test and commission.

1.3.7 The CSIP shall provide the software, programs, parameter and hardware settings as required to integrate the following new systems into the Townships overall SCADA system:

.1 Automated polymer preparation system

.2 Ammonium sulphate pump skid

.3 Actiflo PLC Control Panel

.4 All other new and replacement instruments, as indicated on the drawings, Division 13, and the instrument list.

1.4 Standards

1.4.1 Equipment furnished under this section shall be designed, constructed, and tested in accordance with the latest edition and requirements of the followings:

.1 Canadian Standards Association (CSA)

.2 Canadian Electrical Manufacturers Association (CEMA)

.3 National Electrical Manufacturers Association (NEMA), and NEMA ICS-1-109.60

.4 International Society for Measurement and Control

.5 The Instrumentation, Systems, and Automation Society (ISA)

.6 FCC Part 15 – Class A / Canadian’s Interference-Causing Equipment Standards (ICESs)

.7 Institute of Electrical and Electronics Engineers IEEE-519

.8 ANSI C37.90.

1.5 Submittals

1.5.1 Conform with requirements of Division 1, including Sections 01330.

1.5.2 Provide a new SCADA communications architecture schematic as required.

1.5.3 A detailed submittal package as per Section 13100.

1.6 Operation and maintenance manuals

1.6.1 Provide as per Section 13100.

1.7 Work Included

1.7.1 The Control System Integrator/Programmer (**CSIP**) shall be responsible for:

.1 Coordinating with the respective Control System Integrator/Programmers of packaged equipment systems and executing the verification of the SCADA system including all PLC control panels, communication panels, and associated communication links provided as part of this project.

.2 Providing and implementing test PLC programming to verify and demonstrate that all new PLC's are capable of monitoring all inputs and control of all outputs. Test programming shall demonstrate that all communications links identified on the SCADA architecture drawings operate as required.

.3 Providing and implementing a test OIT procedure or application to demonstrate and verify that the respective points in the PLC data table are correctly configured and operating. The OIT test application shall display the status of all I/O and include the ability to toggle discrete outputs and to adjust analogue input words between 0 to 100% to facilitate the verification of analogue outputs.

.4 Demonstrating the operation of the SCADA system and placing into service all SCADA equipment to the satisfaction of the Engineer.

.5 Integrate the process equipment packaged automation systems into the main SCADA HMI application. Reproduce all control/status/alarm/historical features that included the package system OIT applications into the main plant SCADA HMI application. Detailed HMI application graphics to be reviewed during the integration meeting process

.6 Provide a controls description for the process control logic, based on the Process Narrative.

.7 Development of the custom graphical user interface application for the purpose of control and monitoring of the Deep River WTP.

.8 Development of the user programs in the new PLC systems.

.9 Development of custom reports in accordance with the MOE compliance requirements for reporting.

.10 Development of a custom remote alarming application to suit the specific requirements of the Township.

.11 Development of SCADA system to provide daily reports, trends, alarm functions, historic data collection, and the associated displays, etc.

.12 Providing a manual that fully documents the operation, features and functions of the SCADA system.

.13 Demonstrating the complete specified functionality of the SCADA system to show compliance with these specifications through Factory and Site Acceptance Testing (FAT and SAT).

.14 Providing training/familiarization courses in the operation, trouble-shooting, and maintenance of the complete SCADA system. Training to take place at the Deep River WTP or another location specified by the Township.

.15 Providing support to the Engineer and Contractor during site acceptance testing (SAT).

.16 Assisting with the start-up & commissioning of all PLC/SCADA controlled equipment, including those in vendor supplied packages.

.17 Providing documentation, custom PLC programming and SCADA HMI integration in accordance with the Township requirements.

.18 Verification of all I/O on site.

.19 Assist with start-up & commissioning of all PLC/SCADA controlled equipment.

1.7.2 Programming

.1 The CSIP shall be responsible for programming for the new process system PLCs, database creations, and generation of all graphic display screens, alarm configurations, instantaneous trend, historical trends and reporting for the SCADA HMI at the Deep River WTP.

.2 The CSIP configuration engineer shall meet with the Engineer, Owner and Operations Staff to review the overall plant control system display configurations as per the integration meeting requirements described in this specification.

1.7.3 Operating Displays

.1 Process Screen Development:

.1 Process equipment shall be illustrated on process screens to closely resemble their appearance and function. Develop a library of graphic symbols to represent piping, valves, devices, and equipment for process screens and submit for approval and acceptance by the Owner and Engineer. All screen shots shall be submitted to the Owner and Engineer a minimum of two weeks prior to commissioning of the system for review and comments.

.2 The colour scheme for the process screen shall generally conform to the process equipment and pipe painting colour schedule selected for the process.

.3 All analog values and status of process equipment and devices pertaining to the process shall be displayed on the corresponding process screen. Analog values and status information shall be displayed on several screens as directed by the Engineer. The status of equipment shall be displayed by changing the colour utilizing high performance graphics and colours.

.4 Graphical animations shall be submitted and reviewed by the Township.

.5 Select a process screen as a trial screen and review it with the Engineer and Owner for format, spacing, colour, displays, etc. After the final revisions to this screen are accepted, develop, and submit a general layout for each screen to the Engineer and Owner for review. The layouts shall be corrected and resubmitted until accepted by the Engineer at no additional cost to the Owner.

1.7.4 Trending:

.1 Trending screens shall conform to Township requirements.

1.7.5 Reports:

.1 Reporting files shall conform to Township requirements.

1.7.6 Integration Meetings

.1 A total of two integration meetings shall be held to suit the custom development of the PLC programming and SCADA HMI development.

.2 The meetings are to be hosted by the CSIP and must be located at the CSIP office or a location selected by the client. The CSIP shall provide meeting facilities to accommodate all the CSIP personnel required to suit the PLC Programming, SCADA HMI development and 8 representatives from the Engineer/Owner. The CSIP shall equip the meeting faculties with visual aids, video monitors, and projectors as required to suit the presentation of the custom SCADA HMI applications.

.3 Prior to the first integration meeting, the CSIP is required to submit the following documentation:

.1 PLC architecture schematic

.2 Equipment submittals for PLC's, SCADA HMI, communications modules

.3 List of SCADA HMI software and software licences in the name of the Township.

.4 Process control narrative.

.5 Listing of all CSIP supplied equipment & instrumentation

.6 Listing of all PLC I/O.

.4 Meeting One (1)

.1 Establish PLC programming conventions that will facilitate the remote control and monitoring of the processes via the Deep River WTP HMI SCADA computer application.

.2 Confirm that the general conventions for the graphical styles, symbols, status and control graphics, control methods, colour schemes, alarm schemes, trending schemes, and reporting methods and the HMI computer hardware are in accordance with Township Standards.

.3 Discuss and determine if the established HMI conventions for the ET's HMI computer application are within technical limits of the HMI software.

.4 The CSIP shall produce <u>preliminary</u> HMI graphic displays for the first integration meeting. The preliminary HMI graphic displays shall demonstrate that the CSIP has conformed to general color conventions, navigational menus, instantaneous/historical trending and basic process components. It is to be

expected that the Township and/or the Engineer can request changes to the HMI and ask for additional meetings.

.5 Confirm that the tagging conventions are in accordance with the project requirements.

.6 At the minimum, the CSIP's technical programming personnel shall be present for one day.

.5 Meeting Two (2)

.1 Final review of the HMI applications. The HMI submission is to be 95% complete.

.2 Provide proposed tagging convention for all real/virtual signals, to be included in the PLC programming, and SCADA HMI application

.3 The CSIP shall forward preliminary colour copies of the HMI application to the Owner and the Engineer 2 Weeks prior to the second integration meeting.

.4 The CSIP shall implement all final comments identified by the Owner and Engineer.

.5 The PLC programming coordination will be held during the same trip as the integration meetings described in this document.

.6 If necessary, the CSIP shall move data to contiguous memory locations within the PLC for more efficient Deep River WTP system access.

.7 All PLC and HMI programming shall strictly follow these control systems standards and conventions as determined in these meetings. Many changes to the manufacturer's standard programming should be expected if it does not meet these standards.

.8 At the minimum, the CSIP's technical programming personnel shall be present for one day

1.8 Warranty

1.8.1 Provide written warranty for all work completed under this contract. The warranty shall provide for corrections of any documented software errors within two (2) business days of formal notification by the Owner.

1.8.2 The term of the warranty shall be one year, commencing at final acceptance of the work undertaken under this contract.

1.8.3 Modification of any software programming or configuration originally completed by this contractor shall be under taken only by this contractor for the period of the warranty

1.8.4 If requested by the Owner, provide a priced quotation for alternative warranty service and response.

1.9 License

1.9.1 All software created for use on the subject project shall be licensed to the Township for their non-exclusive, royalty-fee use on the device/system where first installed for the subject project.

1.10 Process Control Narrative and I/O list

1.10.1 The Process Control Narrative document prepared by CIMA+ is provided as part of the tender documents. The PCNs and P&IDs are draft and subject to minor changes throughout the detailed design process.

1.10.2 The CSIP is required to produce an updated PCN based on the integration meeting discussions and the information in the tender documents including PCN, P&ID, I/O lists.

1.11 Acceptable suppliers/Integrators

1.11.1 The system integrator for this project shall be one of the following:

.1 Capital Controls

Contact – Mark Robson (mark.robson@capitalcontrols.ca)

.2 Approved equivalent

2 PRODUCT (NOT APPLICABLE)

3 EXECUTION

3.1 Documentation

3.1.1 All documentation detailed below shall be provided in hard copy form (one copy) and in digital form:

.1 Operating Manuals for the new SCADA system(s) provided under the contract

.2 A listing for each HMI station and OIT program developed as part of this contract

.3 A copy of all system and database files in their final form

.4 Database listings for all SCADA work

.5 Manual for the custom HMI application, Historian, MOE compliance reporting, and alarming applications

.6 An update of the New SCADA system I/O list equivalent to the as-built condition at the completion of this contract, including all database tags, analog point ranges, analog point engineering units, and digital state words.

3.2 Coordination

3.2.1 Attend all meetings as necessary and as requested by the client or consulting engineer to ensure complete coordination and integration of all equipment and systems. The estimated number is provided in this section above.

3.3 Testing

3.3.1 Factory Acceptance Test (FAT): Supplier shall shop test all logic and/or programming to ensure that all systems and narratives are verified. Control signals are to be simulated where necessary. Provide a copy of the test procedures before starting any programming. Submit FAT report prior to commissioning on site. The CSIP is required to coordinate with the control system supplier to obtain hardware required to perform a SCADA Software FAT.

3.3.2 Site Acceptance Tests (SAT): Upon completion of termination of field wiring by the installing Contractor the Supplier will be required to verify all field wiring I/O connections between all field devices, local control panels, RPUs and the SCADA system including all individual control loops and communication links. The Supplier shall assist with plant commissioning to ensure complete functionality of all control logic.

3.4 Training/Familiarization

3.4.1 The training/familiarization sessions, are intended for plant operators, supervisory management, and others who wish to attend. The training to take place at the Deep River WTP (or another location that may be specified by the Township) with a maximum of 12 attendees at any session. The number and the duration of training sessions are tabulated in Table 1 below.

3.4.2 Submit course outline for review by the owner not less than four weeks prior to the scheduled training.

Table 1 Training Sessions

	Training
Upgraded SCADA System	One (1) session for PLC/SCADA, HMI applications, Historian, Reporting, alarming and vendor supplied packages; duration as required. Located at the Deep River WTP.

END OF SECTION

1 GENERAL

1.1 Conform to Sections of Division 1, as applicable

1.1.1 The General Conditions of Contract, Form of Tender, Information for Tenders, Tender Regulations, Specified Provisions and General Requirements under Division 1, herein before specified, in addition to any and all addenda, shall be read in conjunction with and shall apply to and govern each item of this division.

1.1.2 Conform to Section 13100 and 13110 to suit the custom PLC automation programming and HMI graphical application for the Deep River WTP SCADA system.

1.1.3 It is the intent of this section to provide Supervisory Control and Data Acquisition System (SCADA) hardware and software to suit the architecture in the detailed in the communication drawing.

1.1.4 Provide all software related to the SCADA HMI application, PLC programming, alarming, reporting, historical database, and custom OIT application development. All software is to be licenced in the name of the Township.

1.1.5 SCADA hardware and software items covered under this division refer to the supply, installation and satisfactory items specified herein and/or detailed on the control wiring drawings.

1.1.6 A Control System Supplier (CSS) has been pre-selected for this project and is responsible for the scope identified herein inclusive, to provide all SCADA system hardware including control panels, communication equipment, software and development tools. The CSS for this project shall be one of the following:

.1 Veolia

.2 Capital Controls

.3 Approved equivalent

1.2 Description

1.2.1 The work consists of assembly, supply, shop testing, communications testing, delivery, installation and commissioning by the manufacturer and guaranteeing of the complete SCADA system herein described, and in Division 16.

1.2.2 Supply and installation of all SCADA system hardware and software as specified and/or as shown on the control and instrumentation drawings.

1.2.3 The CSS has the following duties and responsibilities with respect to the complete supply and installation of the SCADA hardware and software:

.1 Supply and installation of all SCADA equipment hardware and software as per the contract documents herein described and/or shown on the drawings.

.2 Detailed submittal documents as described in this section. Including: original manufacturer’s specifications, detailed wiring diagrams, descriptions of operations of all SCADA equipment hardware and software.

.3 Detailed communications architecture wiring drawings for the proposed SCADA hardware in AutoCad v.2008 or newer.

.4 Supply of the SCADA communications equipment including installation of all, hardware and peripheral devices as per the contract drawings and specification.

.5 Configure all SCADA communications equipment to suit the communication architecture as shown on the drawings. All configuration settings are to be submitted as part of the shop drawing submissions.

.6 Shop and field testing of all communications links, for the proposed SCADA communication equipment herein described and/or shown on the contract drawings.

.7 Provide test programming for all PLC/RTU/RPU automation hardware specified herein and shown on the drawings to demonstrate all hardwire input and output signals and demonstrate communications between all devices.

.8 Once the control wiring drawings, SCADA Computer Hardware and HMI/OIT Panel mount computer hardware and software submissions are approved, the Contractor shall provide the equipment to the control systems integrator for the purpose of developing and testing the custom PLC/HMI applications.

1.3 Related Work Specified Elsewhere

1.3.1 Division 16

1.3.2 Section 16122 - Wire and Cables 0-1000V

1.3.3 Section 13100 - Control and Instrumentation Systems

1.3.4 Section 13110 - SCADA Integration Services

1.4 Quality Assurance

1.4.1 The materials, design, and workmanship employed in the manufacture of all equipment shall conform to the applicable standards established by the A.S.A. (American Standards Association), C.E.C. (Canadian Electrical Code) including the Ontario Supplement, I.E.E.E. 802.3 (Institute of Electrical and Electronics Engineers), C.S.A. (Canadian Standards Association), and the I.S.A. (Instrument Society of America). Canadian Standards shall take precedence over American Standards in the case of duplication or conflict.

1.5 Job Conditions

1.5.1 Examine the site and contract documents in accordance with Instructions to Bidders.

1.6 Warranty

1.6.1 The CSS shall pay for and obtain all the necessary guarantees required in order to warranty that the entire SCADA hardware and software system will perform as herein described. Therefore, the CSS will pay for all suppler engineering required, including the necessary software configuration, shop drawings, and site visits.

2 PRODUCTS

2.1 General Requirements

2.1.1 The CSS shall provide all SCADA equipment hardware and software as per the contract documents herein described and/or shown on the drawings.

3 EXECUTION

3.1 Installation of Equipment

3.1.1 Provide all necessary labour, equipment, tools, etc., for the complete installation of all equipment specified under this Division.

3.1.2 Install all equipment in a workmanlike manner and in accordance with the manufacturer's drawings, instructions and/or under the direction of his qualified technical representative unless otherwise specified or instructed by the Engineer.

3.1.3 Installation location to be approved by the Engineer.

3.1.4 All equipment shall be connected in the shop via temporary Ethernet and Fiber optic cable to confirm communications compatibility. CSS shall supply all temporary cable lengths.

3.2 Shop Testing

3.2.1 Prior to shipping any of the above equipment, it shall be thoroughly tested in the shop both for individual unit operation, and in simulation tests as a control system. The Engineer reserves the right to witness all testing, and must be given 5 working days notice prior to the commencement of any test.

3.2.2 Demonstrate to the Engineer the complete custom PLC programming and SCADA graphical application for the water treatment process, in the CSS's shop testing facilities, prior to the installation of the automation and HMI equipment in the field.

3.2.3 The new SCADA HMI application and PLC programming shall be free of any deficiencies identified during the shop testing, prior to installing the equipment in the field.

3.3 Cleaning

3.3.1 Comply with Section 01740 – Cleaning.

3.3.2 Remove all debris, surplus material and all tools.

3.4 Submittals

3.4.1 A detailed submittal package identifying the equipment to be supplied and its' operation, shall be furnished. The intent of the submittal is to ensure complete project scope coverage and does not relieve the supplier from fulfilling any specified requirements. The submittal shall consist of legible printed text and high quality CAD drawings bound in three -ring notebooks with index tabs that identify major sections of the document. The submittal shall address all hardware and software to be supplied. In addition:

.1 Identification of the respective responsibilities of each party to the project. Include what is provided by the system manufacturer, what is to be subcontracted, etc.

.2 Description of the major user related features and operating characteristics of the proposed system.

.3 Description of all site hardware and software.

.4 All significant equipment to be supplied shall be listed followed by descriptive data sheets. The equipment list shall include each component name, manufacturer, model number, a description of the operation, quantity supplied and any special set-up and operation and maintenance characteristics.

.5 Drawings of equipment to be supplied shall include, as a minimum, overall dimension details for each unit including installation arrangements and door mounted operator devices including nameplate designations. Wiring diagrams of all PLC's and other system equipment including field device connections shall be included and specific installation wiring responsibilities identified.

.6 Provide 24hour toll free emergency service numbers to suit all SCADA and communications equipment including computers, HMI software, Ethernet network hardware.

3.4.2 The CSS shall prepare a product description sheet for each item or package submitted for shop drawing approval.

3.4.3 The product description sheet shall have the following format:

Submission date:	Project:
Submission #:	Prepared by:
Quantity:	Instrumentation Tag:
Manufacturer:	Model No.:
Description:	Contractor ID No.:

3.4.4 The shop drawing overview submission sheet shall have the following format:

Date of submission:

Project:

Prepared by:

Product	**ID No.**	**Submission #**	**# of Copies**

3.5 Operations and Maintenance Manuals

3.5.1 The following printed materials shall be provided:

.1 Detailed (O&M) manuals shall be provided with complete information concerning the operation of the SCADA hardware and software.

.2 A user manual to suit the custom developed SCADA HMI graphical application. User manual shall include full-scale colour print outs of all graphical screens including specific images depicting graphical setpoint and control functions.

.3 Data sheets shall be supplied for all significant equipment used in the system. The data shall include, as a minimum, the component name, manufacturer, model number, quantity and any special and/or custom configuration characteristics.

.4 Final as-built drawings of equipment shall be provided and as a minimum include:

.1 Overall dimension details for each equipment(s) including nameplate designations.

.2 Interconnecting wiring diagrams of all control equipment, Hubs, media converters and other system equipment including field device connections and interface with pre-selected equipment.

.3 As build configuration settings for all Ethernet network equipment

3.6 Supervisions and Commissioning

3.6.1 The start-up procedures will not be carried out without the co- operation and presence of the Engineer. The Contractor shall be responsible for co-ordinating the work, and for making the CSS available to completely commission the SCADA computer hardware. The Contractor remains responsible for a complete and working system, in full accordance with these documents, and at the price bid in his tender.

3.6.2 Non-Operational Tests – On site

.1 Verify all communications links

.2 Demonstrate Ethernet communications between the respective local devices and remote locations.

3.6.3 Operational Tests – On Site

3.6.4 The CSS shall provide the services of the installing network and controls technician on site for a period of not less than seven (7) non-consecutive days during start-up/commissioning and witness testing. Any changes or adjustments to field wiring, tuning and calibration shall be at no cost.

END OF SECTION

1 GENERAL

1.1 Related Sections

.1 Section 01330 – Submittal Procedures

.2 Section 01820 – Demonstration and Training

.3 Section 11190 – Pipe and Valve Supports

.4 Division 13

.5 Section 16010 – Electrical General Requirements

1.2 Scope

.1 This section covers the furnishing of all instrumentation equipment required for the Control & Instrumentation System as indicated on the P&ID drawings and the sections herein.

.2 Principal components of the instrumentation systems shall be as indicated on the P&ID drawings. The contractor is required to provide all instruments including electronic/electrical and non-electronic/electrical instruments.

.3 Provide product submittal data sheets for all instrumentation supplied under this project in the format identified in the sample forms included at the end of this section.

.4 Section 13100 shall apply to all systems described in this section. All applicable requirements defined in Section 13100 shall apply to equipment and services provided under Section 13560. Equipment and services in this section shall be provided by the Section 13100 – Control and Instrumentation.

1.3 General

.1 The Control System Supplier (CSS) shall select the equipment furnished under this section for its superior quality and the intended performance. The CSS shall install all equipment in accordance with the manufacturer's instructions. Equipment and materials used shall be subject to review and shall comply with the following requirements.

.2 Refer to Division 1 specifications for general equipment requirements which shall apply to all equipment furnished under this section.

.3 Supplementing this section, the drawings indicate locations and arrangement of instruments and enclosures, provide mounting details, and may show device schedules and other information regarding the connection and interaction with other equipment.

.4 Governing Standards for instruments shall be as indicated in Section 13100.

.5 All parts, which are exposed to corrosive conditions, shall be made from corrosion resistant materials. CSS shall submit certification that the instrument manufacturer approves the selection of materials of primary elements that are in contact with the specified process fluid to be inert to the effects of the process fluid.

.6 Elevation and Temperature. All instruments shall be designed to operate within a range of elevation and temperature as required.

.7 Power and Instrument Signals. Unless otherwise indicated, electric power supply to the instrumentation equipment will be unregulated 120VAC and emergency electrical power will be from a diesel generator. All line powered instruments suitable for use on these supplies shall be provided with appropriate CSA approval. Line voltage ac powered instrument not CSA certified must bear an Electrical Safety Authority Special Approvals Branch label.

.8 Unless otherwise indicated, all transmitted electronic analog instrument signals shall be 4-20 mA DC and shall be linear with the measured variable.

.9 Appurtenances. Signal converters, signal boosters, amplifiers, special power supplies, special cable, special grounding, and isolation devices shall be furnished as needed for proper performance of the equipment.

.10 Interchangeability and Appearance. To the extent possible, instruments used for similar types of functions and services shall be of the same brand and model line. Similar components of different instruments shall be the products of the same manufacturer to facilitate maintenance and stocking of repair parts. Whenever possible, identical units shall be furnished.

.11 Programming Devices. A programming or system-configuring device shall be provided for systems that contain equipment that requires such a device for routine calibration, maintenance, and troubleshooting. The programming device shall be complete, newly purchased for this project, and shall be in like-new condition when turned over to the Town of Deep River at completion of startup.

.13 Device Tag Numbering System. All devices shall be provided with permanent identification tags. The tag numbers shall agree with CSS'S equipment drawings and shall be as close as practical to the tag numbers used on the project drawings and device schedules. All field-mounted transmitters and devices shall have stamped stainless steel identification tags. Panel, subpanel, and rack-mounted devices shall have laminated phenolic identification tags securely fastened to the device. Hand-lettered or tape labels will not be acceptable.

.14 Indoor Installation. Unless otherwise shown or specified, enclosures for all instruments located indoors in dry non-hazardous areas shall be as a minimum EEMAC12. Basement, Pump Room and Chemical Rooms shall be NEMA 4X.

.15 Outdoor Installation. Unless otherwise shown or specified, instruments located outdoors shall be suitable for the surrounding climate and appropriately installed with:

.1 An EEMAC4 enclosure including gasketed windows for displays, containing a thermostatically controlled heater and disconnect switch – minimum typical enclosure to be an O Brien VIPAK series or equal.

.2 A combined rain/ice/snow protection shield and sun shade for all electronic instruments which are already provided with sturdy EEMAC4 enclosures by the manufacturer. Supply tip-up type hoods for access for routine calibration and maintenance.

.3 Drawing submissions must clearly show the enclosures proposed for each instrument.

.4 Unless otherwise shown or specified, instruments located in areas subjected to flooding shall be provided submergence rated enclosures.

1.4 Submittals

.1 Submittals shall be as required in Section 13100 - Control and Instrumentation System and Section 01330 – Submittal.

.2 Product Data Sheets. Provide completed product Data Sheets specifying instruments and equipment conforming to ISA specification sheet standards. Complete blank spaces on these sheets with the information noted below and other data pertinent to the equipment and the application.

.1 Use the product data sheet for documenting installation and testing.

.2 Include the following upon initial submission (to accompany Shop Drawings):

.1 Project Name

.2 Tag number and description.

.3 Manufacturer, Model and Part Numbers.

.4 Identification Nameplate details.

.5 The product manufacturer and the supplier or representative.

.6 The complete model and catalogue numbers including special options.

.7 The available adjustment ranges and the project operating ranges.

.8 Web link for each product manufacturer.

.9 On each sheet, add the following information following field calibration:

.1 Serial numbers.

.2 Date of installation.

.3 Date, time and person who performed calibration.

.4 Calibration data.

.5 Input, output, and error at 0, 25, 50, 75, 100 per cent of span for analog instrument.

.6 Switch setting, contact action, and dead band, if applicable, for discreet elements.

.7 Certification by installer and acknowledgement by contractor.

.8 Special procedures and equipment required to duplicate calibration.

.9 Comments, including calibration changes, repair or replacement works performed.

.10 Add the following upon final submission (immediately following site acceptance):

.1 Signature by the Contractor and the Engineer indicating acceptance.

.2 Phone and fax numbers of contact person for product support/service.

.3 Provide a completed Instrumentation Installation “Checklist” form for each instrument.

1.5 Delivery, Storage, and Shipping

.1 Delivery, storage and shipping shall be as required in Division 1 and Section 13100.

1.6 Spare Parts

.1 Spare parts shall be provided as following: duplicated full set of lamps for indicating lights, terminal blocks, fuses, breakers, relays and timers.

.2 Supply spare parts required to commission instruments. Include five spare fuses of each type for each instrument panel.

2 PRODUCTS

2.1 Individual Device Specifications

.1 Individual instruments and related devices shall be provided as specified in the following sections:

.1 Section 11190 – Pipe, Valve and Instrument Supports

.2 Section 13100 – Control and Instrumentation

.3 Section 13563 – Pressure and Level Instruments

.4 Section 13565 – Turbidity Analyzers

.5 Section 13566 – Magnetic Flow Meters

.6 Section 13567 – Chlorine Residual Analyzers

3 EXECUTION

3.1 Instrumentation Installation Requirements

.1 Additional instrumentation installation requirements are specified in Section 13100.

.2 Instrumentation field wiring shall be continuous, no splices.

.3 Complete an Instrumentation Installation Checklist Form and Instrumentation Calibration Form for each instrument that is tested and commissioned. Testing and commissioning of the instruments will be considered incomplete unless the respective instrument is provided with an Instrumentation Calibration Form, with all fields completed. The contractor shall provide a typed version of the all completed calibration forms to be included in the maintenance manual.

.4 Field Calibration. After each instrument has been installed, a technical representative of CSS shall calibrate each instrument and shall provide a written calibration report for each instrument, indicating the results and final settings. The adjustments of calibrated instruments shall be sealed or marked, insofar as possible, to discourage tampering. Instrument calibration shall be done before checkout of the system operation. A typical instrument calibration form and Instrumentation Installation Checklist form is attached to the end of each section.

.5 Systems Check. A technical representative of CSS shall participate in the checkout of instrumentation systems. Systems check requirements shall be as specified in Section 13100.

.6 Installation Test Equipment. Unless specified otherwise, all test equipment for the calibration and checking of system components shall be provided by CSS for the duration of the testing work and this test equipment will remain the property of CSS.

.7 Mounting of Field Instruments. Instruments shall be mounted so that they can be easily read and serviced and so that all appurtenant devices can be easily operated. Installation details for some instruments are indicated on the drawings. Where installation details are not indicated, the installation performed by the CSSs shall conform to the manufacturer's instructions and/or API RP 550 recommendations.

.1 Individual analog signals shall be run shielded multi-conductor cables, however multiple 4-20mA signals may not be combined into a single multi-conductor cable.

.2 Unless otherwise shown or specified, all required mounting hardware, enclosures, termination's, junction boxes, etc., shall be provided. Refer to the tender drawings and the manufacturer's documentation to confirm the necessary hardware and construction for specific mounting assemblies where such details are not specified herein.

.3 No instruments shall be mounted on vibrating structures (e.g. handrails), or on piping or near equipment that induces vibration. No instruments shall be mounted below or directly adjacent to lines conveying corrosive chemicals or near sources of leakage or spillage.

.4 Metal surfaces shall be prepared and supports or frames shall be painted the same color as the member of the complete assembly is mounted on.

.5 Unless otherwise shown or specified, instruments shall be mounted 1.4m above finished floors, grade or platforms. Allow for cabinet plinth/floor-pad heights when locating panel instruments. Instruments that are not easily accessible for operation or maintenance, or indicator that is not easily and readily visible must be relocated as directed by the Engineer at no cost to the contract.

.6 When drilling or installing conduit entry points in instruments, protect internally mounted equipment from vibration, shock and metal filings. Conduit entries much maintain the equipment or panel EEMAC rating.

.7 Lengths for transducer cables and similar items shall be field measured prior to ordering. Cables shall be mechanically protected and adequately secured in place without sagging.

.8 All instruments shall be provided with minimum 2-valve calibration manifolds.

.9 All instrument cables shall be protected with capillaries throughout their length without sagging by using painted/galvanized angle iron and clips. Avoid sharp bends in capillary and coil excess close to the sensor end. Protect the coiled capillary by clipping to a steel plate or other safe method.

.10 Sensing and sample lines shall be run in ½" stainless steel tubing with "Swagelok" compression type fittings.

.11 Install process sample piping and sensing lines to avoid accumulation of vapor or gas in liquid service and of liquid or condensate on vapor or gas service as appropriate.

.12 Instruments shall be positioned so that they do not block or obstruct walkways or access points and adequate space shall be provided around installation for removal of covers, etc.

.13 Instrument support brackets shall not be welded to process piping or equipment, but should generally be pedestal or wall mounted.

.14 Field cables for analogue signals shall be run in separate conduit from 120V AC/24VDC control or 120VAC power supply cables.

.15 Field junction boxes suitable for the area classification to "marshal" groups of signals of the same type in an area and cable back to buildings and local control panel with multi-core cables shall be used.

.16 Junction boxes may be PVC or stainless steel material suitable for the area and rust and weather resistant. Terminals inside field junction boxes are to be DIN rail mounted.

.17 Once an instrument has been inspected by the Engineer and initially calibrated, it is to remain powered up at all times unless servicing the instrument itself.

.18 Instrument calibration, setpoints and other programmable parameters are to be confirmed with the Engineer during on-site inspection as soon as site conditions are sufficiently ready. Final calibration values may be adjusted to values different than the nominal values specified in the Product Data Sheets at no extra cost to the contract.

.19 Final calibration, setpoints and other programmable values must be documented by the CCS, and provided as submittal

3.2 Customer Training

.1 Provide Instrumentation training in accordance with Section 13100 and Section 01820 Demonstration and Training.

3.3 Forms

.1 Complete an Instrumentation Installation Checklist Form and Instrumentation Calibration Form for each instrument that is tested and commissioned.

Instrumentation Installation Checklist

Project Name:	Project Number:	
Contractor:	Contract Number:	

EQUIPMENT:	**DATE INSTALLATION** **COMPLETE:**
SERIAL NO.:	**MAKE AND MODEL NO.:**

PRE-START-UP	**CHECKED BY**	**DATE**	**REMARKS**
Installation/Mounting Sensor/Transmitter			
Wiring/Conduit Termination and Seals			
Check Fuse Ratings (Internal)			
Tagging/Nameplate			
Compliance Section 16			
Test (Ground Loop, Continuity, Installation)			
Power Supply			
Check Instrument Air/Adjust Filter/Regulator			
Check Temp. Control (Internal/Heat Tracing)			
Configure Calibration			
Tailback lights			
START-UP			

Verify Operation Under Max Process Conditions			
Correct Quantities of Expandable Material			
* Indicates (N/A) if not applicable			
Comments:			

Inspection Result	Passed Installation and Start-up checkout. Equipment certified ready for service		Failed – Contractor to schedule equipment re-inspection	

_____ _____

Contractor

_____ _____

Supplier Date Date

_____ _____

System Integrator Date

_____ _____

Consultant Date

_____ _____

City/Operator Date

Instrumentation Calibration Form

Project Name:	Project Number:	
Contractor:	Contract Number:	

Equipment:	
Tag/Instrument Number:	
PLC:	
Input Point:	
Manufacturer:	
Model Number:	
Serial Number:	
Calibration Range:	

Service

Temperature		Chlorine Residual	
Pressure		pH	N/A
Differential Pressure	N/A	Density	N/A
Flow		Dissolved Oxygen	N/A
Level		Gas monitoring	N/A
Weight	N/A	Others	

Type

4-20 mA		0-100 VDC	N/A
0-20 mA	N/A	Digital Input	
1-5 VDC	N/A		

Power Source

120 VAC		Dry Contact	Not Required
24 VDC			

Test Full Range			
0 %		75 %	
25%		100 %	
50 %			
On/Off (Digital)			
Verification			
Contractor			
Consultant			
City			
Date			
Comments			

Inspection Result	Passed Installation and Start-up checkout. Equipment certified ready for service		Failed – Contractor to schedule equipment re-inspection	

_____ _____

Contractor Date

_____ _____

Supplier Date

_____ _____

System Integrator Date

_____ _____

Consultant Date

_____ _____

City/Operator Date

END OF SECTION

Item	Field Device Tag No.	Connected to PLC #	Device Type	Service Description	ICP / Controller	Input Type	Output Type	Power	P&I Drawing	Specification	Remarks
1	FIT-201	Actiflo PLC (Tag# FIT1-011)	Magnetic Flow Meter and Transmitter	Actiflo #1 Influent Flow Meter	RPU	Analog 4-20mA - Flow Indication Digital - General Alarm	N/A	120VAC, 60Hz, 36VA	D-601	13566	Supplied by Contractor
2	FIT-202	Actiflo PLC (Tag# FIT1-021)	Magnetic Flow Meter and Transmitter	Actiflo #2 Influent Flow Meter	RPU	Analog 4-20mA - Flow Indication Digital - General Alarm	N/A	120VAC, 60Hz, 36VA	D-601	13566	Supplied by Contractor
3	FIT-203	Actiflo PLC (Tag# FIT1-031)	Magnetic Flow Meter and Transmitter	Actiflo #3 Influent Flow Meter	RPU	Analog 4-20mA - Flow Indication Digital - General Alarm	N/A	120VAC, 60Hz, 36VA	D-601	13566	Supplied by Contractor
4	FIT-302	PLC1	Magnetic Flow Meter and Transmitter	Filter #2 Effluent Flow Meter	RPU	Analog 4-20mA - Flow Indication	N/A	120VAC, 60Hz, 36VA	D-602	13566	Supplied by Contractor
5	TIA-301	PLC1	Turbidity Meter and Controller	Filter #1 Turbidity Meter	RPU	Analog 4-20mA - Turbidity Level	N/A	120 VAC, 60 Hz, 24 VDC	D-602	13565	Supplied by Contractor
6	TIA-302	PLC1	Turbidity Meter and Controller	Filter #2 Turbidity Meter	RPU	Analog 4-20mA - Turbidity Level	N/A	120 VAC, 60 Hz, 24 VDC	D-602	13565	Supplied by Contractor
7	TIA-303	PLC1	Turbidity Meter and Controller	Filter #3 Turbidity Meter	RPU	Analog 4-20mA - Turbidity Level	N/A	120 VAC, 60 Hz, 24 VDC	D-602	13565	Supplied by Contractor
8	CIA-502	PLC1 (Tag# CIA-502) - Existing Instrument to remain	Free Chlorine Analyzer	Clearwell Discharge	RPU	Analog 4-20mA - Chlorine Residual Digital - General Alarm	N/A	120 VAC, 60 Hz, 24 VDC	D-603	13567	Existing instrument sample location to be relocated by Contractor
9	CIA-501	N/A - new instrument	Total Chlorine Analyzer	Treated Water Discharge Header	RPU	Analog 4-20mA - Chlorine Residual Digital - General Alarm	N/A	120 VAC, 60 Hz, 24 VDC	D-603	13567	Supplied by Contractor
10	LIT-709	N/A - new instrument	Ultrasonic Level Sensor/Transmitter	Actiflo Polymer Maturation Tank Level Indication	RPU	Analog 4-20mA - Level Indication Digital - General Alarm	N/A	120 VAC, 60 Hz, 24 VDC	D-604	13563	Supplied by Veolia
11	LIT-710	N/A - new instrument	Ultrasonic Level Sensor/Transmitter	Actiflo Polymer Storage Tank Level Indication	RPU	Analog 4-20mA - Level Indication Digital - General Alarm	N/A	120 VAC, 60 Hz, 24 VDC	D-604	13563	Supplied by Veolia
12	LSL-701	N/A - new instrument	Low Level Switch	Actiflo Polymer Service Water Inlet Low Level Switch	RPU	Digital - Low Level Alarm	N/A	120 VAC, 60 Hz, 24 VDC	D-604	13563	Supplied by Veolia
13	LSL-702	N/A - new instrument	Low Level Switch	Actiflo Polymer Hopper Low Level Switch	RPU	Digital - Low Level Alarm	N/A	120 VAC, 60 Hz, 24 VDC	D-604	13563	Supplied by Veolia
14	AMT01-LI01	N/A - new instrument	Ultrasonic Level Sensor/Transmitter	Ammonium Sulphate Storage Tank Level Indication	RPU	Analog 4-20mA - Level Indication Digital - General Alarm	N/A	120 VAC, 60 Hz, 24 VDC	D-606	13563	Supplied by Contractor
15	AMP01_PI	N/A - new instrument	Pressure Gauge	Ammonium Sulphate Pump #1 Discharge Pressure Gauge	N/A	N/A	N/A	N/A	D-606	13563	Supplied by Contractor
16	AMP02_PI	N/A - new instrument	Pressure Gauge	Ammonium Sulphate Pump #2 Discharge Pressure Gauge	N/A	N/A	N/A	N/A	D-606	13563	Supplied by Contractor
17	AMP_FIT01	N/A - new instrument	Magnetic Flow Meter and Transmitter	Ammonium Sulphate Discharge Flow Indication	RPU	Analog 4-20mA - Flow Indication Digital - General Alarm	N/A	120VAC, 60Hz, 36VA	D-606	13566	Supplied by Contractor
18	AMT_LSH1	N/A - new instrument	Spill Detection Level Sensor/Transmitter	Ammonium Sulphate Secondary Containment Spill Detection	RPU	Digital - Spill Detection	N/A	120 VAC, 60 Hz, 24 VDC	D-606	13563	Supplied by Contractor

Note: The Contract Drawings shall take precedence if there is any discrepancy between drawings and instrument schedules.

1 GENERAL

1.1 Related Sections

1.1.1 Division 1 – General Requirements All Sections

1.1.2 Section 13100 – Control & Instrumentation

1.1.3 Section 13560 – Instrumentation General Requirements

1.1.4 Division 16 – Electrical All Sections

1.2 Scope

1.2.1 This section covers the furnishing of all pressure instruments and accessories required for the Control and Instrumentation System as indicated on the drawings.

1.2.2 Equipment and services provided under this section shall be subject to the requirements specified in Section 13100 – Control & Instrumentation and Section 13560 – Instrumentation General Requirements. This section shall be used and referenced only in conjunction with Section 13560 – Instrumentation General Requirements. Supplementing Section 13560 – Instrumentation General Requirements, instrument data, special requirements, and options are indicated on the drawings or the Instrument Device Schedule. Equipment and services in this section shall be provided by the Section 13100 – Control & Instrumentation.

1.2.3 Section 13100 – Control & Instrumentation shall apply to all systems described in this section. All applicable requirements defined in Section 13100 – Control & Instrumentation shall apply to equipment and services provided under Section 13560 – Instrumentation General Requirements.

1.3 Design Criteria

1.3.1 Each device shall be a pre-assembled, packaged unit. Upon delivery to the work site, each device or system shall be ready for installation with only minor piping and electrical connections required by the Contractor.

1.3.2 Primary elements shall derive any required power from the transmitter, unless otherwise indicated.

1.3.3 The instruments shall be installed to measure, monitor, or display the specified process at the ranges and service conditions indicated on the drawings or as indicated in the Instrument Device Schedule. The instruments shall be installed at the locations indicated on the drawings or in the Instrument Device Schedule.

1.3.4 Where possible, each instrument shall be factory calibrated to the calibration ranges indicated in the drawings or in the Instrument Device Schedule. Transmitters or similar measurement instruments shall be calibrated using National Institute of Standards and Technology (NIST) approved bench calibration procedures, when such procedures exist for the instrument type. For "smart" devices, calibration data shall be stored digitally in each device, including the instrument tag designation indicated on the drawings and/or Instrument Device Schedule.

1.4 Submittals

1.4.1 Submittals shall be made in accordance with the requirements of Section 01330 – Submittals.

1.5 Shipment, Protection and Storage

1.5.1 Equipment provided under this section shall be shipped, protected, and stored in accordance with the manufacturer's requirements and requirements noted in Section 13560 – Instrumentation General Requirements. Identification of packaging shall be as described in Section 13560 – Instrumentation General Requirements.

2 PRODUCTS

2.1 General

2.1.1 The following paragraphs provide minimum device requirements. The drawings or Instrument Device Schedule shall be used to determine any additional instrument options, requirements, or service conditions.

2.1.2 Interconnecting Cable. For systems where the primary element and transmitter are physically separated, interconnecting cable from the element to the transmitter shall be provided. The cable shall be the type approved by the instrument manufacturer for the intended purpose of interfacing the element to the transmitter. Length of cable shall be a minimum of three meters or as indicated in the drawings or Instrument Device Schedule.

2.1.3 Programming Device. For systems that require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided. The programming device shall include appropriate operation manuals and shall be included in the training requirements. For systems that allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device:

.1 The programming device shall be complete, newly purchased for this project, and shall be in like-new condition when turned over to Owner at completion of start-up.

.2 At least one smart instrument calibration device shall be provided for every 10 smart instruments:

.1 Handheld communicator shall be ABB DHH805

.2 or Rosemount model 275 HART Communicator complete with memory pack 100

2.1.4 Configuration Software/Serial Interface. Devices indicated as requiring a serial interface shall be provided with all accessories required to properly communicate over the serial link. As a minimum, an appropriate cable shall be provided to allow the transmitter serial interface to be connected to a personal computer. One licensed copy of the diagnostic/interface software shall be provided for each Owner facility. Software shall be capable of running under Microsoft's Windows 2000, Windows 98/Me, Windows NT 4.0, and Windows XP operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device shall not be furnished.

2.2 Pressure Instrumentation

2.2.1 Pressure Gauges (for Ammonium Sulphate pump discharge lines):

.1 The Contractor and Supplier shall confirm the required pressure range for each pressure gauge based on the pressure in the lines. No extra cost to the Owner shall be permitted for the Engineer to determine the range. Refer to the discharge pressure of the pumps, fans and blowers.

.2 Supply and install pressure gauges size and location as shown on the Contract Drawings and/or specified herein.

.3 Pressure gauges shall be 114 mm dial size with fiberglass reinforced polypropylene case, threaded ring, solid front, blow out back, molded acrylic window.

.4 Movement shall be stainless steel.

.5 Bourdon tube shall be bronze.

.6 Dial face shall be white with black figures, pointer shall be micrometer adjustable type.

.7 Dual scale and operating range 0 to be suitable to design range specified.

.8 Pressure gauges shall be liquid filled.

.9 All pressure gauges shall be supplied with a Campbell Microbeam isolating dampening valve.

.10 Each pressure gauge shall be furnished with a flow-through annular seal which is of stainless steel 316L.

.11 Acceptable Suppliers:

.1 Trerice Type 450 LFSS, Ashcroft Durogauges Type 1279 ASL, or Agency Approved Equal

2.3 Level Instrumentation

2.3.1 Ultrasonic Level Transmitters.

.1 Each ultrasonic level transmitter shall be a microprocessor based electronic unit consisting of a sensor assembly, a signal converter/transmitter, and an interconnecting cable. The sensor shall be encapsulated in a chemical and corrosion resistant material such as kynar or CPVC and shall be suitable for operation over a temperature range of -40° to 80°C and a relative humidity of 100 percent condensing. The sensor shall be compatible with the process media being measured. Sensors mounted in direct sunlight shall be provided with sunshades.

.2 The supplier shall coordinate the sensor mounting requirements and furnish drawings complete with dimensions and elevations. General installation requirements are indicated on the drawings.

.3 The ultrasonic level transmitter shall have automatic compensation for changes in air temperature at the sensor location. If separate temperature sensing probes are provided, they shall be mounted with or adjacent to the ultrasonic sensor, as recommended by the manufacturer. The transmitter shall have a local backlit HMI display with local four-button programming, which displays level in engineering units, with additional indicators for alarms and status conditions. The transmitter shall be designed to ignore momentary level spikes, false targets, or momentary loss of echo.

.4 A loss of echo condition shall be indicated on the transmitter unit and shall be available as an alarm contact output. The loss-of-echo alarm shall fail to “Hold Last State” position after five minutes. The transmitter output shall be an isolated 4 - 20 mA dc signal linearly proportional to the measured level range. Calibration parameters shall be entered through a keypad on the unit and shall be stored in nonvolatile EEPROM memory.

.5 Transmitters shall have Microsoft windows based graphical programming software. and Local User Interface for echo profile viewing and troubleshooting. The transmitter can accept 4-20 mA input from external device instead of the transducer input. Accuracy of the transmitted signal shall be +/-0.25 percent of measuring Range with repeatability of +/-0.5 percent of full scale and linearity of +/-0.25 percent of full scale.

.6 Transmitters shall contain SIX independently adjustable level alarm contact outputs; Form “C” (SPDT) relays rated 5A at 115V AC.

.7 A sufficient length of sensor to transmitter signal cable shall be furnished with the instrument to locate the sensor up to 10 m from the signal converter.

.8 The signal converter electronics is housed in a weatherproof, corrosion resistant NEMA4X, IP65 enclosure suitable for wall, panel or pipestand mounting and for operating temperatures of -20 to +50 °C (-4 to +122 °F) and a relative humidity of 10 to 100 percent. A thermostatically controlled strip heater shall be provided in the signal converter enclosure.

.9 Transmitters to include HART communication.

.10 The Contractor and Instrument Supplier shall confirm the transducer (sensor) locations and provide the extended rod if required. No extra cost shall be permitted for the extended rods.

.11 Acceptable Suppliers:

.1 The below Supplier list shall not be construed as automatically acceptable, but the Owner or Engineer shall have the right, in its sole and absolute discretion, to accept or reject the shop drawing if the Supplier selected by the Contractor does not comply with the Contract Drawings and specification requirements herein.

.2 Siemens LUT400 complete with XPS 15 transducer, Endress+Hauser, or Approved Equal

2.3.2 Ammonium Sulphate Secondary Containment Spill Level Switch

.1 The chemical spill detecting level switch shall be float actuated and shall be suitable for wall or sump mounting as required. The switch float mechanism shall actuate when the water level rises to 25mm above the bottom of the housing. The switch contacts shall

be hermetically sealed, rated for 0.1 amp at 120VAC, and shall be field changeable from normally open to normally closed. Sway control rings, hanger brackets, and local junction boxes are to be included.

.2 Acceptable Product: Flygt “ENM-10”, or approved equal.

3 EXECUTION

3.1 Warranty

3.1.1 The analyzers and sensors shall be warranted against defects in workmanship and materials for five (5) years from the date of installation.

3.1.2 Shop testing shall be performed to ensure the meters are free of defective parts, cracks or any other defects.

3.1.3 Unit shall be pre-calibrated at the factory. A copy of the factory calibration report shall be provided to the Owner.

3.2 Field Services

3.2.1 Manufacturer’s field services shall be provided for installation, field calibration, startup, and training as specified in Sections 13100 – Control & Instrumentation and 13560 – Instrumentation General Requirements.

3.2.2 Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation. CSS shall be responsible for coordinating the installation schedule with the Installation Contractor. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of common construction or cleaning chemicals that may affect instrument operation.

END OF SECTION

1 GENERAL

1.1 Scope

1.1.1 This section specifies the supply, installation, field-testing, removal of existing and placing into operation of turbidity analyzers for the Deep River WTP filter effluent.

1.1.2 All conduit and cabling necessary for installation of new instruments to be integrated into the SCADA system as per the Contract Drawings.

1.2 Related Sections

1.2.1 Division 1 – General Requirements All Sections

1.2.2 Section 13100 – Control & Instrumentation

1.2.3 Section 13560 – Instrumentation General Requirements

1.2.4 Division 16 – Electrical All Sections

1.3 References

1.3.1 ANSI/ISA-S5.1-1984 (R. 1992) Instrumentation Symbols and Identification.

1.3.2 ANSI/ISA-S5.4-1976 (Revised 1989) Instrument Loop Diagrams.

1.3.3 ISA-S20-1981 Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.

1.4 Submittals

1.4.1 Submittals shall be made in accordance with the requirements of Section 01330 – Submittals.

1.4.2 Shop drawing submittal shall include:

.1 Instrument data sheets, conforming to ISA-S20.

.2 Descriptive literature.

.3 Manufacturer’s installation diagrams for field-mounted equipment.

.4 Piping drawings for field-mounted equipment.

.5 Loop wiring diagrams and control schematics showing the connections at each device and wiring or cabling between devices. The diagrams are to be fully comprehensive so that every circuit loop can be followed completely. Indicate types of loads, switches, transducers and power supplies such as motors, relays, lights, indicators, float switches, hand switches, isolators, signal selectors, dedicated 24 VDC power supplies, etc. The number and identify each component circuit and terminal. Contain a loop on a maximum of two sheets, preferably one sheet. (This is required for modifications to existing facilities and new equipment).

.6 Instrument panel layout drawings.

.7 Instrument panel wiring diagrams.

.8 Maintenance manuals.

.9 A list of recommended spare parts including the make, model number, suggested quantity, cost, and required a lead time of each part.

.10 Instrument calibration forms.

.11 Control Loop checkout/verification forms.

.12 Programmable Instrument and Equipment Configuration Summaries.

2 PRODUCTS

2.1 Turbidity Analyzers

2.1.1 Turbidity analyzers' model shall use laser-based technology for turbidity measurement.

2.1.2 The following table lists the conditions of service and the number of turbidity analyzers required:

Analyzer Tag No.	Qty.	Range (NTU)	Accuracy	Repeatability	Power and Control	Output Span
TIA-301 TIA-302 TIA-303	3	0.001 - 5	+/- 2% of reading	Better than +/- 1% of reading or +/- 0.002 NTU	120 VAC, 60 Hz, Form "C" relays rated 5A at 115VAC, 4-20mA feedback to SCADA	Programmable over any portion of the 0-100 NTU range

2.1.3 Enclosure Rating

.1 Electronic compartment IP55; all other functional units IP65 with process head/ACM attached.

2.1.4 Controller

.1 Provide three (3) SC 4500 controllers, one for each turbidimeter's operation.

2.1.5 Acceptable manufacturer: HACH TU5400sc, or pre-approved equal.

3 EXECUTION

3.1 Installation

3.1.1 Install all instruments in strict accordance with the manufacturer's requirements and recommendations.

3.1.2 Use 316L stainless steel hardware for all installations, except where manufacturer's recommendations state otherwise or otherwise specified in the Contract Documents or Contract Drawings. Ensure dissimilar metals are not combined. Ensure all supports are retractable to provide convenient access for maintenance and servicing of instrumentation.

3.1.3 Contractor to wire all alarm points in a 'failsafe' configuration, such that the loss of power, opening of the contact or break in the control circuit wiring will activate an alarm.

3.1.4 Ensure all installations allow for ease of access for future maintenance and calibration.

END OF SECTION

1 GENERAL

1.1 Intent of Section

1.1.1 This section covers the work necessary to furnish electromagnetic meters, to measure raw water, filtered water, and ammonium sulphate flows at the Deep River WTP.

1.2 Related Sections

1.2.1 Division 1 – General Requirements

1.2.2 Division 11 – Equipment

1.2.3 Division 13 – Instrumentation, Control and SCADA

1.2.4 Division 16 – Electrical

1.3 General

1.3.1 Equipment provided under this section shall be fabricated, assembled, and place in proper operating condition in full conformity with the drawings, specifications, engineering data and instructions, unless exceptions are noted by the Engineer.

1.3.2 Equipment and services provided under this section shall be subject to the requirements specified in Section 13100 – Control & Instrumentation and Section 13560 – Instrumentation General Requirements. This section shall be used and referenced only in conjunction with Section 13560 – Instrumentation General Requirements. Supplementing Section 13560 – Instrumentation General Requirements, instrument data, special requirements, and options are indicated on the drawings or the Instrument Device Schedule. Equipment and services in this section shall be provided by the Section 13100 – Control & Instrumentation.

1.3.3 Section 13100 – Control & Instrumentation shall apply to all systems described in this section. All applicable requirements defined in Section 13100 – Control & Instrumentation shall apply to equipment and services provided under Section 13560 – Instrumentation General Requirements.

1.4 Submittals

1.4.1 In accordance with Section 01330 – Submittals.

1.4.2 Complete detailed specifications, and data covering materials used, parts, devices, and other accessories forming a part of the equipment furnished, shall be submitted in accordance with the submittals section.

1.4.3 Detailed information regarding the magmeters shall be provided for record purposes, including materials, methods of application, maintenance requirements, and other pertinent data.

1.4.4 The shop drawing submission shall include, but shall not be limited to, the following:

.1 General dimensional information and materials of construction

.2 Installation details, including dimensions, flange ratings, flange styles, and external wiring requirements

.3 Input and output signal ranges and calibrated ranges

.4 Product Options

.5 Descriptive material in sufficient detail to show the general construction pertinent to the proper review of the equipment

.6 All ancillary equipment to be provided by the Supplier shall be listed.

1.5 Applicable Codes and Standards

1.5.1 The following minimum applicable codes, standards and regulations must be adhered to in the design, installation and services provided by the Vendor. In the case of conflicting information among these codes, it is the Vendor's responsibility to inform and obtain written approval from the Purchaser of any exceptions hereby taken.

1.5.2 Requirements from the following organizations shall be considered as a minimum:

.1 OSHA – Occupational Safety and Health Act

.2 ANSI – American National Standards Institute

.3 UL – Underwriter Laboratories

.4 CSA – Canadian Standards Association

.5 NIST – National Institute of Standards and Technology

.6 CE – Conformité Européenne

.7 City, Regional, Provincial Codes

2 PRODUCTS

2.1 Service Conditions

2.1.1 All electromagnetic meter sensors and components that come in contact with water shall be NSF certified.

2.1.2 Three (3) electromagnetic meter assemblies shall be used to measure raw water (source: Ottawa River).

2.1.3 One (1) electromagnetic meter assembly shall be used to measure the filter water.

2.1.4 One (1) electromagnetic meter assembly shall be used to measure the ammonium sulphate chemical solution discharge flow.

2.2 General Requirements

2.2.1 All readouts, indicators, recorders, etc., shall be in metric units, whether shown or not and in engineering scales. All final units, ranges, set points, colours, etc., will be finalized on the shop drawings.

2.2.2 Mounting brackets, hooks, plates, screws, bolts, anchors, etc., shall be 316L stainless steel and of sufficient size to permanently mount the equipment.

2.2.3 Each instrument mechanism shall be within a CSA rated NEMA 4X enclosure.

2.2.4 The flowmeter shall be a velocity sensing electromagnetic type, complete with a solid-state electronic signal converter, sealed housing, flanged tube meter for 150 psi working pressure.

2.2.5 The meter shall be manufactured to the highest standard available for magnetic flowmeters.

2.2.6 The magnetic flowmeter shall have a digital indicator having a range of 0 to a specified flow and shall be equipped with a six-digit digital totalizer for forward reading.

2.2.7 The magmeter shall be resistant to abrasion and chemical corrosion and be capable of measuring the continuous flowstream despite the presence of solids.

2.2.8 The magmeter must be fully operational in full pipe conditions. An empty pipe detector shall be provided to ensure that the outputs are driven to a predetermined flow condition when the electrodes become uncovered.

2.2.9 The magmeter must be a full bore meter with the magnetic field traversing the entire cross-section of the flow tube.

2.2.10 The magmeter shall be properly sized to ensure the flow velocity through the meter shall be within the range of 0.3 - 5 m/s.

2.2.11 Installation Requirements: Not less than 5 pipe diameters upstream & 3 pipe diameters downstream to obtain rated accuracy.

2.2.12 Performance requirements:

Number of Pulse/Frequency Output	1
Current Output	0/4-20mA DC into 0-600W load
Minimum Pressure Limits of Liner	150 psi @ 60°C

2.2.13 Flowmeters shall be installed in the following locations and be sized as follows:

Location	Tag Number	Liquid type	Pipe Size, mm	Number of units	Flow, L/s
Actiflo Influent	FIT-201 FIT-202 FIT-203	Raw Water	200	3	0-100

Location	Tag Number	Liquid type	Pipe Size, mm	Number of units	Flow, L/s
Filter #2 Effluent	FIT-302	Filtered Water	250	1	0-100
Ammonium Sulphate Pump Discharge	AMP_FIT01	Ammonium Sulphate (41%)	50	1	0-1.5

2.2.14 All flow transmitters supplied shall have latest firmware from manufacturer.

2.2.15 All flow transmitters supplied shall be compatible with and enabled for performing self verification through Heartbeat Technology, Smart Meter Verification, Ability Verification or Owner's approved equivalent.

2.2.16 As part of installation and commissioning, a detailed flowmeter verification report shall be generated for each new flow transmitter. The verification report shall contain both verifications of the sensor and the transmitter. The verification report shall show an overall verification result of "Passed" and be presented to the Owner, otherwise the flow transmitter will not be accepted by the Owner.

2.3 Flow Tube

2.3.1 End Connection: SS304, ASTM-A774 for fittings as Schedule 10S

2.3.2 Flow Meter Body and Grounding Rings:

.1 The meter body shall be fabricated of SS304 pipe with SS flanges.

.2 Grounding Rings (in non-conductive or insulated pipe installations): SS304.

2.3.3 Electrodes: 316L SS, Bullet nose

2.3.4 Empty Pipe Detect: Yes.

2.3.5 Carbon steel body and flanges with lining shall not be acceptable.

2.3.6 Size to suit installation location. Flanged connection type to suit installation location and process piping.

2.4 Transmitter

2.4.1 Each flow meter shall come with remote display option.

2.4.2 Panel mounted enclosure, LCD display, and digital output for reverse flow detection. Remote flow transmitter to be mounted within the flow meter panel located in unclassified area as shown on the contract drawings.

2.4.3 Power Supply: 120VAC/60Hz.

2.4.4 Output: 4–20mA with HART isolated, additional 24VDC scaled pulse output contact for totalizing flow, One (1) Form C SPDT fault relay rated 5A at 115V AC

2.4.5 1 Form C SPDT fault relay.

2.4.6 Pulse Output: 1Pulse/m^3.

2.4.7 Calibration Range: As indicated above.

2.4.8 Accuracy: ± 0.3 percent of measured value, maximum error over entire velocity range

2.4.9 Repeatability: plus or minus 0.05 percent.

2.4.10 Local Display: LCD, rate of flow and flow totalized displayed in engineering units, flow (L/s) and totalized flow (L on m^3).

2.4.11 Continuous automatic re-zeroing calibration and auto ranging.

2.4.12 Flow meters are to include HART communication

2.4.13 Flowmeter shall perform self-calibration through Hart.

2.4.14 Provide a minimum of 30m of signal cables, but the Manufacturer shall confirm the required length (plus 3m additional coil). Cables shall be neatly arranged and grouped together with heavy duty tie raps.

2.4.15 Provide calibration certificate with installed flow meter and include in Operations and Maintenance Manual. Calibration is to include at least 5 tested points distributed evenly across the full specified flow range.

2.4.16 Accessories: Protective inlet grounding ring (stainless steel).

2.4.17 Shop testing shall be performed to ensure that the electromagnetic flow meter is free of defective parts, cracks or any other defects.

2.4.18 In the event that a component fails to perform as specified or is proven defective in service during the warranty period, the manufacturer shall promptly repair or replace the defective part at no cost to the Owner. Include regular field services and maintenance work as required to satisfy extended warranty.

2.5 Acceptable Manufacturers

2.5.1 The below Supplier list shall not be construed as automatically acceptable, but the Owner or Engineer shall have the right, in its sole and absolute discretion, to accept or reject the shop drawing if the Supplier selected by the Contractor does not comply with the Contract Drawings and specification requirements herein.

2.5.2 ABB WaterMaster, or Pre-Approved Equal.

2.6 Warranty

2.6.1 The electromagnetic flow meter shall be warranted against defects in workmanship and materials for a minimum of five (5) years from the date of installation.

3 EXECUTION

3.1 Installation

3.1.1 The electromagnetic flow meter shall be installed in accordance with the manufacturer's drawings and instructions. Suitable electromagnetic flow meter mounting configurations shall be specified and determined by the vendor with the Engineer's approval.

3.1.2 The electromagnetic flow meter shall be mounted in accordance with Contract Drawings.

3.1.3 The converter shall be supplied complete with the totalizer and all its electrical components shall be remotely mounted from the electromagnetic flow meter electrode element.

3.2 Volumetric Testing

3.2.1 Volumetric testing of all meters shall be performed and approved prior to shipment.

3.2.2 The complete meter assembly and signal converter must be accuracy tested and calibrated in accordance with NIST standards at near minimum, intermediate and maximum Manufacturer's specified flow ranges of meter.

3.2.3 The test facility shall be certified annually to an accuracy of ±0.5% and be traceable to the NIST. If desired, the Engineer or their selected agent shall witness the tests and a copy of the certified accuracy test records must be furnished at no charge to the Owner.

3.3 Field Quality Control

3.3.1 Installation Check. The electromagnetic flow meter manufacturer shall provide the services of a qualified field representative according to the quality control section to assist during installation of the equipment by the Contractor. As a minimum, the manufacturer's field representative shall be made available as follows:

.1 Installation and Startup 4 trips, 5 days total

3.3.2 Training. Training shall be in accordance with Section 01820 – Demonstration and Training.

END OF SECTION

1 GENERAL

1.1 SCOPE

.1 This section covers the supply, delivery, supervision of installation, testing, and commissioning of the following equipment:

.1 One (1) chlorine residual analyzer to measuring total and free chlorine residual, complete with sensors, sensor signal cables, sensor housings, reagents (if applicable) and accessories such as pressure reducing and flow control valves as required by the manufacturer. Acceptable manufacturers are listed herein.

.2 This section describes the general requirements, operating conditions, shop drawings, the product, and execution of installation, start-up, inspection, testing, and commissioning.

.3 The Contractor shall be responsible for overall coordination of the above equipment to ensure their compatibility with the sample stream, sensor housing, mounting hardware and control equipment.

1.2 INTENT OF SECTION

.1 The section intends to specify the general requirements, product and execution required for the equipment stated under the scope.

.2 This section does not include the equipment for the introduction of chemicals into the system.

.3 The plans and specifications are intended to set the acceptable minimum and shall not be construed to relieve this Contractor of the responsibility of:

.1 Installing a complete, trouble free system

.2 Good workmanship

1.3 GENERAL

.1 Refer to Section 10010 for General Requirements.

.2 The contractor is to clearly identify on the shop drawings any deviation from the specification.

.3 Contractor is to furnish copies of the manufacturer’s warranties.

.4 Supply, install and test all meters and transmitters as shown in the Contract Drawings, as specified herein, in accordance with Manufacturer’s recommendations and as approved by the Engineer.

1.4 RELATED SECTIONS

.1 DIVISION 1 – GENERAL REQUIREMENTS

.2 DIVISION 11 – EQUIPMENT

.3 DIVISION 13 – SPECIAL CONSTRUCTION

.4 MECHANICAL SPECIFICATIONS ON CONTRACT DRAWINGS

.5 DIVISION 16 – ELECTRICAL

1.5 REFERENCES

.1 ANSI/ISA-S5.1-1984 Instrumentation Symbols and Identification.

.2 ANSI/ISA-S5.4-1976 (Revised 1989) Instrument Loop Diagrams.

.3 ISA-S20-1981 Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves or most current standard.

1.6 MEASUREMENT AND PAYMENT

.1 Work outlined in this section is included in the lump sum bid price.

1.7 OPERATING CONDITIONS

.1 The following site operating and water quality conditions must be assumed for all design calculations:

.1 Process Fluid: Potable Water

.2 40^0C maximum/5^0C minimum ambient air temperature

.3 25^0C maximum/0.5^0C minimum water temperature

.4 95% maximum relative humidity (non-condensing)

.5 6.8 – 8.5 water pH

.6 Normal Range: 1 to 2 mg/L with Extreme Range: 0 to 5 mg/L

.7 Fully enclosed facility

1.8 SHOP DRAWINGS

.1 Submit the Shop Drawings for review in accordance with Section 01330 – Submittal Procedures.

.2 The shop drawing submission shall include, but not be limited to, the following:

.1 Provide basic design details for each piece of equipment, including exact catalogue or model numbers, input output signal ranges and calibrated ranges, all interlocks and connections, product options, control schematics and wiring diagram(s).

.2 Descriptive material in sufficient detail to show the general construction pertinent to the proper review of the equipment.

.3 General dimensioned layout and mounting detail.

.4 A precise list of all electrical requirements for the equipment including cable and wire requirements, all controls monitoring equipment and instruments shall be given including all power characteristics.

.5 A list of recommended spare parts and recommended replacement frequency, including replacement of the chlorine sensor, and individual price for each item.

.6 The supplier shall indicate recommended manufacturer preventative maintenance frequency and cost per visit.

.7 All ancillary equipment to be provided by the Supplier shall be listed.

.8 Special accessories or tools for the adjustment or removal of parts required for any piece of equipment shall be listed and furnished as part of the supply.

.9 Factory test result documents, where applicable.

1.9 MAINTENANCE DATA

.1 Refer to Section 01780 – Closeout Submittals.

2 PRODUCTS

2.1 GENERAL REQUIREMENTS

.1 Work includes supply, delivery, installation, commissioning and training for total chlorine analyzer, as shown on the contract drawings and as specified herein.

.2 The sensor, sensor housing and analyzer shall be of the same Manufacturer to assure compatibility and provide sole source responsibility.

.3 The manufacturer shall provide a one-year warranty on all system components. All components shall be fully tested prior to shipping.

.4 The Contractor shall supply all components necessary for a functional system, including sample line piping and valves to sensor housing and from sensor housing to drain, and all accessories required for the proper performance of the analyzer.

.5 The Contractor shall supply if necessary, sampling pumps of adequate capacity and/or pressure reducing valves for the sample flows in accordance with Manufacturer’s recommendations.

.6 The Contractor shall provide connection of sample flow to the sensor housings, if applicable.

.7 Sample water from the sensor assembly shall not be contaminated and shall be capable of being directly discharged to drain.

2.2 TOTAL CHLORINE RESIDUAL ANALYZER

.1 Online chlorine analyzer for continuous monitoring of total residual chlorine in water. Instrument chemistry will employ N, N-diethyl-p-phenylenediamine (DPD) method.

.2 Analyzer and flow monitor shall be mounted as indicated on the Contract Drawings with all necessary piping, valves, regulators, and appurtenances as required.

.3 The manufacturer of the above specified equipment shall warranty it for a period of 24 months from the date of commissioning. In the event that a component fails to perform as specified or is proven defective in service during the warranty period, the manufacturer shall promptly repair or replace the defective part at no cost to the Owner. Include regular field services and maintenance work as required to satisfy extended warranty.

.4 Analyzer shall be supplied with a label in accordance with Section 11005 – Identification of Equipment and Valves.

.5 The chlorine residual analyzer shall include a controller with the following channels.

.1 One channel measuring total chlorine.

.6 The chlorine analyzer shall comply the minimum performance:

.1	Measurement Range:	0 to 10 mg/L total residual chlorine
.2	Accuracy:	± 5% of reading or ±0.04 mg/L, whichever is greater from 0 to 5 mg/L as Cl_2; +/- 10% from 5 to 10 mg/L as Cl_2
.3	Precision:	5% of reading or 0.01 mg/L, whichever is greater
.4	Lower Limit of Detection:	0.03 mg/L
.5	Resolution:	0.01 mg/L
.6	Repeatability:	5% of reading or 0.01 mg/L, whichever is greater.
.7	Cycle Time:	2.5 minutes

.7 The sensors shall conform to the following specifications:

.1 Housed in an IP66-rated enclosure.

.2 Capable of measuring free or total residual chlorine by changing the tubing and indicator and buffer solutions.

.3 Utilizes a built-in flow meter.

.4 Real-time flow rate is measured when sample is flowing through the analyzer and results are displayed on a controller display or web-enabled display in mL / min.

.5 Connects to a standard controller, which controls and provides power to the analyzer.

.6 Performs a blank reference measurement check between analysis points to compensate for sample color, turbidity, and changes in light intensity due to voltage fluctuations or light source aging.

.7 Operates with an LED light source at a peak wavelength of 510nm.

.8 Capable of operating unattended for 30 days between chemical reagent changes and measurement cell cleaning.

.9 Utilizes a three-color status light to indicate operating status.

.10 Utilizes three measurement cycle indicator lights to display the phase of the measurement cycle being performed.

.11 Has a colorimeter measurement cell window for viewing sample inside cell.

.12 Provides step-by-step, on-screen instructions for all routine maintenance activities, including reagent changes, tubing changes, and cell cleanings.

.13 When connected to a cloud-based standard controller is capable of providing remote monitoring of measurement and instrument data on a web-enabled device.

.8 The Transmitter and Controller conform to the following specifications

.1	Enclosure:	Wall mounted
.2	Cabinet mounting:	IP 54 (based on NEMA 4 X)
.3	Power Supply:	115VAC 60Hz Single Phase
.4	Sensor Cable	As required.
.5	Analogue Outputs:	2x 4-20mA Isolated 600 Ohm Max.
.6	Relay Outputs: relays rated 5A at 115V AC	2 x alarm and 1 x general fault Form “C” (SPDT)
.7	Alarm delay:	Switch-on & Switch-off delay. Programmable 0-9999 sec.
.8	Indication:	LCD Display of: Measured Value, Status, Error Conditions, Display turns Red in Error
.9	Touch Keypad:	Provide with Menu-Driven Calibration
.10	Security:	Pass code to restrict access to configuration settings
.11	Data Logging:	Data logging for measured value, control Variables, calibration data and events, stored on SD Card.

2.3 OTHER FOR CHLORINE RESIDUAL ANALYZER

.1 Supply and install the pressure regulation and flow control per manufacturer recommendation.

.2 Pressure Regulation: Chemline S.R 50 Series PVC Pressure Regulating Valve or approved equivalent.

.3 Sample Flow Control: As recommended by manufacturer and approved by Engineer.

.4 Supply and install two (2) upstream Filters

.1 Filter: 10” filter, 1-micron, 10” high x 2.5” diameter, to fit “standard 10 inch water filter housing”: Make Watts, Model: FPMB1-978

.2 Filter Housings: Watts, clear lucite, with 0.5” FNPT fittings, pressure relief “button”, with adapters for 0.25” poly tube, One option: Watts PWHP1012BPR

.3 Filter Housing Bracket: Watts PWMBVIH

.4 Bracket for two filter housings

.5 Filter In/Out/Bypass ball valves: PVC

.6 For Filter elements, an alternate supplier is VIQUA, model: SW1-1

.5 Electrolytic caps (consumable): p/n 790488

.6 Electrolyte solution, 100mL (consumable): p/n 506270

2.4 APPROVALS

.1 Approval from C.S.A. is required.

2.5 SPARES

.1 Contractor shall provide six (6) months’ supply of reagent and cell cleaning supplies, and one (1) analyzer tubing replacement kit.

2.6 ACCEPTABLE MANUFACTURER

.1 The below Supplier list shall not be construed as automatically acceptable, but the Owner or Engineer shall have the right, in its sole and absolute discretion, to accept or reject the shop drawing if the Supplier selected by the Contractor does not comply with the Contract Drawings and specification requirements herein.

.2 HACH Model CL17sc with SC4500 controller, or pre-approved equal.

3 EXECUTION

3.1 GENERAL

.1 The chlorine analyzer supplier shall provide site services as required to facilitate analyzer installation including site supervision during installation, commissioning and training.

.2 Install all instruments in strict accordance with the manufacturer’s requirements and recommendations.

.3 Use stainless steel hardware for all installations. Ensure all supports are retractable to provide convenient access for maintenance and servicing of instrumentation.

.4 Contractor to wire all alarm points in a ‘fail safe’ configuration, such that the loss of power, opening of the contact or break in the control circuit wiring will activate a SCADA alarm.

.5 Ensure all installations allow for ease of access for future maintenance and calibration.

3.2 SITE VERIFICATION

.1 Complete field performance verification upon installation of the chlorine analyzer.

3.3 SYSTEM START-UP AND COMMISSIONING

.1 Section 01 91 00 – Commissioning – General Requirements.

.2 All instrumentation equipment is to be checked and adjusted by a competent service representative of the respective instrument manufacturer or supplier. After all calibration and other adjustments are carried out, and the equipment is fully operable, the accuracy, serviceability and function of all units are to be demonstrated to the Engineer’s satisfaction. Upon completion of this work, provide copies of a written report to the Engineer and include in the final Operations and Maintenance Manuals.

.3 Provide on-site assistance to complete I/O check and to be present during initial testing of software. Work with Owner’s Representative during site start-up of system.

.4 The chlorine analyzer supplier shall provide site services as required to facilitate flow meter commissioning including (but not limited to) the following: supervision during start-up (minimum two days), training (minimum two days), commissioning (minimum two days), one year inspection and analyzer verification (two days). Do not assume any of the specified days above will overlap.

3.4 INSTALLATION, INSPECTION AND TRAINING

.1 The chlorine residual analyzers shall be installed as indicated on the Contract Drawings, in accordance with the Manufacturer’s recommendations, and as approved by the Engineer.

.2 Refer to Section 01820 – Demonstration and Training.

.3 Provide the services of a factory trained representative to inspect, operate, test, adjust, and troubleshoot the installation.

.4 The factory trained representative, mentioned above, will certify that the equipment is ready for operation before use. In addition, the factory trained representative shall instruct the owner’s operation personnel of the proper operation and maintenance of the equipment supplied.

.5 Provide for additional supervision of installation by equipment Supplier as required.

.6 Arrange with the Engineer a mutually agreeable date when the representative should be on site.

.7 Submit a report, signed by the Manufacturer’s representative, describing in detail the inspection, tests, and adjustments made, quantitative results and suggestions for precautions to be taken to ensure proper maintenance. The report must verify that the equipment conforms to all specifications.

.8 Inspection to include checking for:

.1 Cracks and other damaged or defective parts. The equipment must be undamaged, without cracks and free of defective parts.

.2 Completeness of installation as specified and as recommended by the Manufacturer.

.3 Correctness of setting, alignment and relative arrangement of various parts of the system.

.4 Follow manufacturer's instructions.

.5 Use separate conduits for signal and power wiring.

.6 Avoid custom cable lengths if possible.

3.5 TESTING AND CERTIFICATION

.1 After start-up and prior to final acceptance, the Contractor shall conduct Engineer witnessed performance tests on the equipment.

.2 The field service representative will perform functionality tests of all the functions the chlorine residual analyzer and temperature transmitter are designed to perform. Tests will be scheduled with the Engineer at least two (2) weeks prior to the planned test date.

.3 The field service representative shall submit to the Engineer a written report stating that the equipment has been checked and is suitable for operation.

3.6 SUPERVISION OF INSTALLATION AND COMMISSIONING

.1 Test and commission the equipment in accordance with section 01810 – Testing and Commissioning.

.2 At the completion of satisfactory installation, each unit shall be started by the General Contractor under the supervision of the Supplier and in cooperation with plant operations staff. All controls and alarms shall be checked and tested to ensure proper control and equipment protection.

.3 Equipment shall only be accepted after receipt of a satisfactory report submitted by the Manufacturer's representatives.

.4 Modify or replace equipment or materials failing required tests.

.5 Perform additional testing required due to changes of materials, and/or failure of materials or construction to meet specifications at no extra cost to the Corporation.

3.7 STORAGE

.1 Prior to the installation, the chlorine residual analyzer, temperature transmitter, sensors and accessories should be protected and stored indoors in a dry area, in accordance with the Manufacturer's recommendations.

3.8 MAINTENANCE

.1 Provide maintenance on Supplier's material as required by the Supplier from the date of delivery to the initial start-up.

END OF SECTION

DIVISION 14 – CONVEYING AND HOISTING SYSTEMS

Section No.	Title
14310	Hoists and Trolleys
14660	Gantry Crane

1 GENERAL

1.1 Intent of Section

1.1.1 This section covers supply, delivery, supervision of installation and commissioning of hoist system and related accessories to be used at Deep River WTP to hoist ammonium sulphate solution IBC totes.

1.1.2 The Contractor is responsible for overall coordination of the hoist equipment package to avoid interference with proposed equipment and structures.

1.2 Related Sections

1.2.1 DIVISION 1 – GENERAL REQUIREMENTS

1.2.2 DIVISION 11 - EQUIPMENT

1.2.3 DIVISION 13 – INSTRUMENTATION AND CONTROL

1.2.4 SECTION 14660 GANTRY CRANE

1.2.5 DIVISION 15 – MECHANICAL

1.2.6 DIVISION 16 – ELECTRICAL

1.3 Operating Conditions

1.3.1 The following site operating and water quality conditions must be assumed for all design calculations:

.1 Maximum operation air temperature refers to Division 16 for electrical device requirement

.2 Maximum relative humidity refers to Division 16 for electrical device requirement

.3 Fully enclosed facility.

1.3.2 Refer to the contract drawings for further details.

1.4 Reference Standards

1.4.1 ASME HST-4-21 Performance Standard for Overhead Electric Wire Rope Hoists

1.4.2 ANSI MH 27.1-2016 - Specifications for Under-Hung Cranes and Monorail Systems

1.4.3 ANSI B30.11-10 Monorails and Underhung Cranes - Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, And Slings

1.4.4 ASME B30.16-22 – Overhead Underhung and Stationary Hoists

1.4.5 ASME B30.17-20 – Cranes and monorails (with underhung trolley or bridge)

1.4.6 ASTM A123/A123M-17 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

1.4.7 ASTM F3125-23 – Standard Specifications for High Strength Structural Steel Bolts, and Alloy Steel, Heat Treated

1.4.8 CISC Design Guide – Crane-Supporting Steel Structures, 4th Edition, 2021.

1.4.9 CSA B167-16(R2021) – Overhead cranes, gantry cranes, monorails, hoists and jib cranes

1.4.10 CSA C22.1-24 - Canadian Electric Code, Part 1

1.4.11 CSA C22.2 No. 33-23 - Electrical safety requirements for cranes and hoists

1.4.12 CSA G40.20-13/G40.21-13 (R2023) - General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel

1.4.13 CSA S16-19 – Design of Steel Structures

1.4.14 CSA W47.1- 19 (R2024) - Certification of Companies for Fusion Welding of Steel Structures

1.4.15 CSA W59-24 – Welded Steel Construction

1.4.16 Crane Manufacturer's Association of America (CMAA)

.1 Specifications for Top Running and Under Running Single Girder Electric Overhead Cranes Utilizing Under Running Trolley Hoist – No. 74 (2020)

1.4.17 CSA Standard C22.2 No. 33-23, Electric Cranes and Hoists. Electric Component Enclosures – EEMAC-4 (NEMA)

.1 National Electric Code (NEC)

.2 Article 100, Article 240-1, Article 430-31, Article 430-51, Article 610-1, Article 610-3).

1.4.18 Ontario Hydro Electrical Safety Code

1.4.19 Ontario Occupational Health and Safety Act and Regulations Part 1926.554 – Overhead Hoists

1.4.20 Ontario Building Code 2024

1.5 Submittals

1.5.1 Submit the shop drawings in accordance with Section 01330 – Submittal Procedures.

1.5.2 Provide sufficient detail to show the general construction pertinent to the proper review of the equipment. Description of the materials of construction of the major components, including:

.1 General assembly drawings of trolleys, hoists and other major components.

.2 All required connections.

.3 Details of electrical conductors and collectors.

.4 Hoist hook travel range and lifting range

.5 Indicate design forces/reactions forces induced by the operation of the hoist.

1.5.3 Wire and schematic diagrams.

1.5.4 A precise list of all electrical requirements for the equipment, including all controls and instruments shall be given, including all power characteristics and materials of construction.

1.5.5 The Supplier shall indicate a list of spare parts that they recommend be purchased and individual prices for each item.

1.5.6 All ancillary equipment to be provided by the Supplier shall be listed.

1.5.7 Special accessories or tools for the adjustment or removal of parts required for any piece of equipment shall be listed and furnished as part of the supply.

1.5.8 Submit installation manuals before shipping equipment.

1.5.9 Submit certified test results of load tests for hoists.

1.5.10 Submit Operating and maintenance manual.

1.6 Warranty

1.6.1 Provide manufacturer's warranty for a period of five (5) years. Warranty period to begin upon hoist and trolley final acceptance. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse or neglect do not constitute defective material or workmanship.

1.7 Qualifications

1.7.1 Supplier shall have a minimum of five (5) years of recent manufacturing experience in the hoist, crane and monorail business.

1.8 Maintenance Data

1.8.1 Refer to Section 01780 – Closeout Procedures.

1.9 Measurement and Payment

1.9.1 Work outlined in this section is included in the lump sum tender price.

1.10 Storage

1.10.1 The equipment and accessories shall be stored indoors in a dry area in accordance with the manufacturer's recommendations.

2 PRODUCTS

2.1 General

2.1.1 Products including components shall be approved by Canadian Standards Association (CSA).

2.1.2 The entire lift system, including hoist, trolley and gantry crane shall be manufactured from the same manufacturer.

2.1.3 Provide one (1) complete hoist system as shown on the drawings. The system shall include a beam hoist trolley and electric chain hoist. The characteristics of the hoist system are described in the tables below.

Electric Chain Hoist

Capacity	Lift	Listing Speed	Motor (HP)
2 tons	Min.3 m	Max.2.4 m/min.	1

The capacity of the beam hoist trolley shall be 2 tons.

2.2 Materials

2.2.1 The hoist trolleys shall have adjustable width to fit flat and tapered flange beams. Bumpers protect steel wheels from collision needs. Maintenance-free sealed bearings.

2.2.2 The electric chain hoist shall lift loads effortlessly with the press of a button. Overload protection prevents operation if load exceeds capacity. Handheld control is with 1.8m cord and 4.5m power cord with three-prong plug. Motor is completely enclosed by aluminum housing with NEMA 4 rated and 115V. Zinc-plated steel chain resists corrosion, including fabric chain bag. All shall be approved by CSA.

2.3 Bolts, Nuts and Clamps

2.3.1 Provide all bolts and nuts, grade ASTM A325 galvanized.

2.4 Motors

2.4.1 Motors shall be totally enclosed, fan cooled or non-ventilated type. Motors shall be designed to operate from 3 phase, 60 hertz, 600 volts power supply.

2.5 Limit Switches

2.5.1 An upper and lower limit switch shall be provided, operated by the hoist rope guide, in addition to the block-operated upper limit switch. Limit switches shall be of the control circuit type.

2.5.2 To prevent the operator from lifting excessive overloads, a factory set load limiter shall be provided.

2.6 Brakes

2.6.1 The hoist shall be directly fixed to the main gear case and operates on the primary drive shaft. The brake shall be single disc type, be of a failsafe design and is spring applied with a DC rectified magnetic coil release. Its failsafe operation shall hold the load in the event of an interrupted power supply.

2.7 Capacity Nameplates

2.7.1 Provide stick-on or painted nameplates indicating crane capacity.

2.8 Acceptable Manufacturers

2.8.1 Equipment must be supplied from one of the following acceptable manufacturers:

.1 Kone Crane

.2 Zelus Material Handling

.3 Stahl CraneSystems Inc.

.4 Columbus McKinnon Corporation

.5 RWS Hoist and Cranes Inc.

.6 Liftsafe Engineering and Service Group Inc.

.7 Uline.ca

.8 Approved equivalent

3 EXECUTION

3.1 Installation and Inspection

3.1.1 The hoist and monorail systems shall be installed as indicated on the Contract drawings, in accordance with the manufacturer's recommendations and, as approved by the Engineer.

3.1.2 Provide the services of a factory-trained representative to inspect, operate, test, adjust and trouble-shoot the installation.

3.1.3 Provide and install all lubricants and liquids necessary for initial operation of the equipment.

3.1.4 Inspection to include checking for:

.1 Cracks and other damaged or defective parts. Each monorail system, as well as accessories, must be undamaged, without cracks and free of defective parts.

.2 Completeness of installation as specified and as recommended by the manufacturer.

.3 Correctness of setting, alignment and relative arrangement of various parts of the system.

3.1.5 Provide for additional supervision of installation by equipment supplier as required.

3.1.6 Arrange with the Engineer a mutually agreeable date when the representative should be on site.

3.1.7 Submit a report, signed by the manufacturer's representative, describing in detail the inspection, tests and adjustments made, quantitative results and suggestions for precautions to be taken to ensure proper maintenance. The report must verify that the equipment conforms to all specifications.

3.2 Mechanical Testing and Certification

3.2.1 After start-up and prior to final acceptance, the Contractor shall conduct engineer-witnessed performance tests on the equipment.

3.2.2 The field service representative will cause the hoist and monorail mechanism to perform all mechanical functions that the mechanism is designed to perform. Tests will be scheduled with the Engineer at least two (2) weeks prior to the planned test date.

3.2.3 The field service representative shall submit to the Engineer a written report stating that the equipment has been checked and is suitable for operation.

3.3 Supervision of Installation and Commissioning

3.3.1 Test and commission the equipment in accordance with Section 01810 – Testing and Commissioning.

3.3.2 At the completion of satisfactory installation, each unit shall be started by the General Contractor under the supervision of the Supplier and in conjunction with plant operating conditions. All controls and alarms shall be checked and tested to ensure proper control and equipment protection.

3.3.3 Equipment shall only be accepted after receipt of a satisfactory report submitted by the manufacturer's representatives.

3.3.4 Modify or replace equipment or materials failing required tests.

3.3.5 Perform additional testing required, due to changes of materials and/or failure of materials or construction, to meet specifications at no extra cost to the Owner.

3.4 Testing

3.4.1 Submit certified test results of load tests for the hoists and the complete crane system.

3.4.2 Test all equipment after installation in the presence of the Engineer to verify that it meets the stated specifications, local codes and Ministry of Labour requirements.

3.4.3 After installation has been completed and before being placed into service, the hoist system shall be operated by power.

3.4.4 After the above has been completed, the hoist system will be tested with the hook carrying:

.1 Rated load: during these tests, the specified speed need not be attained but the equipment shall show itself capable of dealing with the overload without difficulty.

.2 After 25 percent overload: during this test, the specified speed need not be attained but the equipment shall show itself capable of dealing with the overload without difficulty.

.3 After the 25 percent overload test: the hoist overweight limit switch shall be readjusted so the hoist will cut out at a ten percent overload.

.4 All test weights and slings shall be provided.

.5 Where the equipment does not meet the specifications, it is to be revised, replaced or readjusted to the satisfaction of the Engineer until it does meet the specifications.

.6 A written test report shall be sent to the Engineer and be included in the maintenance manual.

3.5 Maintenance

3.5.1 Provide maintenance on Supplier's material, as required by the Supplier, from the date of delivery to the initial start-up.

END OF SECTION

1 GENERAL

1.1 Intent of Section

1.1.1 This section covers supply, delivery, supervision of installation and commissioning of portable lifting davits, gantry cranes, chain hoists and related accessories for ammonium sulphate solution IBC totes.

1.2 Related Sections

1.2.1 DIVISION 1 – GENERAL REQUIREMENTS

1.2.2 DIVISION 11 – EQUIPMENT

1.2.3 SECTION 14310 Hoists and Trolleys

1.2.4 DIVISION 15 - MECHANICAL

1.3 Operating Conditions

1.3.1 The following site operating and water quality conditions must be assumed for all design calculations:

.1 Maximum operation air temperature refers to Division 11 and 15 for equipment requirement

.2 Maximum relative humidity refers to Division 11 and 15 for equipment requirement

1.3.2 Refer to the Contract Drawings for further details.

1.4 Reference Standards

1.4.1 ASME HST-4-2021 - Performance Standard for Overhead Electric Wire Rope Hoists

1.4.2 ASME B30.2-2022 - Overhead and Gantry Cranes.

1.4.3 CSA W47.2-11 (R2020) - Certification of Companies for Fusion Welding of Aluminum

1.4.4 Ontario Occupational Health and Safety Act and Regulations.

1.5 Submittals

1.5.1 Submit the Shop Drawings for review in accordance with Section 01330 – Submittal Procedures.

1.5.2 The shop drawing submission shall include, but not be limited to, the following:

.1 Submission details covered in Section 01330 – Submittal Procedures.

.2 Provide sufficient detail to show the general construction pertinent to the proper review of the equipment and of the description of the materials of construction, including;

.1 Details of vertical, diagonal, and horizontal members, chains suspension fittings, safety stops and bumpers.

.3 Hoist technical details from the manufacturer.

.4 General assembly drawings of the components.

.5 The Supplier shall indicate a list of spare parts which they would recommend be purchased and individual prices for each item.

.6 All ancillary equipment to be provided by the Supplier shall be listed.

.7 Special accessories or tools for the adjustment or removal of parts required for any piece of equipment shall be listed and furnished as part of the supply.

1.5.3 Submit load testing plans and certified test results.

1.6 Qualifications

1.6.1 The Supplier shall have a minimum of five (5) years of recent experience in the manufacturing of portable gantry cranes.

1.7 Maintenance Data

1.7.1 Maintenance manual shall be supplied and shall be submitted in accordance with the submittals section. Refer to section 01780 – Closeout Procedures. Equipment designations used shall correspond to those indicated on the drawings.

1.7.2 Maintenance manuals shall include the following:

.1 Equipment function and limiting conditions.

.2 Assembly, installation, alignment, adjustment, and checking instructions.

.3 Parts lists and predicted life of parts subject to wear

.4 The maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered.

2 PRODUCTS

2.1 General

2.1.1 Products including components shall be approved by the relevant Canadian authorities.

2.1.2 The entire lift system, including hoist, trolley and gantry crane shall be manufactured from the same manufacturer.

2.1.3 Refer to the Contract Drawings for further details.

2.1.4 All lifting systems shall be capable of overcoming the initial dislodging force, overcoming friction including hosit and lifting chain weight (the sum of all of these weights is referred to as the minimum weight).

2.1.5 Portable systems shall be manufactured from materials that are compatible and shall not corrode, and will operate safety, in all weather conditions.

2.2 Gantry Crane

2.2.1 Provide one (1) lightweight, portable and adjustable gantry crane to the following specifications:

.1 Lightweight, corrosion-resistant and all aluminium alloy construction

.2 Minimum 2000 Kg lifting capacity.

.3 Minimum 3m overall length between supporting legs, usable length to minimum 2.4m, with a usable minimum height of 3m (from ground to hook).

.4 Adjustable support leg height.

.5 Fittings

.1 Provide adequately sized fabricated fittings for the indicated loads and factor of safety.

.6 Safety Stops and Bumpers

.1 Fit safety stops or bumpers to prevent the hoist or loads from bumping the support legs.

.7 Bolts, Nuts and Clamps

.1 Provide screwed-on, painted and weatherproof nameplates indication crane capacity, as approved by the Engineer.

.8 Gantry base with four caster wheels with 360 swivel and locking casters.

2.3 Warranty

2.3.1 The manufacturer shall provide a five (5) year warranty on all components against defects in workmanship and materials from the data of startup. All components shall be fully tested prior to shipping.

2.4 Acceptable Manufacturers

2.4.1 Equipment must be supplied from the following acceptable Manufacturer:

.1 EME – Easily Moved Equipment.

.2 Thern Winches and Cranes.

.3 LiftSafe Service Group

.4 O’Brien Lifting Solutions Inc.

.5 Uline.ca

.6 Approved equivalent

2.4.2 Devices whose Manufacturer does not have substantiated test data from recognized and independent testing facilities for exact design being provided, shall not be allowed.

3 EXECUTION

3.1 Installation and Inspection

3.1.1 The hoist system shall be installed as indicated on the Contract Drawings, in accordance with the Manufacturer's recommendations and as approved by the Engineer.

3.1.2 Provide the services of a factory trained representative to inspect, operate, test, adjust, and troubleshoot the installation.

3.1.3 Provide and install all lubricants and liquids necessary for initial operation of the equipment.

3.1.4 Inspection to include checking for:

.1 Cracks and other damaged or defective parts. Each system, as well as accessories, must be undamaged, without cracks and free of defective parts.

.2 Completeness of installation as specified and as recommended by the Manufacturer.

.3 Correctness of setting, alignment and relative arrangement of various parts of the system.

3.1.5 Provide for additional supervision of installation by Equipment Supplier as required. Arrange with the Engineer a mutually agreeable date when the representative should be on site.

3.1.6 Submit a report, signed by the Manufacturer's representative, describing in detail the inspection, tests, and adjustments made, quantitative results and suggestions for precautions to be taken to ensure proper maintenance. The report must verify that the equipment conforms to all specifications.

3.2 Mechanical Testing and Certification

3.2.1 After startup and prior to final acceptance, the Contractor shall conduct Engineer witnessed performance tests on the equipment.

3.2.2 The field service representative will cause the hoist system mechanism to perform all mechanical functions that the mechanism is designed to perform. Tests will be scheduled with the Engineer at least two (2) weeks prior to the planned test date.

3.2.3 The field service representative shall submit to the Engineer a written report stating that the equipment has been checked and is suitable for operation.

3.3 Supervision of Installation and Commissioning

3.3.1 Test and commission the equipment in accordance with Section 01810 – Testing and Commissioning.

3.3.2 At the completion of satisfactory installation, each unit shall be started by the General Contractor under the supervision of the Supplier and in conjunction with plant operating conditions. All controls and alarms shall be checked and tested to ensure proper control and equipment protection.

3.3.3 Equipment shall only be accepted after receipt of a satisfactory report submitted by the Manufacturer's representatives.

3.3.4 Modify or replace equipment or materials failing required tests.

3.3.5 Perform additional testing required due to changes of materials, and/or failure of materials or construction to meet specifications at no extra cost to the Owner.

3.4 Testing

3.4.1 Test all equipment after installation in the presence of the Engineer to verify that it meets the stated specifications, local codes and Ministry of Labour requirements.

3.4.2 After installation has been completed and before being placed into service, the portable lifting systems shall be operated manually and tests carried out to provide the following:

.1 All clearances and alignments are in order.

.2 All protective devices operate satisfactorily.

3.4.3 After the above has been completed, the portable lifting systems will be tested with the hook carrying:

.1 Rated load: During these tests, the equipment shall show itself capable of dealing with the overload without difficulty. Load test to 125% of the rated load.

.2 All test weights and slings shall be provided.

.3 Where the equipment does not meet the specifications, it is to be revised, replaced or readjusted to the satisfaction of the Engineer until it does meet the specifications.

.4 A written test report shall be sent to the Engineer and be included in the maintenance manual.

3.5 Training

3.5.1 Operator instruction and training on equipment shall be provided. The training will give a complete overview of all equipment, testing, adjusting, and maintenance procedures.

3.6 Storage

3.6.1 The equipment and accessories shall be stored indoors in a dry area, in accordance with the Manufacturer's recommendations.

3.7 Maintenance

3.7.1 Provide maintenance on Supplier's material as required by the Supplier from the date of delivery to the initial startup.

END OF SECTION

DIVISION 16 – ELECTRICAL

Section No.	Title
16010	Electrical General Requirements
16021	Demolition of Electrical Systems
16062	Grounding Secondary
16090	Equipment Identification
16122	Wires and Cables 0-1000V
16131	Splitters, Junction and Pull Boxes
16132	Outlet, Conduit Boxes and Fittings
16133	Conduits, Fastening and Fittings
16222	AC Induction Motors
16223	Motor Starters to 600V
16400	Basic Electrical Equip and Materials
16412	Moulded Case Circuit Breakers
16423	Control Devices
16441	Panel Boards Breaker Type

1 GENERAL

1.1 Description

1.1.1 This section describes the following:

.1 General and common requirements for Division 16 (Electrical Work)

.2 Overall scope of work for Division 16

.3 General coordination between Division 16 and related work in other Divisions, particularly Divisions 11, 13 and 15.

1.2 Scope of Work

1.2.1 This section provides a summary of the scope of work. In addition to scope identified herein, refer to the electrical drawings for more details and additional scope items. The work to be carried out by the Contractor shall include, but not be limited to the supply and installation of the following:

1.2.2 Installation of pre-purchased process equipment supplied by Veolia, as listed below:

.1 Actiflo® Automated Polymer Mixing System (Hydrapol).

.2 Programmable Logic Control (PLC) Actiflo® Control Panel.

.3 Lamella plate air scour system (AERSHAFT).

.4 Microsand Feeding System (HydraSand Mini).

.5 Ammonium Sulphate Pump Skid

1.2.3 The Contractor shall install pre-purchased equipment, providing all required power, control, and signal wiring for complete and functional integration with the plant's electrical distribution, control, and instrumentation systems. Installation shall be fully coordinated with Veolia to confirm interface points, connection details, and installation requirements.

1.2.4 Supply and install 600V power feeder from the existing MCC 2 to the vendor supplied Aershaft Air Scour starter wall-mount panel. Note that the panel is provided under Division 11; however, the Contractor is responsible for mounting the panel, installing conduits, power cabling, and field cabling from the Aershaft Air Scour starter panel to the respective field devices such as the motor, instruments, field I/O, etc. Electrical Sub-contractor is to review the Aershaft Air Scour shop drawings and provide power feeds, field wiring, etc, based on vendor recommendations.

1.2.5 Retrofit existing Distribution Panel "F"

.1 The Contractor shall modify the existing distribution panel "F" located in the Electrical Service Room to provide power to all new 600VAC loads as indicated on the drawings.

.2 The contractor shall provide as-built printed distribution panel schedule that includes all new and existing breakers sizes and respective equipment feeds.

.3 Contractor to retain the existing distribution panel manufacturer and provide new breakers and all necessary equipment in accordance with contract specifications Division 16.

.4 All new distribution panel equipment such as breakers shall be identical as existing including rating.

1.2.6 Retrofit existing Lighting Panel “G”

.1 The Contractor shall modify the existing lighting panel “G” located in the Electrical Service Room to provide power to all new 120/208VAC loads as indicated on the drawings.

.2 The contractor shall provide an as-built printed lighting panel schedule that includes all new and existing breaker sizes and respective equipment feeds.

1.2.7 Retrofit existing Lighting Panel “M”

.1 The Contractor shall modify the existing lighting panel “M” located outside of the Electrical/MCC Room to provide power to all new 120/208VAC loads as indicated on the drawings.

.2 The contractor shall provide an as-built printed lighting panel schedule that includes all new and existing breaker sizes and respective equipment feeds.

.3 Contractor to retain the existing lighting panel manufacturer and provide new breakers and all necessary equipment in accordance with contract specifications Division 16.

.4 All new lighting panel equipment such as breakers shall be identical as existing including rating.

1.2.8 Replacement of the existing PLC Actiflo Control Panel:

.1 The new PLC Actiflo Control Panel is provided under Division 11; however, the Contractor is responsible for coordinating removal and reconnection of existing power and control field wiring with the equipment vendor.

.2 Reconnect, test and commission power and control conductors to the new PLC Actiflo Control Panel.

1.2.9 Retrofit existing Main PLC panel:

.1 Provide power/control wiring, conduit and all ancillary electrical apparatus, to connect new instruments to the Main PLC panel. Refer to the contract drawings for more details.

.2 Provide one (1) CAT6 cable from the Main PLC panel to the new automated polymer system control panel. Refer to the contract drawings for more details.

1.2.10 Retrofit existing Chemical PLC panel:

.1 Provide power/control wiring, conduit and all ancillary electrical apparatus, to connect new instruments to the existing Chemical PLC panel. Refer to the contract drawings for more details.

1.2.11 Replacement of existing process equipment including, two (2) chlorinators, three (3) turbidity meter and four (4) influent flow meters.

1.2.12 Re-locate existing Actiflo Polymer Pump Skid field wiring as required.

1.2.13 Replacement of existing HVAC equipment including, one (1) exhaust fan and eight (8) unit heaters.

1.2.14 Contractor is responsible for removals and disposal from site of electrical and instrumentation removals as shown in the contract drawings and specified herein. The Owner has the right to request for any equipment during construction that is being removed to be returned in working condition.

1.2.15 Provide new instrumentation and control conduit systems to suit the requirements of all equipment, including all hardware required to install and support the conduit systems.

1.2.16 Provide power distribution, communications and control wiring to suit all controls including power cables, power supplies to the respective control panels/local control station/instruments/communication cabinets, control wiring communications wiring, and related distribution conduit.

1.2.17 Provide motor starters, junction boxes, fittings to suit all HVAC control systems. Coordinate with the HVAC equipment and control system supplier to confirm the wiring requirements, and conduit sizing for each application. Provide separate conduits as required to suit the respective voltage levels in accordance with the OESC. All HVAC control wiring is to be provided by the contractor. Provide conduit raceway applications, power distribution and controls for all HVAC interconnection/control wiring.

1.2.18 All conduit and wiring of electrical and control equipment supplied under other Divisions, as shown on the drawings and specified herein.

1.2.19 Provide grounding and ground continuity to suit all equipment, metal enclosed current carrying equipment and distribution. Provide bonding conductors to all electrical distribution equipment that are connected directly to the main service ground and/or electrical room grounding loop in accordance with the Electrical Safety Code.

1.2.20 Electrical testing, cabling meggering, hi-pot testing, component tuning, calibration, adjustment, start-up and commissioning.

1.3 General

1.3.1 Read and conform to the General Requirements (Division 1), which applies to and forms part of all sections of the work. The general instructions are intended to supplement and not to replace Division 1 requirements.

1.3.2 The specifications are divided into Divisions of work and a Division may consist of the work of more than one (1) subcontractor. The responsibility as to which subcontractor provides labour, materials, equipment and services required to complete the work rests solely with the Contractor.

1.3.3 The Contractor shall provide all labour, supervision, tools, equipment, materials, services and miscellaneous expenses necessary to complete the work as outlined in this Section. Install and connect all electrical and instrumentation equipment, controls and devices supplied under other sections.

1.3.4 Remove existing equipment made obsolete by this project and also disconnect/reconnect existing equipment either relocated or serviced from new equipment.

1.3.5 Visually inspect the existing site conditions, including below grade areas, prior to the project award to suit the installation of the new power and controls distribution.

1.3.6 Furnish, install, test and commission a complete operational electrical system as required by the drawings and as herein specified.

1.4 Related Sections

1.4.1 Read and conform to all Sections of the specifications. References to specific sections of the specifications do not relieve the Contractor of the requirement to read and follow all sections as a complete document.

1.4.2 The general instructions are intended to supplement and not to replace Division 1 requirements. Where requirements conflict, apply the more strenuous requirement.

1.4.3 The drawings, specifications, and standards are complimentary to one another, meaning that, that which is called for on one is meant to be called for on all. Where conflict exists between the Sections, Standards and/or Drawings, obtain clarification before any material is purchased or work commences.

1.4.4 If it is not clear from the Drawings and Specifications, which Division is responsible for performing certain works, obtain clarification of the item and/or items in question.

1.5 Codes and Standards

1.5.1 All equipment and work shall meet or exceed the requirements of the Ontario Electrical Safety Code (OESC) and to all standards referenced therein.

.1 The OESC is CSA C22.1, Canadian Electrical Code, Part 1, and the Ontario Amendments to that Code

.2 All electrical equipment shall bear all required approval marks to demonstrate approval to all applicable codes and standards.

.3 Provide underground systems in accordance with CSA C22.3 No.7 except where specified otherwise.

.4 Code requirements shall be considered a minimum standard. When materials shown on drawings as indicated in the specifications exceed code requirements, the plans and specifications shall govern.

.5 All references to regulations, codes and standards shall be made to the latest edition.

1.6 Definitions

1.6.1 The following are definitions of terms and expressions used in the specification:

.1 “Indicated” is defined as shown on the drawings or noted in contract documents.

.2 “Inspection Department/Authority” means an agent of any authority having jurisdiction over construction and safety standards associated with any part of electrical work on site. For this project the Inspection Authorities include:

.3 The Electrical Safety Authority (ESA)

.4 The Technical Safety and Standards Authority (TSSA)

.5 The local building inspector

.6 The local fire inspector

.7 “OESC” is defined as CSA C22.1, Canadian Electrical Code, Part 1, and the Ontario Amendments to that Code.

.8 “Provide” is defined as to supply install, verify, test and commission.

.9 “Supply Authority” is defined as the local electrical distribution company. For this project the Supply Authority is North Wellington Power.

.10 “Wiring” means wiring of power and control conductors to lighting, receptacles, as well as any controlling or controlled devices associated with them.

.11 “concealed” – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls, partitions and floors.

.12 “exposed” – means Work normally visible, including Work in equipment rooms, tunnels, and similar spaces.

.13 “provide” (and tenses of “provide”) – means supply and install complete.

.14 “install” (and tenses of “install”) – means install and connect complete.

.15 “supply” – means supply only.

1.7 Coordination with Other Trades

1.7.1 The specification is divided into divisions of work and a division may consist of the work of more than one (1) subcontractor. The responsibility as to which subcontractor provides labour, materials, equipment and services required to complete the work rests solely with the Contractor.

1.7.2 The Contractor shall be responsible for all electrical wiring and terminations required for equipment supplied in other Divisions, irrespective whether or not it is shown or mentioned on the drawings and specifications respectively so as to supply a complete working system.

1.7.3 Where special wiring (cables supplied with instruments, etc.) is supplied by other Divisions, the Contractor will be responsible for the installation of this wiring in coordination with the Division supplying said wiring unless stated otherwise.

1.7.4 Where equipment is supplied by other Divisions and installed under this Division:

.1 The Contractor shall be responsible for the proper installation of all panels, enclosures, switches, fixtures, etc., as shown on the drawings.

.2 Provide all terminations, junction boxes, fittings and flex connectors, such that raceway is continuous for its intended application. The Contractor shall be responsible for coordination with other Divisions supplying equipment, as to the exact location for installation of said equipment.

.3 Raceway types are to conform with to the space classification.

.4 The Contractor shall request from other Divisions supplying equipment for installation and/or wiring under this Division, all pertinent instruction manuals, diagrams, specifications sheets, etc., required for the proper installation of the equipment.

.5 The Contractor shall be responsible for verifying that the equipment's electrical specifications are suitable for the intended application as per Division 1. Check all voltage ratings, wiring terminations, current ratings and other electrical characteristics so as to supply a complete working system.

1.8 Coordination with Authority

1.8.1 Arrange inspections of all work by the Authorities having jurisdiction over the work. On completion of the work, present to the Owner the final unconditional certificates of approval of the Inspection Authorities.

1.8.2 Pay associated fees, for all permits, inspections, and power outages to suit supply authority/utility requirements.

1.8.3 The Contractor shall provide Engineer with copies of all ESA reports, inspections, etc.

1.9 Permits, Fees and Inspection

1.9.1 The Engineer shall obtain Electrical Safety Authority (ESA) plan review prior to commencement of work. The Contractor is required to comply with all recommendations and comments provided by the ESA in the plan review report, at no additional cost.

1.9.2 Submit all necessary documentation to the ESA during the construction period including electrical distribution equipment shop drawings, short circuit protection coordination study and the arc flash hazard study. The Contractor shall abide by all comments and recommendations provided by the ESA based on the submitted information, at no additional cost.

1.9.3 Notify the Engineer of changes required by Electrical Safety Authority (ESA) prior to making changes.

1.9.4 Furnish Certificates of Acceptance from the ESA on completion of work to the Engineer.

1.9.5 Before starting any work, submit the required number of copies of drawings and specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Engineer immediately of such changes for proper processing of the requirements. Prepare and furnish any additional drawing details for information as may be required.

1.9.6 The Contractor shall submit the following documentation to the Electrical Safety prior to proceeding with construction:

.1 Electrical Shop Drawings of All 600V distribution equipment, switchgear, ATS, MCC, switchboards rated over 400A.

1.10 Contract Drawings and Specifications

1.10.1 Follow the Contract Drawings to become familiar with all conditions affecting the work and verify spaces in which the work will be installed.

1.10.2 The drawings for electrical work are performance drawings, diagrammatic, intended to convey the scope of work and indicate general arrangement and approximate locations of apparatus, fixtures and approximate sizes and location of equipment and outlets. The drawings do not show architectural, process and structural details.

1.10.3 Do not scale the drawings to determine dimensions but obtain information for accurate dimensions by referring to architectural and structural drawings, or by site measurements.

1.10.4 Work which is indicated, but not completely detailed shall be installed by common practice or as directed by the Engineer.

1.10.5 Make, at no additional cost, changes or additions to materials and equipment necessary to accommodate structural conditions (runs around beams, columns, etc.).

1.10.6 Alter, at no additional cost, the location of materials and/ or equipment as directed, provided that the changes are made before installation and do not necessitate additional material.

1.10.7 Arrange work neatly and in compact fashion to maximize space available to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or material supplied by other trades as well as to accommodate unplanned future equipment. Verify spaces in which work is to be installed. Install conduit and cable runs to maintain headroom and clearances to conserve space.

1.10.8 Confirm on the site the exact location of outlets and fixtures. Confirm location of outlets for equipment supplied by other trades.

1.10.9 If discrepancies are found for work related to instrumentation and controls, SCADA system hardware and software, advise the Engineer for clarification. In each case, the stringent statement or value takes precedence and will govern.

1.10.10 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the Work.

1.10.11 If discrepancies or omissions in the drawings or specifications are found, or if the intent or meaning is not clear, advise the Engineer for clarification before submitting tender.

1.10.12 Responsibility to determine which Division provides various products and work rests with the Contractor. Additional compensation will not be considered because of differences in interpretation of specifications.

1.11 Construction/Shop Drawings

1.11.1 Submit shop drawings in accordance with Section 01330 – Submittal Procedures.

1.11.2 Submit data (drawings) for review prior to commencement of manufacturing or installing with the exception of conduit, standard conduit fittings and low voltage wiring.

1.11.3 Prior to submitting the shop drawings, the Contractor shall review the shop drawings to determine that the equipment complies with the requirements of the specifications and drawings.

1.11.4 If drawings are being resubmitted, the Contractor is required to provide a written response to all previous comments and confirm how the respective comments were addressed in the latest submission.

1.11.5 Each submission is to include the equipment TAG, Process P and ID tag, and description.

1.11.6 Assume responsibility for accuracy of equipment dimensions related to available space and accessibility for maintenance and service, and compliance with codes and inspection authorities.

1.11.7 Show all details of construction, dimensions, capacities, weights, and electrical performance characteristics of equipment or material.

1.11.8 Obtain manufacturer's installation directions to aid in properly executing the work. Submit two copies of such directions to the Engineer prior to installation, for use in inspecting the work.

1.11.9 Prepare composite construction drawings, fully dimensioned of cables, conduit, cable tray, sleeves, clearances, pipes, ducts, etc., and equipment in mechanical and electrical equipment rooms, ceiling spaces and all other critical locations to avoid a conflict of trades. Base drawings on manufacturer’s shop drawings. Drawings should be developed from consultation with and agreement of all trades involved.

1.11.10 Prepare drawings of equipment bases, anchors, slabs, floor and roof curbs, if needed, for the electrical work.

1.11.11 In addition to the requirements of Section 01330 – Submittal Procedures, provide working drawings with, but not necessarily limit to, the following additional information:

.1 Manufacturer's and Supplier's name

.2 Manufacturer’s bulletins, leaflets and specifications of major electrical equipment

.3 Catalogue model number

.4 Number identifying item on the drawings and in the specifications such as equipment, item number, panel identification letters, etc.

.5 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.6 Where applicable, include wiring, single line and schematic diagrams.

.7 Include wiring diagrams or diagrams showing interconnections with work of other sections.

.8 Lighting fixtures, including photometric data

1.11.12 The Contractor is responsible for providing shop drawings showing the integration between supplied control panels and control panels supplied with equipment. These drawings are to be a single drawing for each specific device, showing interconnection between the device and all associated panels and terminal blocks. Engineer reserves the right to request more detailed drawings if those provided are deemed insufficient.

1.11.13 Submit samples of material and equipment where specified or as may reasonably be requested by the Engineer for review before ordering same in accordance with Division one. The Engineer may retain the samples until the completion of the contract.

1.11.14 Complete all work in accordance with reviewed shop drawings.

1.11.15 Where conduits, cable trays and lay-in ducts are not detailed, submit conduit, cable tray and wiring layout drawings. Show conduit/tray and cable sizes including number of cables / conductors in each conduit / tray. Drawings shall be on the same size sheets as the contract drawings.

1.11.16 Provide a single line diagram for installation at the service entrance in accordance with the OESC.

1.11.17 Indicate the number or letter used on the drawings/specifications as an identification symbol on product data for transformers, panelboards, light fixtures, and other equipment submitted.

1.11.18 Bind one complete set of construction / shop drawings showing “as built” conditions in each operating and maintenance instruction manual.

1.12 Record Drawings

1.12.1 Comply with requirements for record drawings stated in 01330 – Submittal Procedures.

1.12.2 Before commencing work, obtain two sets of electrical drawings for showing “As Built” conditions. As job progresses, mark on field set of prints to indicate accurately all installed work. At completion stage, transfer all information onto master set of drawings and indicate “Contractors Certified Approval of Accuracy” before submitting to Engineer for review and record use.

1.12.3 Indicate on record drawings “As Built” stamp.

1.12.4 Show on the record drawings as-built, all outlets and equipment such as runs of conduit, locations of pull boxes, outlets, motors, panels, etc., as well as all services entering the building and on the property.

1.12.5 Dimension underground services and concealed main and sub-feeder conduits at key points of every run-in relation to structure and building. Record all elevations for underground services in relation to the ground floor level of the building. Indicate on record drawings, location of all buried services. This information is to be certified correct by Engineer before backfilling commences.

1.12.6 Indicate exact location of all services left for future work.

1.13 Operations and Maintenance Manuals

1.13.1 Comply with requirements for operating and maintenance manuals stated in 01330 – Submittals.

1.13.2 In addition to the requirements of 01330 – Submittals, include in the Operations and Maintenance Manuals:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items and parts lists. Advertising or sales literature are not acceptable.

.3 Wiring and schematic diagrams and performance curves.

.4 Names and addresses of local suppliers for items included in Maintenance Manuals.

.5 Copy of test data.

.6 List of spare parts of all electrical equipment complete with names and addresses of sales, service representatives and suppliers.

.7 A motor list showing each motor number, name, horsepower, full load amps, overload settings, nameplate, current rating, heater size and type, and current being drawn, etc.

.8 Copy of final inspection certificate.

.9 Copy of the purchase order, showing equipment make and model numbers issued to the manufacturer complete with all addenda. All cost details may be hidden.

.10 Copy of all warranty certificates.

.11 Set of final reviewed Shop Drawings.

1.14 Voltage Ratings

1.14.1 Operating voltages: to CAN2-C235-83.

1.14.2 Control and distribution devices and equipment to operate satisfactorily at 60Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.15 Site Conditions

1.15.1 Voltage Supply, 600 V: 3-phase, 4-wire, solidly grounded.

1.15.2 Voltage Supply, other: as shown on drawings.

1.15.3 Temperature range:

.1 Indoor: 10°C to 40°C

.2 Outdoor: -35°C to +40°C

1.15.4 Altitude: <1000 m ASL

2 PRODUCTS

2.1 Materials and Equipment

2.1.1 Unless otherwise indicated, all equipment shall be new, of first quality, and wherever possible shall be of a manufacturer’s standard design.

2.1.2 Equipment and material must be certified to a recognized Canadian standard (CSA, CUL, etc.).

.1 Where listed equipment is not available, obtain special approval acceptable to the ESA and pay all associated fees.

2.1.3 Unless otherwise indicated all equipment shall conform to customary North American standards (e.g. NEMA, ANSI, ASTM, CSA, etc).

2.1.4 Factory-assemble control panels and component assemblies.

2.1.5 All new electrical wiring, equipment, and new local control panels are to be supplied to meet the electrical and environmental classifications of area in which they are to be installed.

2.1.6 Equipment and material must be CSA certified. Where there is no alternative to supplying equipment that is CSA certified, obtain special approval from Electrical Inspection Department. Pay all associated fees and perform all required retrofits to obtain special inspection certification.

2.1.7 CSA labels shall be visible and legible after equipment is installed.

2.2 Finishes

2.2.1 Unless otherwise noted in the equipment sections or drawings, finish all equipment as follows.

2.2.2 All shop finishes for steel enclosures shall include cleaning, iron phosphate wash, rinsing, rust resistant primer inside and outside, and at least two coats of finish enamel with appropriate baking to cure each paint application.

2.2.3 Colours:

.1 Paint outdoor electrical equipment “equipment green” finish to ANSI C57.12.28.

.2 Paint indoor switchgear and distribution enclosures ANSI- 61 light grey (Munsell 8.3G 6.1/05) to EEMAC 2Y-1-1958.

.3 Paint the interior of control compartments semi-gloss white.

2.2.4 Stainless steel enclosures shall not be painted.

2.2.5 Paint and primer application shall be power coat unless otherwise specified or approved in writing by the Engineer.

2.2.6 On site, clean and touch up any scratched or marred surfaces of on shop painted equipment scratched or marred during shipment or installation, to match original paint.

2.2.7 Break and deburr all edges.

2.2.8 Clean and prime exposed non galvanized and non-stainless hangers, racks and fastenings to prevent rusting.

2.3 Enclosure Ratings

2.3.1 Enclosure ratings to be as follows unless indicated otherwise in the contract documents:

.1 Below grade, damp or outdoor locations: NEMA 4X or as noted on drawings.

.2 Classified areas: NEMA 7.

2.4 Equipment identification

2.4.1 All equipment, wiring and conduits shall be identified as described in 16090 and in the contract documents.

2.5 Warning Signs

2.5.1 As specified and to meet requirements of Electrical Inspection Department and Engineer.

2.5.2 Decal signs, minimum sized 175 x 250mm.

2.5.3 Protect exposed live equipment during construction for personnel safety.

2.5.4 Shield and mark live parts with appropriate voltage values in English.

2.6 Single Line Electrical Diagrams

2.6.1 Provide as-built single line electrical diagrams under Plexiglass as follows:

.1 Electrical distribution system: Locate in all main electrical rooms. Coordinate location with the Engineer and Owner.

.2 Single line diagrams shall include all 600V distribution complete with all protection equipment settings, cable sizes, raceways, and distribution equipment specifications.

.3 Single line diagrams shall include the as-built transformer ratios. For multi-tap CTs, indicate the as-left tap settings.

2.6.2 Drawings: 600 x 600mm minimum size.

2.6.3 Drawings shall meet the requirements of the power supply authority and local inspection authority's single line diagram requirements, and a minimum of shall include transformer ratings and connections, breaker ratings, relays, and main cable sizing information. Drawing is to be reviewed by Construction Manager for accuracy and completeness.

2.7 Insert, Sleeves, Fastenings and Supports

2.7.1 Provide all necessary inserts, hangers, fastenings, sleeves and curbs for electrical equipment, suspended from or passing through structural walls or floors, to suit the specific location, and as approved by the Engineer.

2.7.2 Sleeves: allow 12 mm clearance over the O.D. of all cables and conduits, 25 mm horizontally and vertically for rectangular openings.

3 EXECUTION

3.1 General

3.1.1 The Contractor shall provide all labour, supervision, tools, equipment, materials, services and miscellaneous expenses necessary to complete the work as outlined in this Section. Install and connect all electrical and instrumentation equipment, controls and devices supplied under other sections. The word "provide" shall be defined to mean supply and install.

3.1.2 The use of permanent electrical system for temporary construction service shall be only with written permission of the Engineer.

3.1.3 Maintain at the job site, at all times, qualified personnel and supporting staff, with proven experience in erecting, supervising testing projects of comparable nature and complexity.

3.1.4 Expedite the work as follows:

.1 Continuously check and expedite delivery of equipment and materials.

.2 If necessary, inspect at the source of manufacture.

.3 Continuously check and expedite the flow of necessary information to and from all parties involved.

.4 Inform the Engineer promptly where information is required.

3.1.5 The work of this division shall be coordinated with other divisions in such a manner as not to interfere with other work. In areas where the ducts, pipes, wiring and equipment for other sections will be installed in proximity to pipes, wiring and equipment pertaining to this division, cooperate to ensure that all pipes, ducts, wiring and equipment are installed to the best advantage.

3.1.6 Equipment, conduit, etc., installed but not coordinated with the work of other trades shall be relocated as directed by the Engineer without extra cost to the Owner.

3.1.7 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance and to function properly to the satisfaction of the Engineer. Install exposed conduit runs parallel and perpendicular to building planes. Install conduit concealed in chases, behind furring, or above ceiling, except in unfinished areas. Install exposed systems neatly and group to present a neat appearance.

3.2 Workmanship

3.2.1 Install all equipment, conduit and cables in a workmanlike manner to present a neat appearance and to function properly.

3.2.2 Install exposed systems and equipment neatly and grouped to present a neat appearance, without conflict to other services.

3.2.3 Install equipment and apparatus requiring maintenance, adjustment or eventual replacement with due allowance therefore, in terms of space and accessibility.

3.2.4 Include in the work all requirements of manufacturers shown on the shop drawings or manufacturers' installation instructions, and make provision for future and equipment as shown.

3.2.5 Replace without extra cost work unsatisfactory to the Engineer.

3.2.6 Protect all equipment from damage during delivery to the site and during installation. Make good any damage or deterioration whatsoever and have it covered by replacement guarantee.

3.3 Pre-construction Inspection

3.3.1 The Contractor is required to visually inspect the existing site conditions, including below grade areas, prior to the project award, to suit the installation of the new power and controls

distribution. The Contractor is required to coordinate the installation of the new power/control infrastructure with the existing conditions and services.

3.3.2 The Contractor is required to visually inspect the existing building conditions, including below grade areas, prior to the project award, to suit the installation of the new power and controls distribution. The Contractor is required to coordinate the installation of the new power/control infrastructure with the existing conditions and services. The Contractor shall verify all existing conditions including building services that are in close proximity to the proposed cable installation as shown on the drawings.

3.4 Excavation and Backfill

3.4.1 Ensure that route and depth of excavation for underground electrical services are as indicated. Provide protective materials around and over services and be present at all times during excavation and backfilling to supervise work.

3.5 Cutting, Patching and Welding

3.5.1 Conform to the requirements of Division 1 in respect to cutting, patching, and fitting electrical equipment.

3.5.2 Where installation of equipment by this section requires cutting or patching of new or existing work, the work shall be performed by, and under direction and supervision of, this section. Make good surface finishes to satisfaction of the Engineer.

3.5.3 Locate and provide holes and sleeves required for electrical work. Relocate improperly located holes and sleeves at no cost.

3.5.4 Finish sleeves flush with wall finish (each side) or the ceiling to curb top.

3.5.5 No cutting or welding of beams, columns or structural surfaces is permitted without approval of the Engineer and all damage to finished or unfinished surfaces shall be made good to the satisfaction of the Engineer.

3.5.6 Pay all costs for cutting and patching resulting from failure to co-ordinate timely installation of electrical inserts, sleeves, etc., into masonry structures.

3.6 Securing of equipment

3.6.1 Secure equipment to poured concrete with expandable inserts, properly sized for the load to be carried.

3.6.2 Secure equipment to hollow masonry walls or suspended ceilings with factory made threaded or toggle type inserts, properly sized for the load to be carried.

3.6.3 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields, properly sized for the load to be carried.

3.7 Mounting Heights

3.7.1 Mounting height of equipment is from finished floor to centreline of equipment

3.7.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

3.7.3 No controls shall be mounted at greater than 1800 mm above finished floor or grade.

3.8 Conduit and Cable Installation

3.8.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete shall be plastic, sized for free passage of conduit, and protruding 50mm either side.

3.8.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

3.8.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.9 Wiring - General

3.9.1 Unless otherwise indicated on the drawings all power and control wiring shall be installed in surface-mounted conduit.

.1 Conduit types shall be as indicated in Section 16133.

3.9.2 Provide spare conductors as follows:

.1 10% or minimum three (3) spare conductors in each 120 V power conduit

.2 20% spare control wiring or minimum four (4) spare conductors in each control-wiring discrete control signal conduit

.3 20% or minimum one (1) analog twisted shielded pair which ever quantity is greater.

.4 20% spare control conductors in each multi-conductor armoured discrete control cable.

.5 Provide space for 20% additional conductors in each low voltage power and control conduit and box.

.6 All conductors are to be continuous with no splices for each application.

.7 All conductors shall be stranded copper unless otherwise indicated.

.8 All wiring shall be identified in accordance with 16090.

.9 Provide a dedicated green jacket bond conductor in all raceways including PVC and metallic conduits.

.10 Provide a ground/bond conductor to suit all power distribution wiring applications. Unless otherwise indicated on the drawings the ground conductors are to be sized in accordance with the Ontario Electrical Safety Code – Latest Edition.

3.10 Wiring Terminations

3.10.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

3.10.2 Where stranded conductors terminate on a screw terminal, the conductor will be terminated with a full ring terminal.

3.10.3 Under no circumstances will more than one (1) conductor or ground be installed in a screw type connector, lug or terminal block.

3.11 Cleaning

3.11.1 Comply with Section 01000 – General Requirements.

3.11.2 Before energizing any system, inspect and clean all the inside of all electrical enclosures to ensure that they are free from dust and debris.

3.11.3 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.

3.11.4 Clean all polished, painted and plated work brightly.

3.11.5 Remove all debris, surplus material and all tools.

3.12 Field Quality Control (Testing)

3.12.1 Prior to the Owner's acceptance, all electrical equipment, materials and systems installed shall be subject to an inspection and applicable performance tests supervised by the Engineer to ensure that the operation of the system and components satisfy the requirements of the Contract Documents.

3.12.2 Comply with requirements of:

.1 Section 01810 – Testing and Commissioning

3.12.3 All equipment and electrical systems which are provided under this Division shall be performance tested for electrical and mechanical defects and all defects and adjustments made, prior to requesting inspection by the Engineer.

3.12.4 Tests requiring initial power-up of a system shall not be made without notification of the Engineer.

3.12.5 Carry out tests in presence of Engineer.

3.12.6 Furnish labour, materials, instruments and bear all costs for tests as requested by the Engineer.

3.12.7 Conduct all testing by fully qualified personnel only.

3.12.8 In addition to tests on purely electrical systems, supply the necessary labour and equipment for operational tests required by other Divisions where electrical services are involved and make final adjustments to the electrical controls at no additional cost to the Engineer.

3.12.9 Perform tests on auxiliary or specialized systems with the assistance of the manufacturer's representative. Upon successful conclusion of the tests, obtain a certificate from the manufacturer stating that the system has been installed to their satisfaction and that it is in good working order.

3.12.10 Clean all equipment prior to testing.

3.12.11 Ensure that the system and its components are ready prior to the inspection and test for acceptance.

3.12.12 All testing shall be scheduled and coordinated through the Engineer. No testing of any kind shall be done without this clearance. Give three (3) working days' notice of proposed tests.

3.12.13 Carefully check wiring for each system and/or part of a system to ensure that the system will function properly as indicated by wiring and schematic diagrams, description of operation, etc.

3.12.14 Manually operate alarms and control devices to check whether their operation during normal and abnormal operating conditions causes the proper effect.

3.12.15 Document all testing. Record test procedures, acceptable results, actual results, remedial work performed and final outcome.

3.12.16 Submit original copies of letters from the manufacturers of auxiliary systems indicating that their technical representatives have inspected and tested the respective systems and are satisfied with the methods of installation, wiring and operation.

3.12.17 Submit two (2) copies of test results for Engineer's review in addition to copies included in maintenance data.

3.12.18 Replace at no additional cost all fuses, relays, or other devices destroyed during field quality control testing.

3.13 Care, Operation, and Start up

3.13.1 Instruct Engineer and operating personnel in the operation (testing), care and maintenance of equipment.

3.13.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start up of installation, check, adjust, balance and calibrate components.

3.13.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

3.14 Trial Usage

3.14.1 The Owner and Owner's representatives shall have the privilege of trial usage of the electrical system or parts thereof for the purpose of testing and verifying operational procedures.

3.14.2 Trial usage by the Owner shall not waive the Contractor/Sub-Contractor of any responsibility because of trial usage.

3.14.3 Trial usage shall not be construed as acceptance by the Owner.

3.15 Demonstration and Training

3.15.1 Instruct Owner's personnel in the operation, care and maintenance of equipment. Perform demonstration and training in accordance with project requirements

END OF SECTION

1 GENERAL

1.1 General Conditions

1.1.1 Comply with Division 1 - General Requirements and Sections 02050 - Demolition and 16010 - General Electrical Requirements.

1.1.2 Refer to all other Divisions of the Specifications and these documents to determine their effect upon the work of this section.

1.1.3 Demolition is to include removal and disposal from site including all materials that are rendered redundant as a result of the removals.

1.1.4 The contractor is required to restore all voids left by the removals, to match the original conditions and finish of surrounding surfaces. Restore all wall and floor penetrations as required.

1.1.5 Unless otherwise indicated on the drawings or required to facilitate the new construction, underground raceways that are redundant as a result of the removals may be abandoned in place. Remove all electrical cabling from underground raceways.

1.1.6 Dispose of all infrastructure, cabling, equipment, power distribution, etc., that is rendered redundant as a result of the equipment removals identified on the drawings. Isolate and remove redundant power distribution up to the first point of overcurrent protection that is part of equipment to remain in service.

1.1.7 Remove and dispose of all above grade distribution, raceways, conduits, junction boxes, cabling, etc. that is rendered redundant as a result of the equipment removals. Restore all surfaces to their original condition

1.2 Scope of Demolition of Electrical Systems Work

1.2.1 Furnish all labour, materials, equipment, transportation, services, facilities and supervision necessary to demolish and/or remove all equipment, systems and materials specified herein and on the drawings.

1.2.2 Remove all power distribution and related infrastructure as shown on drawings, and specified here in.

1.2.3 Furnish all labour, materials, equipment, transportation, services, facilities and supervision necessary to dispose of all equipment, systems and materials listed for removal from site herein and on the drawings.

1.2.4 Furnish all labour, equipment and supervision necessary to surrender (hand over) to the Municipality all equipment, systems and materials specified herein and on the drawings.

1.2.5 Prepare drawings, stamped and signed by a licensed professional engineer, indicating temporary bracing and/or supporting structures required during the demolition of doors and/or walls as described herein.

1.2.6 In general, the demolition of major electrical systems comprises, but is not limited to:

.1 The existing PLC Actiflow Control Panel is to be replaced with a new like-for-like panel, provided under Division 11. The Contractor shall coordinate with the vendor to manage the removal and re-termination of all wiring associated with the panel. Remove the all power and control conductors, as well as any conduit sections, as required to allow for the safe and efficient removal of the existing panel and installation of the new one.

.1 The Contractor is responsible for the disposal of the existing PLC Actiflow Control Panel. Prior to removal, the Contractor shall confirm with Operations whether there are any components or devices that need to be retained.

.2 Demolish polymer day tank mixer and LIT-709 power and control wiring.

.3 Disconnect and remove all other equipment including junction boxes, pull boxes, abandoned conduits etc.

1.3 Submittals

1.3.1 Provide stamped and signed drawings for all structural demolition and temporary supporting works.

1.3.2 Provide a written procedure for all lifting operations involving the existing facility cranes. Include weights and dimensions of items to be lifted and details of slings or other lifting tackle required.

1.3.3 The Contractor shall inspect the cranes and provide inspection certificates before and after usage.

1.3.4 Contractor to submit all lift plans, complete with area shutdowns, road closures etc., as required. Work to be approved by Contract Administrator.

1.4 Procedures and Stages

1.4.1 Plant normal operation and life safety procedure (such emergency light, egress, fire alarm, PA, etc.) shall be maintained during demolition and construction period.

1.4.2 Demolition of the existing electrical equipment shall not begin prior to the installation and commissioning and satisfactory operation of all temporary power equipment or existing equipment used for temporary power during the construction.

1.4.3 Demolition of equipment must follow the approved sequencing schedules.

1.4.4 Perform demolition of electrical systems such that availability and continuity of supply, monitoring and control of the common systems and auxiliaries are maintained.

1.4.5 Demolition of existing equipment shall not start unless all required new equipment are on site. Contractor shall receive approval from Contract Administrator prior to demolition of any electrical equipment.

2 PRODUCTS

2.1 General

2.1.1 Supply and install the necessary temporary bracing, supporting structures, guards, warning signs, etc. necessary to complete the project safely and in accordance with all regulations and/or codes.

3 EXECUTION

3.1 General

3.1.1 Organize the work and provided sufficient labour and equipment to ensure safety at all times.

3.1.2 All workers shall be competent in, and trained to perform, the tasks that they perform. Where applicable, workers shall be licensed or otherwise qualified for the tasks that they perform.

3.1.3 Prior to starting demolition, the contractor shall inspect with the city all facilities described to ascertain the limits of the works.

3.1.4 Do not commence any demolition work until a complete survey is performed on the equipment to be removed.

3.1.5 All the demolition work shall be done in a systematic fashion and in such a manner to not damage other services and equipment and to not affect the use and function of any process equipment and any services (electrical power, lighting, communication, heating, water supply) for the remaining facilities.

3.1.6 There shall be no additional compensation for carrying out any condition embodied by the requirements stipulated under this section.

3.1.7 When relocating equipment, should any circuit be abandoned, the conductors to these circuits must be removed. This also applies to all abandoned conductors that exist at the site.

3.1.8 The Contractor is responsible for lock-out/tag-out procedures during demolition and for ensuring that all equipment is deenergized.

3.1.9 As soon as a load is disconnected, remove the tags from all breakers feeding the load and retag the breaker as 'SPARE'.

.1 Tags on distribution equipment that shall remain in service beyond the end of the project shall meet the requirements of 16090.

.2 Tags for distribution equipment that will be removed during the project shall be clearly legible and sufficiently permanent to last for the duration of the project. Tags written on tape are not deemed sufficiently permanent.

3.1.10 Co-ordination of work:

.1 Co-ordinate demolition work with the Contract Administrator, and Municipality staff to ensure no disruption of station operation.

.2 Refer to section 16010 of this specification for co-ordination with all other trades.

3.1.11 Demolition and disposal:

.1 Remove the equipment or material from site and dispose in accordance with all applicable regulations and codes. Contractor to pay all associated fees for disposal.

.2 The Contractor shall take all reasonable steps to ensure that equipment removed from site is reused or recycled.

.3 Unless noted otherwise all power distribution identified for demolition is to be removed and disposed of from site.

3.2 Demolition Procedure for the 600 V MCC

3.2.1 Ensure that the equipment has been fully de-energized and locked-out prior to demolition.

3.2.2 Remove cells prior to removing frames.

3.2.3 Contractor shall not leave any portion of the vertical or horizontal bus exposed while energized during demolition or any other prior investigations.

3.3 Demolition Procedure for the LV Cabling

3.3.1 The timing of cable demolitions shall be in accordance with the approved sequence schedules.

3.3.2 Ensure that all replacement cables have been run before removing existing cables. Remove existing cables from site.

3.3.3 Remove all redundant wiring and cables that will not be used after this contract is completed.

3.4 Demolition for Unused Conduits

3.4.1 Wherever the non-used conduits buried in the wall is not removable, cut the conduit back to the wall and cap it.

3.4.2 Remove surface-mounted conduits made obsolete by this project and remove from site.

END OF SECTION

1 GENERAL

1.1 Description

1.1.1 This section describes the requirements for the main circuit breaker and generator ground and general grounding and bonding requirements.

1.2 Scope

1.2.1 Use the existing main circuit breaker grounding conductor to ground the new circuit breaker. Make all required modifications to the existing grounding conductor, if required, to achieve an acceptable main circuit breaker grounding.

1.2.2 Provide bonding conductors for all electrical equipment. Unless otherwise indicated provide a dedicated bond conductor for each piece of equipment, sized in accordance with Table 16 of the Ontario Electrical Safety Code.

1.2.3 Bond all non-current carrying metallic equipment including metallic piping, raceways and tray and building steel to ground.

1.2.4 Provide a dedicated ground/bond conductor to suit each directly buried cable, and/or metallic raceway power distribution application sized in accordance with Table 16 of the Ontario Electrical Safety Code. Ground conductor to be buried adjacent to the current carrying conductors.

1.3 References

1.3.1 ANSI/IEEE 837-2014, Qualifying Permanent Connections used in Substation Grounding.

1.3.2 IEEE Standard 142™-2007 IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems

1.3.3 IEEE 81.2-1991 IEEE Guide for Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems.

2 PRODUCTS

2.1 Equipment

2.1.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

2.1.2 Copper conductor: minimum 3 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.

2.1.3 Rod electrodes: copper clad steel 19mm diameter, by 3m long.

2.1.4 Grounding conductors: bare stranded copper, tinned, soft annealed size as indicated.

2.1.5 Insulated grounding conductors: green, size: as indicated on the drawings or required by code.

2.1.6 Ground bus: copper bus with insulated supports complete with fastenings, connectors.

2.1.7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Compression-type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

3 EXECUTION

3.1 Installation General

3.1.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where a metal duct, conduit or raceway is used, run a dedicated ground wire in conduit.

3.1.2 The grounding system shall be bonded to the buildings foundation reinforcing steel and supporting steel columns. Potable water piping, low pressure effluent water piping, separated water piping, natural gas piping, scrubber drain piping, and fire protection system piping shall be bonded to the grounding system by connecting to the first flange inside the building with a copper bar or strap. The flange shall be drilled and tapped to provide a bolted connection.

3.1.3 Install connectors in accordance with manufacturer's instructions.

3.1.4 Provide a dedicated bonding conductor in all metallic and non-metallic raceways.

3.1.5 Protect exposed grounding conductors from mechanical injury.

3.1.6 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.

3.1.7 Use mechanical connectors for grounding connections to equipment provided with lugs.

3.1.8 Soldered joints not permitted to suit ground connections.

3.1.9 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solder-less lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

3.1.10 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

3.1.11 Install separate ground conductor to outdoor lighting standards.

3.1.12 Connect building structural steel and metal siding to ground by welding copper to steel.

3.1.13 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.1.14 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.1.15 Ground secondary service pedestals.

3.2 System And Circuit Grounding

3.2.1 Install system and circuit grounding connections to neutral of primary 600V system and secondary 120/240V and 120/208V systems.

3.3 Equipment Bonding

3.3.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, and outdoor lighting.

3.3.2 Install bonding connections between distribution components and equipment in accordance with code requirements including but not limited to, primary distribution system switchgear, auxiliary MCC, distribution panel boards, transformers, packaged equipment, motor frames/housing, and control panels.

3.4 Field Quality Control

3.4.1 Perform tests in accordance with Section 16010 - Electrical General Requirements.

3.4.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the Contract Administrator and the local authority having jurisdiction over installation.

END OF SECTION

1 GENERAL

1.1 Description

1.1.1 Provide identification nameplates for all electrical apparatus; i.e. panels, motor starters, disconnect switches, breakers, contactors, system control panels, panelboards, etc.

1.1.2 Provide directory cards for all panel boards; i.e. power, lighting, low voltage systems, communications, etc. All power and systems wiring shall be colour coded in accordance with this Section and be provided with appropriate wire markers identifying panel circuits.

2 PRODUCTS

2.1 Lamicoid Nameplates

2.1.1 All identification nameplates and nametags unless otherwise specified shall be engraved black letters on white Lamicoid stock with bevelled edges. The Lamicoid stock shall be 3 mm minimum thickness.

2.1.2 The nameplates shall be engraved with the following information:

.1 Nameplates for panel and cabinet identification shall typically include the following:

.1 LP-“A” …. 13mm high lettering

.2 120/240V …. 8mm high lettering

.3 Fed from main panel …. 8mm high lettering

.2 All other electrical equipment shall be typically identified as follows:

.1 Supply Fan “FN-1” …. 8mm high lettering

.2 120V – 1 Phase …. 8mm high lettering

.3 Fed from “LP-A” …. 8mm high lettering

2.1.3 Disconnects, starters and contactors: indicate equipment being controlled and voltage

2.1.4 Terminal cabinets and pull boxes: indicate equipment being controlled and its voltage

2.1.5 Nameplates for junction boxes, terminal boxes, pull boxes, etc. larger than a 100mm square to indicate system voltage characteristics.

2.1.6 Issue nameplates lists for review prior to manufacture

2.1.7 Disconnect switches and starters: Plates shall be mounted externally on switch box cover. Typical identification example – “Supply Fan, 600V, three-phase”.

2.1.8 Individual pilot devices on control stations, contactors, and starters shall be identified with small lamicoid plates indicating the function that it provides.

2.1.9 Control devices nameplate to indicate device tag, panel and PLC I/0 number. Provide size five nameplate.

2.1.10 Provide size seven name plate on all PLC panels indicating panel name, number, voltage, current, frequency.

2.1.11 Provide self-adhesive labels within the interior of all control panels and control stations to indicate the specific device (push-button, pilot light, etc.) reference number.

2.1.12 Submit list of nameplates indicating size, colour, and description to the owner's representative for approval prior to ordering.

2.1.13 The final wording of all nameplates shall be reviewed and approved by the Owner and Consultant prior to fabrication.

2.1.14 Provide laminated plastic nameplates with white lettering on red background. Nameplate size 3" x 1" on the following equipment.

.1 At local pushbutton stations, similar to item 4.

.2 At valves lettering ½" high on one line. Valve numbering as per valve list.

.3 At instruments ½" high on one line. Instrument numbering as per instrument list.

.4 At local disconnect switches, lettering ¼" high on two lines

.1 Equipment description

.2 Equipment number

2.1.15 Mechanically attach nameplates with self tapping screws.

.1 Do not use self adhesive nameplates.

.2 Use rivets and nut and bolts where access may conflict with a protruding screw point.

2.1.16 Allow for average of 25 letters per nameplate

2.1.17 Identification to be English

2.1.18 Plates shall be installed after all painting has been completed.

2.1.19 Have the manufacturers' nameplates affixed to each equipment showing the size, name of equipment, serial number and all information usually provided, including voltage, cycle phase, horsepower, etc., and the name of the manufacturer and their address. Ensure that all stamped, etched or engraved lettering on plates is perfectly legible. Do not paint over nameplates and where apparatus is to be concealed, attach the nameplate in an approved location on the equipment support or frame.

.1 Nameplate sizes:

Size One	10 x 50 mm	One line	3mm high letters
Size Two	12 x 70 mm	One line	5mm high letters

Size Three	12 x 70 mm	Two line	3mm high letters
Size Four	20 x 90 mm	One line	8mm high letters
Size Five	20 x 90 mm	Two line	5mm high letters
Size Six	25 x 100 mm	One line	12mm high letters
Size Seven	25 x 100 mm	Two line	6mm high letters

2.2 Panel Directories

2.2.1 Each panel circuit directory card shall have clearly typed information as with the following example:

.1 Panel Name …. LP-“A”

.2 Panel Voltage …. 120/240V

.3 Panel Supply …. 200A

Circuit Number	Load	Room No. or Locations
1	Lighting	Chemical Room
2	Receptacles	Pump Room
3	Heat Pump ACC-01	Outdoors

2.2.2 All systems distribution cabinets shall be complete with a directory card showing circuit numbers, room locations, and a blank column for "REMARKS".

2.3 Wiring and Conduit Identification

2.3.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

2.3.2 Colour code conduits, boxes and metallic sheathed cables

2.3.3 Colours: 25mm wide prime colour and 20mm wide auxiliary colour

2.3.4 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 10m intervals

	Prime	**Auxiliary**
Up to 250 V	Yellow	
Up to 600 V	Yellow	Green
Up to 5 kV	Yellow	Blue
Telephone	Green	
Other communication systems	Green	Blue

Fire alarm	Red	
Emergency voice	Red	Blue
Other security systems	Red	Yellow

2.4 Manufacturers and CSA Labels

2.4.1 Visible and legible after equipment is installed

2.5 Warning Signs

2.5.1 Provide warning signs as specified or to meet requirements of the Electrical Safety Authority (ESA) and Engineer.

2.5.2 Unless otherwise specified, signs shall comply with CAN/CSA-Z321-96 Signs and Symbols for the workplace.

2.5.3 Decal signs, minimum sized 175x50mm.

2.5.4 Protect exposed live equipment during construction for personnel safety.

2.5.5 Shield and mark live parts “LIVE 240 VOLTS”, or with appropriate voltage in English.

3 EXECUTION

3.1 General

3.1.1 Lamicoid nameplates shall be mounted behind the panel door, mechanically fastened or secured with contact cement.

3.1.2 Temporary panel directory cards shall be provided and filled in as the circuits are installed. The temporary directory card shall be replaced with a typed permanent directory at job completion.

3.1.3 The panel directory card shall be inserted in the card holder on the inside of the panel door and be protected by a clear plastic sheet.

3.1.4 Feeder cables shall be colour coded in each terminal panel and junction box with a minimum 75mm taped band.

3.1.5 All power and systems junction and terminal box covers shall be marked with permanent black marker as to system installed (i.e. "F.A." for Fire Alarm) and other details such as circuit numbers, detection zone, etc. Exposed boxes shall have marking on inside face of cover.

END OF SECTION

1 GENERAL

1.1 Description

1.1.1 This Section, "Wire and Cable", shall apply to all systems of this Contract. Variations or alterations of the requirements for a system will be specified in that system section.

1.1.2 Refer to Section 16090 "Equipment Identification" for Wire and Cable tagging and colour coding.

1.2 Scope

1.2.1 Supply and install wire and cable to suit the installation shown on the drawings.

1.3 Related Sections

1.3.1 Section 01330 – Submittal Procedures

1.3.2 Section 16133 – Conduits, Conduit Fasteners and Conduit Fittings

1.4 References

1.4.1 CSA C22.2 No.0.3-92, Test Methods for Electrical Wires and Cables

1.4.2 CAN/CSA-C22.2 No.131-M89 (R1994), Type TECK 90 Cable

1.5 Product Data

1.5.1 Submit product data in accordance with Section 01330 - Submittal Procedures.

2 PRODUCTS

2.1 Power Wiring, General

2.1.1 All conductors shall be of copper unless specified or shown otherwise on the drawings.

2.1.2 Conductors: stranded for all conductors.

2.1.3 Conductors below grade in conduit shall be type RWU90 cross-link polyethylene.

2.1.4 Motor or branch circuit feeder sizes shall be as noted on drawings and in no case shall be smaller than #12AWG.

2.1.5 All feeders shall be run in continuous length between power supply point and the load. No splices will be allowed in feeder cable.

2.1.6 Ground wire to be green with RW90 insulation when run in ducts, cable trays or conduits.

2.1.7 All wiring for remote DC emergency fixtures shall be #10AWG.

2.1.8 Identify all wiring with wire markers at both ends.

2.1.9 All necessary power and control wiring to all equipment shall be supplied and installed to suit the power and control requirements noted on the drawings. It shall be noted that the drawings do not necessarily indicate the locations of each individual feeder, but these shall be located to best suit the site conditions.

2.1.10 All wiring shall be sized so that voltage drop between the panel board and the furthest outlet shall not exceed 2% when the circuit has a full load.

2.1.11 Only circuits of the same voltage shall be installed in a common conduit or duct or share the same ground return line. Do not mix voltage in the same duct or conduit.

2.2 Building Wires

2.2.1 Copper conductors: size as indicated, with 1000V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2.2 Conductors below grade in conduit shall be type RWU90 cross-link polyethylene.

2.2.3 Ground wires shall be green with RW90 insulation when run in ducts, cable trays or conduits.

2.2.4 All necessary power and control wiring to all equipment shall be supplied and installed to suit the power and control requirements noted on the drawings. It shall be noted that the drawings do not necessarily indicate the locations of each individual feeder, but these shall be located to best suit the site conditions.

2.2.5 Minimum #12 AWG for branch circuit wiring including grounding.

2.2.6 Minimum #14 AWG for 120V control signals.

2.2.7 Chemically cross-linked polyethylene insulation.

2.2.8 Rated for 900 C, 600V, wet installations.

2.2.9 Suitable for handling to - 40C.

2.2.10 For interior and exterior installations in conduit.

2.3 Identifications

2.3.1 All wiring shall be identified with Brady Markers at junction boxes and termination points.

2.3.2 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

2.3.3 Identify all wiring with wire markers at both ends.

2.3.4 All branch circuit wiring and all systems wiring shall be identified at all panels and terminal boxes with Thomas and Betts SM markers.

2.3.5 Control wiring to have same tag at both ends.

2.3.6 Provide wire tag and circuit identification in all junction boxes.

2.3.7 All equipment internal control wiring to be labelled using heat shrink markers.

2.3.8 All cables and conductors to have their ratings, size and type clearly marked along the insulation.

2.3.9 Colour codes of insulation to be as follows:

.1	One-phase, Two wire (PH-N)	Black-White
.2	One-phase, Three wire (PH-PH-N)	Black-White
.3	Three-phase, Four wire (A-B-C-N)	Red-Black-Blue-White
.4	AC control	Oranges
.5	DC control	(-) Blue, (+) Red

2.3.10 Colour Coding:

.1 Phase A – Red

.2 Phase B – Black

.3 Phase C – Blue

.4 Neutral – White

.5 Ground – Green or bare

.6 Foreign Source (inside equipment) - Yellow

2.4 TECK Cable

2.4.1 Cable: to CAN/CSA-C22.2 No.131.

2.4.2 Conductors:

.1 Grounding conductor: copper

.2 Circuit conductors: copper, size as indicated

2.4.3 Inner jacket: polyvinyl chloride material

2.4.4 Armour: aluminium

2.4.5 Overall covering: polyvinyl chloride material, FT4, -40 deg. C rated.

2.4.6 Fastenings:

.1 One-hole malleable iron straps to secure surface cables 50mm and smaller. Two hole steel straps for cables larger than 50mm.

.2 Channel type supports for two or more cables at 600mm centres

.3 Threaded rods: 6 mm diameter to support suspended channels

2.4.7 Connectors:

.1 Watertight approved for TECK cable.

2.5 Armoured Cables

2.5.1 Conductors: insulated, copper, size as indicated.

2.5.2 Armour: interlocking type fabricated from aluminium strip.

2.5.3 Type: PVC flame retardant jacket over thermoplastic armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No.0.3 with maximum flame travel of 1.2m.

2.5.4 Connectors: specific to type of cable.

2.6 Communications Cables

2.6.1 Supply and install all communications cables to suit the SCADA system architecture connection requirements.

2.6.2 All communications cables located outdoors or in classified areas are to be installed in dedicated PVC encapsulated rigid metal conduit, Plasti-Bond type.

2.7 Instrumentation, Control, Communication, and Special Field Wiring

2.7.1 Conform to the requirements of Division 16.

2.7.2 Control Wiring (Field)

.1 All control wiring to be stranded, annealed copper conductors, 600V minimum rating 14AWG, RW90 XLPE, 600V rated conductors to be provided.

.2 Where conductors are to be buried in conduit 14AWG, RWU90, XLPE, 600V rated conductors are to be provided.

2.7.3 Instrumentation Cable (Field)

.1 Cable to be 300V rated and meet CSA, C22.2 No. 239 standard with the following features:

.1 Seven strand copper conductor with TW75 (-40°C) 105°C dry PVC insulation formed into pairs or triads.

.2 Aluminium/polyester tape shield over individual pairs or triads

.3 Individual shield, seven strand tinned copper drain wire

.4 Aluminium/polyester tape shield over cable

.5 Overall shield, seven strand tinned copper drain wire

.6 Ripcord

.7 90°C (-40°C) FRPVC jacket

.2 Cable to be as manufactured by SHAWFLEX LTD. or BELDEN LTD

2.7.4 Communication and Special Wire and Cable (Field)

.1 The Contractor shall provide all wiring and cable, including connectors, plugs and termination devices required for the wiring of the systems and equipment shown on the drawings, unless otherwise specified.

.2 Provide quantities and lengths of cable and wire type as recommended by the system equipment manufacturers. Do not de-rate cabling and wire. No wire/cable to be sized less than 18AWG unless approved by the Engineer or unless a specific requirement of the equipment manufacturer.

.3 Coordinate with the manufacturer and other sections of these specifications to ensure proper conduit type (i.e. metal) and sizes are provided.

.4 Provide, as part of shop drawing submittal, cable and wire specifications and data for each system. Include written proof that cable and wire meets requirements of equipment supplier.

.5 Wire and cable installed that does not meet the wiring specifications of the equipment manufacturer shall be removed and replaced (including conduits, if necessary), at the Contractor's expense.

3 EXECUTION

3.1 Applications

3.1.1 Building Wires:

.1 Install building wires in conduit in accordance with Section 16132.

3.2 Installation

3.2.1 Wire pulling compound such as Ideal - Yellow 77 or equal shall be used for service, feeder and power cable installations.

3.2.2 Insulated ground conductors shall be the same type as the line conductors.

3.2.3 Higher temperature rated wire may be used if preferred by the Contractor, but sizes shall be based on a 90℃ insulation rating.

3.2.4 All branch circuit wire feeding a 20 amp protected lighting circuit shall be minimum No. 10 AWG wire. All branch circuit wiring feeding a 15A protected circuit which is over 150' in length shall be minimum No. 10 AWG wire.

3.2.5 Each feeder and branch circuit shall be provided with a separate ground conductor sized in accordance with Ontario Electrical Safety Code regulations. All 120 V (single phase) branch circuits shall be provided with a separate neutral conductor for each circuit.

3.3 General

3.3.1 Only circuits of the same voltage shall be installed in a common conduit or duct or share the same ground return line. Do not mix voltage in the same duct or conduit.

3.3.2 All cables and wire to be continuous runs.

3.3.3 Run all non-armoured wiring in conduit or duct (underground wire) unless otherwise specified. Refer to this division and to the drawings for additional information, requirements and details.

3.3.4 Run armoured wiring surface-mount or in tray.

3.3.5 In each conduit or multi-conductor cable, provide minimum 20 per cent spare wiring or two conductors (one pair) whichever is greater for each run.

3.4 Terminations

3.4.1 All wiring shall be continuous and without splices. Splices shall NOT be accepted.

3.4.2 Where conductors are terminated it shall be done in the following manner:

.1 Where a single solid conductor is terminated in a device under one screw or clamping mechanism, no additional terminating hardware is required.

.2 Multiple conductors shall not be terminated in a device under one screw or clamping mechanism.

.3 Approved compression lugs shall be used for larger conductor sizes.

.4 Conductors connected to ground rods for service or equipment grounding or to building structural or architectural elements shall be terminated, connected and spliced using a thermo weld process or approved non-mechanical compression type connectors.

.5 All service and feeder conductors shall be installed as continuous lengths without breaks, measured and cut based on site dimensions.

3.5 Installation of Building Wires

3.5.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 16133 - Conduits, Conduit Fasteners and Conduit Fittings

.2 In underground ducts in accordance with Section 16051 – Installation of Cables in Trenches and Ducts

3.5.2 Cables to submersible pumps shall have sufficient cable slack to permit adjustment and removal of equipment.

3.6 Installation of TECK Cable 0 – 1000V

3.6.1 Install cables.

3.6.2 Group cables wherever possible on channels.

3.6.3 Install cable in cable trays as indicated on the drawings.

3.6.4 Install cable in trenches in accordance with Section 16051 – Installation of Cables in Trenches and Ducts.

3.7 Installation of Armoured Cables

3.7.1 Group cables wherever possible.

3.7.2 Install cable in trenches in accordance with Section 16051 – Installation of Cables in Trenches and Ducts.

3.8 Control Wiring – General

3.8.1 All control wiring connections shall be made with T and B Sta-Kon pressure connector, or approved equal, applied with a pressure tool.

3.8.2 Wiring connections, where required, shall be made with CSA approved compression tool with a nylon cap equal to Buchanan “Pres Sure”.

3.8.3 All wiring shall be sized so that voltage drop between the panel board and the furthest outlet shall not exceed two per cent when the circuit has a full load.

3.9 Testing

3.9.1 Perform 1000 V DC megger test on all power cables specified in this section.

3.9.2 Provide a written (typed) report to suit the test results for each cable.

3.9.3 The Contractor shall repeat the test in the presence of the Engineer for cable listed in the test report, at the request of the Engineer.

3.10 Field Quality Control

3.10.1 Feeders and branch circuits rated 100 amperes or greater shall be checked with a 1000 V Megger for 15 seconds before energization.

3.11 Voltage Drop

3.11.1 Voltage drop in power and control conductors shall be in accordance with the requirements of the Ontario Electrical Safety Code. Size conductors accordingly when sizes are not identified.

END OF SECTION

1 GENERAL

1.1 Intent

1.1.1 Provide splitters, junction boxes, pull boxes and wiring cabinets for the power, control and communications wiring systems as shown on the drawing and as required to complete the wiring systems described in the drawings.

1.2 Related Sections

1.2.1 Section 01330 – Submittal Procedures

1.2.2 Section 16090 – Equipment Identification.

1.3 Shop Drawings and Product Data

1.3.1 Submit shop drawings and product data for junction and pull boxes in accordance with Section 01330 – Submittal Procedures.

1.4 General Requirements

1.4.1 All mounting hardware shall be of non-corrosive type material including:

.1 Stainless steel

.2 Aluminium

.3 PVC encapsulated metal

1.4.2 Splitter, Junction Boxes, Pull Boxes and Cabinets installed indoors or outdoors shall be ULC and UL listed.

1.5 Enclosure Ratings

1.5.1 Dry, non-corrosive areas (electrical room only): NEMA 12, sprinkler proof

1.5.2 Wet, damp and/or corrosive areas: NEMA 4X

2 PRODUCTS

2.1 PVC Pull and Junction Boxes

2.1.1 Provide cast PVC boxes with external mounting lugs.

2.1.2 Provide PVC Cover with retaining screws and seamless gasket all around.

2.1.3 Acceptable manufacturer: same as conduit system.

2.2 Aluminium Pull and Junction Boxes, Non-Classified

2.2.1 Provide welded or die-cast aluminium boxes with

2.2.2 Covers shall be hinged covers with minimum two retained screw fasteners and a seamless gasket all around.

2.2.3 Acceptable manufacturer: same as conduit system.

2.3 Composite Concrete Pull and Junction Boxes

2.3.1 Provide polymer concrete underground pull boxes as shown on the drawings.

2.3.2 Covers shall be polymer-concrete with a minimum of two, captive, penta-head retaining bolts.

2.3.3 Provide lifting handles in covers

2.3.4 Unless otherwise noted, emboss covers with the following in minimum 35 mm high letters:

.1 ‘Electrical’ for all boxes containing power and/or control wiring

.2 ‘Communications’ for all boxes in the communications system

2.3.5 Load rating: Tier 22 per ANSI/SCTE 77 unless otherwise indicated

2.4 Concrete Underground Pull Boxes and Vaults

2.4.1 Provide pre-cast concrete pullboxes as shown on the drawings.

2.4.2 Comply with all LDC requirements where applicable.

2.5 Steel Pulling Cabinets

2.5.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

2.5.2 Type T: sheet steel cabinet, with hinged door, latch, lock, two keys, containing Unistrut backing flush mounted.

2.5.3 Cabinets to be rated NEMA 4X unless indicated otherwise on the drawings.

3 EXECUTION

3.1 Splitter Installation

3.1.1 Install splitters and mount plumb, true and square to the building lines.

3.1.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 Junction, Pull Boxes and Cabinets Installation

3.2.1 Boxes shall be surface mounted in unfinished areas and flush mounted in finished (e.g. office) areas.

3.2.2 Install pull boxes in inconspicuous but accessible locations.

3.2.3 Mount cabinets with top not higher than 2 m above finished floor.

3.2.4 Install terminal block as indicated in Type T cabinets.

3.3 Identification

3.3.1 Identify all junction and pull boxes in accordance with Section 16090 – Equipment Identification.

END OF SECTION

1 GENERAL

1.1 Description

1.1.1 The Contractor shall provide a conduit system throughout the project unless indicated otherwise. The conduit systems shall consist of all the necessary conduit, fittings, fastenings, boxes, special supports, etc.

1.2 Definitions

1.2.1 The definitions of "Conduit" (Rigid Metal, Rigid P.V.C., Rigid F.R.E., Flexible, and Electrometallic Tubing) shall be as defined in the Electrical Safety Code. Other definitions shall be as follows.

1.3 "Slabbed Conduit"

1.3.1 Slabbed conduit shall mean conduit which is installed within a monolithic concrete floor slab. No slabbed conduit shall be allowed to be installed for this project - use underground conduit where approved.

1.4 "Underground Conduit"

1.4.1 Underground conduit shall mean conduit or duct which is installed below the finished earth grades or below the lower edge of an on grade or sub-grade floor slab.

1.5 References

1.5.1 Ontario Electrical Safety Code, latest edition.

1.6 General Requirements

1.6.1 All mounting hardware shall be of non-corrosive type material including:

.1 Stainless steel

.2 Aluminium

.3 PVC encapsulated metal

1.6.2 Outlet and Conduit Boxes must be of the same material as the conduit application.

2 PRODUCTS

2.1 Outlet and Conduit Boxes General

2.1.1 Size boxes in accordance with code requirements.

2.1.2 102 mm square or larger outlet boxes as required for special devices.

2.1.3 Gang boxes where wiring devices are grouped.

2.1.4 Blank cover plates for boxes without wiring devices.

2.1.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.1.6 All boxes used with exposed conduits to be galvanized rigid metal. Boxes are to be as manufactured by Appleton or equal.

2.1.7 Each light, switch, receptacle and/or outlet shall be provided with suitable outlet box, each approved for the particular area which it is to be installed.

2.1.8 One outlet box shall be installed per switch, receptacle, light, etc.

2.2 Conduit, Connectors and Fittings

2.2.1 Conduit, connectors and fittings as standard in the trade will be accepted unless noted herein or on the drawings to be of a specific type, manufacturer, trade name, series or catalogue number.

2.3 Flexible Conduit

2.3.1 All fittings must be steel set screw or rain-tight type. All conduit terminations shall have bushings with insulated plastic lining.

2.3.2 All exposed flexible conduit shall be metallic liquid tight type.

2.3.3 Non-metallic type flexible conduit may be used, but only inside concrete block walls.

2.4 Rigid P.V.C

2.4.1 Use only thick wall schedule 40 type conduit and approved rigid P.V.C. solvent cement fittings for all joints.

2.5 Sheet Steel Outlet Boxes

2.5.1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38mm or as indicated. 102mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

2.5.2 Electro-galvanized steel utility boxes for outlets connected to surface mounted EMT conduit, minimum size 102 x 54 x 48mm.

2.5.3 102mm square or octagonal outlet boxes for lighting fixture outlets.

2.5.4 102mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

2.6 Masonry Boxes

2.6.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.7 Concrete Boxes

2.7.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.8 Conduit Boxes

2.8.1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.9 Outlet Boxes for Non-metallic Sheathed Cable

2.9.1 Electro-galvanized, sectional, screw ganging steel boxes. Minimum size 76x50x 63mm with two double clamps to take non-metallic sheathed cables.

2.9.2 Outlet boxes, junction boxes, etc. shall be of the types approved for the application. The following types shall be used for the noted applications:

.1 Recessed boxes in concrete or masonry - Type MBD or MBS boxes.

.2 Surface mounted with EMT conduit - Type 1110 or 2020 "Utility" box.

.3 Surface mounted with rigid conduit - Type FS or FD boxes.

2.10 Fittings - General

2.10.1 Bushing and connectors with nylon insulated throats.

2.10.2 Knock-out fillers to prevent entry of debris.

2.10.3 Conduit outlet bodies for conduits up to 32m and pull boxes for larger conduits

2.10.4 Double locknuts and insulated bushings on sheet metal boxes

2.11 Service Fittings

2.11.1 ‘High tension’ receptacle fitting made of two piece stainless steel housing finish for one single receptacle. Bottom plate with two knockouts to be used for centred or offset installations. 12x102mm extension piece as indicated.

2.11.2 Pedestal type ‘low tension’ fitting made of two piece stainless steel housing finish to accommodate two Amphenol jack connectors.

2.12 Miscellaneous

2.12.1 Rigid Metal Expansion Joint - Crouse Hinds "XJ" series with bonding strap or equivalent.

2.12.2 Rigid P.V.C. Expansion Joint - Scepter "O" Ring expansion joint "EJ" series or expansion coupler "EC" series, to suit expected length of movement.

2.12.3 All electrical fittings, supports, hangers, brackets, etc., and related fasteners shall be stainless steel, galvanized or have a corrosion resistant finish. Touch up with appropriate treatment all finishes damaged on site.

3 EXECUTION

3.1 Application

3.1.1 Rigid PVC conduit shall be used for the following:

.1 Conduit sizes 100 mm and less, where not specified or required to be otherwise due to special applications or conditions.

3.1.2 Liquid tight conduit shall be used as the raceway between the distribution conduit and equipment terminal boxes of vibrating and rotating equipment. The length shall generally be restricted to 600 mm.

3.1.3 Rigid P.V.C. or Rigid F.R.E. conduit shall be used as an underground raceway for building services or as a slabbed conduit where approved. Rigid P.V.C. conduit shall be used as underground raceways for branch circuit wiring to exterior connections.

3.1.4 Corrosion resistant conduit shall be used where indicated on the drawings.

3.2 Installation

3.2.1 Support boxes independently of connecting conduits.

3.2.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

3.2.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6mm of opening.

3.2.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

3.2.5 Where more than one type of product or method of installation could apply, the most restrictive products and methods of installation shall take precedence.

3.2.6 All conduit connections shall be as tight as possible. Failure to tighten any conduit connections in block, tile or concrete elements will result in the element being removed and reinstalled at the Electrical Contractor's expense.

3.2.7 The conduit system shall not be used as the ground path for the building wiring system. All wiring systems shall be provided with a separate copper ground conductor sized in accordance with requirements of the Ontario Electrical safety Code.

3.2.8 Conduit shall be concealed in all finished wall areas but may be run exposed in service and equipment rooms.

3.2.9 Where conduit is run exposed it shall be run parallel to the building lines. Where two or more conduits are grouped concentric bends shall be installed.

3.2.10 Do not install conduit horizontally in masonry walls.

3.2.11 All conduits shall be laid out and installed to avoid the proximity of heating pipes and ducts. Conduit shall not run within 900 mm of such pipes and ducts.

3.2.12 Conduit ends shall be plugged during construction with plastic push pennies. Conduits stubbed for future use shall be capped with conduit caps and sealed, if below grade.

3.2.13 Conduit systems shall be rigidly and securely supported with conduit straps to the building structure. Multiple conduit runs if not easily attached to the building structure directly, shall be supported by Unistrut hanger or bracket assemblies. Bailing wire or flexible metal strapping will not be accepted.

3.2.14 Concrete encased underground conduits shall be enclosed within a minimum 100 mm monolithic poured concrete envelope.

3.2.15 Underground conduits installed below a building on-grade or below grade floor slab shall be installed minimum 460 mm below the finished surface.

3.2.16 All underground conduit routes shall be co-ordinated with other trades to prevent interference. Provide sleeves for all underground conduits passing through structural or foundation elements.

3.2.17 Conduits stubbed through equipment bases shall extend a minimum of 38 mm above the base.

3.2.18 Install a nylon pull cord in all empty conduits. Provide tags at both ends indicating system and destination. Maintain a pull cord in systems conduits used only to partial capacity.

3.2.19 Colour code all conduit systems throughout the building during installation with a patch of paint at all junction and pull boxes and points of concealment as follows:

Black	Power Distribution (also indicate specific source/panel)
Red	Fire Alarm System (also indicate circuits)
Orange	Emergency Power System
Green	Communication System
Blue	Control System

3.3 Underground

3.3.1 All underground conduit shall be provided with a copper ground conductor.

3.3.2 Rigid P.V.C. conduit shall be protected with steel sleeves or box out sections where they pass through foundation walls or footings.

3.3.3 Where single phase cables are run separately in a duct or conduit, steel conduit or sleeves shall not be used.

3.4 Rigid P.V.C Conduit

3.4.1 Rigid P.V.C. conduit shall be bent on site using a non-flame type heat source to accommodate the required contours.

3.4.2 All rigid P.V.C. conduit fittings, couplings, etc. shall be watertight type, fastened with an approved cement.

3.4.3 Rigid P.V.C. conduit shall not penetrate fire rated walls, floors or ceilings.

3.5 Outlet Boxes

3.5.1 The location of outlets, fixtures, panels, etc., as shown on the drawings, are approximately correct, but the Consultant reserves the right to alter the location of any number of them up to 3000 mm without incurring extra cost, if altered before installation is commenced on any individual item.

3.5.2 In general, 100mm octagon boxes shall be used for light fixture outlets.

3.5.3 Boxes set in concrete slabs or walls shall not be less than 50mm deep.

3.5.4 Outlet boxes installed outside of the building shall be watertight with screw fittings and watertight gaskets.

3.5.5 In general, provide outlet boxes of adequate size and required dimensions for all outlet and conduit junctions.

3.5.6 All outlet boxes must be rigidly secured in position by approved methods. Those intended for hanging fixtures shall be provided with fixture studs, self aligning type for sloping ceilings.

3.5.7 Outlet boxes designated for future use shall be provided with blank PVC cover-plates. Cover-plates on outlet boxes designated for other than future wiring devices, shall be installed in time to be painted over by the Painting Contractor.

3.5.8 Pull boxes and terminal boxes shall be placed in inconspicuous but accessible locations.

3.5.9 All outlets, panelboards, switches, panels and equipment shall be centred on construction panels, wood paneling or boarding, ceiling tile, etc.

3.5.10 Components or devices such as switches and receptacles or thermostats and receptacles, etc., which occur one above the other in the same general location, shall be installed in the same vertical line.

3.5.11 Adjacent items such as panels and fire hose cabinets, etc., shall have the tops of their trims in line.

3.5.12 Light switches shall be located on the knob side of door within 150 mm of the jamb. Verify door swings before proceeding with installation of the switch box and associated conduit/wiring.

3.5.13 Ensure all outlet boxes are installed with vapour barrier protection integral with specific wall or ceiling construction. For each outlet box installed which pierces a vapour barrier, provide an appropriately sized vapour barrier box surrounding outlet box to seal all air leaks and maintain vapour barrier continuity. Verify exact requirements on site with the Consultant prior to proceeding with installations.

3.6 Conduit Seals

3.6.1 In areas where conduits pass through walls or other building surfaces in which different temperatures exist (i.e. refrigerated spaces or exterior walls and insulated ceilings or roofs,

etc.), the conduits shall be sealed off with appropriate materials and methods to prevent breathing and subsequent condensation. The sealing shall be done such that moisture is not trapped at the seal.

END OF SECTION

1 GENERAL

1.1 Related Sections

1.1.1 Section 07900 – Joint Sealants

1.2 Scope

1.2.1 Provide conduit system for all un-armoured wiring including power, control and communications wiring, unless indicated otherwise on the drawings.

1.2.2 The conduit system shall consist of separate systems for different voltages, source and signal types.

1.2.3 Provide pull boxes, elbows, seals and other accessories as required to complete the conduit system.

1.3 References

1.3.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18-92, Outlet Boxes, Conduits Boxes, and Fittings

.2 CSA C22.2 No. 45-M1981 (R1992), Rigid Metal Conduit

.3 CSA C22.2 No. 56-1977(R1977), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit

.4 CSA C22.2 No. 83-M1985 (R1992), Electrical Metallic Tubing

.5 CSA C22.2 No. 211.2-M1984 (R1992), Rigid PVC (Un-plasticized) Conduit

.6 CAN/CSA C22.2 No. 227.3-[M91], Flexible Non-metallic Tubing

1.4 General Requirements

1.4.1 All indoor conduits shall be Rigid PVC.

1.4.2 All direct-buried conduits located below grade shall be Rigid PVC.

1.4.3 All concrete encased conduit shall be PVC type DB2

1.4.4 Above-grade exterior conduit shall be aluminium.

1.4.5 All conduits required to be metallic shall be aluminium.

1.4.6 All mounting hardware shall in un-conditioned spaces be of non-corrosive type material including:

.1 Stainless steel

.2 Aluminium

.3 PVC encapsulated metal

2 PRODUCTS

2.1.1 Rigid Conduit

.1 Rigid PVC conduit for surface installations on walls and ceilings, and where indicated on the drawings

.2 Rigid PVC conduit for beneath grade application

.3 Minimum size of conduit is 21mm

2.1.2 Conduit Fittings and Boxes

.1 Conduit Bends: factory made bends for all conduit 50 mm and larger, except where concentric bends are required on grouped conduit runs.

.2 Fittings: cast malleable iron fittings suitable to the conduit used.

.3 Conduit Plugs (caps): recessed, with square or hex slot top.

.4 Expansion Joints: watertight construction complete with grounding strap and clamps.

.5 Outlet Boxes: PVC type

.6 Use sealed covers and/or fasteners to protect wiring and components to suit the environment.

.7 All conduit and fittings from the same manufacturer

.8 Manufacturers: provide conduit fittings and boxes as manufactured by Appleton, Crouse-Hinds, Ideal, Septer, Thomas and Betts, or approved equal.

2.1.3 Flexible Conduit and Fittings

.1 Liquid-tight flexible conduit complete with copper ground wire.

.2 Fittings: liquid-tight connectors suitable for the conduit used.

.3 BX wiring is acceptable for receptacles and lighting fixtures in offices.

2.1.4 Conduit Supports

.1 Conduit Straps: malleable iron, one-hole clamps and clamp backs for supporting surface-run conduit.

.2 For attaching conduit to structural steel, use clamps manufactured especially for that purpose. Appleton AJ series beam clamps or equal.

.3 Unistrut or similar support channels complete with clamps and hardware from the same manufacturer for supporting groups of conduit.

2.2 Conduits

2.2.1 Rigid PVC conduit: to CSA C22.2 No. 211.2.

2.2.2 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2.3 Rigid Aluminium Conduit:

.1 Rigid Aluminium Conduit to be manufactured of 6063 alloy in temper designation T-1 listed by U.L.6 ”Standard for Rigid Metal Conduit” and manufactured to ANSI C80.5

2.2.4 PVC Schedule 40 Conduits:

.1 Meet requirements of CSA C22.2 No. 211.2 and NRMA TC 2.

.2 Suitable for areas NOT exposed to physical damage, underground direct burial, concealed or direct sunlight exposure and 90°C insulated conductors.

2.2.5 PVC Schedule 80 Conduits:

.1 Meet requirements of CSA C22.2 No. 211.2 and NEMA TC 2.

.2 Suitable/listed for areas exposed to physical damage, for underground direct burial, concealed or direct sunlight exposure and 90°C insulated conductors.

2.2.6 Rigid Aluminium Conduit:

.1 Rigid Aluminium Conduit to be manufactured of 6063 alloy in temper designation T-1 listed by U.L.6 ”Standard for Rigid Metal Conduit” and manufactured to ANSI C80.5

2.3 Conduit Fastenings

2.3.1 One hole steel straps to secure surface conduits NPS 2 50mm and smaller. Two hole steel straps for conduits larger than NPS 2 50mm.

2.3.2 Beam clamps to secure conduits to exposed steel work.

2.3.3 Channel type supports for two or more conduits at 15m oc.

2.3.4 Threaded rods, 6mm diameter, to support suspended channels

2.4 Conduit Fittings

2.4.1 Fittings: manufactured for use with conduit specified. The fitting material and coating shall be the same as conduit used in the application.

2.4.2 Rigid Galvanized Steel

.1 General:

.1 Meet requirements of CSA C22.2 No. 45.

.2 Type: Threaded, galvanized - Set screw and thread-less compression fittings not permitted.

.2 Bushing:

.1 Material: Malleable iron with integral insulated throat, rated for 150°C.

.2 Manufacturers and Products:

.3 Appleton: Series BU-1

.4 O-Z/Gedney: Type HB

.3 Grounding Bushing:

.1 Material: Malleable iron with integral insulated throat rated for 150°C, with solderless lugs.

.2 Manufacturers and Products:

.3 Appleton: Series GIB

.4 O-Z/Gedney: Type HBLG

.4 Conduit Hub:

.1 Material: Malleable iron with integral insulated throat with bonding screw.

.2 UL listed for use in wet locations.

.3 Manufacturers and Products:

.4 Appleton: Series HUB-B

.5 O-Z/Gedney: Type CH

.6 Meyers: ST Series

.5 Conduit Bodies:

.1 Sized as required by CEC

.2 Manufacturers and Products (for normal Conditions)

.1 Appleton: Form 35 threaded unilets

.2 Crouse-Hinds; Form seven or eight threaded condulets

.3 Killark: Series O electrolets

.4 Thomas a Betts: Form seven or eight

.6 Couplings: As supplied by conduit manufacturer

.7 Unions:

.1 Concrete tight, hot-dip galvanized, malleable iron.

.2 Manufacturers and Products:

.1 Appleton: Series SCC Bolt-On Coupling or Series EC Three-Piece Union

.2 O-Z/Gedney: Type SSP split coupling or Type 4 Series, three-piece coupling.

.8 Conduit Sealing Fitting Manufacturers and Products

.1 Appleton: Type EYF, EYM or ESU

.2 Crouse-Hinds; Type EYS or EZS

.3 Killark: Type EY or EYS

.9 Drain Seal Manufacturers and Products

.1 Appleton: Type SF

.2 Crouse-Hinds; Type EYD or EZD

.10 Drain/Breather Fitting Manufacturers and Products

.1 Appleton: Type ECDB

.2 Crouse-Hinds; ECD

.11 Expansion Fitting Manufacturers and Products

.1 Deflection/Expansion Movement

.1 Appleton: Type DF

.2 Crouse-Hinds: Type XD

.2 Expansion Movement Only:

.1 Appleton: Type XJ

.2 Crouse-Hinds: Type XJ

.12 Cable Sealing Fittings

.1 To form watertight nonslip cord or cable connection to conduit

.2 For conductors with OD of 13mm or less; Neoprene bushing at connector entry

.3 Manufacturers and Products

.1 Appleton: CG-S

.2 Crouse-Hinds: CGBS

2.4.1 Rigid Aluminium Conduits:

.1 General:

.1 Meet requirements of CSA C22.2 No. 45.

.2 Type: Threaded, copper free - Set screw and fittings not permitted.

.2 Insulated Bushing:

.1 Material: Cast aluminium with integral insulated throat, rated for 150°C.

.2 Manufacturers and Products: O-Z/Bedney: Type AB

.3 Grounding Bushing:

.1 Material: Cast aluminium with integral insulated throat rated for 150°C, with solder-less lugs.

.2 Manufacturers and Products: O-Z/Bedney: Type ABLG

.4 Conduit Hub:

.1 Material: Cast aluminium with integral insulated throat.

.2 UL listed for use in wet locations.

.3 Manufacturers and Products:

.1 O-Z/Gedney: Type CHA

.2 Thomas and Betts: Series 370AL

.3 Meyers: Series SA

.5 Conduit Bodies:

.1 Manufacturers and Products (for normal Conditions)

.1 Appleton: Form 85 threaded unilets

.2 Crouse-Hinds; Mark 9 or Form 7-SA threaded condulets

.3 Killark: Series O electrolets

.6 Couplings: As supplied by conduit manufacturer

.7 Conduit Sealing Fitting Manufacturers and Products:

.1 Appleton: Type EYF-AL or EYM-AL

.2 Crouse-Hinds; Type EYS-SA or EZS-SA

.3 Killark: Type EY or EYS

.8 Drain Seal Manufacturers and Products:

.1 Appleton: Type EYDM-A

.2 Crouse-Hinds; Type EYD-SA or EZD-SA

.9 Drain/Breather Fittings Manufacturers and Products:

.1 Appleton: Type ECDB

.2 Crouse-Hinds; ECD

.10 Expansion Fittings Manufacturers and Products:

.1 Deflection/Expansion Movement: Steel City: Type DF-A

.2 Expansion Movement Only: Steel City: Type AF-A

.11 Cable Sealing Fittings: To form watertight nonslip cord or cable connection to conduit.

.1 Bushing: Neoprene at connector entry

.2 Manufacturer: Appleton: CG-S

2.4.2 PVC Conduit and Tubing:

.1 Meet requirements of NEMA TC-3.

.2 Type: PVC, slip-on

2.4.3 PVC-Coated Rigid Galvanized Steel Conduit:

.1 Meet requirements of NEMA RN 1.

.2 Fittings: Rigid galvanized steel type, PVC coated by conduit manufacturer.

.3 Conduit Bodies: Cast metal hot-dipped galvanized or urethane finish. Cover shall be of same material as conduit body. PVC coated by conduit manufacturer.

.4 Finish: 40mil PVC exterior, 2mil urethane interior.

.5 Overlapping pressure sealing sleeves

.6 Conduit Hangers, Attachments, and Accessories: PVC-coated

.7 Manufacturers:

.1 Robroy Industries

.2 Ocal

.8 Expansion Fitting Manufacturer and Product: Ocal; OCAL-BLUE XJG

2.4.4 Flexible, Non-metallic, Liquid-Tight Conduit:

.1 Type: High strength plastic body, complete with lock nut, O-ring, threaded ferrule, sealing ring, and compression nut.

.2 Body/compression nut (gland) design to assure high mechanical pull-out strength and watertight seal.

.3 Manufacturers and Products:

.1 Carlon: Type LT

.2 O-Z/Gedney: Type 4Q-P

.3 Thomas and Betts: Series 6300

2.4.5 Watertight Entrance Seal Device:

.1 New construction:

.1 Material: Oversized sleeve, malleable iron body with sealing ring, pressure ring, grommet seal, and pressure clamp.

.2 Manufacturer and Product: O-Z/Gedney; Type FSK or WSK, as required

.2 Cored-Hole Application

.1 Material: Assembled dual pressure disks, neoprene sealing ring, and membrane clamp.

.2 Manufacturer and Product: O-Z/Gedney: Series CSM.

2.5 Expansion Fittings for rigid Conduit

2.5.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200mm linear expansion.

2.5.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19mm deflection in all directions.

2.5.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 Fish Cord

2.6.1 Polypropylene, 6mm in all empty conduits

2.7 Accessories

2.7.1 Identification Devices:

.1 Raceway Tags

.1 Material: Permanent, nylon or polyethylene

.2 Shape: Round

.3 Raceway Designation: Pressure stamped, embossed, or engraved.

.4 Tags relying on adhesives or taped-on markers not permitted.

.2 Wraparound Duct Band:

.1 Material: Heat-shrinkable, cross-linked polyolefin, pre-coated with hot-melt adhesive.

.2 50mm width (minimum)

.3 Manufacturer and product: Raychem: Type TWDB.

3 EXECUTION

3.1 Installation

3.1.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

3.1.2 Conceal all conduits in finished rooms that are equipped with suspended ceilings.

3.1.3 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

3.1.4 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

3.1.5 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

3.1.6 Install fish cord in empty conduits.

3.1.7 Run 2-25mm spare conduits at ceiling space and 2-25mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152x152x102mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

3.1.8 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

3.1.9 Dry out conduits before installing wire.

3.2 Surface Conduits

3.2.1 Run parallel or perpendicular to building lines.

3.2.2 Locate conduits behind infrared or gas fired heaters with 1.5m clearance.

3.2.3 Run conduits in flanged portion of structural steel.

3.2.4 Group conduits on suspended surface channels wherever possible.

3.2.5 Do not pass conduits through structural members except as indicated.

3.2.6 Do not locate conduits less than 75mm parallel to steam or hot water lines with minimum of 25mm at crossovers.

3.3 Conduits in Cast-In-Place Concrete

3.3.1 All cast in place conduit installations not specified on the drawings must be approved by the Engineer.

3.3.2 Locate to suit reinforcing steel. Install in centre one third of slab.

3.3.3 Protect conduits from damage where they stub out of concrete.

3.3.4 Install sleeves where conduits pass through slab or wall.

3.3.5 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

3.3.6 Do not place conduits in slabs in which slab thickness is less than four times conduit diameter.

3.3.7 Encase conduits completely in concrete with minimum 25mm concrete cover.

3.3.8 Organize conduits in slab to minimize crossovers.

3.4 Conduits in Cast-In –Place Slabs on Grade

3.4.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

3.5 Conduits Underground

3.5.1 Slope conduits to provide drainage.

3.5.2 Waterproof joints (except PVC) with heavy coat of bituminous paint.

3.6 Connections

3.6.1 For motors, wall or ceiling mounted fans and unit heaters, dry type transformers, electrically operated valves, instrumentation, and other equipment where flexible connection is required to minimize vibration:

.1 Conduit size 103mm or less: flexible, liquid-tight conduit.

.2 Conduit size over 103mm: nonflexible.

.3 Wet or Corrosive areas: flexible, non-metallic, and liquid-tight.

.4 Dry Areas: flexible, metallic liquid-tight.

.5 Length: 450mm minimum, 1500mm maximum, sufficient to allow movement or adjustment or equipment.

3.6.2 Outdoor areas, process areas exposed to moisture, and areas that require oil-tight and dust-tight conditions: flexible non-metallic, liquid-tight conduit.

3.6.3 Under equipment mounting pads: PVC schedule 80 conduit

3.6.4 Exterior light pole foundations: rigid aluminium conduit.

3.7 Penetrations

3.7.1 Make at right angles, unless otherwise shown.

3.7.2 Notching or penetration of structural members, including footings and beams, not permitted.

3.7.3 Fire-Rated walls, floors, or ceilings: fire-stop openings around penetrations to maintain fire-resistance rating in accordance with CSA standards and to use ULC approved products.

3.7.4 Apply single layer of wraparound duct band to all metallic conduit protruding through concrete floor slabs to a point 50mm above and 50mm below concrete surface.

3.7.5 Concrete walls, floors, or ceilings (aboveground): provide non-shrink grout dry pack or use watertight seal device.

3.7.6 Entering Structures:

.1 General: Seal raceway at the first box or outlet with oakum or expandable plastic compound to prevent the entrance of gases or liquids from one area to another.

.2 Concrete roof or Membrane Waterproofed Wall or Floor:

.1 Provide a watertight seal.

.2 Without concrete encasement: Install watertight entrance seal device on each side.

.3 With concrete encasement: Install watertight entrance seal device on the accessible side.

.4 Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.

.5 Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.

.3 Heating, Ventilating, and Air Conditioning Equipment:

.1 Penetrate equipment in area established by manufacturer.

.2 Terminate conduit with flexible non-metallic conduit at junction box or condulet attached to exterior surface of equipment prior to penetrating equipment.

.3 Seal penetration with Type 5 sealant, as specified in Section 07900 – Joint Sealants.

.4 Corrosive-Sensitive Areas:

.1 Seal all conduits passing through room walls.

.2 Seal conduit entering equipment panel boards and field panels containing electronic equipment.

.3 Seal penetration with Type 5 sealant, as specified in Section 07900 – Joint Sealants.

.5 Existing or Precast Wall (Underground): Core drill wall and install a watertight entrance seal device.

.6 Non-waterproofed Wall or Floor (Underground without Concrete Encasement):

.1 Provide Schedule 40 galvanized pipe sleeve, or watertight entrance seal device.

.2 Fill space between raceway and sleeve with expandable plastic compound or oakum and lead joint on each side.

.7 Maintenance Holes and Hand holes:

.1 Metallic Raceways: Provide insulated grounding bushings.

.2 Non-metallic Raceway: Provide bell ends flush with wall.

.3 Install such that raceways enter as near as possible to one end of wall unless otherwise shown.

3.8 Support

3.8.1 Support from structural members only, at intervals not exceeding Canadian Electrical Code requirements and in not exceeding 3.0 metres. Do not support from piping, pipe supports or other raceways.

3.8.2 Multiple Adjacent Raceways: Provide ceiling trapeze. For trapeze-supported conduit allow 25 per cent extra space for future conduit.

3.8.3 Application/Type of Conduit Strap:

.1 Aluminium Conduit: Aluminium or stainless steel

.2 Non-metallic Conduit: Non-metallic or PVC coated metal.

3.8.4 Provide and attach wall brackets, strap hangers, or ceiling trapeze as follows:

.1 Wood: wood screws

.2 Hollow Masonry Units: toggle bolts

.3 Concrete or Brick: expansion shields or threaded studs driven in by powder charge with lock washers and nuts

.4 Steelwork: machine screws

.5 Location/Type of Hardware:

.1 Dry, noncorrosive areas: galvanized

.2 Wet, noncorrosive areas: stainless steel

.3 Corrosive areas: stainless steel

3.8.5 Nails or wooden plugs inserted in concrete or masonry for attaching raceway not permitted. Do not weld raceways or pipe straps to steel structures. Do not use wire in lieu of straps or hangers.

3.8.6 Support aluminium conduit on concrete surfaces with stainless steel or non-metallic spacers or aluminium non-metallic framing channel.

3.9 Bends

3.9.1 Install concealed raceways with a minimum of bends in the shortest practical distance.

3.9.2 Make bends and offsets of longest practical radius. Bends in conduits and ducts being installed for fibre optic cables shall be not less than 20 times cable diameter, 375mm minimum.

3.9.3 Install with symmetrical bends or cast metal fittings.

3.9.4 Avoid field-made bends and offsets, but where necessary, make with acceptable hickey or bending machine. Do not heat metal raceways to facilitate bending.

3.9.5 Make bends in parallel or banked runs from same center or centreline with same radius so that bends are parallel.

3.9.6 Factory elbows may be installed in parallel or banked raceways if there is change in plane of run and raceways are same size.

3.9.7 PVC Conduit:

.1 Bends 30° and larger: provide factory-made elbows.

.2 Use manufacturer’s recommended method for forming smaller bends.

3.9.8 Flexible Conduit: Do not make bends that exceed allowable conductor bending radius of cable to be installed or that significantly restricts conduit flexibility.

3.10 Expansion/Deflection Fittings

3.10.1 Provide on all raceways at all structural expansion joints and in long tangential runs.

3.10.2 Provide expansion/deflection joints for 14°C maximum temperature variation.

3.10.3 Install in accordance with manufacturer’s instructions.

3.11 PVC Conduit

3.11.1 Solvent Welding:

.1 Provide manufacturer recommended solvent: apply to all joints

.2 Install such that joint is watertight.

3.11.2 Adapters:

.1 PVC to metallic fittings: PVC terminal type

.2 PVC to rigid metal conduit: PVC female adapter

3.11.3 Belled End Conduit: Bevel the un-belled end of the joint prior to joining.

3.12 PVC Encapsulated Rigid Steel Conduit

3.12.1 Install in accordance with manufacturer's instructions.

3.12.2 All tools and equipment used in the cutting, bending, threading and installation of PVC-coated rigid steel conduit shall be designed to limit damage to the PVC coating.

END OF SECTION

1. GENERAL

1.1. Description

1.1.1. This specification includes general requirements for AC Induction motors and is intended to be a supporting document for motors supplied under other divisions.

1.1.2. Refer to equipment specifications in other divisions for specific application requirements.

1.1.3. Provide power factor correction capacitors where indicated.

1.2. General

1.2.1. Requirements in the equipment sections in other divisions (eg. div 11, 13 or 15) shall take precedence over contradictory requirement in this section.

1.2.2. The Contractor shall supply and install the equipment specified herein and in the driven-equipment sections and as shown on the contract drawings.

1.3. References

1.3.1. NEMA Standard MG1, Motors and Generators

1.3.2. NEMA Standard MG2, Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators

1.3.3. CSA C22.2 No. 100, Motors and Generators

1.3.4. CSA C390, Test methods, marking requirements, and energy efficiency levels for three-phase induction motors

1.3.5. C22.2 NO. 145-11, Electric motors and generators for use in hazardous (classified) locations

1.3.6. IEEE 114, Test Procedure for Single Phase Motors

1.3.7. IEEE 841 Petroleum and Chemical Industry—Premium- Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors—Up to and Including 370 kW (500 hp)

1.4. Definitions

1.4.1. TEFC: Totally-enclosed, fan-cooled

1.4.2. TEEP: Totally-enclosed, explosion proof

1.4.3. ODP: Open, drip-proof

1.5. Quality Assurance

1.5.1. IEEE 117 classification tests.

1.5.2. All motors shall be constructed in accordance with latest, CEMA, NEMA, ANSI standards.

1.5.3. Verify motor performance in accordance with CSA C390.

1.5.4. Unless noted otherwise, prior to shipment from motor manufacturer's factory, subject motors to routine tests as defined by NEMA MG1.

1.5.5. Perform tests at motor full speed and at each intermediate speed for multi-speed motors.

1.5.6. Statically and dynamically balance motors over 0-125% speed range.

1.6. Submittals

1.6.1. Submit the following as shop drawings:

.1 Efficiency and power factor at 1/2, 3/4 and full load.

.2 Outline dimensions of each motor, showing sizes and location of terminal boxes and horizontal and vertical clearances necessary for maintenance purposes

.3 Mechanical mounting information

.4 Total weight and heaviest shipping weight of motor

.5 Design information regarding shaft and sheave sizes for coordination with driven equipment.

.6 Outline dimensions and technical data for auxiliary equipment, such as power-factor correction capacitors, surge capacitors and arresters

.7 Permissible number of fully loaded and unloaded starts over a defined time period (e.g. starts per hour)

.8 Electrical schematic of windings and terminations

.9 Electrical schematic and wiring diagrams of auxiliary systems, such as resistance temperature detectors (RTDs), thermistors, temperature indicators, vibration detectors, temperature selector switches, temperature relays, leak detectors (for submersible motors) and anti-condensation heaters.

.10 Nameplate drawings

1.6.2. Submit shop drawing information with driven equipment submittal.

1.7. Delivery, Storage, and Handling

1.7.1. Inspect the motor thoroughly for damage upon delivery to the job site.

1.7.2. Handle in accordance with the manufacturer's instruction. Under no circumstances shall the motor be lifted by using the shaft, as an attachment point.

1.7.3. Store motors under cover in a clean, dry location and protect from rapid temperature changes.

1.7.4. If storage is anticipated to be longer than two (2) months, take the following additional steps:

.1 Motors with sleeve bearings shall have the oil reservoirs filled to the proper level with the specified oil.

.2 Motors with anti-friction bearings shall receive an initial change of grease and then be re-greased every six months until fully commissioned and operational.

.3 The motor shaft braces shall be removed and the motor shaft rotated every two weeks. The shaft braces shall be replaced prior to relocation to the installation site. Under no circumstances shall the motor be lifted without the braces in place.

1.8. Operation and Maintenance Manuals

1.8.1. Ship two (2) copies of the motor operation and maintenance manual with each motor. Include instruction leaflets and instruction bulletins for the complete storage, handling and installation of the motor.

1.8.2. Submit bound and indexed copies of operating and maintenance manuals including, but not limited to, the following:

.1 Storage instructions

.2 Complete parts list

.3 Installation instructions

.4 Operating instructions

.5 Maintenance instructions

.6 Factory or Field test results

1.9. Site Conditions

1.9.1. Site operating conditions are as follows:

.1 Indoor locations: 40°C maximum/-18°C minimum, air ambient temperature.

.2 Outdoor locations: 40°C maximum/-40°C minimum, air ambient temperature.

.3 < 1000 m above sea level

.4 Indoor locations: 95% maximum relative humidity (non-condensing).

2. PRODUCTS

2.1. General Requirements

2.1.1. Unless noted otherwise, design for the following voltages and characteristics:

.1 115 V, single phase, 60 Hz - for motors 0.37 kW and below

.2 575 V, three phase, 60 Hz - for motors 0.55 kW and up

.3 75 kW and larger to be suitable for solid state reduced voltage starting.

2.1.2. Motors and individual components thereof to perform at full nameplate rating in ambient conditions specified.

2.1.3. Unless otherwise noted, motor power rating indicated represents a nominal rating. Consult related driven equipment manufacturer for exact requirements and supply a higher base rating (without service factor multiplier) if necessary to meet equipment operational requirements.

2.1.4. Provide design B squirrel cage induction motor where this design meets starting and operating requirements of the driven equipment. Minimum starting and breakdown torque as indicated in EEMAC MG1. If larger load torque or WK^2 requirements are encountered, other motor design type selection is acceptable subject to prior acceptance by Engineer.

2.1.5. All motors shall be suitable for across-the-line starting.

.1 Motors shall also be suitable for specified starting methods shown on the drawings or described in the specifications.

2.1.6. Design motors to operate continuously at rated load without exceeding maximum temperature rise above ambient temperature as indicated.

2.1.7. Design motors to operate continuously at rated load under a combination of ±10% voltage variation, 2% phase voltage imbalance without the winding hot-spot temperature exceeding the insulation class rating.

2.1.8. Do not exceed the maximum locked rotor current values as listed in EEMAC Standard MG1 for the specified EEMAC design and rating.

2.1.9. Pulsating motor currents: Full load and peak current variations to comply with EEMAC MGI-20.82.

2.1.10. Provide class F Insulation except as noted.

2.1.11. Provide motors suitable for operation with emergency generating set which has a 25% drop in rated voltage during starting of large motors.

2.1.12. Non-compliance: Special motors forming part of an integral, standard manufactured equipment assembly, such as valve operators, damper motors, submersible pumps, metering pumps and hoists, which require non-standard (non-EEMAC) design, mounting or housing, to be accepted in writing by the Engineer and of the type recommended by manufacturer for application indicated. Comply with functional and performance requirements stated herein and in driven equipment specification section.

2.2. Sound

2.2.1. Maximum overall sound pressure level: For motor rated 22 kW and larger, unless otherwise indicated: 65 dBA at 1 m. Measure at 4 points evenly spaced around the motor. Refer to driven equipment specification for additional noise level restrictions.

2.2.2. The noise level at base speed of each motor shall comply with NEMA MG1.

2.3. Constant Speed Motors

2.3.1. Minimum service factor of 1.25

2.3.2. Motors greater than 50 hp shall be suitable for reduced-voltage, soft starting.

2.3.3. Unless otherwise indicated, design motor for a minimum number of hot starts per hour as determined by driven equipment manufacturer, but not less than two.

2.4. Two-Speed Motors

2.4.1. Same minimum NEMA torques for a given NEMA design, power rating and speed as for single-speed motors.

2.5. Inverter Duty Motors

2.5.1. All motors driven by variable speed drives shall meet NEMA MG-1 part 31

2.5.2. Motor shall normally be operated from an IGBT based PWM type variable frequency drive (VFD).

2.5.3. Provide motors suitable for operation on variable frequency drives without restrictions or limitations for the length of feeder cable between motor and drive or for the switching frequency. If filters are required to suit the supplied motors, the Contractor shall supply without additional costs to the Owner.

2.6. Service Factors

2.6.1. Constant speed & two-speed applications <100 hp: 1.25

2.6.2. Constant speed & two-speed applications <100 hp: 1.15

2.6.3. Motors on variable speed drives: 1

2.6.4. Size motors for duty point conditions without including service factor.

2.7. Efficiency and Power Factor

2.7.1. Measure motor efficiency in accordance with CSA C390.

2.7.2. Motors shall be NEMA premium efficiency per NEMA MG-1, where the NEMA premium efficiency tables apply except that:

.1 NEMA Premium Efficiency ratings are not required for multispeed, short-time rated, submersible motors, or for motors driving gates, valves, elevators, cranes, trolleys, and hoists.

2.7.3. The minimum guaranteed full-load efficiency for motors larger than 375 kW not covered by the NEMA premium efficiency tables shall be 95.0%

2.7.4. The minimum guaranteed full-load efficiency for submersible motors rated greater than 50 kW and for all submersible motors designed for non-intermittent duty shall be 90%

2.7.5. The minimum guaranteed full load power factor shall be 88.3

2.8. Terminal Boxes

2.8.1. Provide waterproof, oversized terminal boxes.

2.8.2. NEMA position F1 (left hand side when facing the shaft), convertible to F2.

2.8.3. Provide solderless type motor lead terminations for incoming cable connections and clamp terminal for ground connections.

2.8.4. A frame grounding lug shall be provided in each conduit box.

2.8.5. Seal frame to terminal box cable passage to prevent the entrance of moisture or foreign matter.

2.8.6. Provide gaskets between all mating surfaces.

2.8.7. Provide separate termination box for ancillary devices.

2.9. Mechanical Construction

2.9.1. The motors shall be capable of being floor, ceiling or wall mounted. The shaft location in all cases shall be parallel to the horizontal plane.

2.9.2. All windings shall be copper with end turn lacing every two (2) slots. A varnish treatment shall be applied to all motors designed for mill and chemical duty. This treatment shall allow installation in environments where relative humidity can reach 100%.

2.9.3. All dimensions including that of the motor shaft shall be in accordance with NEMA MG-1. Where shaft modifications are required they will be noted in the motor schedule.

2.9.4. Motor leads shall have an insulation class equal to or better than the insulation class of the motor windings.

2.10. Construction, General

2.10.1. Refer to the other division equipment specifications for additional details.

2.10.2. Motor enclosures shall meet or exceed the requirements of the OESC for the specific application and location.

2.10.3. Where the location meets more than one description, e.g. wet & corrosive, products shall be more stringent requirements for both locations.

2.11. Construction, Ordinary Locations

2.11.1. Enclosure type: ODP.

2.11.2. Guard bottom ventilation openings with baffles to prevent direct entrance of liquids that might be released by pump seal failure. Provide drip covers for the top side openings.

2.11.3. Vertical motors: Guard bottom ventilation openings with baffles to prevent direct entrance of liquids that might be released by pump seal failure. Provide drip covers for the top side openings.

2.11.4. Provide space heaters shall be as indicated on the drawings.

2.12. Construction, Damp/Wet/Outdoor Locations

2.12.1. Enclosure type: Weather protected, type I (WPI)

2.12.2. Provide low sheath temperature space heaters in motors 50 hp and larger.

2.13. Construction, Corrosive Locations

2.13.1. Enclosure type: TEFC

2.13.2. Provide low sheath temperature space heaters in motors 50 hp and larger.

2.13.3. Motors shall meet IEEE 841.

2.13.4. Paint system to exceed the 250 hour salt fog test.

2.13.5. Paint all exterior and interior surfaces

2.13.6. All painted surfaces shall be chemical-duty epoxy finish.

2.14. Construction, Classified Locations (if applicable)

2.14.1. Classified areas: TEFC, Standard Duty

2.14.2. The motor shall be totally enclosed and shall be designed to withstand an explosion which may occur within the enclosure.

2.14.3. The enclosure shall also prevent the ignition of the specified gas, vapour or dust surrounding the machine by means of sparks, flashes or explosion of this gas or vapour within the motor enclosure.

2.14.4. Provide threaded openings in terminal box.

2.14.5. Provide Class B Insulation system.

2.14.6. The motor will be designed for the classified areas as shown on the drawings.

2.14.7. The motor frame and end bracket shall be cast iron construction

2.14.8. Provide NEMA 7 enclosures.

2.15. TEFC Enclosures

2.15.1. The motor frame, end bracket and terminal box shall be cast iron construction.

2.15.2. The fan shall be constructed of a corrosion resistant, non-sparking material.

2.15.3. All fasteners and motor hardware shall be non-corroding.

2.15.4. Bronze breather drains shall be installed on all motors built on 254T frames or higher.

2.15.5. All interior and exterior surfaces shall have a base coat and finish coat of corrosion resistant epoxy paint.

2.16. Bearings and Lubrication

2.16.1. Provide ball bearings on all motors rated < 150 hp.

2.16.2. Provide roller bearings for motors rated 150 hp or more.

2.16.3. For belted service, bearings shall carry a “C-3” clearance classification.

2.16.4. Motors shall have a double shielded sealed bearing system, except two pole motors that may have a single shielded bearing on the drive end.

2.16.5. Motors built on larger frames shall be equipped with re-greaseable bearings.

2.16.6. The grease fittings shall be designed so that no uncoupling is necessary to perform the required maintenance.

2.16.7. Ball or roller type: Antifriction design, interchangeable, cartridge type housing preferred, with grease nipples.

2.16.8. Life expectancy: B-10 as defined by the Anti-Friction Bearing Manufacturer's Association at rated conditions of service of at least 100,000 working hours.

2.16.9. Vertical motors: Anti-friction, thrust bearings for maximum axial up and down thrusts imposed by the driven equipment. Split ring under motor hub on bottom of shaft.

2.17. Lifting Provisions

2.17.1. For motors weighing more than 20 kg, provide one or more lifting eyebolts, rings, or lugs.

2.17.2. For motors weighing more than 100 kg, provide two or more lifting eyebolts or lugs.

2.17.3. If lugs are concealed by enclosure, attach nameplates to both sides of motor warning against improper lifting.

2.18. Rotor Assembly

2.18.1. Rotation: For motors designed for single direction operation only, clearly indicate direction of rotation by means of arrow on non-driving end. Painted arrows are not acceptable.

2.18.2. Shaft extensions: With keys.

2.18.3. Keyway: NEMA standards for NEMA frame motors.

2.19. Stator

2.19.1. Windings and terminal leads: Copper conductors, with ends brought into terminal box.

2.19.2. Insulation: Moisture proof, class F minimum unless otherwise indicated.

2.19.3. Winding temperature detection

.1 For motor rated 22 kW and larger unless otherwise indicated, two type PTC thermistors per phase in the stator windings, with leads brought out to a separate terminal box, suitable for Siemens 3UN2100 tripping unit. Identify temperature sensor terminals as to phase location.

.2 For motors rated 200 kw and higher provide stator and bearing RTDs brought out to an ancillary terminal box.

2.19.4. For submersible motors, provide a combined leak and temperature detection system (includes detectors and a MiniCAS relay with light and Reset push button)

2.20. Nameplates & Identification

2.20.1. Identify equipment in accordance with 16090.

2.20.2. Provide stainless steel nameplates showing the information required by NEMA MG-1.

2.20.3. Provide permanent identification of terminals and terminal boxes.

2.20.4. Provide permanent wiring diagrams for:

.1 All ancillary devices

.2 Winding connections

2.20.5. Motor leads shall be permanently marked in accordance with NEMA MG-1 designations

2.21. Power Factor Correction Capacitors

2.21.1. Where shown on the drawings, provide power factor correction capacitors (PFCC).

2.21.2. PFCC shall be supplied by the motor manufacturer as a package.

2.22. Manufacturers

2.22.1. Canadian General Electric

2.22.2. Etect

2.22.3. LeRoy Somers

2.22.4. U.S. Motors

2.22.5. Westinghouse

2.22.6. Toshiba

2.22.7. Baldor

2.22.8. Or, approved equal

3. EXECUTION

3.1. Installation

3.1.1. The motors shall be installed by the Contractor in accordance with the manufacturer’s instructions.

3.1.2. Any slushing compound on the shaft or other parts shall be removed using a petroleum type solvent.

3.1.3. Any and all shaft shipping braces shall be removed after the motor is placed in its final location.

3.1.4. The motor shall be mounted in accordance with the manufacturer's instructions. Special care shall be taken to ensure that the motor shaft is level.

3.1.5. If a soleplate has been provided, it must be located, levelled and grouted into place following the best practices.

3.1.6. Co-ordinate with trade installing driven equipment in the alignment and coupling of motor to driven machinery. Conform to the manufacturer's instructions and ensure use of correct parts such as couplings, belts, sheaves, as provided by motor manufacturer.

3.1.7. The Contractor shall install the motor coupling in accordance with the coupling manufacturer's instruction. Under no circumstances shall the motor shaft be modified to accommodate the coupling.

3.1.8. The motor shall be aligned axially with driven equipment. This alignment shall be done in accordance with the manufacturer's instruction.

3.1.9. Make electrical connections as indicated. Install liquid-tight PVC jacketed flexible conduit section between rigid conduit feeds and motor where applicable.

3.1.10. Where applicable, make flexible conduit or armoured cable long enough to permit movement of motor over entire length of slide rails.

3.1.11. All secondary wiring connections shall be made in accordance with the Contract documents and manufacturer's wiring diagrams.

3.1.12. Dry out motor in accordance with manufacturer's recommendations if dampness present.

3.2. Field Adjustments

3.2.1. The Contractor shall fill any oil reservoir with the manufacturer's specified oil.

3.2.2. If the manufacturer requires that the anti-friction bearings receive an initial change of grease, the Contractor shall perform such work.

3.2.3. The motor shaft shall be turned by hand to ensure there is free rotation.

3.2.4. For TEFC motors, the area around the external fan inlet shall be checked for loose debris that could be drawing into the fan during operation.

3.2.5. All external, factory made, bolted joints should be checked for tightness.

3.3. Field Testing

3.3.1. Review installation methods prior to energizing motor.

3.3.2. Before connecting feeder cable, measure winding insulation resistance between each phase and ground. Repeat tests after connecting feeder cable at supply. Where applicable, disconnect power factor capacitors, surge arresters and solid state equipment during test.

3.3.3. Witness final tests and provide certification that the complete installation of the motor, both mechanically and electrically, is per manufacturer's recommendations.

3.3.4. Record results and include in Installation, Operations and Maintenance manual.

3.3.5. Verify operation and settings of motor protection system before energization.

3.3.6. Check motor lubrication, alignment and direction of rotation.

3.3.7. Perform motor rotation check under the supervision of the Contract Administrator and the driven equipment supplier. Uncouple motor from load where incorrect rotation is likely to damage equipment.

3.3.8. Conduct additional tests as required and directed by manufacturer or Engineer.

3.4. Manufacturer's Services

3.4.1. Furnish manufacturer's representative at site for installation assistance, inspection, equipment testing, and start-up assistance for motors larger than 200 horsepower, unless otherwise noted. Provide manufacturer's Certificate of Proper Installation.

END OF SECTION

1. GENERAL

1.1. Description

1.1.1. This section describes the requirements for motor starters supplied under the contract as stand-alone devices or as part of an MCC or other equipment.

1.1.2. This section shall apply to starters supplied with or as part of equipment supplied by all divisions.

1.1.3. The section describes the requirements for the following types of motor starters supplied under the contract:

.1 Full-voltage, non-reversing (FVNR)

.2 Full-voltage, reversing

.3 Reduced-voltage, soft-starters (RVSS)

.4 Two-speed, single-winding starters.

1.1.4. This section describes starters with a nominal voltage of 600 V or less.

1.1.5. Refer to 16224 for variable frequency drives to 600 V.

1.2. General

1.2.1. This section applies to starters supplied:

.1 With or as part of equipment supplied by all divisions,

.2 As stand-alone devices in enclosures, and/or

.3 For retrofit into existing enclosures.

1.2.2. Starters shall be NEMA style and listed CSA C22.2 No. 60947.

1.2.3. Starters shall consist of a disconnect means, short circuit protective device, one or more contactors and overload relays complete with the necessary control devices to achieve the functionality described on the drawings and specifications.

.1 The disconnect means and short circuit device may be a single device that performs all required functions

1.3. Related Sections

1.3.1. Section 01330 – Submittals

1.3.2. Section 01820 – Demonstration & Training

1.3.3. Division 11 – Equipment

1.3.4. Division 13 – Instrumentation, Control and SCADA

1.3.5. Division 15 – Mechanical

1.3.6. Section 16010 – Electrical General Requirements

1.3.7. Section 16225 – Motor Control Centres

1.3.8. Section 16423 – Control Devices

1.3.9. Section 16671 – Surge Protective Devices

1.3.10. Driven equipment sections

1.3.11. Associated equipment section (e.g. MCC, control panels)

1.4. References

1.4.1. International Electro-technical Commission (IEC)

.1 IEC 947-4-1-1990, Part 4: Contactors and motor starters.

1.4.2. CSA C22.2 No. 14 Industrial Control Equipment

1.4.3. CSA C22.2 No. 60947-1 Low-Voltage Switchgear and Controlgear - Part 1: General Rules

1.4.4. CSA C22.2 No. 60947-4-1 Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-Starters - Electromechanical Contactors and Motor-Starters.

1.5. Coordination

1.5.1. The contractor shall provide the starter supplier with:

.1 Details of the driven equipment

.2 Accessories supplied with the driven equipment for installation in the starter (e.g. temperature/leakage monitors for submersible pumps).

1.5.2. The contractor shall coordinate the starter supplier and the driven equipment manufacturer to ensure that the starter and driven equipment are compatible.

1.5.3. Coordinate with the motor supplier to tie in auxiliary equipment such as temperature leakage monitoring relays, RTDs, etc. The motor wiring schematics are shown for reference only and shall be verified and modified as required by the Contractor during the shop drawings phase as well as the final SAT.

1.5.4. Where the intent of control diagrams is not clear, contact the Engineer prior to submitting shop drawings.

1.6. Measurement and payment

1.6.1. Where starters are supplied as part of another equipment package (e.g. blowers supplied with starters or MCCs) include the cost of the starters in the bid form cost for that equipment.

1.6.2. Include costs for stand-alone starters in the bid form under Section 16223. These costs will not be measured but will be paid for at the price included in the bid form for this section.

1.7. Quality Assurance

1.7.1. Inspection and testing, by the Owner, is not intended to relieve Contractor of responsibility but is a precaution against errors. Defective materials or workmanship, if found at any time prior to final acceptance of work, shall be rejected regardless of previous inspection.

1.8. Submittals

1.8.1. Make submittals in accordance with Section 1330 Submittals

1.8.2. Shop drawings to indicate:

.1 Mounting method and dimensions

.2 Starter size and type

.3 Layout of identified internal and front panel components

.4 Required enclosure size and ventilation requirements

.5 NEMA and/or IEC enclosure rating

.6 Interconnection diagrams

.7 Wiring diagram for each type of starter

1.9. Operations & Maintenance Manual

1.9.1. Provide operation and maintenance data for motor starters for incorporation into manual, specified in Section 01330.

1.9.2. Include operation and maintenance data for each type and style of starter.

1.9.3. Provide a replacement and spare parts list for each different size and type of starter.

1.10. Training

1.10.1. Provide training for each type and configuration of starter.

.1 Refer to 01820 – Demonstration & Training

1.10.2. Include operation and maintenance data for each type and style of starter.

1.11. Maintenance Materials

1.11.1. Provide maintenance materials in accordance with Section 01810 – Testing and Commissioning.

1.11.2. Provide listed spare parts for each different size and type of starter:

.1 Contacts, stationary.

.2 Contacts, movable.

.3 1 contact, auxiliary.

.4 1 control transformer.

.5 1 operating coil.

.6 2 fuses.

1.11.3. 10% LED push to test type bulbs.

2. PRODUCTS

2.1. Materials

2.1.1. Starters: to IEC 947-4 with AC4 utilization category.

2.2. Design Criteria

2.2.1. Starters shall be sized and suitable for the supplied equipment.

.1 The ratings shown on the drawings are nominal only. The supplier shall select input protective devices (e.g. motor circuit protectors), contactors and overload devices to suit the as-supplied driven equipment and the application as described in the contract documents.

2.2.2. Contactors shall break all poles simultaneously.

2.2.3. All starters shall be lockable in the off position.

2.2.4. All starters shall have type 2 coordination per IEC 947.

2.2.5. Provide auxiliary contactor and overload contacts where indicated on drawings or required by application.

2.2.6. Incoming line terminals shall be shielded to provide operator protection level of !P20.

2.2.7. Starters shall be suitable for operation at full motor load including service factor at ambient temperatures between -5 °C and 50 °C.

2.3. Operator inferface, all starters

2.3.1. All starter functions shall be operable from the exterior of the enclosure unless otherwise indicated. At a minimum, provide the following controls:

.1 Start/Stop control

.2 Overload reset

.3 Open/close of the disconnect switch of breaker.

2.3.2. Provide the following visual indications on the enclosure exterior unless otherwise indicated:

.1 Running

.2 Overload.

2.4. Enclosure

2.4.1. Supply and install the respective motor starters in the respective MCC's and/or in dedicated motor starter enclosures as indicated on the drawings.

2.4.2. Refer to 16010 for enclosure requirements.

2.4.3. Dedicated Motor Starter enclosures shall have a minimum rating of NEMA 12 unless otherwise indicated on the drawings. All dedicated motor starter enclosures shall include a front door complete with a full piano door hinge and external operating handle that is interlocked with the door to prevent live access to the motor starter interior components.

2.5. Manual Motor Starters

2.5.1. Provide single or three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

2.5.1.1. Quick make, quick break switching mechanism using a stored energy mechanism. The make/break action shall not be reliant on the speed of the operating handle.

.1 Three overload heaters, manual reset, trip indicating handle.

.2 Class 10 overload

.3 Fixed short circuit trip.

.4 Adjustable motor overload.

.5 Screw terminals for line and load side.

2.5.2. Accessories:

.1 Selector switch and/or push button: heavy duty/oil tight labelled as indicated.

.2 Indicating light: oil tight type and colour as indicated. (LED push to test type).

.3 Locking tab to permit padlocking in “ON” or “OFF” position.

2.6. Full Voltage Starters

2.6.1. Provide starters of the Full Voltage (FV) type as specified and shown on the drawings.

2.6.2. Provide NEMA starter size to suit the electrical name plate data of the respective motor application.

2.6.3. Each starter shall be provided with a control transformer, 600V, fused, primary connections phase to phase and 115V secondary shall be grounded on X2 secondary side and a suitable control circuit fuse provided on the other side.

2.6.4. Control power transformers shall be adequately rated to carry continuously the control circuit burdens and intermittently, the inrush currents imposed by the contactor coil.

2.6.5. One (1) side of coil shall be connected to the grounded side of the C.P.T. secondary.

2.6.6. Provide a minimum of two (2) normally open and two (2) normally closed auxiliary contacts for control and interlocking.

2.6.7. Each starter shall be provided with a cover mounted red indicating light which is visible with the door closed to indicate when the motor is running, and a green indicating light when motor is not running.

2.6.8. Provide heavy duty oil tight pushbutton, or selector stations in the covers of those starters as indicated on the drawings.

2.6.9. Each motor starter and unit compartment shall be provided with flange formed doors with concealed hinges, and large captive screws for fastening in closed position.

2.6.10. All starters shall be closed transition type and designed for front access. Each starter shall be provided with a cover mounted red indicating light which is visible with the door closed to indicate when the motor is running, and a green indicating light when motor is not running. Provide heavy duty oil tight pushbutton, or selector stations in the covers of those starters as indicated on the drawings. Each motor starter and unit compartment shall be provided with flange formed doors with concealed hinges, and large captive screws for fastening in closed position. Starters shall be capable of being removed from a section for maintenance without the need of disconnecting power to any or complete MCC. Motor starters of EEMAC size No. 5 and smaller shall be connected to vertical bus by means of “stab-on” connectors providing a positive tin-plated contacts with both sides of the bus at all times and shall be easily removable from the unit compartment and readily interchangeable with other starters of same size. Means shall be provided in the stationary structure for supporting and aligning starter units during their removal or replacement.

2.6.11. Provide all control wiring, interlocking, auxiliary contacts, timers, double voltage relays or Ontario Electrical Safety Code approved Mylar barriers called for on the drawings or required for proper operation. Each terminal block shall be isolated to permit working on any section with MCC

with the remainder of MCC energized. Terminal blocks and terminals shall be numbered and clearly identified.

2.7. Reversing Starters

2.7.1. Reversing starters shall consist of a two contactors and one overload.

2.7.2. Reversing starters shall be mechanically and electrically interlocked to prevent closing both contactors simultaneously.

2.7.3. Contactors shall meet the requirements for full-voltage, non-reversing starters and shall also:

.1 Be rated for plugging duty.

2.8. Two-Speed Starters

2.8.1. Provide two contactors and two overloads.

.1 Contactors shall meet the requirements for full-voltage, non-reversing starters.

2.8.2. All starters shall be closed transition type.

2.9. Reduced Voltage soft Starters

2.9.1. Provide reduced-voltage, soft starters (RVSS) where shown on the drawings and/or in the specifications.

2.9.2. RVSS shall employ SCRs to provide controlled starting and stopping of motors.

.1 SCRs shall be rated for a minimum peak inverse voltage rating of 1600 volts PIV.

.2 Resistor/capacitor snubber networks shall be used to prevent false firing of SCRs due to dv/dt effects.

2.9.3. Where units require fans to maintain starter temperatures within allowable limits:

.1 Run fans only when required.

.2 Monitor the temperatures that the fans must control

.3 Monitor fans and alarm on failure.

.4 Provide spare fan assembly.

2.9.4. The logic board shall be identical for all ampere ratings and voltage classes and shall be conformably-coat logic boards.

2.9.5. Provide integrated, non-fully rated bypass contacts

.1 The bypass contactor shall energize when the motor reaches approximately full speed

.2 Contacts shall be rated to close/open under locked rotor current.

2.9.8. Provide surge protective devices ahead of the RVSS where the starter is:

.1 In an MCC that does not have an SPD, or

.2 In an outdoor panel.

2.9.9. Provide capacitor contactors for switching in motor power factor correction capacitors once motor is up to speed.

.1 Capacitor contactors shall be suitably rated for capacitor switching.

.2 Select contactors to provide number of operations not less than the rated operations of the starter.

2.9.10. The starter shall be capable of the following soft-starting modes, all with adjustable kick start current limits:

.1 Constant current

.1 Linear acceleration

.2 'S' or pump curve acceleration

2.9.11. Provide electronic overload relay with the following protection features:

.1 Motor overload based on current sampling and using inverse-time curve

.2 Supply voltage phase rotation

.3 Undervoltage on any supply phase.

.4 Current imbalance

.5 Motor thermal switch/thermistor or RTD protection where shown on the drawings/specifications

.6 Motor stall (during starting)

.7 Motor jam (running at speed)

.8 Overtemperature of the power electronics

2.9.12. Starter shall be capable of either an automatic or manual reset after a fault.

2.9.13. Provide the following form 'c' digital outputs:

.1 Fault

.2 Up-to-speed

.3 Contacts shall be rated 240V AC and 24V DC max, 3 amps as standard

2.9.14. Provide a human-machine interface on the device keypad to indicate:

.1 Current device status (ready, faulted, running, etc.)

.2 Current operating parameters (voltages, currents, temperature of the electronics, etc.)

.3 Type of fault (Overtemp, Phase Loss, Jam, Stall, Phase Reversal, and Overload).

2.9.15. The starter shall be capable of the following adjustments:

.1 Overload protection: 30 to 125% of the motor full load current

.2 Overload class: 5, 10, 20 or 30

.3 Selectable Torque Ramp Start or Current Limit Start

.4 Adjustable Kick Start Time: 0-2 seconds

.5 Adjustable Kick Start Torque: 0-85%

.6 Adjustable Ramp Start Time: 0.5-180 second

.7 Adjustable Initial Starting Ramp Torque: 0-85%

.8 Adjustable Ramp Stop Time: 0-60 seconds

2.9.16. Where adjustments are made via computer software, provide one programming cable and one copy of the software.

2.9.17. Supply RVSS with motor circuit protector for short circuit protection and quick disconnect means.

2.9.18. Acceptable Products:

.1 Eaton S801/S811

.2 Rockwell SMC Flex

.3 ABB PSTB

2.9.18.1. Or, approved equal

2.10. Control Power

2.10.1. Provide a dedicated, single phase, dry type, control transformer for each starter.

.1 Size control transformer for control circuit load plus 50% spare capacity.

.2 Secondary voltage shall be 120 VAC unless otherwise indicated.

2.10.2. Provide primary protection as follows:

.1 Fuses where the primary voltage exceeds 240 VAC L-G

.2 Circuit breakers where the primary voltage is 240 VAC L-G or less

2.10.3. Provide miniature circuit breaker on CPT secondary.

.1 Circuit breaker shall be CSA C22.2 No. 5 listed.

2.10.4. Ground the neutral of the secondary.

2.11. Control circuits

2.11.1. Design complete control circuit to provide control logic described in the drawings or specifications.

2.11.2. Incorporate all features and systems required by the supplied components and driven equipment and by code.

2.11.3. Control circuits show only elementary circuit devices to convey the design intent. The supplier shall complete the design with all components necessary for the complete, safe operation including all customarily supplied portions of the control circuit (e.g. anti-pumping mechanisms).

2.11.4. Provide miniature circuit breakers or supplementary protectors for device protection. Do not use fuses.

2.11.5. Provide feed-through type, surge protective devices as described in 16671 for all control circuits with solid state components and all circuits with connections to SCADA.

2.11.6. Do not switch the neutral side of load devices unless required by design.

2.11.7. Refer to 16400 for pilot devices and operator control requirements.

2.11.8. E-stops shall directly remove power from electrically held contactors or shall act through safety relays.

2.12. Overloads

2.12.1. Unless otherwise indicated, provide bimetallic and electronic overloads as follows:

.1 Motors < 10 hp: bi-metallic overloads

.2 Motors 10 hp and up: electronic overloads

2.12.2. Connect overloads directly to contactors.

2.12.3. Bimetalic overloads shall have the following features:

.1 Interchangeable, adjustable heaters

.1 Class 10 unless otherwise indicated

.2 Minimum 1 N.O + 1 N.C., electrically-isolated, auxiliary contacts.

.3 Ambient compensated

.4 Manual reset, accessible from the exterior of the enclosure

.2 Electronic overloads shall have the following features:

.1 Self-powered

.2 The following protection settings:

.1 Overload - Selectable class 10 or 20

.2 Voltage/Current Phase Imbalance

.3 Loss of Phase

.4 Ground Fault

.3 In addition, for motors over 100 hp, provide:

.1 Mechanical jam protection: 1.5 – 4 x FLA

.2 Adjustable Current imbalance: 5-25%

.3 Adjustable ground fault:

.4 Adjustable number of automatic resets

.4 For all motors coupled to moving machinery such as conveyors or equipment with frangible connections in the moving components, provide adjustable mechanical jam protection in the overload relay.

.1 Set the mechanical jam to operate before the physical frangible connections fail.

.2 The mechanical jam setting shall not interfere with the ability of a machine to reverse direction to clear jams.

.5 Minimum 1 N.O + 1 N.C., electrically-isolated, auxiliary contacts

.6 Ambient compensated over an operating range of 0 °C to +50 °C

.7 Impulse withstand: 6 kV on the power and control terminals.

.8 IP20 rated terminal blocks

.9 Manual reset, accessible from the exterior of the enclosure

2.13. Motor Management Relays

2.13.1. Provide motor management relays and remote RTD modules where shown on the drawings.

2.13.2. Where a specific relay is shown on the drawings, no alternates will be considered.

2.14. Equipment Identification

2.14.1. Provide equipment identification in accordance with Section 16090 – Equipment Identification and with Section 16010 – Electrical General Requirements.

2.14.2. Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

2.14.3. Magnetic starter designation label, white plate, black letters, size 2, engraved as indicated.

2.14.4. Indicate sources and levels of remote voltage.

2.15. Spares

2.15.1. Provide listed spare parts for each different size and type of starter:

.1 Contacts, stationary

.2 Contacts, movable

.1 1 contact, auxiliary

.2 1 control transformer

.3 1 operating coil

.4 2 fuses

.3 10% LED push to test type bulbs.

2.16. Finishes

2.17. Apply finishes to enclosure in accordance with Section 16010 – Electrical General Requirements.

3. EXECUTION

3.1. Installation

3.1.1. Install starters, connect power and control as indicated.

3.1.2. Ensure all components are correctly installed.

3.2. Field Quality Control

3.2.1. Perform tests in accordance with Section 16010 – Electrical General Requirements and manufacturer's instructions.

3.2.2. Operate switches, contactors to verify correct functioning.

3.2.3. Coordinate testing and verification to suit HVAC applications.

3.2.4. Perform starting and stopping sequences of contactors and relays.

3.2.5. Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.2.6. Provide a detailed documentation of all Soft Starter configuration settings to the Contract Administrator prior to commissioning.

3.3. Factory Testing

3.3.1. The Engineer and the owner reserve the right to witness factory testing for all reduced-voltage soft starters greater than 100 hp. Provide copies of the factory test procedures and notification of the test to the Engineer and the Owner six weeks in advance of the testing.

3.3.2. Provide electronic copies of the certified test results for all stand-alone starters prior to arrival of equipment at site.

3.4. Shipping, handling and storage

3.4.1. Ship in accordance with manufacturer's instructions.

3.4.2. Protect from impact shock, vibration and moisture.

.1 Install drop and humidity detectors prior to shipment to MCC manufacturer.

.2 Equipment with activated detectors shall not be unloaded at the job site and shall be returned to the supplier's facilities for investigation and disposition.

.3 Do not remove detectors without the contract administrator's approval.

3.5. Preparation for Installation

3.5.1. Installation locations for indoor equipment shall be dry and heated prior to installation.

3.6. Site acceptance Testing

3.6.1. Perform tests in accordance with Section 16010 – Electrical General Requirements and manufacturer's instructions.

3.6.2. Operate switches, contactors to verify correct functioning.

3.6.3. Coordinate testing and verification to suit HVAC applications.

3.6.4. Perform starting and stopping sequences of contactors and relays.

3.6.5. Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.6.6. Provide a detailed documentation of all Soft Starter configuration settings to the Contract Administrator prior to commissioning.

END OF SECTION

1 GENERAL

1.1 Description

1.1.1 This section describes miscellaneous electrical equipment and materials not covered by other sections.

1.2 General

1.2.1 All sections of Division 1 form a part of this Specification.

1.2.2 Refer to all other Divisions of the Specifications and these documents to determine their effect upon the work of this section.

1.2.3 All sections of Divisions 1 to 16 inclusive form part of the Contract Documents. Refer to Section 16010 for General Electrical Requirements related to this work.

1.3 Scope

1.3.1 Furnish all labour, materials, supervision, equipment and services specified, indicated or requested to install all equipment and materials specified herein and on the drawings.

1.3.2 All (local) control panels and pushbutton stations indicated on the Electrical Drawings - Elementary (Schematic) Control Diagrams will be supplied, installed and tested under this section.

1.4 Definitions

1.4.1 The following are definitions of terms and expressions used in the specification:

.1 "Inspection Department/Authority" means an agent of any authority having jurisdiction over construction and safety standards associated with any part of electrical work on site. For this project the Inspection Authority is the Electrical Safety Authority (ESA).

.2 "Electrical Code" is defined as the Ontario Electrical Safety Code, 26th edition, 2015.

.3 "Indicated" is defined as shown on the drawings or noted in contract documents.

.4 "Provide" is defined as to supply install, verify, test and commission.

1.4.2 Refer to CSA C22.2 No.0 for "Definitions and General Requirements".

1.5 Related Sections

1.5.1 Division 1 - General Requirements

1.5.2 Division 13 - Process Control

1.5.3 Division 11 - Equipment

1.6 Codes And Standards

1.6.1 Abbreviations for electrical terms: Refer to CSA Z85.

1.6.2 Ontario Electrical Safety Code latest edition and latest Bulletins of Electrical Safety Authority (ESA)

1.6.3 Building Code of Ontario, O.Reg 413, Latest Revision.

1.6.4 Local applicable codes and regulations.

2 PRODUCTS

2.1 Materials And Equipment

2.1.1 Equipment and material must be CSA certified. Where there is no alternative to supplying equipment that is CSA certified, obtain special approval from Electrical Inspection Department. Pay all associated fees and perform all required retrofits to obtain special inspection certification.

2.1.2 Factory-assemble control panels and component assemblies.

2.2 Local Control Stations

2.2.1 Control stations shall be provided as indicated on the one line diagrams or schematics or as required by the equipment furnished.

2.2.2 Pilot devices shall be heavy duty, oil tight (NEMA 13) and shall perform the functions indicated.

2.2.3 Control stations shall have the following NEMA enclosure ratings:

.1 Indoor, ordinary areas: 12

.2 Indoor, wet, damp or corrosive areas: 4X

.3 Outdoor, non-hazardous areas: 4X

2.2.4 Control stations outdoors or indicated to be weatherproof shall have protective caps on the control devices.

2.3 Control Relays (Instantaneous)

2.3.1 General purpose plug-in type relays, low coil current, heavy duty contacts with multi-contact poles as indicated.

.1 Coil rating (Vac systems): 120 V, 60 Hz.

.2 Coil rating (Vdc systems): 125 V.

.3 Contact rating (Vac systems): 120 V, 10A.

.4 Contact rating (Vdc systems): 125 V, 2A.

2.3.2 Provide overlap contact cartridges where indicated or required by the control logic. Supply in pairs having NO contact that closes before NC contact opens (early make -late break).

2.3.3 Mounting strips: indexed strips easily cut to required length and bolted in place. Relays are installed in rows on strip with captive mounting screws. Rows of relays on mounting strip form their own wiring trough.

2.3.4 Label all relays with the identifier shown on the respective control drawings. Label the relay and the panel location corresponding to the relay.

2.3.5 Acceptable Manufacturers.

.1 Omron

.2 Eaton

.3 Potter-Bromfield

.4 Allen-Bradley

2.4 Timing Relays

2.4.1 General purpose electronic plug-in type relays, low coil current heavy duty contacts with multi-contact poles as indicated. Coil rating: 120 V, 60 Hz. Contact rating: 120 V, 10A.

2.4.2 Potentiometer: self-contained to provide time interval adjustment. Timing range as indicated.

2.4.3 Operation: on-delay or off-delay, as indicated on Drawings.

2.4.4 Timing ranges: minimum 1.0s, maximum 60s, unless otherwise specified.

2.4.5 Temperature range: minus 20 degrees C to 60 degrees C.

2.4.6 Where timed elements shown on drawing are not possible with a single relay, provide multiple timing relays to suit.

2.4.7 Acceptable manufacturers:

.1 Omron

.2 Eaton

.3 Potter-Bromfield

.4 Allen-Bradley

2.5 Interposing PLC Panel Relays

2.5.1 Entrelec. DIN rail mounted.

2.5.2 120VAC Relays:

.1 Rated Voltage: 120VAC

.2 Power: 1VA

.3 Rated Current: 9mA

.4 Drop-out Voltage: 20VAC

.5 RB121AR2, P/N: 010 168.0

2.5.3 24VDC Relays:

.1 Rated Voltage: 24VDC

.2 Power: 0.31W

.3 Rated Current: 13mA

.4 Drop-out Voltage: 2.4VDC

.5 RB122, P/N: 010 159.07

2.6 Pushbuttons

2.6.1 Momentary contact type: Heavy duty - oil tight, operator flush type, colour as indicated, 1-NO and 1-NC contacts rated 5A at 120V AC, labels as indicated.

2.6.2 Push-pull contact type: Heavy duty - oil tight, operator mushroom head type, red colour, provision for padlocking in "OFF" position, 2-NO and 2-NC contacts rated 5A at 120V AC, labels as indicated.

2.6.3 Pushbutton ratings:

.1 NEMA type 13 for indoor control panels

.2 NEMA type 4X/13 for outdoor control panels

2.6.4 Acceptable Manufacturers

.1 Allen-Bradley

.2 Schneider

.3 Cutler Hammer, PB Series

2.7 Selector Switches

2.7.1 Maintained contact type, 2 or 3 positions (as indicated), heavy duty - oil tight, operators standard knob, contact arrangement as indicated rated 5A at 120V AC, labels as indicated.

2.7.2 Provide number of positions as shown on the drawings.

2.7.3 LOCAL-REMOTE switches to be make-before-break.

2.7.4 Switch ratings:

.1 NEMA type 13 for indoor control panels

.2 NEMA type 4X/13 for outdoor control panels

2.7.5 Acceptable Manufacturers

.1 Allen-Bradley

.2 Square D

.3 Cutler Hammer

2.8 Indicating Lights

2.8.1 Heavy duty - oil tight, LED cluster Push-To-Test type, lens colour: as indicated, supply voltage: 120 V, labels as indicated.

2.8.2 Indicating light ratings

.1 NEMA type 13 for indoor control panels

.2 NEMA type 4X/13 for outdoor control panels

2.8.3 Acceptable manufacturers

.1 Allen-Bradley

.2 Square D (Schneider)

.3 Cutler Hammer

2.9 Control Power Transformers

2.9.1 Single phase, dry type

2.9.2 Primary: as indicated, 60 Hz AC.

2.9.3 Secondary: 120V or 24V AC as indicated.

2.9.4 Rating: as indicated plus 20% spare capacity.

2.9.5 Provide secondary fuses kit (terminal block type clips) and fuse, size as indicated.

2.9.6 Transformers shall provide voltage regulation as required by magnet coils and solenoid valves.

2.9.7 Hammond, Rex, or approved equal.

2.10 Control Circuit Breakers

1.1.1. Rail mounted, thermomagnetic, toggle operated.

1.1.2. Entrelec, Weidmuller, Phoenix.

2.11 Terminal Blocks

1.1.3. Terminal blocks shall be of an IEC high-density design rated at no less than 15 Amps at 120 Vac. All terminals shall be DIN rail mount type. All terminals shall be identified with printed numbers (black on white). All terminal block groupings to be identified and secured with end plates and end clamps. All terminal blocks and rail should be of the same manufacturer; Weidmuller, SAK4, Entrelec, or Allen-Bradley.

1.1.4. Provide all terminal block accessories including end plates, retainer clips, center post jumper bars, etc., for a complete system.

1.1.5. Provide a minimum of 20 per cent spare terminal blocks on al terminal block rails.

2.12 Fire Transits

2.12.1 All cable trays, conduit etc. that transitioning through building walls, floors, ceilings to be sealed with a two (2) hour fire rated caulking or fire transit.

2.12.2 Provide shop drawing package for fire transits with data sheets and drawings indicating where each product will be used.

2.12.3 Fire transit to be ULC listed.

2.12.4 Approved Manufacturer: HILTI

3 EXECUTION

3.1 Fire Transits

3.1.1 Install per manufacturer's approved drawings.

3.1.2 Inform contract administrator prior to installation. Contract Administrator reserves the right to witness installation.

3.1.3 Provide manufacturer's letter of proper installation for all fire transits.

3.2 Installation

3.2.1 Install control devices and interconnect as indicated.

3.2.2 Install instruments and interconnect as indicated.

3.2.3 Use lamacoid labels for control switches, lamps and pushbuttons.

3.3 Field Quality Control

3.3.1 Perform tests in accordance with Specification 16010 – Electrical General Requirements.

3.3.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at a time and check out operation of section.

3.3.3 Upon completion of sectional test, undertake group testing.

3.3.4 Check out complete system for operational sequencing.

3.3.5 Submit to Consultant one copy of test results.

END OF SECTION

1 GENERAL

1.1 Related Sections

1.1.1 Section 01330 – Submittal Procedures

1.2 References

1.2.1 CSA C22.2 No.5-02 Moulded Case Circuit Breakers

1.3 Product Data

1.3.1 Submit product data in accordance with Section 01330 – Submittal Procedures

1.3.2 Include time current characteristic curves for breakers with interrupting capacity of 22,000A symmetrical (RMS) and over at system voltage.

2 PRODUCTS

2.1 Breakers General

2.1.1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

2.1.2 Plug-in moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

2.1.3 Common-trip breakers: with single handle for multi-pole applications

2.1.4 Magnetic instantaneous trip elements in circuit breakers to operate only when current reach designated settings. Trip settings on breakers with adjustable trips are to range from 3-10 times current rating.

2.1.5 Circuit breakers with interchangeable trips as indicated.

2.1.6 EEMAC/NEMA equipment only

2.1.7 All breakers shall be CSA listed for applications at 100 percent of their continuous ampere rating in their intended enclosure.

2.1.8 Protective devices shall be moulded case circuit breakers with inverse time and instantaneous tripping characteristics.

2.1.9 Circuit breakers shall be operated by a toggle type handle and shall have a quick make, quick break over centre switching mechanism that is mechanically trip free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

2.1.10 Circuit breakers shall have a minimum symmetrical interrupting capacity of 65,000A or as indicated on the drawings whichever is greater.

2.1.11 Circuit breakers 600 ampere frame and below shall be equipped with thermal magnetic trip units and inverse time current characteristics.

2.1.12 Circuit breakers 800 ampere through 1200 ampere frame shall be equipped with solid state based RMS sensing trip units including ground fault protection.

2.2 Thermal Magnetic Breakers

2.2.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short-circuit protection.

2.3 Magnetic Breaker

2.3.1 Moulded case circuit breakers to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short-circuit protection.

2.3.2 Provide a solid state electronic tripping module for timed and instantaneous overcurrent protection as indicated on the drawings.

2.3.3 Include a solid state electronic tripping module for timed and instantaneous overcurrent and ground overcurrent protection for all breakers rated 1000A or greater.

2.4 Thermal Magnetic Breakers with Current Limiting

2.4.1 Where available short circuit currents exceed rating of standard thermal magnetic breakers range, provide a current limiter.

2.5 Solid State Trip Breakers

2.5.1 Moulded case circuit breaker to operate by means of a solid state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase, ground fault short circuit protection.

2.6 Enclosure

2.6.1 Individual wall mounted breakers to be installed in a NEMA 4 enclosure complete with a hinged door and a lockable external breaker handle.

3 EXECUTION

3.1 Installation

3.1.1 Install circuit breakers as indicated.

END OF SECTION

1. GENERAL

1.1. Scope

1.1.1. The Contractor shall provide and install the panelboards as specified and as shown on the contract drawings.

1.1.2. Provide directory cards for all panel boards; i.e. power, lighting, low voltage systems, communications, etc.

1.2. Related Sections

1.2.1. Section 01330 – Submittal Procedures

1.2.2. Section 16010 – Electrical General Requirements

1.2.3. Section 16412 – Molded Case Circuit Breakers

1.3. References

1.3.1. CSA C22.2 No.29-M1989 (R2000) Panel-boards and Enclosed Panel-boards

1.4. Product Data

1.4.1. Submit shop drawings in accordance with Section 01330 – Submittal Procedures.

1.4.2. Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.5. Submittals

1.5.1. The following information shall be submitted to the Contract Administrator:

.1 Breaker layout drawing with dimensions indicated and nameplate designation.

.2 Circuit designations for all branch breaker applications and including spare breakers

.3 Component list

.4 Conduit entry/exit locations

.5 Assembly ratings including:

.1 Short circuit rating

.2 Voltage

.3 Continuous current

.6 Cable terminal sizes.

.7 Product data sheets

.8 Where applicable the following additional information shall be submitted to the Contract Administrator:

.1 Key interlock scheme drawings and sequence of operations

1.6. Submittals – For Construction

1.6.1. The following information shall be submitted for record purposes:

.1 Final as-built drawings and information for items listed in paragraph 1.4

.2 Installation information

1.6.2. The final (as-built) drawings shall include the same drawings as the construction drawings and shall incorporate all changes made during the manufacturing process.

1.7. Qualifications

1.7.1. The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly including circuit breakers and fusible switches.

1.7.2. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

.1 The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.

.2 The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

.3 The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.8. Regulatory Requirements

1.8.1. The panelboards shall be CSA labelled.

1.9. Delivery, Storage, and Handling

1.9.1. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One copy of these instructions shall be included with the equipment at time of shipment.

1.10. Operation and Maintenance Manuals

1.10.1. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewals parts lists where applicable, for the complete assembly and each major component.

2. PRODUCTS

2.1. Panelboards

2.1.1. Panelboards: product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

2.1.2. Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

2.1.3. Panelboards: Mains, number of circuits, and number and size of branch circuit breakers as indicated.

2.1.4. Two keys for each panelboard

2.1.5. Mains: Suitable for bolt-on breakers or main lugs as indicated

2.1.6. Main lugs shall be nickel plated

2.1.7. Trim with concealed front bolts and hinges

2.1.8. Trim and door finish: Baked grey enamel (ANSI 61)

2.2. Custom Built Panel-board Assemblies

2.2.1. 125mm relay section on both sides of panels as indicated for installation of low voltage remote control switching components.

2.2.2. Double stack panels as indicated.

2.2.3. Contactors in mains as indicated.

2.2.4. Feed through lugs as indicated.

3. Isolated ground bus

3.1. Breakers

3.1.1. Breakers: Section 16412 – Moulded Case Circuit Breakers.

3.1.2. Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

3.1.3. All breaker applications shall include the provision for lockout capability. The lockout feature shall accommodate a safety tag that can be lockout out via a safety padlock.

3.2. Equipment Identification

3.2.1. Provide equipment identification in accordance with Section 16010 – Electrical General Requirements.

3.2.2. Nameplate for each panelboard size four engraved as indicated.

3.2.3. Nameplate for each circuit in distribution panel-boards size two engraved as indicated.

3.2.4. Complete circuit directory with typewritten legend showing location and load of each circuit.

3.3. Ratings

3.3.1. Panelboards rated 240VAC or less shall have short circuit ratings as shown on the drawings or as herein scheduled, but not less than 22,000A RMS symmetrical.

3.3.2. Panelboards rated 600VAC or less shall have short circuit ratings as shown on the drawings or as herein scheduled, but not less than 42,000A RMS symmetrical.

3.3.3. Panelboards shall be labelled with a CSA short circuit rating. When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the CSA series ratings including:

.1 Size and type of main breaker protection

.2 Branch devices that can be used

.3 CSA series short-circuit rating

3.4. Construction

3.4.1. Interiors shall be completely factory assembled devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

3.4.2. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover live parts. Doors shall have a semi flush cylinder lock and catch assembly. Doors over 48 inches in height shall have auxiliary fasteners.

3.4.3. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.

3.4.4. All panelboards shall have drip shields and shall be of sprinkler-proof construction.

3.4.5. Surface trims shall be same height and width as box. Flush trims shall overlap the box by 20 mm on all sides.

3.4.6. A directory with a clear plastic cover shall be supplied and mounted on the inside of each door.

3.4.7. All locks shall be keyed alike.

3.5. Bus

3.5.1. Main bus bars shall be copper sized in accordance with CSA standards to limit temperature rise on all current carrying part to a maximum of 65°C above an ambient of 40°C base.

3.5.2. A system and insulated/isolated ground bus shall be included in all panels.

3.5.3. Full size (100 per cent rated) insulated neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral bus shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200 per cent rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

3.5.4. Main, neutral and ground bus materials: silver-plated or tin-plated copper unless otherwise indicated.

3.6. Branch Circuit Panelboards

3.6.1. The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be fully rated.

3.6.2. Bolt on type, heavy duty, quick make, quick break, single and multi-pole circuit breakers of type specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

3.6.3. Circuit breakers shall be thermal magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100A frame and through 100A trip sizes shall take up the same pole spacing. Circuit breakers shall be ULC listed as type SWD for lighting circuits.

.1 Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

3.6.4. Circuit breakers shall have a minimum interrupting rating of 22,000A symmetrical at 240V, and 42,000A symmetrical at 600V, unless otherwise noted on the drawings.

3.7. Distribution Panelboards – Circuit Breaker Type

3.7.1. Distribution panelboards with bolt on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings. Panelboards shall be full rated.

3.7.2. Distribution panelboards with plug on devices contained therein shall have interrupting ratings as indicated on the drawings. Panelboards shall be fully rated.

3.7.3. Where indicated, provide circuit breakers CSA listed for application at 100 percent of their continuous ampere rating in their intended enclosure.

3.8. Transient Voltage Surge Suppression

3.8.1. Provide surge protective devices as shown on the drawings and as specified in 16671.

3.9. Enclosure

3.9.1. Enclosure shall be at least 500mm wide made from galvanized steel. Provide minimum gutter space in accordance with the Ontario Electrical Safety Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

3.9.2. Enclosure shall be provided with blank ends.

3.9.3. Where indicated on the drawings, branch circuit panelboards shall be column width type.

3.10. Approved Products

3.10.1. Eaton Cutler Hammer – Power R Line

3.10.2. General Electric

3.10.3. Schneider Electric

3.10.4. Siemens

3.10.5. Allen Bradley

3.10.6. Approved Equal

4. EXECUTION

4.1. Factory Testing

4.1.1. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of CSA standards.

4.2. Related Installation

4.2.1. Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

4.2.2. Install surface mounted panelboards on plywood backboards. Group panelboards on a common backboard when practical.

4.2.3. Mount panelboards to height specified in Section 16010 – Electrical General Requirements or as indicated.

4.2.4. Connect loads to circuits.

4.2.5. Connect neutral conductors to common neutral bus with respective neutral identified.

4.3. Panelboards Schedules

4.3.1. Contractor shall provide panel schedules for each panel board.

4.3.2. Each panel schedule card shall have clearly typed information as with the following example:

.1 Panel Name …. Example: LP-A

.2 Panel Voltage …120/208 V

.3 Panel Supply …. 200 A

.4 Fed from TX-##

4.3.3. All systems distribution cabinets shall be complete with a directory card showing circuit numbers, room locations, and a blank column for "REMARKS".

4.3.4. Temporary panel directory cards shall be provided and filled in as the circuits are installed. The temporary directory card shall be replaced with a typed permanent directory at job completion.

4.3.5. The panel directory card shall be inserted in the card holder on the inside of the panel door and be protected by a clear plastic sheet.

4.4. Load Balance

4.4.1. Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

4.4.2. Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

4.4.3. Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

END OF SECTION

DWG FullPath:- P:\DRAWINGS\6.5 - Water & Sewage Works\2016527C_DEEP RIVER WTP\Acmy *E:\DRAWINGS\ARCHITECTURAL\ACTIVE\6527C-ARCH PLANS

DEEP RIVER WATER TREATMENT PLANT UPGRADES

OWNER **SEAL**

THE CORPORATION OF THE TOWN OF DEEP RIVER

signature

Ann Aikens / Belo Cochon / L.H. Simons

Mayor / Town Superintendent & T/Clerk-Administrator

name & title of person signing

WITNESS

signature

name & title of person signing

CONTRACTOR **SEAL**

HARRINGTON MECHANICAL LTD.

signature

MICHAEL HARRINGTON

TREASURER

name & title of person signing

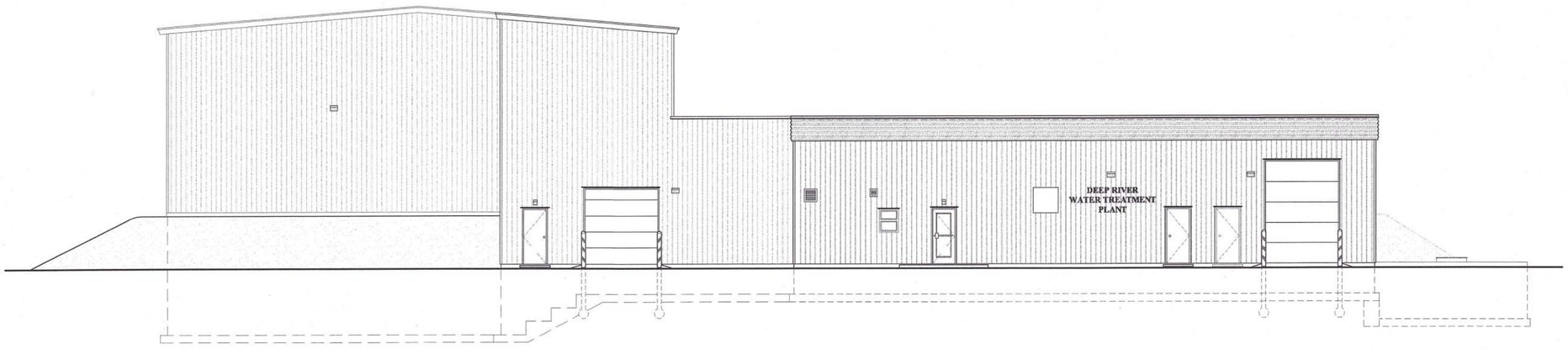
WITNESS

signature

ERIN BOUDENS

SECRETARY

name & title of person signing



LIST OF DRAWINGS

CIVIL

- C-1 Exist. Conditions - Removals, Clearing & Grubbing
- C-2 Site Plan - New Site Layout, Site Servicing & Grading
- C-3 Partial Site Plan - New Septic Area Notes & Details
- C-4 Ditch Details & OPSD Details

ARCHITECTURAL

- A-1 Floor Plan - Existing Modified
- A-2 Floor Plan - New Addition
- A-3 East & West Elevations
- A-4 North & South Elevations
- A-5 Typical Wall Sections
- A-6 Building Sections
- A-7 Building Sections
- A-8 Existing Pumphouse Plans, Sections, & Details
- A-9 Details & Schedules

STRUCTURAL

- S-0 Excavation Conditions
- S-1 Foundation Plan & Details
- S-2 Ground Floor Plan & Details
- S-2A Ground Floor Plan with Aluminum & Below Slab Encased Pipes
- S-3 Ex. Plant - Structural Modifications
- S-4 Roof Plan & Details
- S-5 Frame Details
- S-6 Building Sections
- S-7 Building Sections
- S-8 Ex. Building Frame Modifications
- S-9 Details
- S-10 Typical Details
- S-11 Existing Pumphouse Modifications

MECHANICAL

- MP-1 Plumbing Floor Plan - New Addition
- MP-2 Plumbing Floor Plan - Ex. Modified
- MP-3 Plumbing Details
- MV-1 HVAC Floor Plan - New Addition
- MV-2 HVAC Floor Plan - Ex. Modified
- MV-3 Existing Pumphouse Mechanical

ELECTRICAL

- E-0 Site Plan & Details
- E-1 OPSD Standards & Electrical Schematics
- E-2 Electrical Distribution Floor Plan - New Addition
- E-3 Electrical Distribution Floor Plan - Ex. Modified
- E-4 Electrical Distibution Single Line Diagram
- E-5 Electrical Distribution Panels
- E-6 Electrical Distribution Details
- E-7 Electrical Schematics
- E-8 Electrical Lighting - Floor Plans - New Addition
- E-9 Electrical Lighting - Floor Plan - Ex. Modified
- E-10 Fire Alarm / Security Floor Plan - New Addition
- E-11 Fire Alarm / Security Floor Plan - Ex. Modified
- E-12 Existing Pumphouse Electrical

PROCESS PIPING

- P-1 Removals - Overview of Works in Existing Structure - Plan and Section
- P-2 Low Lift Pumping Station Plans & Sections
- P-3 Existing Plant Plan Below Grade
- P-4 Plant Expansion Plan Below Grade
- P-5 Existing Plant Plan Above Grade
- P-6 Plant Expansion Plan Above Grade
- P-7 Sections A & B
- P-8 Sections C & D
- P-9 Sections E, L & Detail 1
- P-10 Sections F & G
- P-11 Sections H, J, & K

PROCESS SCHEMATIC

- G-1 Low Lift Pumping Station
- G-2 Clarifiers #1 & #2
- G-3 Rapid Sand Filters
- G-4 Reservoir Cells #1 & #2 Pump Well Cells #1 & #2
- G-5 High Lift Pumps & Backwash Pumps
- G-6 Wastewater Surge Tank & Sludge Handling Systems
- G-7 Chemical Systems
- G-8 Chemical Systems
- G-9 Process Hydraulic Profile
- G-10 Detail Sheet 1
- G-11 Detail Sheet 2
- G-12 Detail Sheet 3

PROCESS INSTRUMENTATION

- PI-1 Low Lift Pumping Station
- PI-2 Clarifiers #1 & #2
- PI-3 Rapid Sand Filters
- PI-4 Reservoir Cells #1 & #2 Pump Well Cells #1 & #2
- PI-5 High Lift Pumps & Backwash Pumps
- PI-6 Wastewater Surge Tank & Sludge Handling Systems
- PI-7 Chemical Systems
- PI-8 Chemical Systems

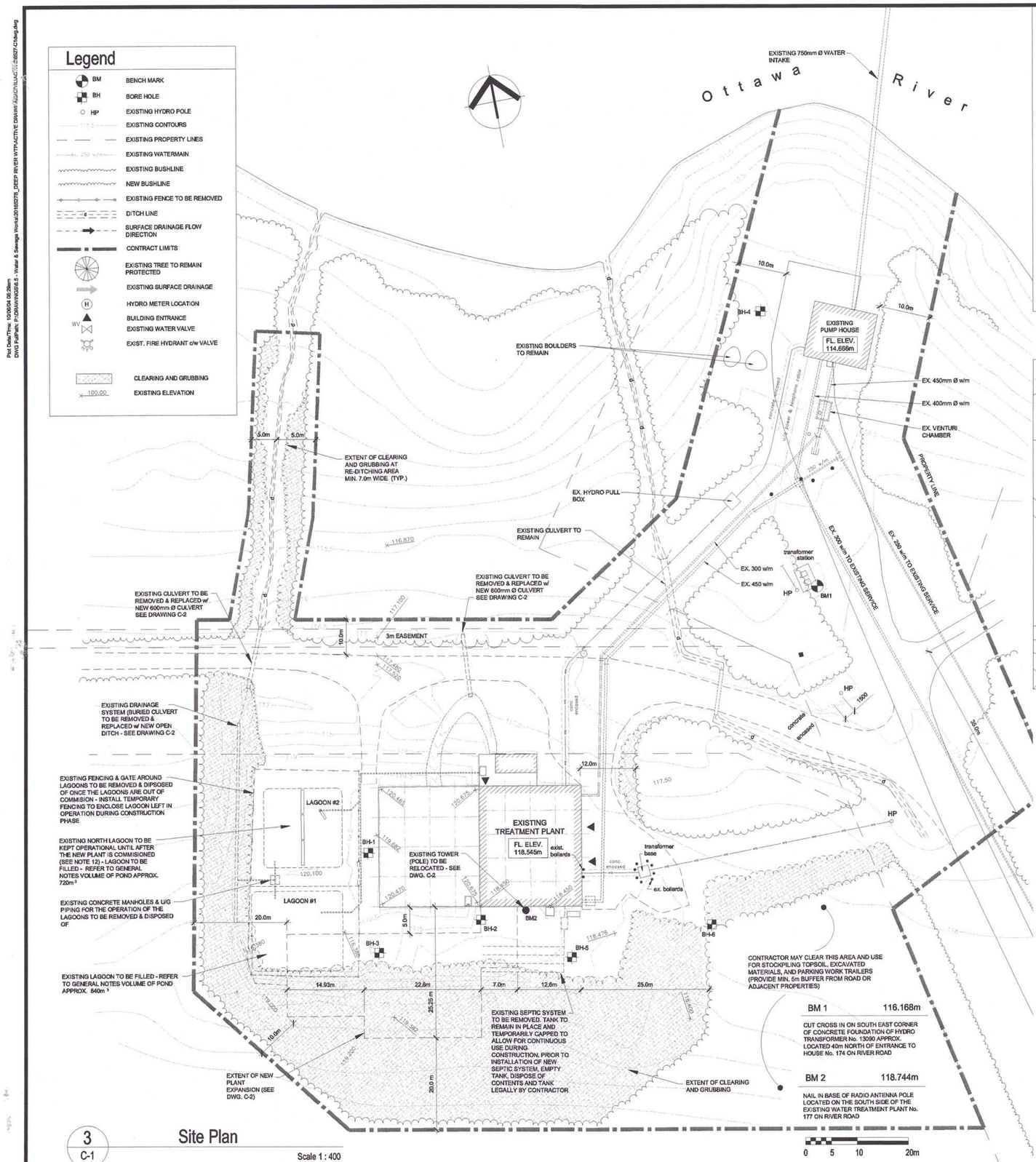
11/14/05 11:18am
DESIGN MODIFICATIONS AUGUST 22 2005

Jp2g Consultants Inc.
ENGINEERS · PLANNERS · PROJECT MANAGERS
PEMBROKE · OTTAWA

Plot Date/Time: 10/30/04 08:28am
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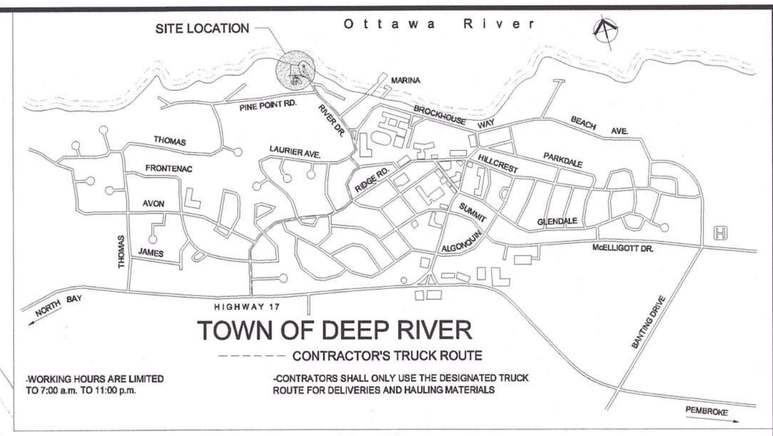
- BM — BENCH MARK
- BH — BORE HOLE
- HP — EXISTING HYDRO POLE
- 115 — EXISTING CONTOURS
- EXISTING PROPERTY LINES
- ex. 250 w/m — EXISTING WATERMAIN
- EXISTING BUSHLINE
- NEW BUSHLINE
- EXISTING FENCE TO BE REMOVED
- d — DITCH LINE
- SURFACE DRAINAGE FLOW DIRECTION
- CONTRACT LIMITS
- EXISTING TREE TO REMAIN PROTECTED
- EXISTING SURFACE DRAINAGE
- H — HYDRO METER LOCATION
- BUILDING ENTRANCE
- WV — EXISTING WATER VALVE
- EXIST. FIRE HYDRANT c/w VALVE
- CLEARING AND GRUBBING
- 100.00 — EXISTING ELEVATION



BM 1 116.168m
CUT CROSS IN ON SOUTH EAST CORNER OF CONCRETE FOUNDATION OF HYDRO TRANSFORMER No. 13030 APPROX. LOCATED 40m NORTH OF ENTRANCE TO HOUSE No. 174 ON RIVER ROAD

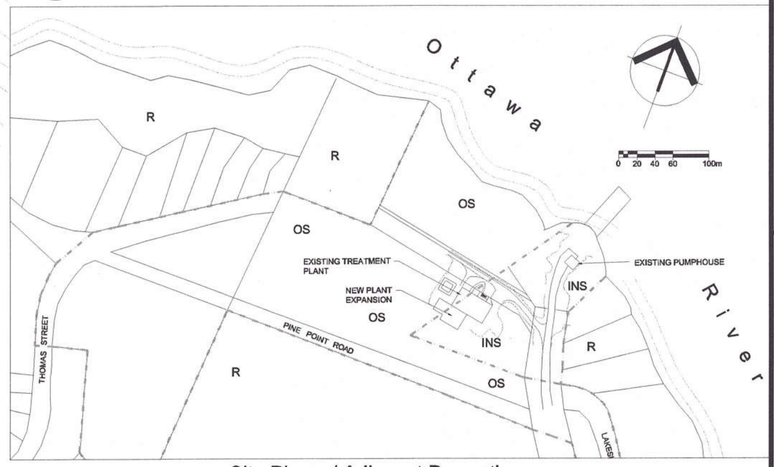
BM 2 118.744m
NAIL IN BASE OF RADIO ANTENNA POLE LOCATED ON THE SOUTH SIDE OF THE EXISTING WATER TREATMENT PLANT No. 177 ON RIVER ROAD

3 / C-1 — Site Plan
Scale 1 : 400



- WORKING HOURS ARE LIMITED TO 7:00 a.m. TO 11:00 p.m.
- CONTRATORS SHALL ONLY USE THE DESIGNATED TRUCK ROUTE FOR DELIVERIES AND HAULING MATERIALS

1 / C-1 — Key Plan
Scale N.T.S.



2 / C-1 — Site Plan w/ Adjacent Properties
Scale N.T.S.

General Notes

1. EXCAVATED MATERIAL TO BE STOCKPILED WITHIN THE CONTRACT LIMITS. EXCESS MATERIALS SHALL BE HAULED AWAY AND STOCKPILED OFF-SITE BY THE CONTRACTOR.
2. ALL TREES AT LOCATIONS NOT DESIGNATED TO BE CLEARED SHALL BE PROTECTED TO THE APPROVAL OF THE CONTRACT ADMINISTRATOR.
3. ALL DIMENSIONS AND ELEVATIONS TO BE CHECKED AND VERIFIED ON THE SITE BY THE CONTRACTOR AND ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER.
4. ALL LOCATIONS AND ELEVATIONS OF EXISTING SERVICE AND UTILITIES SHOWN ON THE PLANS ARE FOR REFERENCE PURPOSES ONLY. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UTILITIES DURING CONSTRUCTION.
5. ALL TRENCHING IS TO BE DONE IN ACCORDANCE WITH THE CONSTRUCTION SAFETY ACT.
6. SERVICE CONNECTIONS SHALL END 1.0m FROM THE FOUNDATION FACE UNLESS OTHERWISE NOTED.
7. WATER SERVICE SHALL HAVE A MINIMUM OF 1.5m COVER. WATER SERVICE TO BE A MINIMUM OF 500mm ABOVE OR BELOW ALL SEWER LINES AND CROSSINGS AS PER PART VII OF THE ONTARIO BUILDING CODE.
8. ALL STRUCTURAL BACKFILLING, GRANULAR BEDDING & ASPHALT TO BE TESTED BY AN APPROVED GEOTECHNICAL COMPANY.
9. MATCH GRADE TO ABUTTING PROPERTIES.
10. THE CONTRACTOR SHALL MAINTAIN ROADS OPEN TO LOCAL TRAFFIC AT ALL TIMES. PROPER SIGNAGE AND TRAFFIC CONTROL SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
11. FILLING OF EXISTING LAGOONS:
    a) ONCE THE LAGOONS HAVE BEEN EMPTIED, SULDGE WILL BE HAULED AWAY BY TOWN, CONTRACTOR TO REMOVE ASPHALT / CONCRETE PLUS APPROX. 500mm OF EARTH AT BOTTOM & SIDES OF EXISTING LAGOONS & DISPOSE OF MATERIALS ACCORDING TO MINISTRY OF ENVIRONMENT REQUIREMENTS.
    b) COMPACT SOIL (PROOF ROLL) REMAINING ON SIDES & BOTTOM TO PROVIDE FIRM BASE.
    c) FILL w/ EARTH EXCAVATED FROM SITE & PLACE IN MAX. 300mm LIFTS COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.
    d) WHERE NEW BUILDING FOOTPRINT ENCROACHES IN EXISTING LAGOON, FILL w/ APPROVED ENGINEERED FILL IN MAX. 200mm LIFTS COMPACTED TO 100% STANDARD PROCTOR MAXIMUM DRY DENSITY AS REQUIRED TO SUIT NEW BUILDING DEPTH.
12. REMOVAL OF LAGOONS:
    a) NORTH LAGOON SHALL BE KEPT OPERATIONAL DURING THE CONSTRUCTION OF THE NEW PLANT.
    b) CONTRACTOR TO SEPERATE #2 EXISTING LAGOON BY INSTALLING 300mm Ø LOG BAFFLES ANCHORED TO BASE w/ CONCRETE WEIGHTS AND POLY ROPES - LOGS TO FLOAT ON SURFACE TO RETAIN SOLIDS TO ONE SIDE.
    c) EXTEND & MODIFY EXISTING EFFLUENT PIPE TO DIRECT FLOW AWAY FROM BAFFLE.
    d) SOUTH LAGOON MAY BE REMOVED IMMEDIATELY AS REQUIRED BY NEW CONSTRUCTION - CONTRACTOR TO MAKE NECESSARY ARRANGEMENTS AND ADJUSTMENTS TO THE SYSTEM TO FACILITATE THE OPERATION OF SINGLE LAGOON.
13. EXISTING PUPHOUSE TO BE LOCKED & KEYS TURNED OVER TO OWNER ONCE NEW LOW LIFT PUMPING STATION IS OPERATIONAL AND EXISTING PUMPHOUSE IS NO LONGER IN SERVICE.
14. CLEARING & GRUBBING AREA: ALL USEABLE LUMBER (100mm Ø OR GREATER) TO BE CUT IN 1200mm LENGTH & STOCKPILED ON SITE FOR TOWN / RESIDENTS TO PICK UP. ANY PILES NOT PICKED UP SHALL BE REMOVED AND DISPOSED OF BY CONTRACTOR INCLUDING ALL LUMBER SMALLER THAN 100mm Ø.

Jp2g Consultants Inc.
ENGINEERS · PLANNERS · PROJECT MANAGERS
PEMBROKE · OTTAWA

PROJECT

DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

EXISTING CONDITIONS
REMOVALS
CLEARING AND GRUBBING

STAMP | NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

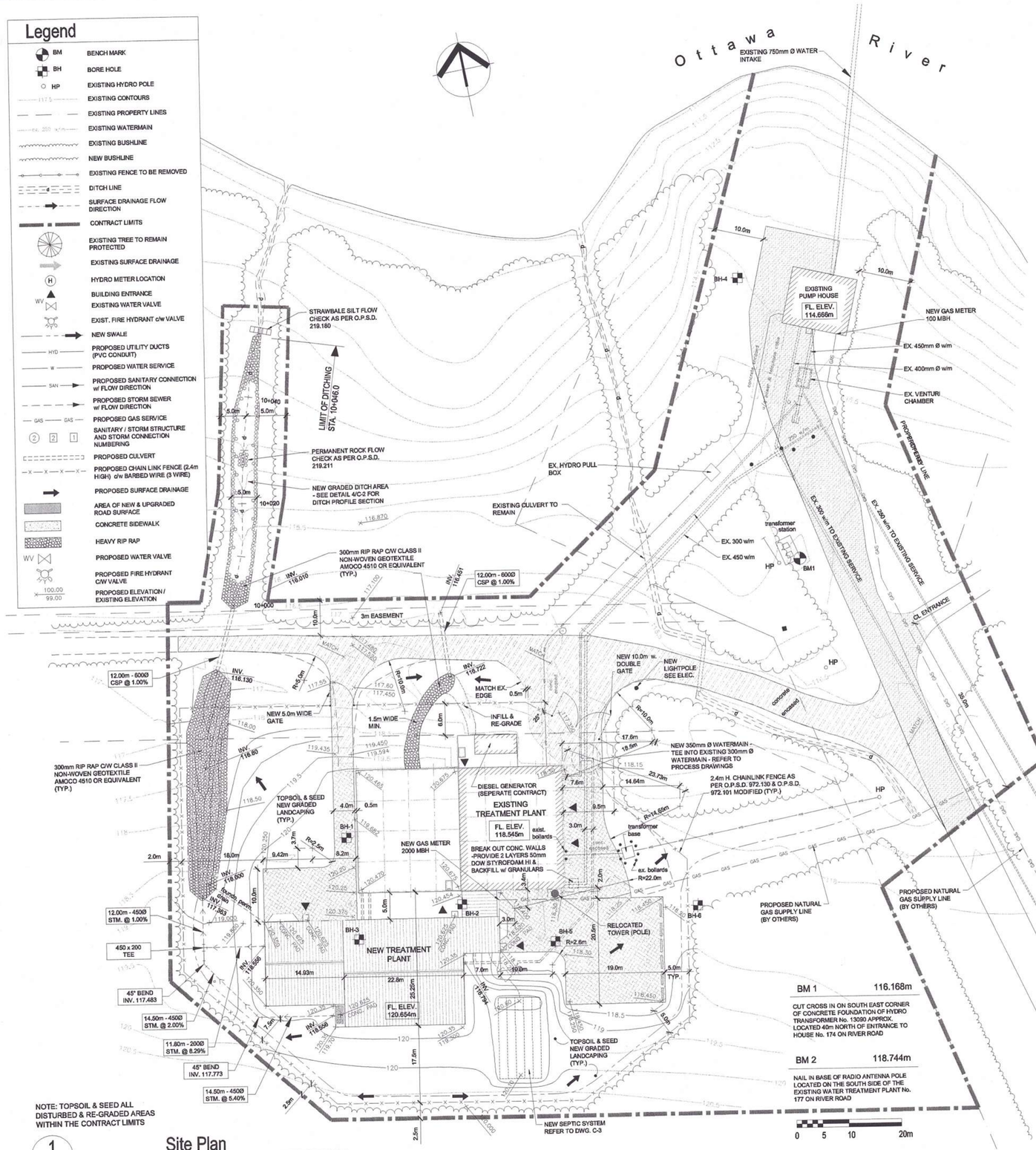
DESIGNED	A.E.E.	DATE	SEPT. 2004
DRAWN	M de R	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	6527-C1
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

DRAWING **C-1**

Plot Date/Time: 10/06/04 08:29am
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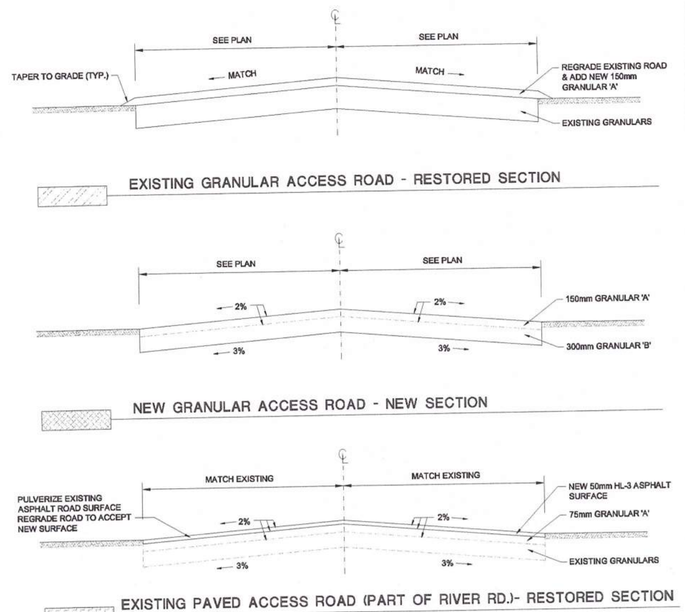
- BM — BENCH MARK
- BH — BORE HOLE
- HP — EXISTING HYDRO POLE
- EXISTING CONTOURS
- EXISTING PROPERTY LINES
- EXISTING WATERMAIN
- EXISTING BUSHLINE
- NEW BUSHLINE
- EXISTING FENCE TO BE REMOVED
- DITCH LINE
- SURFACE DRAINAGE FLOW DIRECTION
- CONTRACT LIMITS
- EXISTING TREE TO REMAIN PROTECTED
- EXISTING SURFACE DRAINAGE
- H — HYDRO METER LOCATION
- WV — BUILDING ENTRANCE / EXISTING WATER VALVE
- EXIST. FIRE HYDRANT c/w VALVE
- NEW SWALE
- HYD — PROPOSED UTILITY DUCTS (PVC CONDUIT)
- W — PROPOSED WATER SERVICE
- SAN — PROPOSED SANITARY CONNECTION w/ FLOW DIRECTION
- PROPOSED STORM SEWER w/ FLOW DIRECTION
- GAS — PROPOSED GAS SERVICE
- SANITARY / STORM STRUCTURE AND STORM CONNECTION NUMBERING
- PROPOSED CULVERT
- PROPOSED CHAIN LINK FENCE (2.4m HIGH) c/w BARBED WIRE (3 WIRE)
- PROPOSED SURFACE DRAINAGE
- AREA OF NEW & UPGRADED ROAD SURFACE
- CONCRETE SIDEWALK
- HEAVY RIP RAP
- WV — PROPOSED WATER VALVE
- PROPOSED FIRE HYDRANT C/W VALVE
- 100.00 / 99.00 — PROPOSED ELEVATION / EXISTING ELEVATION



NOTE: TOPSOIL & SEED ALL DISTURBED & RE-GRADED AREAS WITHIN THE CONTRACT LIMITS

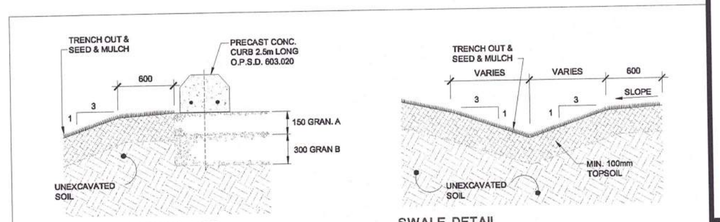
1 / C-2 **Site Plan**

Scale 1 : 400



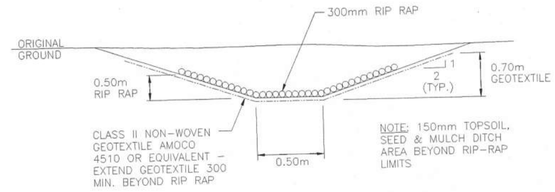
2 / C-2 **Surface Treatment Notes**

not to scale



3 / C-2 **Landscaping Details**

not to scale



TYPICAL DITCH SECTION
N.T.S.

4 / C-2 **Typical Ditch Section**

Scale N.T.S.

Jp2g Consultants Inc.

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PEMBROKE · OTTAWA

PROJECT

DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

SITE PLAN
NEW SITE LAYOUT
SITE SERVICING & GRADING

STAMP

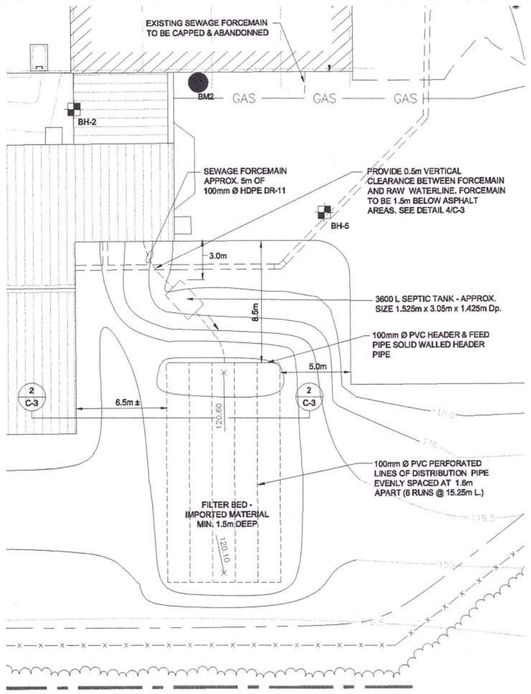
NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	A.E.E.	DATE	SEPT. 2004
DRAWN	M de R / JKB	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	6527-C1
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

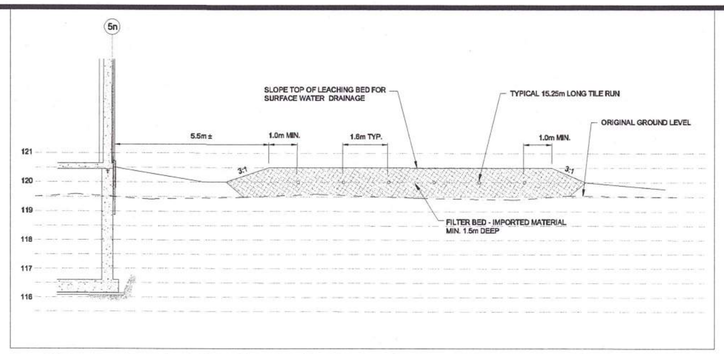
DRAWING

C-2



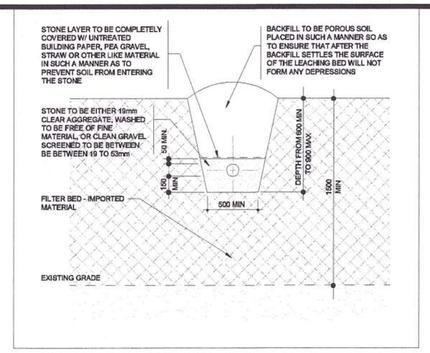
1 C-3 **Plan of Septic System**

Scale 1:200



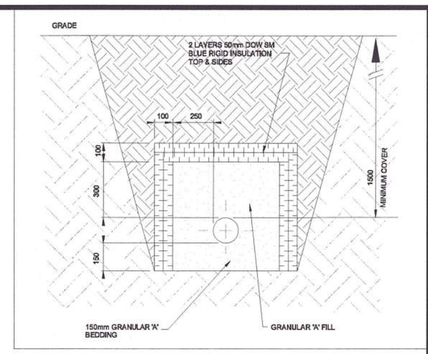
2 C-3 **Section thru Septic System**

Scale 1:100



3 C-3 **Leaching Bed Detail**

Scale N.T.S.



4 C-3 **Insulation Over Pipe Inlet**

Scale N.T.S.

General Notes

1) THE PRECAST CONCRETE CHAMBERS SHALL BE CONSTRUCTED OF REINFORCED CONCRETE TO MEET THE REQUIRED LOADING CONDITION FOR UNDERGROUND INSTALLATION IN LEACHING BED.
2) CHAMBERS TO BE PRECAST CONCRETE TO 20M AT 28 DAYS REINFORCED w/ STANDARD STEEL 150 x 150 WIRE MESH AS PER ASTM, 185 SPECIFICATION. THEY SHALL ALSO CONFORM TO THE REQUIREMENTS OF C.S.A. STANDARD A.23.1 CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION.
3) THE STRUCTURE OF THE CHAMBERS AS WELL AS ALL JOINING SHALL BE WATERTIGHT AS PER ASTM. C-443 A CONCRETE SEALANT SHALL BE USED TO SEAL BETWEEN THE TANK AND COVER (S) AS WELL BETWEEN THE COVERS.
4) THE CONCRETE CHAMBERS SHALL BE PLACED ON UNDISTURBED ORIGINAL SOIL OR VERY WELL COMPACTED MATERIAL. A WELL COMPACTED BASE OF 0.15m TO 0.30m OF SAND, FINE GRAVEL CRUSHED STONE OR 0.15m CONCRETE SLAB IS RECOMMENDED UNDER THE CHAMBER TO ELIMINATE STRESS ON THE STRUCTURE AS WELL AS ANY DISLOCATION DUE TO SETTLING.
5) CHAMBERS SHOULD BE PLACED ON A PREVIOUSLY WELL PREPARED FOUNDATION BASE AND ALL OUTLETS MUST BE EXACTLY AT THE SAME ELEVATION.
6) NOMINAL DIAMETER FOR ALL OUTLET PIPES IS 100mm.
7) NOMINAL DIAMETER FOR INLET PIPE SHALL BE AS SHOWN ON DETAIL DRAWING.
8) LEACHING PIPES TO BE 100mm Ø PVC OR ABS PERFORATED GRAVITY SEWER PIPES. SLOPE TO BE 0.3% MIN. TO 0.5% MAX.
9) THIS DRAWING IS INTENDED TO ILLUSTRATE THE GENERAL LAYOUT OF THE PROPOSED SEPTIC TANK SYSTEM AND IS NOT TO BE USED AS A CONSTRUCTION DRAWING.
10) CONSTRUCTION OF THE SYSTEM AND THE CHAMBER(S) SHALL BE ACCORDING TO ONTARIO REGULATION 374/(81) ENVIRONMENTAL AND LOCAL HEALTH UNIT.
11) CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS BEFORE PROCEEDING w/ WORK AND BE RESPONSIBLE FOR SAME.
12) CONTRACTOR MUST REPORT ANY DISCREPENCIES TO ENGINEER FOR RESOLUTION BEFORE COMMENCING THE WORK
13) DO NOT SCALE DRAWINGS
14) ANY CHANGES MUST BE APPROVED BY THE ENGINEER.
15) EXECUTION OF THIS PROJECT MUST CONFORM TO THE LATEST REQUIREMENTS OF THE APPLICABLE ONTARIO CODES AND REGULATIONS.
16) CO-ORDINATION OF ELECTRICAL AND MECHANICAL SUB-CONTRACTORS AND FOR OBTAINING HYDRO INSPECTION AND ALL ASSOCIATED BUILDING PERMIT APPROVALS.
17) COMPLETION OF NEW INSTALLATION OF ALL ITEMS SHOWN ON DRAWINGS INCLUDING HOOK-UP OF ALL EXISTING SANITARY LINES AND SYSTEM TO BE COMPLETE AND OPERABLE TO APPROVAL OF LOCAL HEALTH AUTHORITIES.

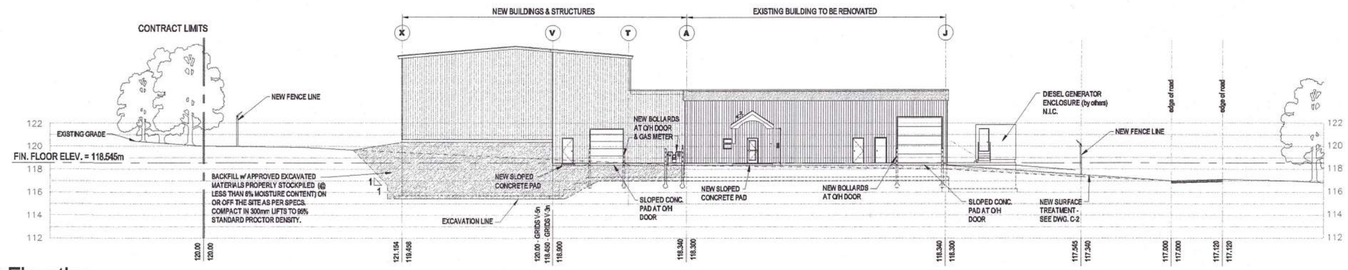
MIN. SETBACKS FROM SEPTIC TANK

A) BUILDING 1.5m
B) PROPERTY LINE 3m
C) DRILLED WELL, PROPERLY SEALED 15m
D) OPEN WATER COURSE 15m

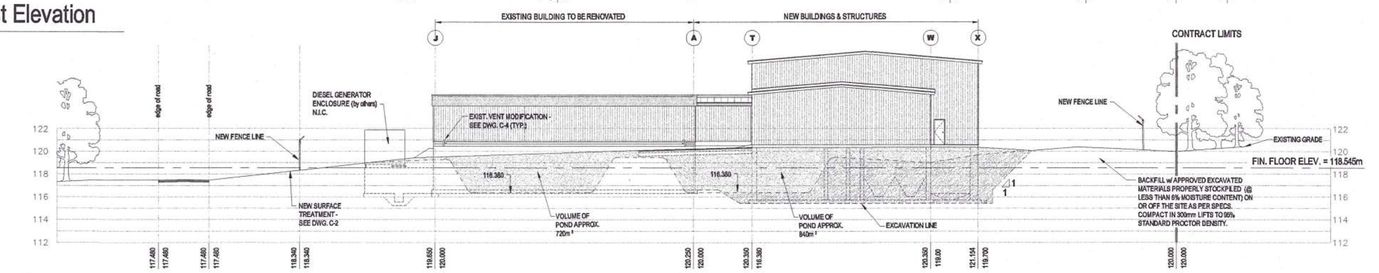
MIN. SETBACKS FROM LEACHING BED DISTRIBUTION PIPE:

(add 2m for each meter leaching bed is above grade)

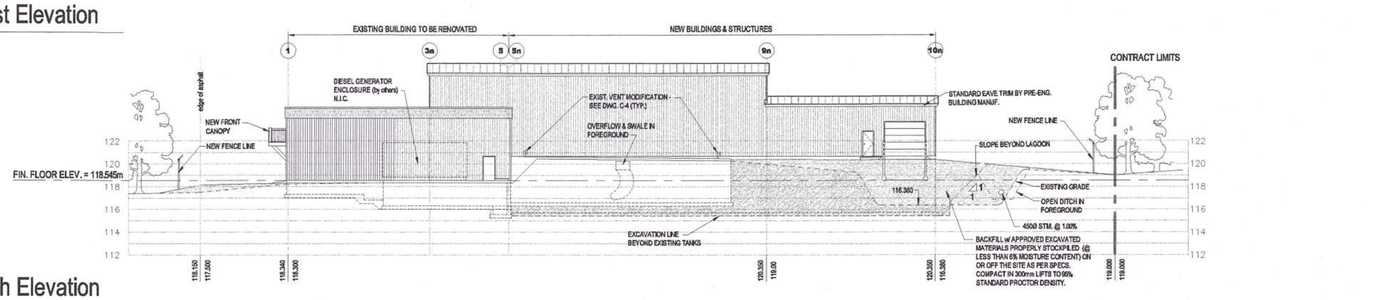
A) BUILDING 5m
B) PROPERTY LINE 3m
C) DRILLED WELL, PROPERLY SEALED 15m
D) OPEN WATER COURSE 15m
E) SHALLOW WELL, IMPROPERLY SEALED 30m



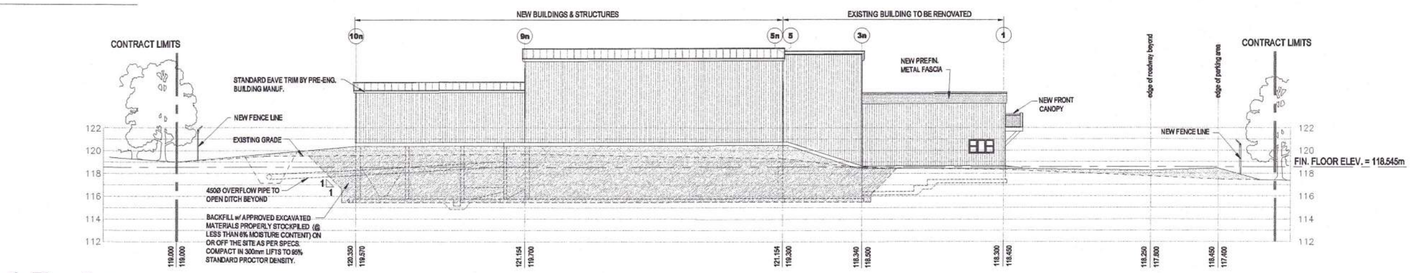
East Elevation



West Elevation



North Elevation



South Elevation

5 C-5 **Site Cross Sections**

Scale 1:250

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

PARTIAL SITE PLAN
NEW SEPTIC AREA
NOTES & DETAILS

STAMP | NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

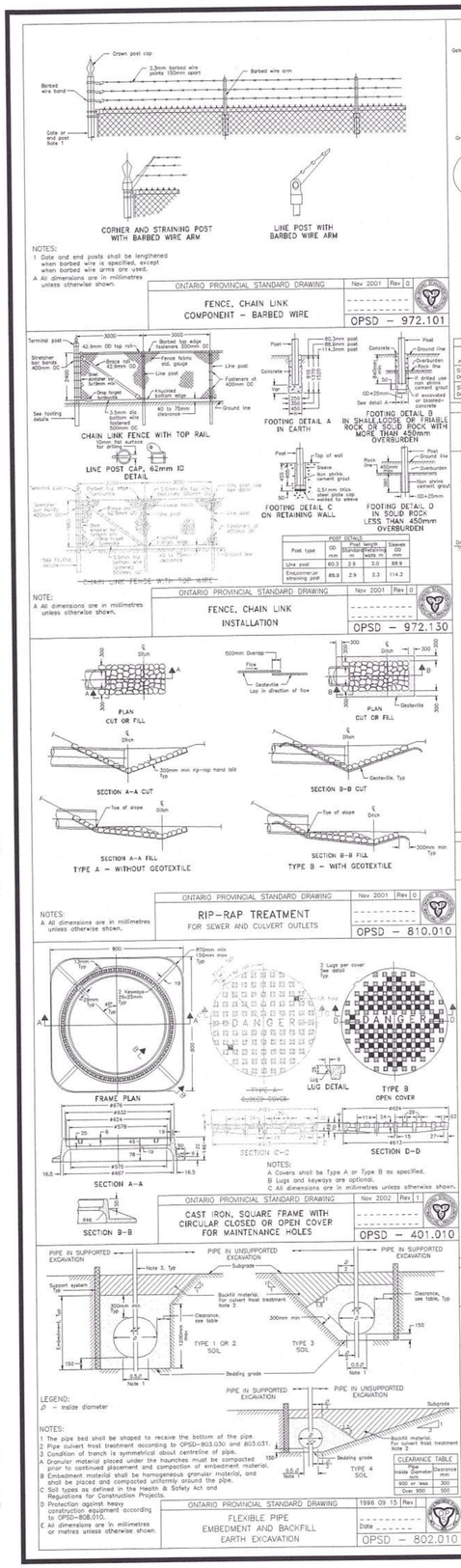
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DRAWN	M de R / JKB	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	6527-C1
APPROVED		PLOT DATE	
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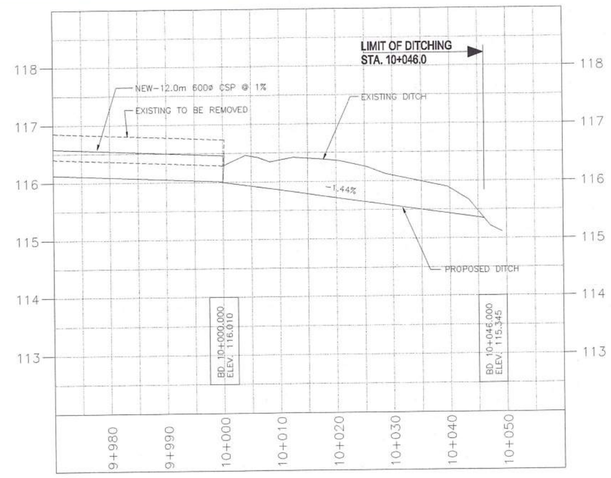
DRAWING

C-3

Plot Date/Time: 10/06/04 08:28am
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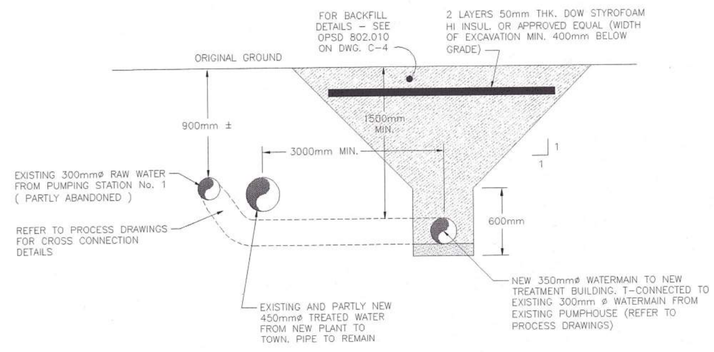
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1 / C-4 **Proposed Offtake Ditch**

Scale: Horiz. 1:500
Vert. 1:50



3 / C-4 **New W/M Trench Detail**

Scale: N.T.S.

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

DITCH DETAILS & OPSD DETAILS

STAMP | NORTH POINT

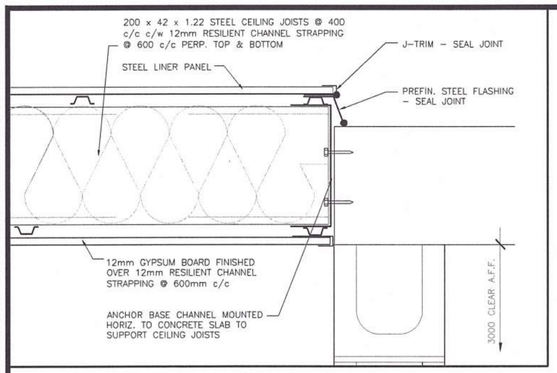
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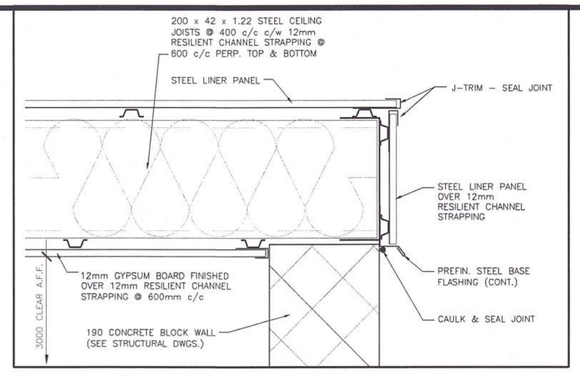
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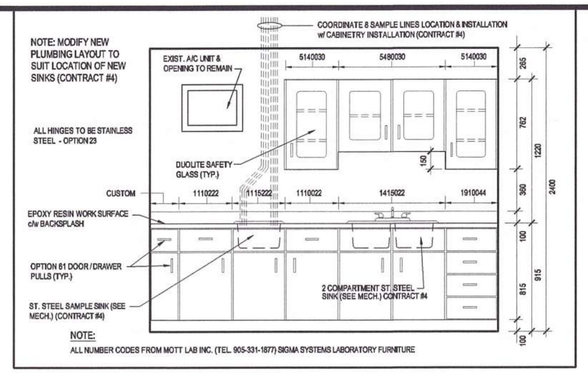
3 A-1 **Ceiling Detail**

SCALE 1 : 5



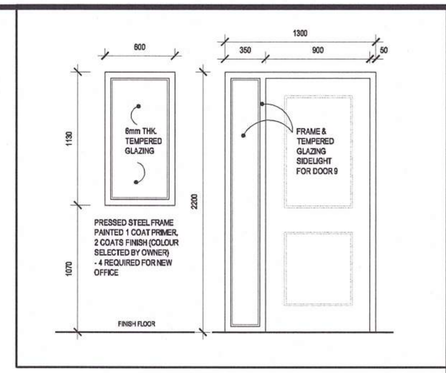
4 A-1 **Ceiling Detail**

SCALE 1 : 5



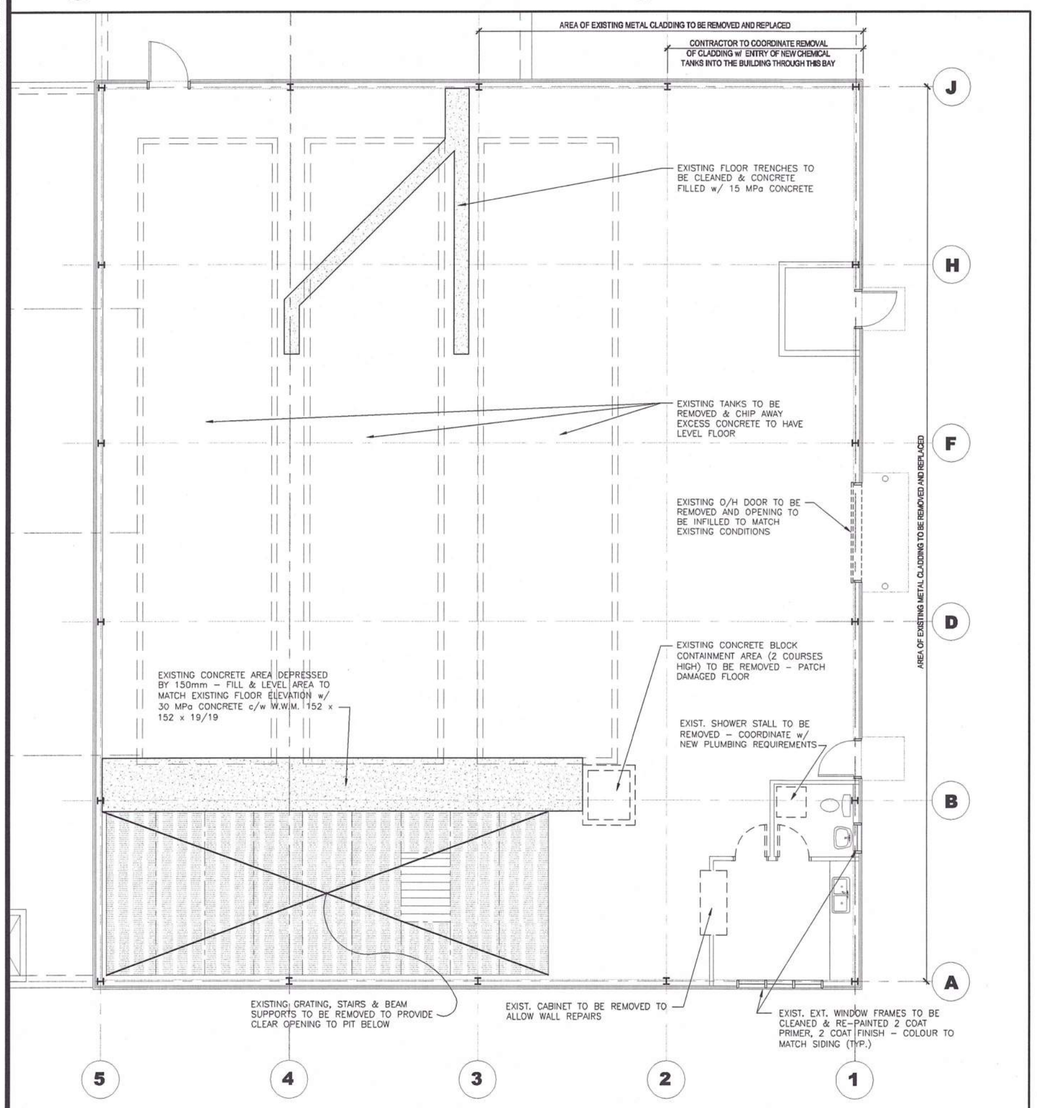
5 A-1 **LAB CABINET ELEVATION**

SCALE 1 : 75



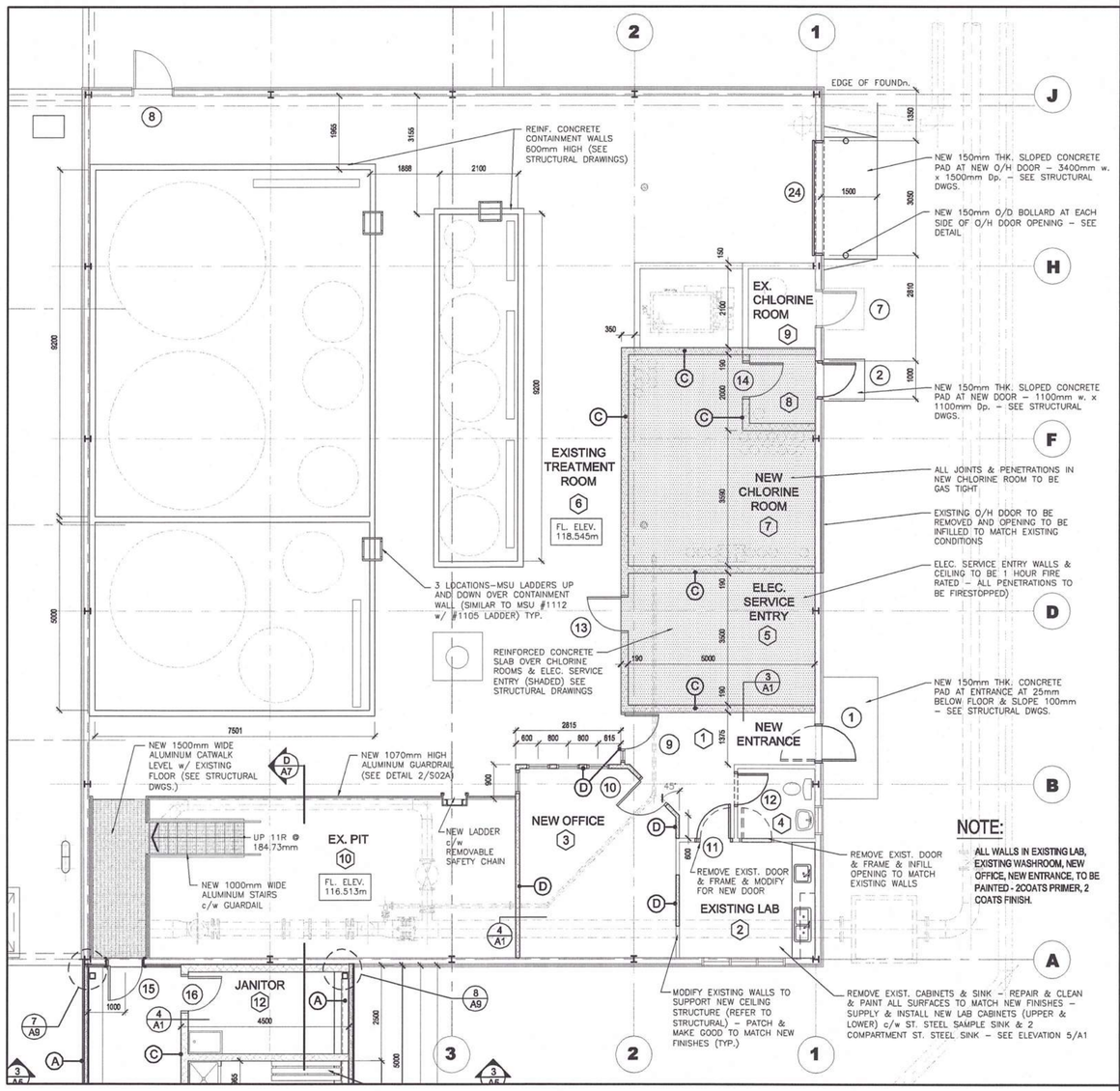
6 A-1 **Interior Windows**

SCALE 1 : 25



2 A-1 **Existing Floor Plan - Demolition & Repair**

SCALE 1 : 75



1 A-1 **Existing Floor Plan Modifications**

SCALE 1 : 75

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PLANT UPGRADES

Deep River, Ontario

DRAWING

FLOOR PLAN
EXISTING MODIFIED

STAMP

NORTH POINT

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SCALE	AS SHOWN		

DRAWING

A-1

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NEW 150mm THK. SLOPED CONCRETE PAD AT NEW O/H DOOR – 3400 w. x 1500 Dp. – SEE STRUCTURAL DWGS.

NEW 150mm THK. SLOPED CONCRETE PAD AT NEW DOOR – 1200mm w. x 1200mm Dp. – SEE STRUCTURAL DWGS.

NOTE: CAULK & SEAL ALL JOINTS w/ FIRE RATED SEALANT TO MAINTAIN FIRE SEPERATION

FLOOR ACCESS HATCH c/w CURB AT PERIMETER (SEE STRUCTURAL)

CYCLONE ROOM 16

ELECTRICAL / M.C.C ROOM 15

BLOCK WALL ABOVE TANK TO U/S OF ROOF

CONCRETE BASE SUPPORTS FOR EQUIP. (SEE STRUCT. & PROCESS DWGS.)

FLOC. TANK

FLOC. TANK

ALUMINUM PLATFORM c/w GUARDRAIL ELEV. 118.408 (SEE SSTRUCTURAL)

1200x1200 SERVICE HATCH SEE STRUCTURAL DWGS.

SETTLING

WASTEWATER AREA 14

CONC. HOUSEKEEPING PADS – SEE PROCESS & STRUCTURAL DWGS.

UP 8R @ 143.125

DN 26R @ 189.85

FILTER WEIR TROUGH OUTLET SEE PROCESS DWGS.

ALUMINUM STAIRS c/w GUARDRAIL (SEE STRUCTURAL)

FLOOR ACCESS HATCH c/w CURB AT PERIMETER (SEE STRUCTURAL)

CONCRETE BASE SUPPORTS FOR EQUIP. (SEE STRUCTURAL)

NEW TREATMENT ROOM 13

FL. ELEV. 120.654m

UP 19R @ 189.47

FILTER #1

FILTER #2

FILTER #3 (FUTURE)

ACTIFLOW CLARIFIER #1

ACTIFLOW CLARIFIER #2

ACTIFLOW CLARIFIER #3

FLOOR ACCESS HATCH c/w CURB AT PERIM. (SEE STRUCTURAL)

JANITOR 12

SHOWER

140mm W. BLOCK WALL TO SUIT SHOWER HEIGHT

NEW BENCH SEE 9/A-9

NEW 1065mm HIGH ALUMINUM GUARDRAIL AT UPPER LEVEL

4 LOCKERS SEE SPECS.

STORAGE AREA 11

FL. ELEV. 118.545m

NEW 1100mm WIDE ALUMINUM STAIRS c/w GUARDAIL

STEP FOUNDn. – SEE STRUCTURAL

UP 11R @ 191.73

FLOOR ACCESS HATCH c/w CURB AT PERIMETER (SEE STRUCTURAL)

NEW 150mm THK. SLOPED CONCRETE PAD AT NEW O/H DOOR – 3400 w. x 1500 Dp. – SEE STRUCTURAL DWGS.

NEW 150mm O/D BOLLARD AT EACH SIDE OF O/H DOOR OPENING – SEE DETAIL

NEW 150mm THK. SLOPED CONCRETE PAD AT NEW DOOR – 1200 w. x 1200 Dp. – SEE STRUCTURAL DWGS.

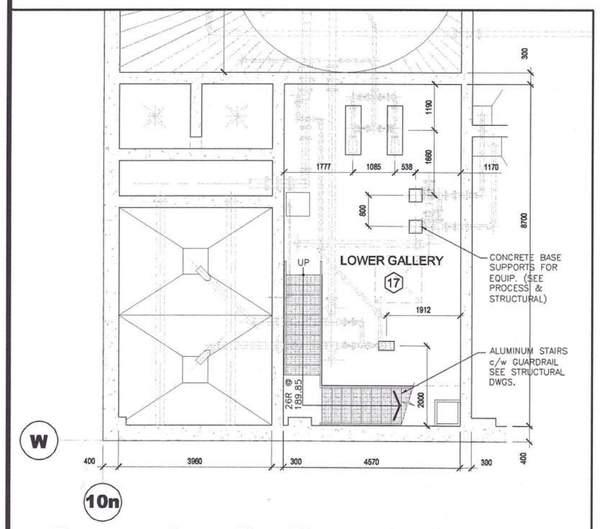
SIMILAR

FLOOR ACCESS HATCH c/w CURB AT PERIMETER (SEE STRUCTURAL)

SIMILAR

1 A-2 Upper Floor Plan

SCALE 1 : 75



2 A-2 Lower Floor Plan - fl. elev. = 115.718m

SCALE 1 : 75

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

FLOOR PLAN
NEW ADDITION

STAMP

NORTH POINT

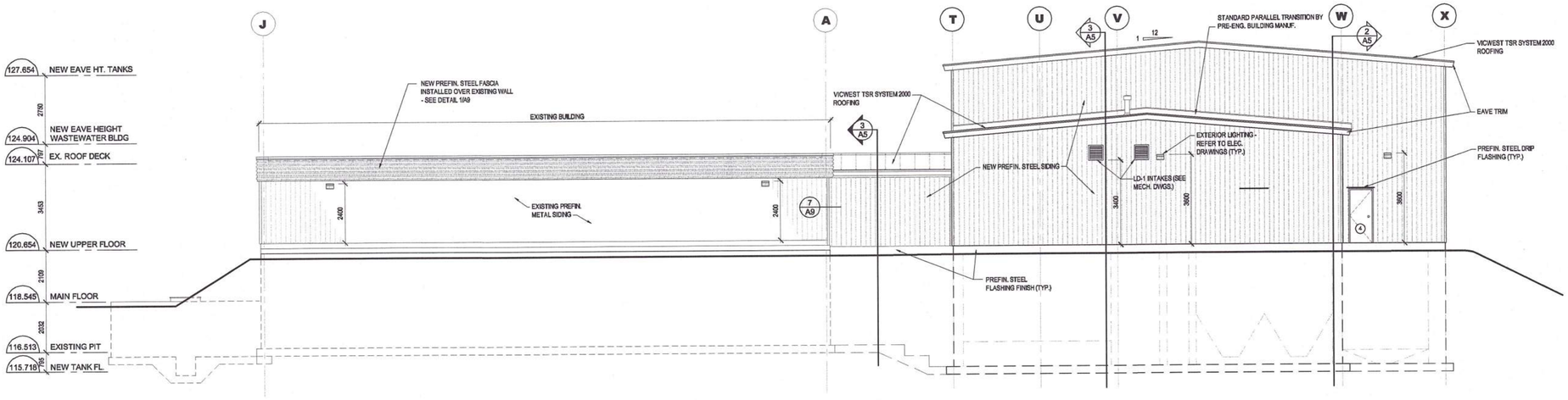
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APPROVED		PLOT DATE	06/29/05
SCALE	AS SHOWN		

DRAWING

A-2

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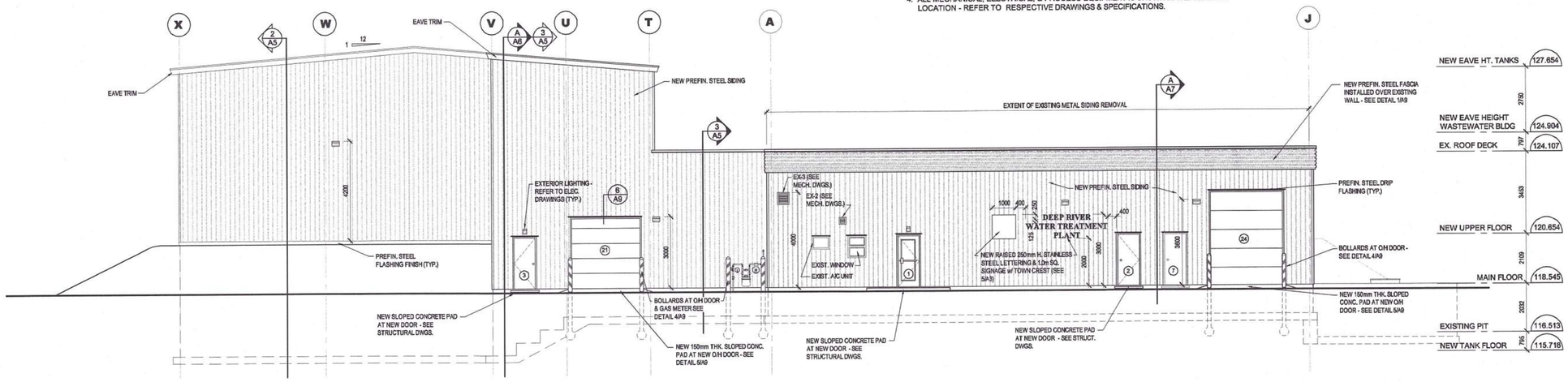


1 / A-3 West Elevation

SCALE 1 : 100

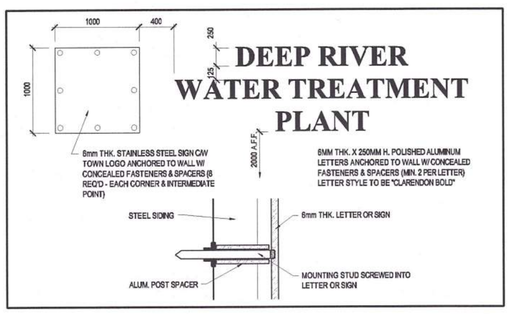
GENERAL NOTES:

1. REFER TO DOOR & WINDOWS SCHEDULES FOR TYPES & SIZES
2. GROUND FLOOR ELEVATION IS GEODETIC AT 118.545m - FOR SITE GRADING AT PERIM. OF BUILDING REFER TO CIVIL DRAWINGS FOR SITEWORKS
3. ALL BUILDING FINISHES ARE NOTED GENERALLY - REFER TO SPECIFICATIONS
4. ALL MECHANICAL, ELECTRICAL, & PROCESS EQUIPMENT IS SHOWN IN THE GENERAL LOCATION - REFER TO RESPECTIVE DRAWINGS & SPECIFICATIONS.



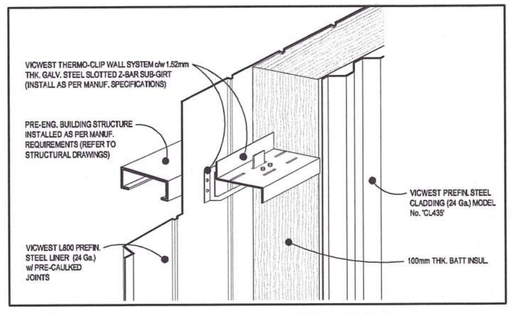
2 / A-3 East Elevation

SCALE 1 : 100



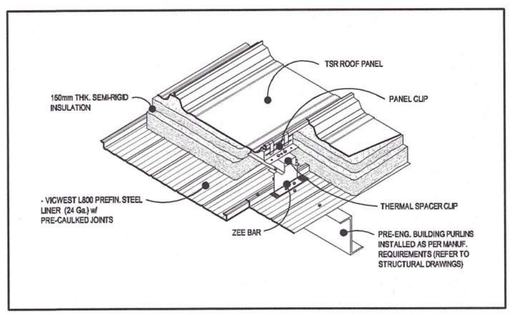
5 / A-3 Signage Installation Detail

SCALE 1:2.5



4 / A-3 Vicwest Thermo-Clip Wall System

SCALE N.T.S.



3 / A-3 Vicwest TSR System 2000 Roofing

SCALE N.T.S.

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PLANT UPGRADES

Deep River, Ontario

DRAWING

EAST & WEST ELEVATIONS

STAMP

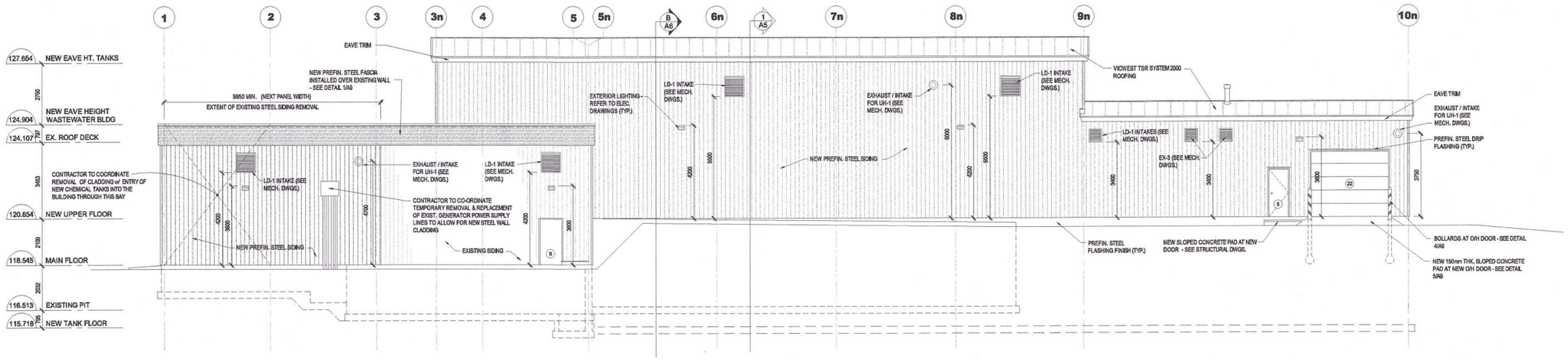
NORTH POINT

No.	DATE	BY	REVISIONS
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APPROVED		PLOT DATE	06/29/05
SCALE	AS SHOWN		
DRAWING			

A-3

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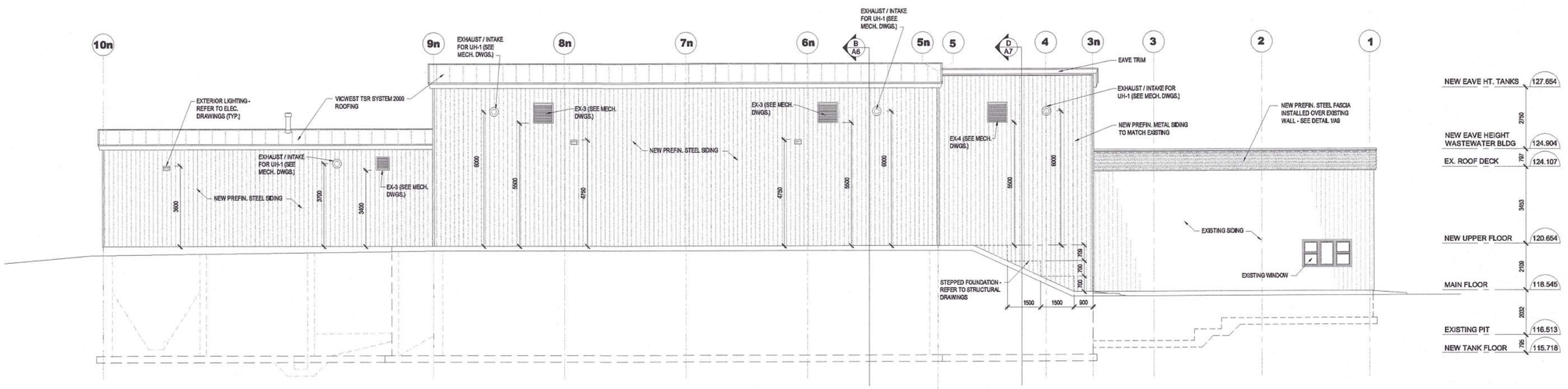


1 / A-4 **North Elevation**

SCALE 1 : 100

GENERAL NOTES:

1. REFER TO DOOR & WINDOWS SCHEDULES FOR TYPES & SIZES
2. GROUND FLOOR ELEVATION IS GEODETIC AT 118.545m - FOR SITE GRADING AT PERIM. OF BUILDING REFER TO CIVIL DRAWINGS FOR SITEWORKS
3. ALL BUILDING FINISHES ARE NOTED GENERALLY - REFER TO SPECIFICATIONS
4. ALL MECHANICAL, ELECTRICAL, & PROCESS EQUIPMENT IS SHOWN IN THE GENERAL LOCATION - REFER TO RESPECTIVE DRAWINGS & SPECIFICATIONS.



2 / A-4 **South Elevation**

SCALE 1 : 100

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PLANT UPGRADES

Deep River, Ontario

DRAWING

NORTH & SOUTH ELEVATIONS

STAMP

NORTH POINT

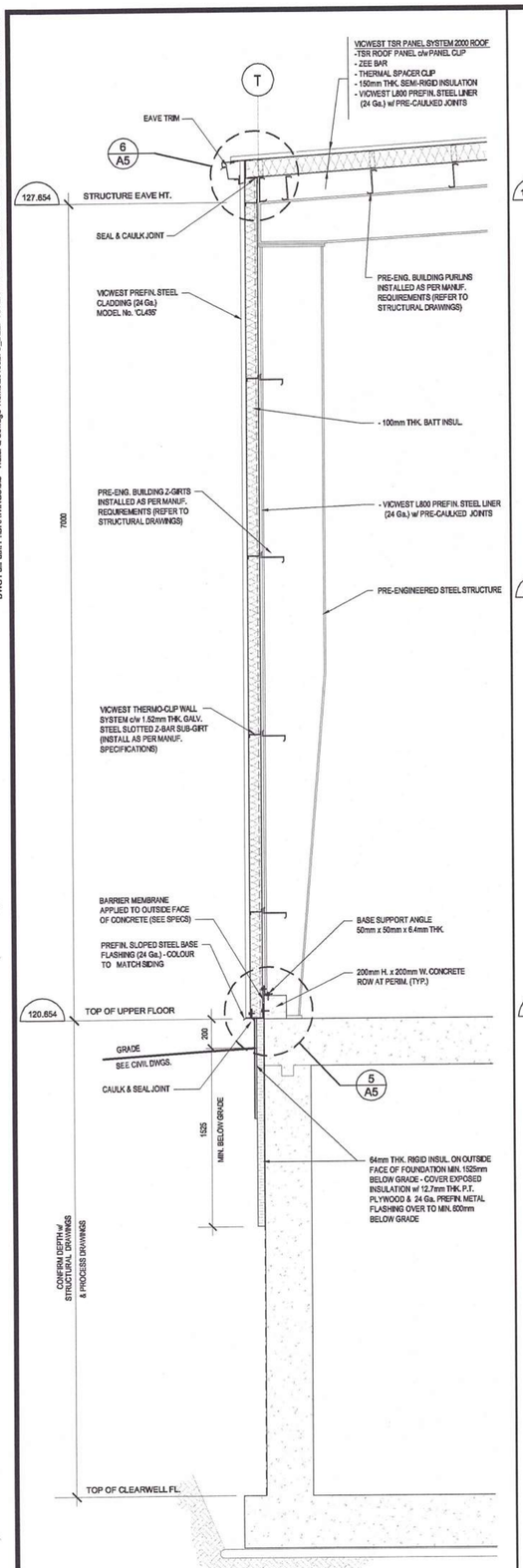
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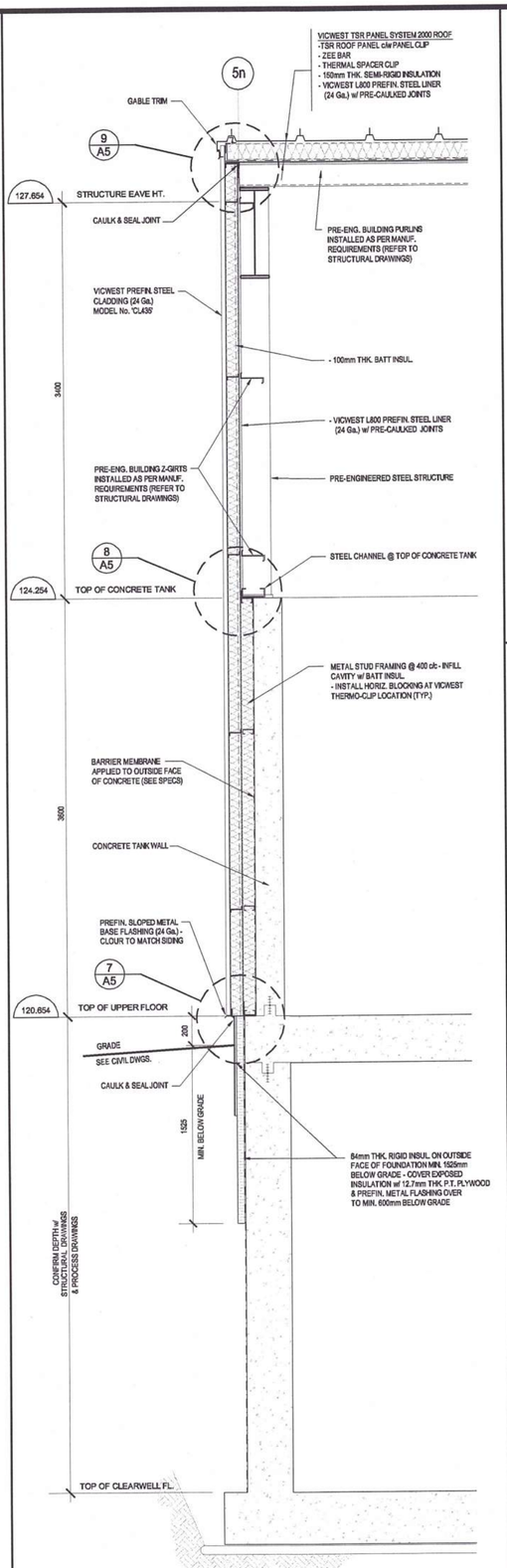
DRAWING

A-4

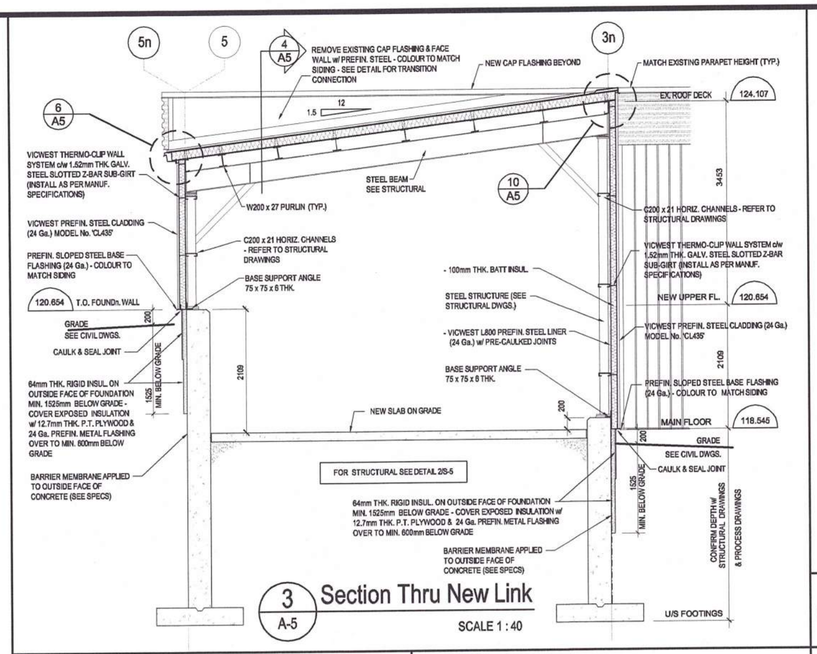
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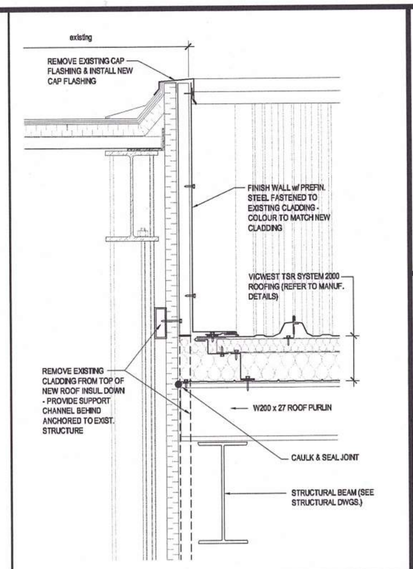
1 A-5 **Typical Wall Section** SCALE 1 : 25



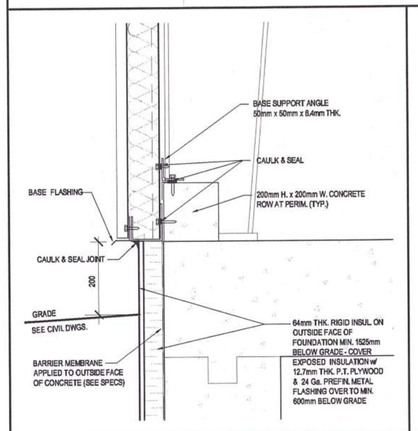
2 A-5 **Wall Section at Clarifier #3** SCALE 1 : 25



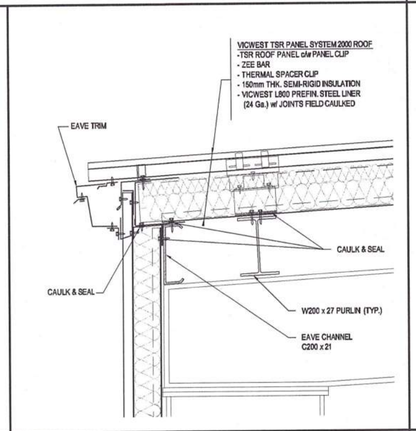
3 A-5 **Section Thru New Link** SCALE 1 : 40



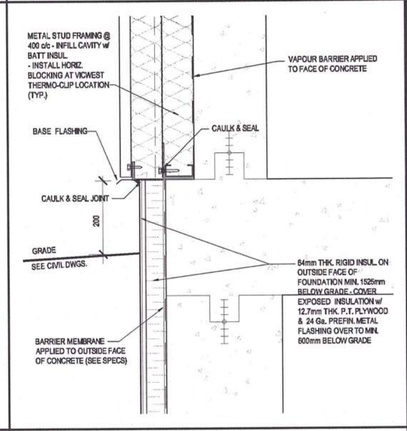
4 A-5 **Sloped Roof to Ex. Wall** SCALE 1 : 10



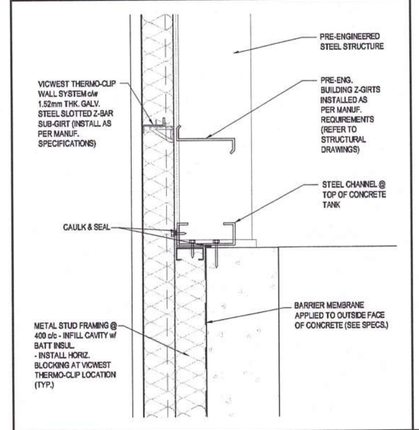
5 A-5 **Base Detail** SCALE 1 : 10



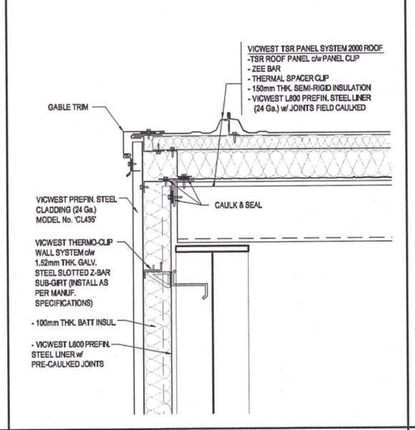
6 A-5 **Eave Detail** SCALE 1 : 10



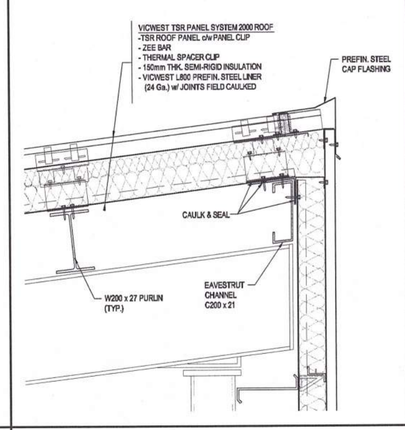
7 A-5 **Base at Conc. Tank Detail** SCALE 1 : 10



8 A-5 **Top of Concrete Tank Detail** SCALE 1 : 10



9 A-5 **Gable Detail** SCALE 1 : 10



10 A-5 **High Eave Detail** SCALE 1 : 10

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PLANT UPGRADES

Deep River, Ontario

DRAWING

TYPICAL WALL SECTIONS

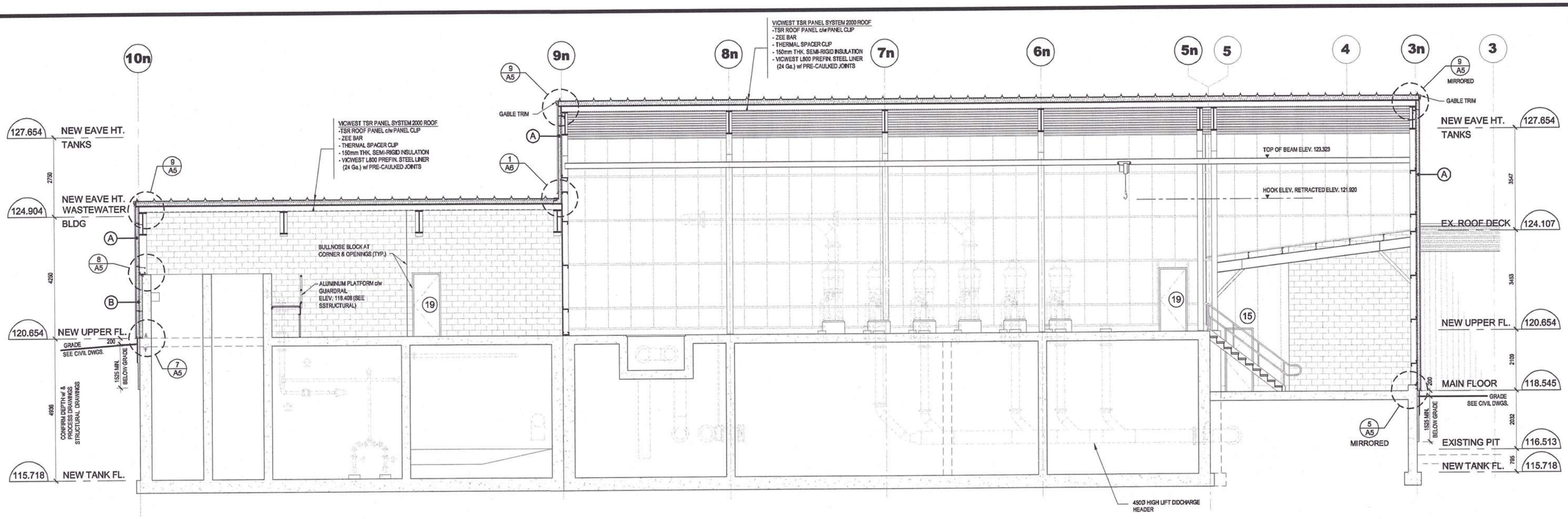
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SCALE	AS SHOWN		

DRAWING **A-5**

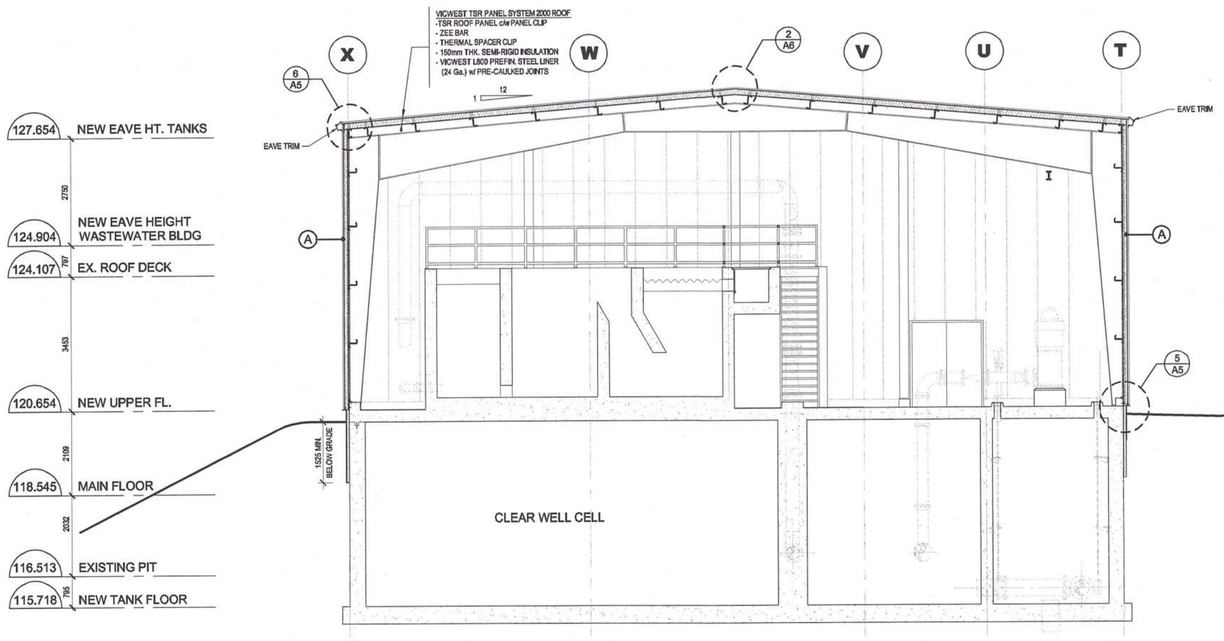
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A
A-6

Section A-A

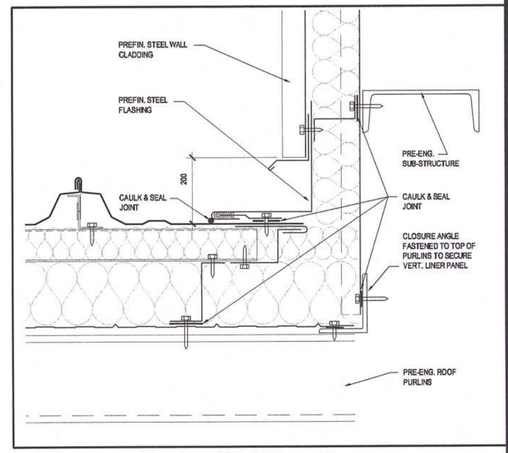
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B
A-6

Section B-B

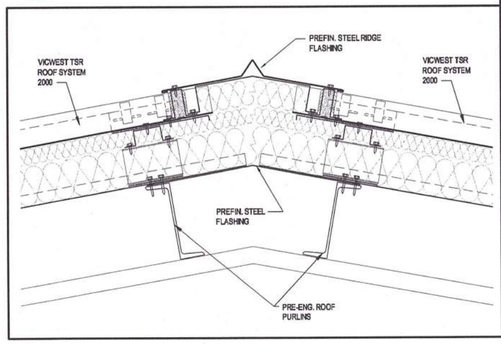
SCALE 1 : 75



1
A-6

Roof to Wall Transition

SCALE 1 : 5



2
A-6

Roof Ridge Detail

SCALE 1 : 5

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PROJECT

DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

BUILDING SECTIONS

STAMP	NORTH POINT

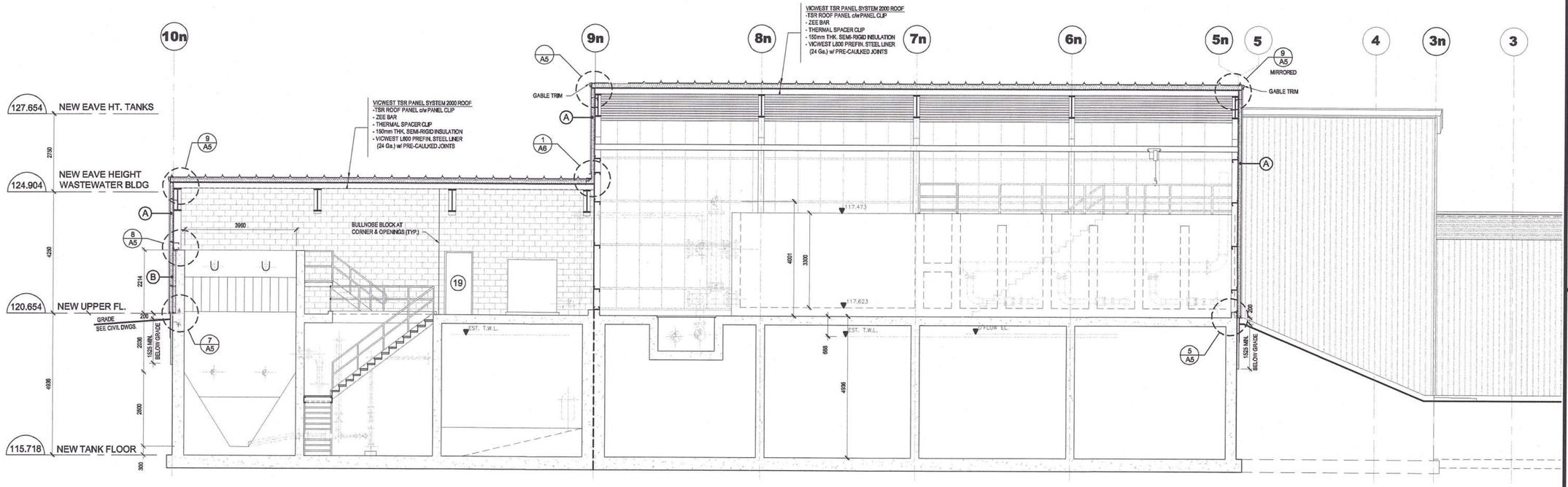
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DRAWN	M de R	PROJECT	2016527B
CHECKED	A.E.E.	ACAD #	SITEPLAN
APPROVED		PLOT DATE	06/29/05
SCALE	AS SHOWN		

DRAWING

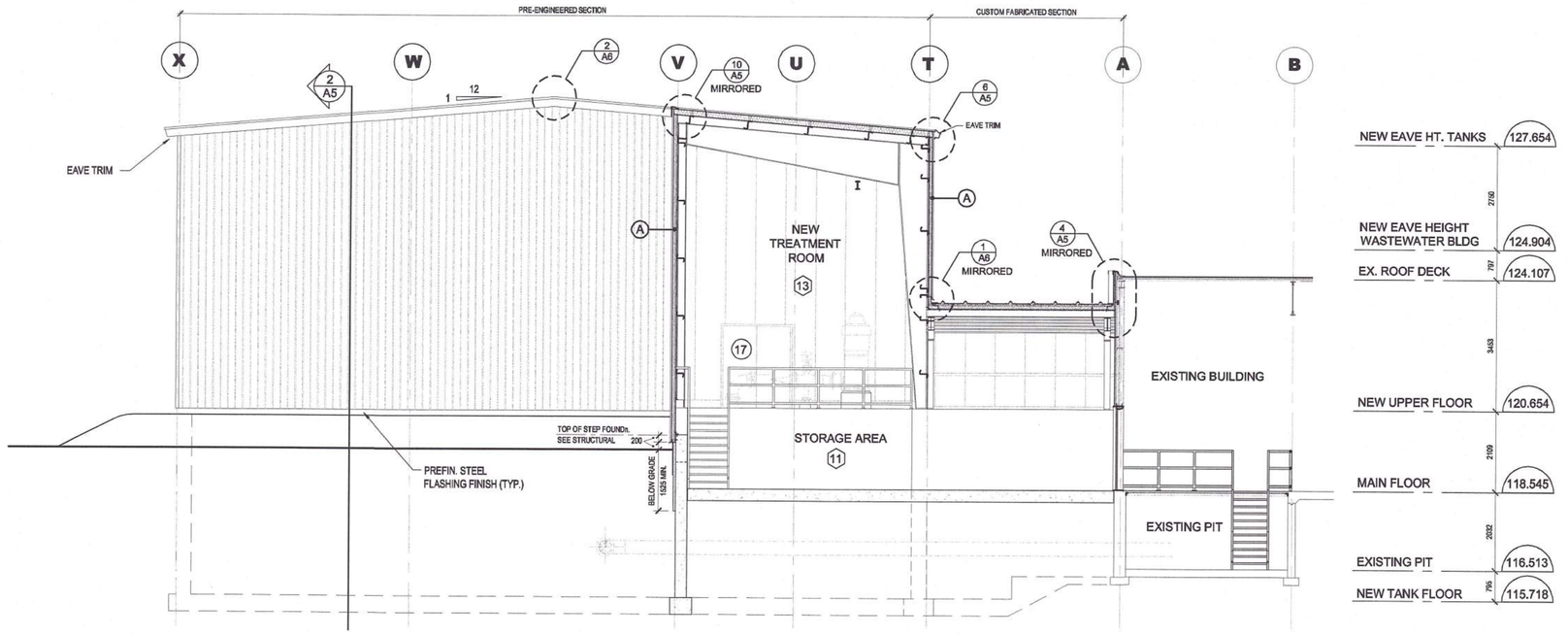
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C / A-7 Section C-C

SCALE 1 : 75



D / A-7 Section D-D

SCALE 1 : 75

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

BUILDING SECTIONS

STAMP

NORTH POINT

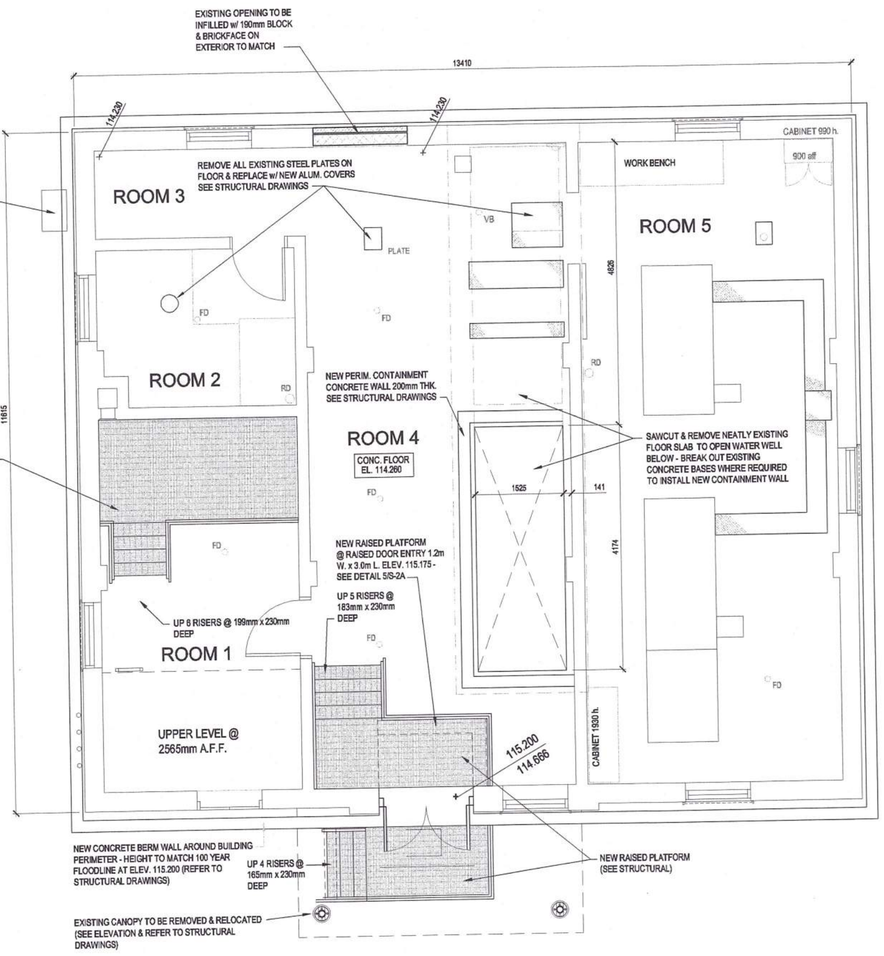
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1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

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DRAWN	M de R	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	SITEPLAN
APPROVED		PLOT DATE	06/29/05
SCALE	AS SHOWN		

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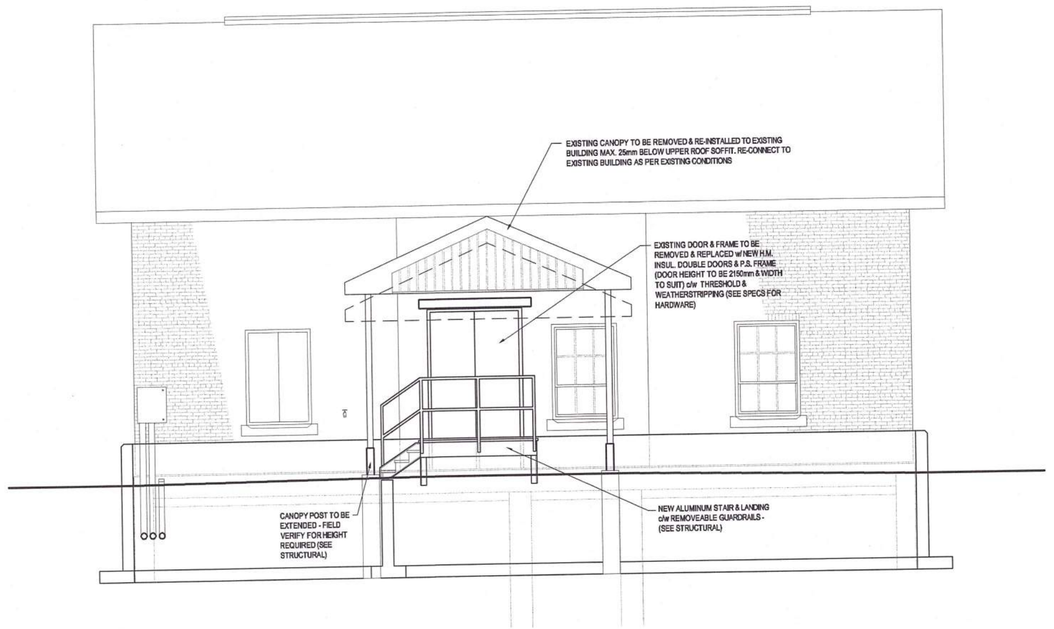
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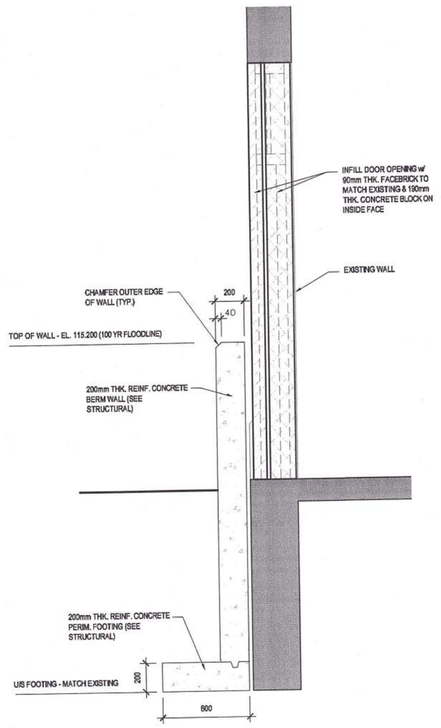
1 / A-8 — Existing Pumphouse Modifications

SCALE 1 : 50



2 / A-8 — Existing Pumphouse Elevation

SCALE 1 : 100



3 / A-8 — River Side Entrance Infill Detail

SCALE 1 : 20

General Notes:

1. CARRY OUT ALL WORK IN ACCORDANCE W/ O.B.C., ONTARIO PLUMBING CODE, ONTARIO CONSTRUCTION & SAFETY ACT & REGULATIONS, & LOCAL AUTHORITIES HAVING JURISDICTION- CONTRACTOR SHALL OBTAIN ALL PERMITS & PAY ALL FEES FOR INSPECTION OF WORK
2. VERIFY ALL DIMENSIONS & REPORT ANY DISCREPENCIES TO ENGINEER BEFORE PROCEEDING W/ WORK
3. DO NOT SCALE DRAWINGS
4. ALL FOUNDATION WORK & EXCAVATION OPERATIONS TO BE CARRIED OUT IN ACCORDANCE w/ THE SOILS REPORT & SPECIFICATIONS
5. REFER TO THE STRUCTURAL DRAWING S-11 FOR ALL STRUCTURAL ELEMENTS
6. REFER TO SPECIFICATIONS FOR DOOR HARDWARE. REFER TO ELECTRICAL DWGS. FOR ELECTRICAL REQUIREMENTS & REFER TO MECHANICAL DWGS. FOR MECHANICAL REQUIREMENTS

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

EXISTING PUMPHOUSE PLANS, ELEVATIONS & DETAILS

STAMP

NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	A.E.E.	DATE	AUGUST 2005
DRAWN	M de R	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	SITEPLAN
APPROVED		PLOT DATE	06/29/05
SCALE	AS SHOWN		

DRAWING

A-8

DWG FullPath: P:\DRAWINGS\6.5 - Water & Sewage Works\2016527C_DEEP RIVER WTP\ACTIVE DRAWINGS\ARCHITECTURAL\ACTIVE\6527C-ARCH PLANS

ROOM SCHEDULE

NOTE: PAINT & FINISH COLOURS TO BE SELECTED BY OWNER

NAME	#	FLOOR	BASE	WALLS NORTH	WALLS SOUTH	WALLS EAST	WALLS WEST	CEILING	HEIGHT	REMARKS
NEW ENTRANCE	1	3mm V.C. TILE	100mm RUBBER	BLOCK PTD.	PTD. DRYWALL	PTD. DRYWALL	PTD. DRYWALL	T-BAR	2400mm	
EXISTING LAB	2	3mm V.C. TILE	100mm RUBBER	PTD. DRYWALL	PTD. DRYWALL	PTD. DRYWALL	PTD. DRYWALL	T-BAR	2400mm	
NEW OFFICE	3	3mm V.C. TILE	100mm RUBBER	PTD. DRYWALL	PTD. DRYWALL	PTD. DRYWALL	PTD. DRYWALL	T-BAR	2400mm	
WASHROOM	4	3mm V.C. TILE	100mm RUBBER	EXIST. /PAINT	EXIST. /PAINT	EXIST. /PAINT	EXIST. /PAINT	T-BAR	2400mm	EXISTING FINISHES TO BE PAINTED
ELEC. SERVICE ENTRY	5	CONCRETE	---	BLOCK	BLOCK	STEEL LINER	BLOCK	PTD. CONCRETE	3000mm	
EX. TREATMENT RM.	6	EXISTING	---	STEEL LINER	STEEL LINER	STEEL LINER	STEEL LINER	EXISTING	EXISTING	FINISH EX. WALLS w/ NEW STEEL LINER
NEW CHLORINE RM.	7	CONCRETE	---	BLOCK	BLOCK	BLOCK	BLOCK	ST. LINER	3000mm	
NEW CHLORINE ENTRY	8	CONCRETE	---	BLOCK	BLOCK	BLOCK	BLOCK	ST. LINER	3000mm	
EX. CHLORINE RM.	9	EXISTING	---	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	
EX. PIT	10	EXISTING	---	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	
STORAGE AREA	11	CONCRETE	---	STEEL LINER	STEEL LINER	STEEL LINER	CONC./ST. LINER	STEEL LINER	6000mm	
JANITOR ROOM	12	CONCRETE	---	STEEL LINER	BLOCK PTD.	STEEL LINER	BLOCK PTD.	STEEL LINER	6000mm	
NEW TREATMENT RM.	13	CONCRETE	---	STEEL LINER	STEEL LINER	STEEL LINER	STEEL LINER	STEEL LINER	VARIES	ST. EAVE HEIGHT AT 7000mm
WASTEWATER AREA	14	CONCRETE	---	C BLK./ST. LINER	STEEL LINER	STEEL LINER	CONCRETE	STEEL LINER	VARIES	ST. EAVE HEIGHT AT 4250mm
ELEC./ M.C.C. ROOM	15	CONCRETE	---	BLOCK	BLOCK	BLOCK	BLOCK	STEEL LINER	VARIES	ST. EAVE HEIGHT AT 4250mm
CYCLONE ROOM	16	CONCRETE	---	STEEL LINER	CONCRETE	BLOCK	STEEL LINER	STEEL LINER	VARIES	ST. EAVE HEIGHT AT 4250mm
LOWER GALLERY	17	CONCRETE	---	CONCRETE	CONCRETE	CONCRETE	CONCRETE	CONCRETE	4635mm	
SHOWER ROOM	18	3mm V.C. TILE	100mm RUBBER	BLOCK PTD.	BLOCK PTD.	BLOCK PTD.	STEEL LINER	STEEL LINER	4635mm	
LOW LIFT STATION	19	CONCRETE	---	STEEL LINER	STEEL LINER	STEEL LINER	STEEL LINER	STEEL LINER	4600mm	

DOOR AND FRAME SCHEDULE

NOTE: CONFIRM DOOR SWINGS WITH FLOOR PLANS

DOOR #	WIDTH	HT.	FROM	TO	SW.	TYPE	REMARKS	FRAME TYPE	FRAME MAT'L	FRAME REMARKS
1	900	2150	EXTERIOR	NEW ENTRANCE	RHR	A	H.M. INSUL. , THERMAL GLAZING	8	PRESSED STEEL	THERMAL BROKEN - INSULATE FRAME
2	900	2150	EXTERIOR	NEW CHLORINE ENTRY	RHR	C	H.M. INSUL.	8	PRESSED STEEL	THERMAL BROKEN - INSULATE FRAME
3	900	2150	EXTERIOR	STORAGE AREA	LHR	C	H.M. INSUL.	1	PRESSED STEEL	THERMAL BROKEN - INSULATE FRAME
4	900	2150	EXTERIOR	NEW TREATMENT RM.	LHR	C	H.M. INSUL.	1	PRESSED STEEL	THERMAL BROKEN - INSULATE FRAME
5	900	2150	EXTERIOR	CYCLONE ROOM	RHR	C	H.M. INSUL.	1	PRESSED STEEL	THERMAL BROKEN - INSULATE FRAME
6	900	2150	EXTERIOR	NEW TREATMENT RM.	LHR	C	H.M. INSUL.	1	PRESSED STEEL	THERMAL BROKEN - INSULATE FRAME
7	EX.	EX.	EXTERIOR	EX. CHLORINE RM.	EX.	EX.	EX.	EX.	PRESSED STEEL	
8	EX.	EX.	EXTERIOR	EX. TREATMENT RM.	EX.	EX.	EX.	EX.	PRESSED STEEL	
9	900	2150	NEW ENTRANCE	EX. TREATMENT RM.	RHR	A	HOLLOW METAL	5	PRESSED STEEL	
10	900	2150	NEW ENTRANCE	NEW OFFICE	RH	A	HOLLOW METAL	3	PRESSED STEEL	
11	900	2150	NEW ENTRANCE	EXISTING LAB	LHR	A	HOLLOW METAL	3	PRESSED STEEL	
12	900	2150	NEW ENTRANCE	WASHROOM	LH	D	HOLLOW METAL "WASHROOM" LOGO	3	PRESSED STEEL	
13	900	2150	EX. TREATMENT RM.	ELEC. SERVICE ENTRY	LHR	C	HOLLOW METAL - 1 HR F.R. LABELED	2	PRESSED STEEL	1 HR F.R. LABELED
14	900	2150	NEW CHLORINE ENTRY	NEW CHLORINE RM.	RHR	C	H.M. INSUL.	2	PRESSED STEEL	
15	900	2150	EX. TREATMENT RM.	STORAGE AREA	RH	A	HOLLOW METAL	4	PRESSED STEEL	
16	900	2150	STORAGE AREA	JANITOR	LH	C	HOLLOW METAL "JANITOR" LOGO	2	PRESSED STEEL	
17	2-900	2150	NEW TREATMENT RM.	WASTEWATER AREA	RHA	B	G.W.G. VISION PANELS	4	PRESSED STEEL	
18	2-900	2150	WASTEWATER AREA	CYCLONE ROOM	RHA	B	G.W.G. VISION PANELS	2	PRESSED STEEL	
19	900	2150	WASTEWATER AREA	ELEC./ M.C.C. ROOM	LH	C	HOLLOW METAL - 1 HR F.R. LABELED	2	PRESSED STEEL	1 HR F.R. LABELED
20	900	2150	STORAGE AREA	SHOWER ROOM	RH	D	HOLLOW METAL "SHOWER" LOGO	2	PRESSED STEEL	
21	3050	3050	STORAGE AREA	EXTERIOR	O/H	E	75mm H.D. TRACK, MOTOR OP., ALL ACC.	6	PRESSED STEEL	STANDARD PRE-ENG. FRAMING
22	3660	3050	CYCLONE ROOM	EXTERIOR	O/H	E	75mm H.D. TRACK, MOTOR OP., ALL ACC.	6	PRESSED STEEL	STANDARD PRE-ENG. FRAMING
23	2-(F. V.)	2150	EX. PUMPHOUSE	EXTERIOR FRONT	RHRA	C	H.M. INSUL.-(F.V.) FIELD VERIFY	BOLT TO EX.	PRESSED STEEL	THERMAL BROKEN - INSULATE FRAME
24	3050	3965	EX. TREATMENT RM.	EXTERIOR	O/H	E	75mm H.D. TRACK, MOTOR OP., ALL ACC.	9	PRESSED STEEL	STANDARD PRE-ENG. FRAMING

WALL TYPES

i - DENOTES BATT INSUL. FOR SOUND BARRIER

- DENOTES FIRE RESISTANCE RATING

A — VICWEST THERMO-CLIP SYSTEM c/w
- VICWEST PREFIN. STEEL CLADDING MODEL No. 'CL435'
- 100mm THK. BATT INSUL.
- VICWEST THERMO-CLIP WALL SYSTEM c/w 1.52mm THK. GALV. STEEL SLOTTED Z-BAR SUB-GIRT (INSTALL AS PER MANUF. SPECIFICATIONS)
- VICWEST L800 PREFIN. STEEL LINER (24 Ga.) w/ JOINTS FIELD CAULKED

B — VICWEST THERMO-CLIP SYSTEM c/w
- VICWEST PREFIN. STEEL CLADDING MODEL No. 'CL435'
- 100mm THK. BATT INSUL.
- VICWEST THERMO-CLIP WALL SYSTEM c/w 1.52mm THK. GALV. STEEL SLOTTED Z-BAR SUB-GIRT (INSTALL AS PER MANUF. SPECIFICATIONS)
- VICWEST L800 PREFIN. STEEL LINER (24 Ga.) w/ JOINTS FIELD CAULKED

AT CONCRETE TANK WALLS ADD:
- 92 x 40 x 1.22 STEEL STUDS @ 400 c/c
- 100mm THK. BATT INSULATION
- VAPOUR BARRIER APPLIED ON CONCRETE (SEE SPECS.)

C — 190mm CONCRETE BLOCK WALL (BULLNOSE BLOCKS AT ALL EDGES)
- 1 COAT PRIMER, 2 COATS FINISH PAINT BOTH SIDES - COLOUR BY OWNER

D — 140mm CONCRETE BLOCK WALL (BULLNOSE BLOCKS AT ALL EDGES)
- 1 COAT PRIMER, 2 COATS FINISH PAINT BOTH SIDES - COLOUR BY OWNER

E — PREFIN. STEEL LINER PANEL
- 12.7mm RESILIENT CHANNELS @ 610mm o.c.
- 50mm x 92mm STEEL STUDS @ 400mm o.c.
- 12.7mm GYPSUM BOARD FINISHED
- 1 COAT PRIMER, 2 COATS FINISH PAINT BOTH SIDES - COLOUR BY OWNER

F — PREFIN. STEEL LINER PANEL
- PRE-ENG. SUB-STRUCTURE (HORIZ. GIRTS)
- PREFIN. STEEL LINER PANEL

-
- INFILL CAVITY w/ 2 LAYERS MINERAL WOOL BATTS (72 Kg/m³) ROXUL RHT 606 (STAGGERED JOINTS MIN. 300mm)

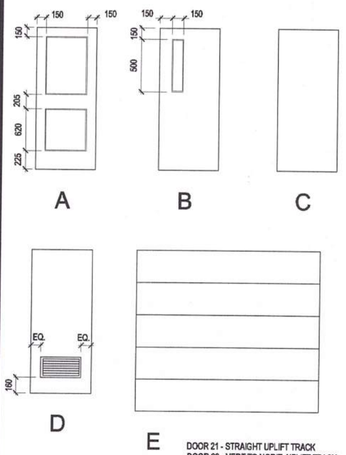
CLADDING PROFILES

VICWEST PREFIN. STEEL CLADDING (24 Ga.) MODEL No. 'CL435' (1015)
⇐ APPROVED EQUIV.:
- IDEAL ROOFING 'UTILITY' PANEL (24 Ga.)
- AGWAY '4-150' (24 Ga.)

VICWEST PREFIN. STEEL CLADDING INSTALLED HORIZ. 'CL6025SR' (24 Ga.) (915)
⇐ APPROVED EQUIV.:
- IDEAL ROOFING 'INDUSTRIAL-METRO' (24 Ga.)
- AGWAY '6-150NP' (24 Ga.)

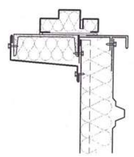
VICWEST PREFIN. STEEL LINER PANEL 'L-800' PRE-CAULKED JOINTS (24 Ga.) (800)
⇐ APPROVED EQUIVALENT:
- IDEAL ROOFING 'SUPREME INTERIOR LINER' PRE-CAULKED JOINTS (24 Ga.)
- AGWAY MODEL No. 'AL-315' PRE-CAULKED JOINTS (24 Ga.)

DOOR TYPES

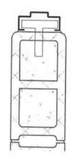


DOOR 21 - STRAIGHT UPLIFT TRACK
DOOR 22 - VERT TO HORIZ. UPLIFT TRACK
DOOR 24 - VERT TO HORIZ. UPLIFT TRACK

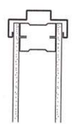
FRAME TYPES



1
- 50mm x 225mm PRESSED ST. FRAME ANCHOR TO PRE-ENG. STRUCTURE
- THERMAL BROKEN & INSULATED
- PRIMED & PAINTED COLOUR BY OWNER
- CAULK JOINTS



2
- 50mm x 172mm PRESSED STEEL FRAME ANCHOR TO BLOCK w/ MASONRY ANCHORS
-PRIMED AND PAINTED COLOUR BY OWNER
- CAULK JOINTS



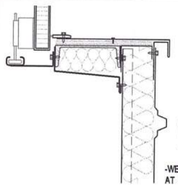
3
-50mm x 145mm P.S. FRAME
-PRIMED AND PAINTED COLOUR BY OWNER
-WRAP AROUND DRYWALL



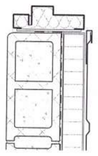
4
- 50mm x 197mm PRESSED ST. FRAME ANCHOR TO PRE-ENG. STRUCTURE
- PRIMED & PAINTED COLOUR BY OWNER
- CAULK JOINTS



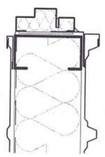
5
- 50mm x 146mm PRESSED ST. FRAME ANCHOR TO STEEL STUDS
- PRIMED & PAINTED COLOUR BY OWNER
- CAULK JOINTS



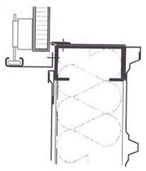
6
-DOOR OPENING TO SUIT DETAILS OF PRE-ENG. STRUCTURE
-PREFIN. STEEL FLASHING OVER P.T. PLYWOOD AT JAMB & HEADER
-WEATHERSTRIPPING AT JAMBS AND HEAD



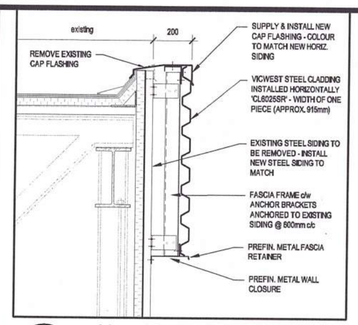
7
- 50mm x 248mm PRESSED ST. FRAME ANCHOR TO BLOCK w/ MASONRY ANCHORS
- THERMAL BROKEN & INSULATED
- PRIMED & PAINTED COLOUR BY OWNER
- CAULK JOINTS



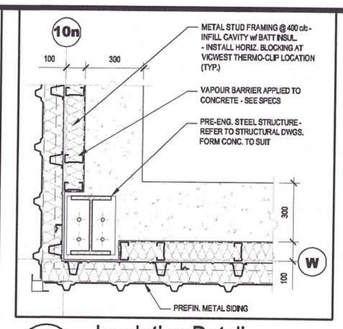
8
- 50mm x 225mm PRESSED ST. FRAME ANCHOR TO PRE-ENG. STRUCTURE
- THERMAL BROKEN & INSULATED
- PRIMED & PAINTED COLOUR BY OWNER
- CAULK JOINTS



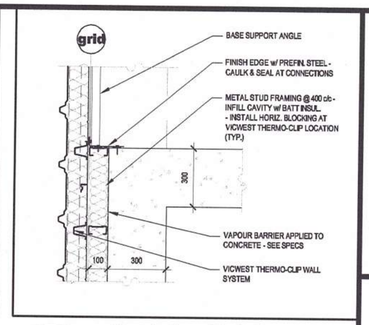
9
-DOOR OPENING TO SUIT DETAILS OF PRE-ENGINEERED STRUCTURE
-PROVIDE PREFIN. FLASHING AROUND DOOR POST
-WEATHERSTRIPPING AT JAMBS AND HEAD



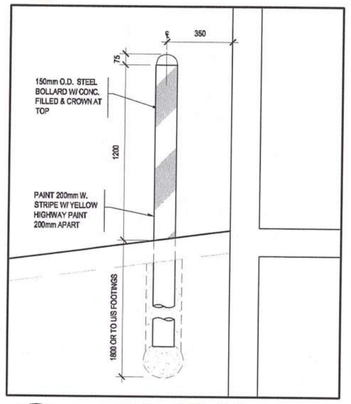
1 / A-9 — New Fascia Detail
SCALE 1 : 15



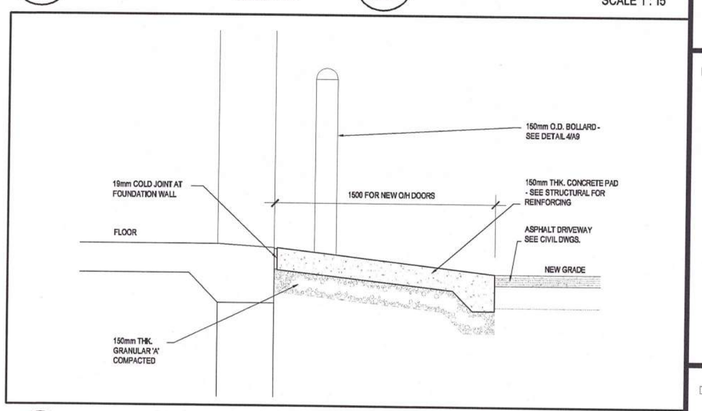
2 / A-9 — Insulation Detail
SCALE 1 : 20



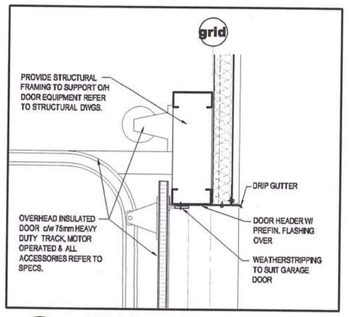
3 / A-9 — Insulation Detail
SCALE 1 : 15



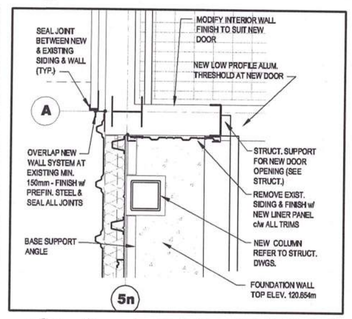
4 / A-9 — Bollard Detail
SCALE 1 : 20



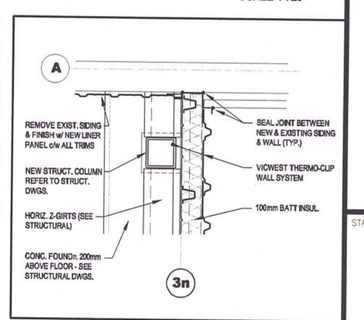
5 / A-9 — SLOPED CONCRETE SLAB DETAIL
SCALE 1 : 20



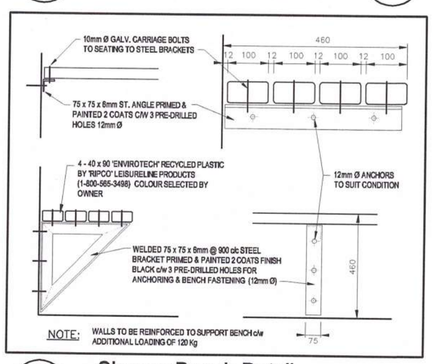
6 / A-9 — O/H Door Header Detail
SCALE 1 : 15



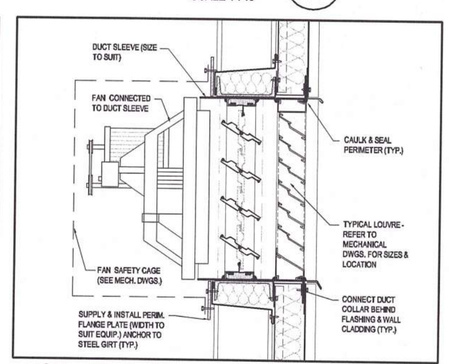
7 / A-9 — New to Existing Wall Detail
SCALE 1 : 15



8 / A-9 — Detail
SCALE 1 : 15



9 / A-9 — Shower Bench Detail
SCALE N.T.S.



10 / A-9 — Typical Louvre & Grille Installation
SCALE 1:5

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

DETAILS & SCHEDULES

STAMP

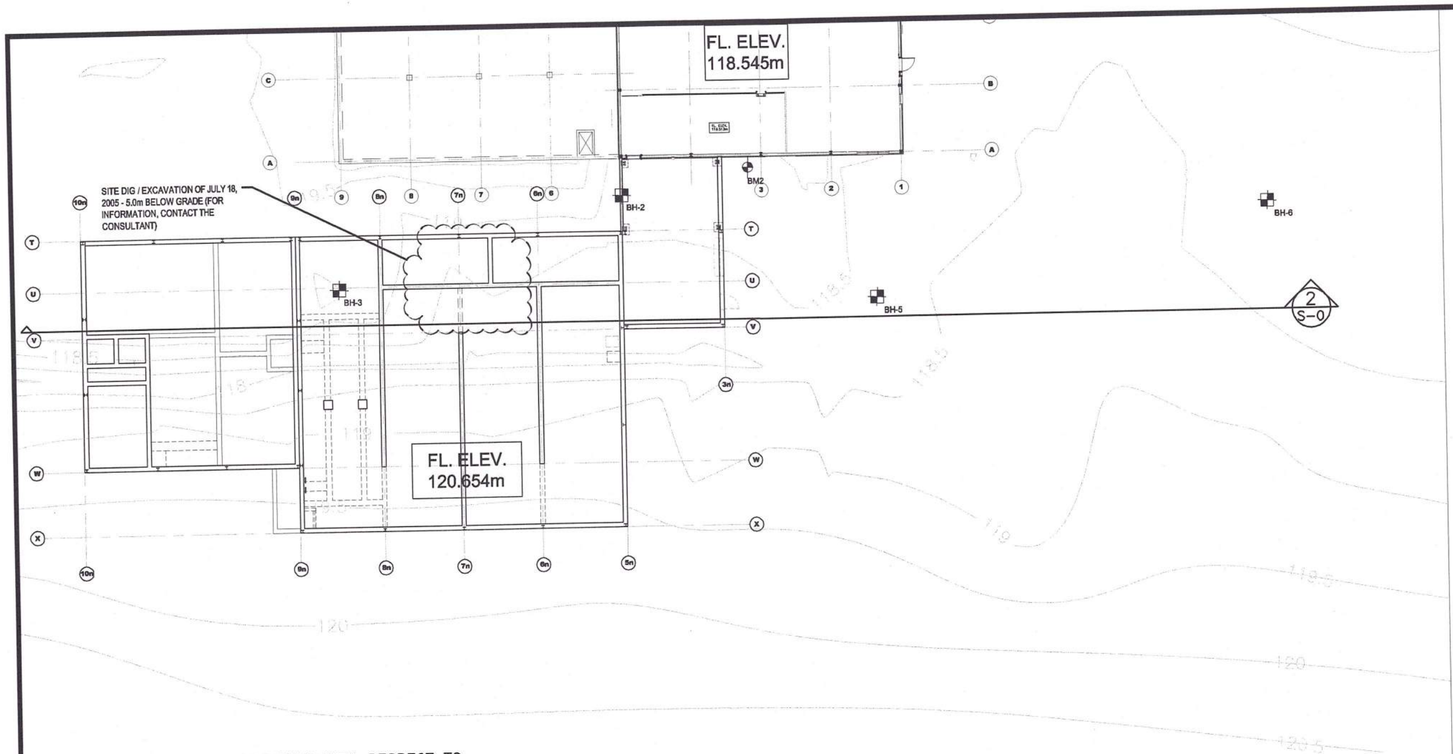
NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	A.E.E.	DATE	SEPT. 2004
DRAWN	M de R	PROJECT	2016527B
CHECKED	A.E.E.	ACAD #	SITEPLAN
APPROVED		PLOT DATE	06/29/05
SCALE	AS SHOWN		

DRAWING

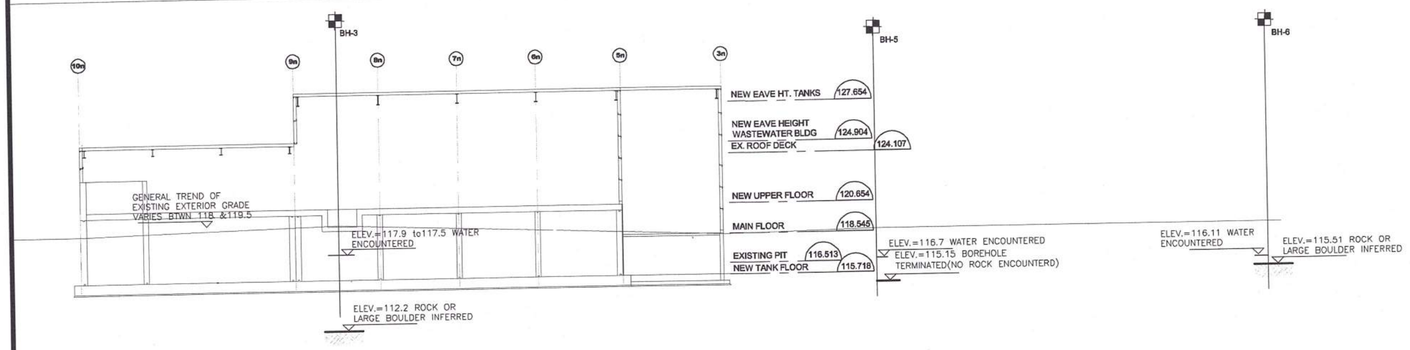
A-9



SUBSURFACE INVESTIGATION WITH RESPECT TO EXISTING TOPOGRAPHY AND PROPOSED MAIN BUILDING STRUCTURE

1 S-0 PLAN

1 : 200



2 S-0 SECTION

1 : 200

GENERAL NOTES:

1. REFER TO SPECIFICATIONS FOR INFORMATION ON SOILS CONDITIONS
2. A SITE DIG / EXCAVATION WAS DONE ON JULY 18th, 2005. NO ROCKS (OVER 0.25m ^{3}) OR BEDROCK WAS FOUND DURING THIS INVESTIGATION. (CONTRACTOR MAY CONTACT CONSULTANT AND ASK FOR MORE DETAILS REGARDING THIS INVESTIGATION)
3. ANY BOULDER REMOVAL (SIZE 0.25m^3 OR OVER) OR ROCK REMOVAL BY MECHANICAL MEANS OR BLASTING SHALL BE DONE IN ACCORDANCE WITH UNIT PRICES INDICATED UNDER PROVISIONAL ITEM.
4. RESPONSIBILITY FOR PROPER DEWATERING OF EXCAVATION SHALL BE SOLELY BY THE CONTRACTOR.

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PLANT UPGRADES

Deep River, Ontario

DRAWING

EXCAVATION CONDITIONS

STAMP

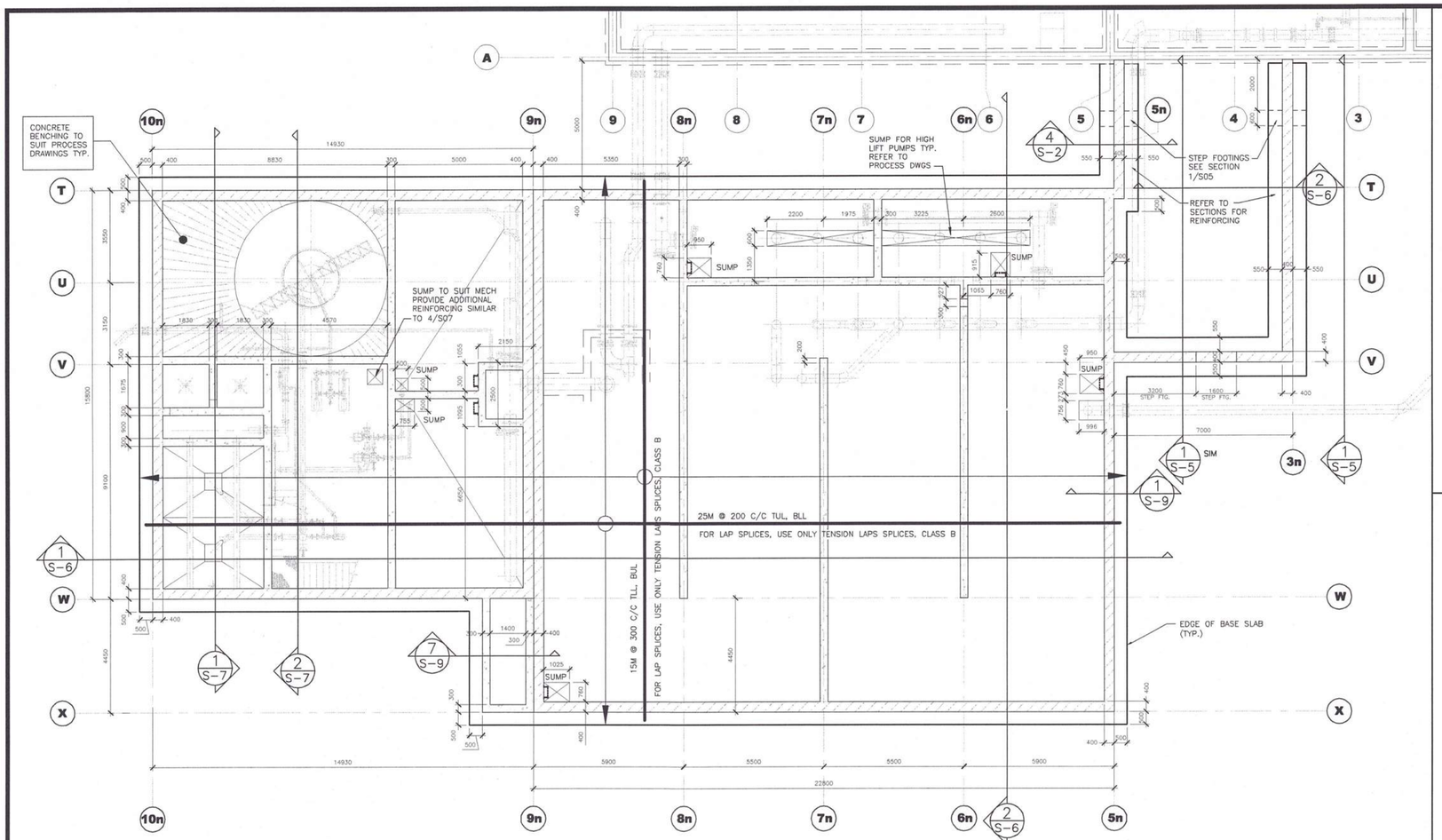
NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	A.E.E.	DATE	AUGUST 05
DRAWN	I.J.F. / M de R	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	
APPROVED		PLOT DATE	08/30/05
SCALE	AS SHOWN		

DRAWING

S-0



1 / S-1 FOUNDATION PLAN
1 : 100

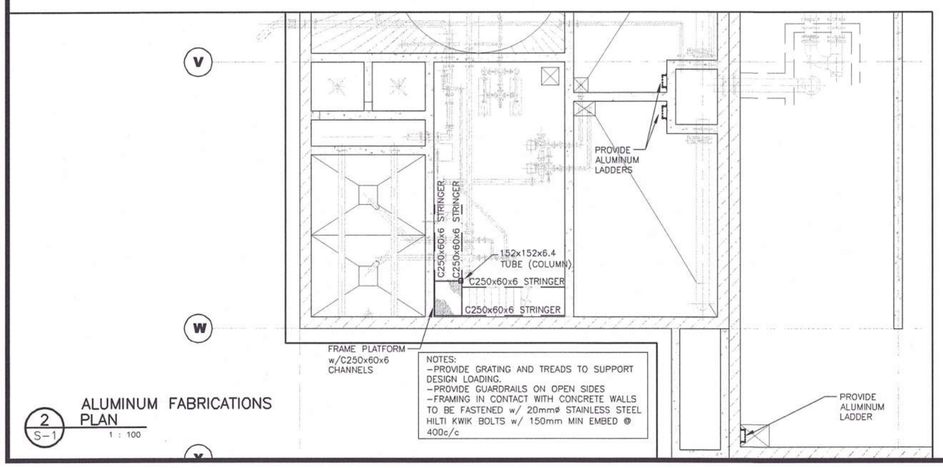
WALL REINFORCING SCHEDULE		
MARK	THICK.	REINFORCING
WALL TYPE 1	400	15M(V) @ 300 c/c E/F + 15M(H) @ 300c/c E/F FACE
WALL TYPE 2	300	15M(V) @ 300 c/c E/F + 15M(H) @ 300c/c E/F FACE

WASTEWATER TREATMENT BUILDING / CLEARWELL HIGH LIFT WELLS BASESLAB TOP OF SLAB ELEVATION 115.718 – SLAB TO BE 450mm THICK

PROCESS PIPING THROUGH WALLS AND SLABS MUST HAVE PUDDLE FLANGE AND/OR THRUST RING CONNECTION CAST INTO THE CONCRETE. BOXING OUT OR SLEEVING OF CONCRETE WILL NOT BE ACCEPTED. REFER TO PROCESS DRAWINGS FOR DETAILS.

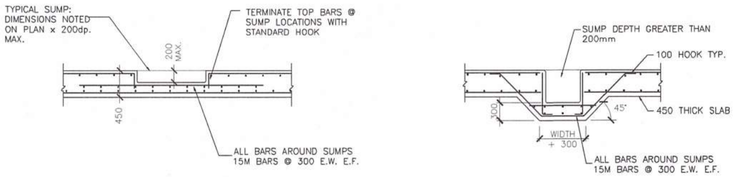
NOTE:

BLL = BOTTOM LOWER LAYER OF REINFORCING
BUL = BOTTOM UPPER LAYER OF REINFORCING
TLL = TOP LOWER LAYER OF REINFORCING
TUL = TOP UPPER LAYER OF REINFORCING



NOTES:
– PROVIDE GRATING AND TREADS TO SUPPORT DESIGN LOADING.
– PROVIDE GUARDRAILS ON OPEN SIDES
– FRAMING IN CONTACT WITH CONCRETE WALLS TO BE FASTENED w/ 20mmø STAINLESS STEEL HILTI KWIK BOLTS w/ 150mm MIN EMBED @ 400c/c

2 / S-1 ALUMINUM FABRICATIONS PLAN
1 : 100



3 / S-1 SUMP SECTIONS
1 : 50

LATERAL LOAD DATA TO BE ACCOMODATED BY THE PRE-ENGINEERED BUILDING DESIGNER

EARTHQUAKE
V = (Ve/R) U
Ve = v S I F W
U = 0.6
R = TO SUIT PRE-ENG BUILDING CONSTRUCTION
v = 0.1
S = 4.2
I = 1.5
F = 1.0
W = WEIGHT OF BUILDING
Za = 4
Zv = 2

WIND
P = q Ce Cp Cg

q = 0.39 kPa (1/100 YEAR WIND)
Ce = 0.9 – 1.1
CpCg = IN ACCORDANCE WITH COMMENTARY B – NBC 1995 STRUCTURAL COMMENTARIES INCLUDING INTERNAL PRESSURE

VERTICAL LOAD DATA

GROUND FLOOR

DEAD LOAD:
= SELF WEIGHT OF SUSPENDED SLAB AND CONCRETE STRUCTURES NOTED ON PLAN + LARGE EQUIPMENT NOTED ON PLAN
SDL = 1.0 kPa (PARTITIONS)
+ 1.5 (M&E)

LL = 14.4 kPa

MEZZANINE WITHIN EXISTING BUILDING

SDL = 1.0 kPa ALL AREAS
+ 1.5 kPa (M&E + CEILING)
LL = 4.8 kPa

ALUMINUM PLATFORMS AND STAIRS
DL = 1.0 kPa
LL = 4.8 kPa

LOW LINK ROOF

SDL = 1.0 kPa
+ 0.5 (M&E)
LL = SNOW DRIFT AS INDICATED

PRE-ENG ROOF

SDL = 0.5 kPa (M&E)
LL = 2.24 kPa + DRIFTING AS NOTED + MONORAIL LOADS (OR IN ACCORDANCE WITH LL's SPECIFIED FOR DEEP RIVER AREA, WICHEVER IS MORE STRINGENT)

SDL = SUPER IMPOSED DEAD LOAD (ie IN ADDITION TO SELF WEIGHT OF STRUCTURE)
LL = LIVE LOAD

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PLANT UPGRADES

Deep River, Ontario

DRAWING

FOUNDATION PLAN & DETAILS

STAMP

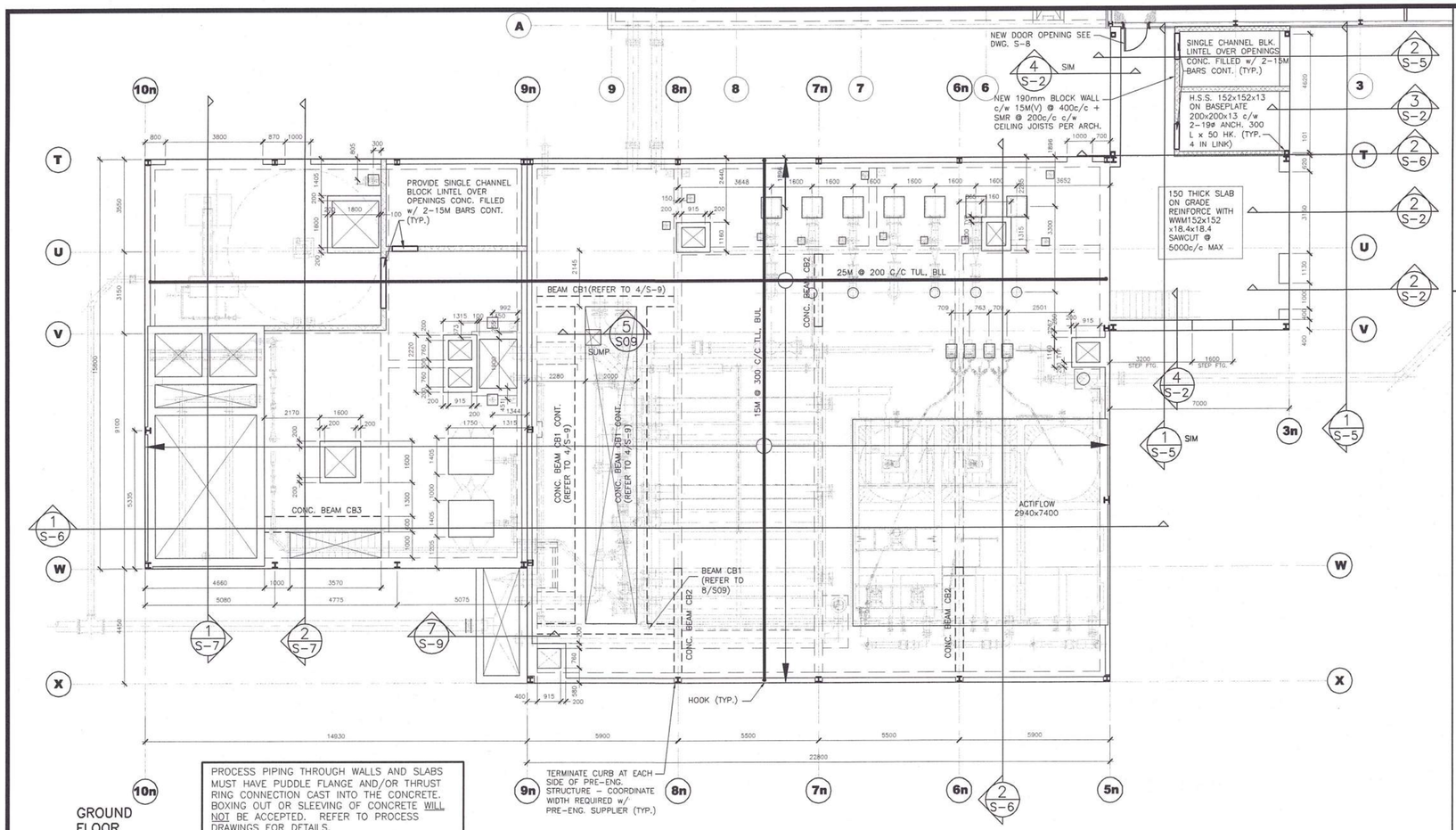
NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	A.E.E.	DATE	AUGUST 05
DRAWN	I.J.F. / M de R	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	
APPROVED		PLOT DATE	09/14/05
SCALE	AS SHOWN		

DRAWING

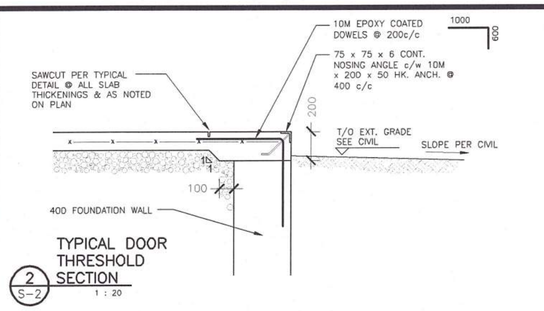
S-1



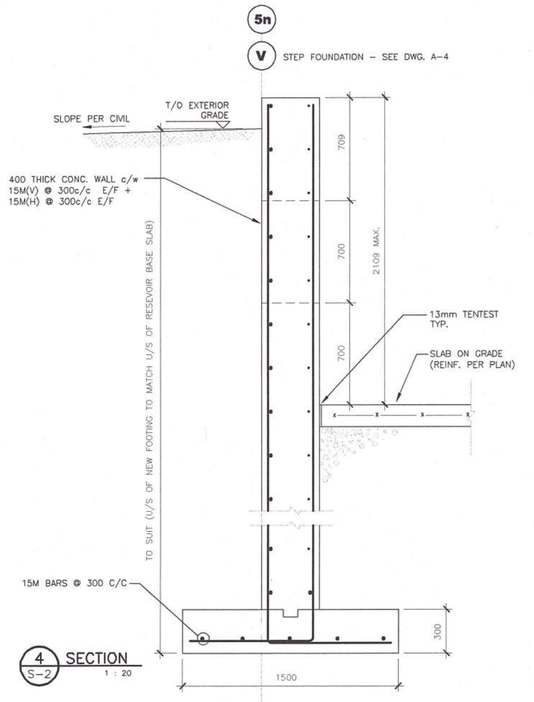
GROUND FLOOR PLAN
1 / S-2 — 1 : 100

PROCESS PIPING THROUGH WALLS AND SLABS MUST HAVE PUDDLE FLANGE AND/OR THRUST RING CONNECTION CAST INTO THE CONCRETE. BOXING OUT OR SLEEVING OF CONCRETE WILL NOT BE ACCEPTED. REFER TO PROCESS DRAWINGS FOR DETAILS.

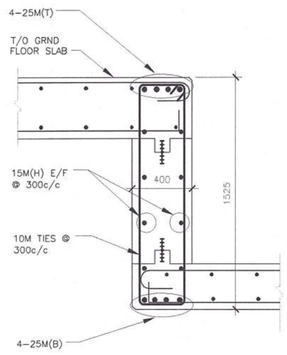
WASTEWATER TREATMENT BUILDING / CLEARWELL
HIGH LIFT WELLS GROUNDSLAB TOP OF SLAB ELEVATION 120.654 – SLAB TO BE 400mm THICK



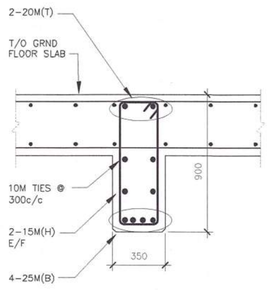
TYPICAL DOOR THRESHOLD SECTION
2 / S-2 — 1 : 20



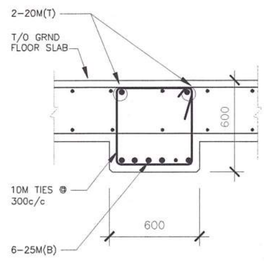
SECTION
4 / S-2 — 1 : 20



CONCRETE BEAM CB1
(OR CHANNEL SIDES)



CONCRETE BEAM CB2



CONCRETE BEAM CB3

CONCRETE BEAM DETAILS
3 / S-2

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PLANT UPGRADES

Deep River, Ontario

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GROUND FLOOR PLAN & DETAILS

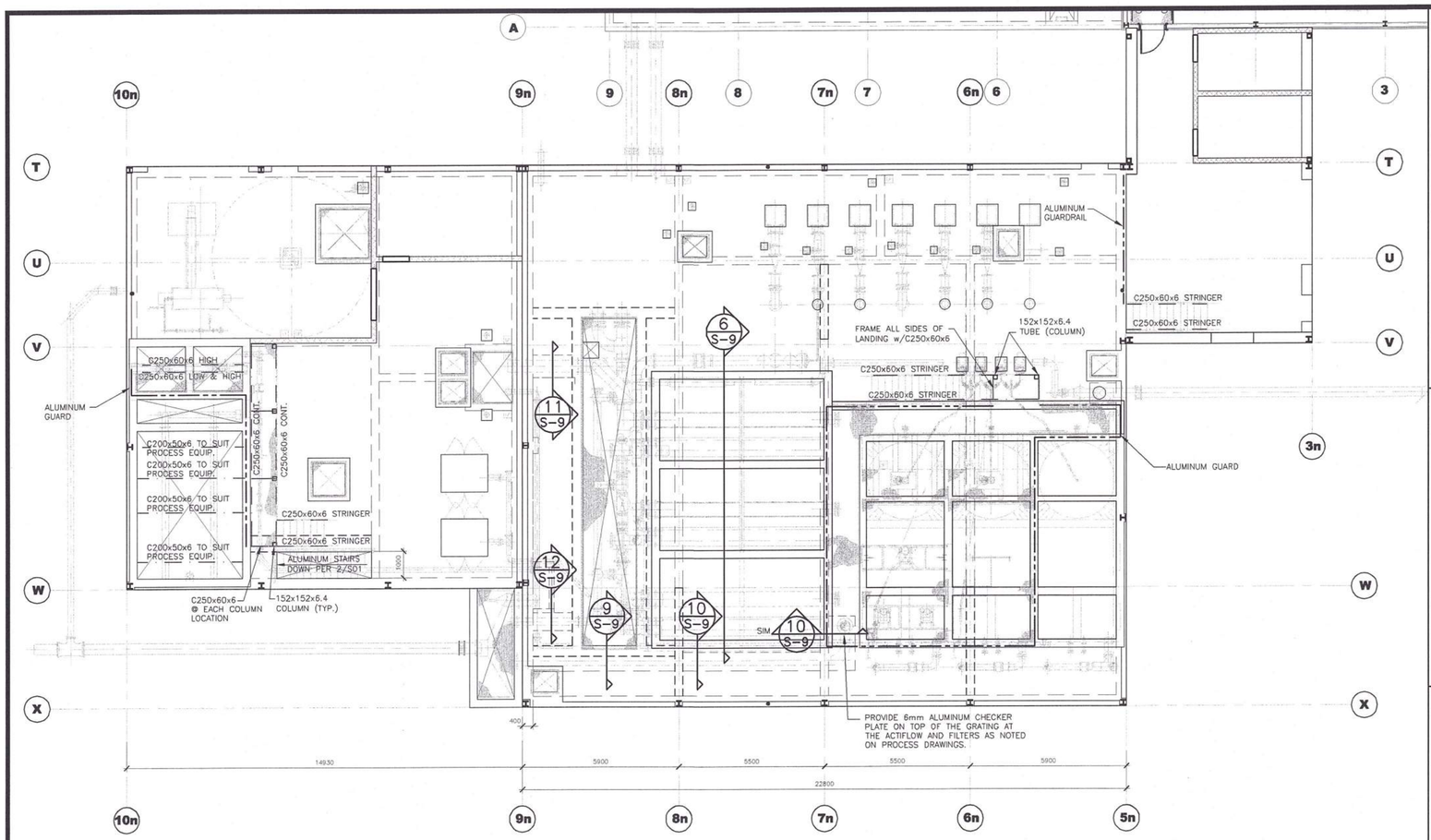
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NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

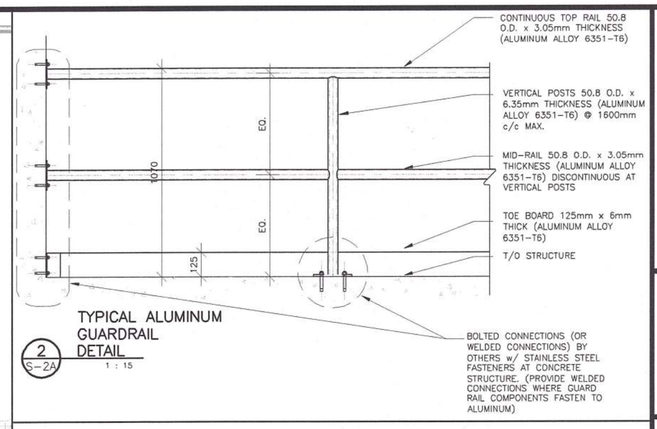
DESIGNED	A.E.E.	DATE	AUGUST 05
DRAWN	I.J.F. / M de R	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	
APPROVED		PLOT DATE	09/14/05
SCALE	AS SHOWN		
DRAWING			

S-2

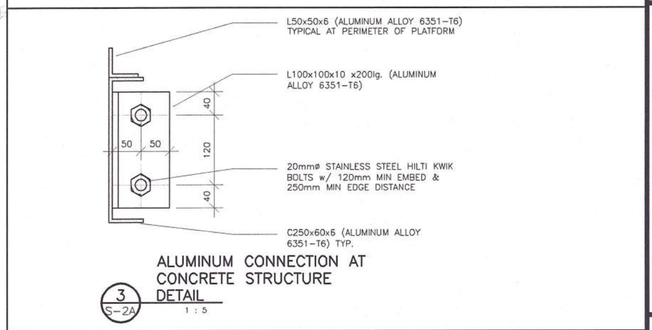


1 S-2A ALUMINUM FABRICATIONS PLAN
1 : 100

NOTES:
- PROVIDE GRATING AND STAIR TREADS TO SUPPORT DESIGN LOADING.
- PROVIDE GUARDRAILS ON OPEN SIDES OF PLATFORMS AND STAIRS
- STAIR AND PLATFORM FRAMING IN CONTACT WITH CONCRETE WALLS TO BE FASTENED w/ 20mmø STAINLESS STEEL HILTI KWIK BOLTS w/ 150mm MIN EMBED @ 400c/c
- ACCESS HATCHES AND LADDERS AS ILLUSTRATED ON PROCESS DRAWINGS. ALL HATCHES TO BE DESIGNED TO SUPPORT THE DESIGN LOADING INDICATED ON THE STRUCTURAL DRAWINGS. LADDERS TO BE COMPLIANT w/ OCCUPATIONAL HEALTH AND SAFETY LOADING REQUIREMENTS.
- ALL ALUMINUM FRAMING COMPONENTS, FLOOR HATCHES AND LADDERS TO BE DESIGNED BY A PROFESSIONAL ENGINEER LICENSED IN ONTARIO AND SUBMITTED THROUGH SHOP DRAWING PROCESS BEARING THE STAMP OF P.ENG.



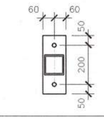
2 S-2A TYPICAL ALUMINUM GUARDRAIL DETAIL
1 : 15



3 S-2A ALUMINUM CONNECTION AT CONCRETE STRUCTURE DETAIL
1 : 5

4 S-2A TYPICAL ALUMINUM PLATFORM DETAIL
1 : 15

TYPICAL ALUMINUM BASE PLATE:
300x120x15 c/w 2-16mmø STAINLESS STEEL HILTI KWIK BOLTS w/ 150mm EMBED



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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

GROUND FLOOR PLAN WITH ALUMINIM & BELOW SLAB ENCASED PIPES

STAMP

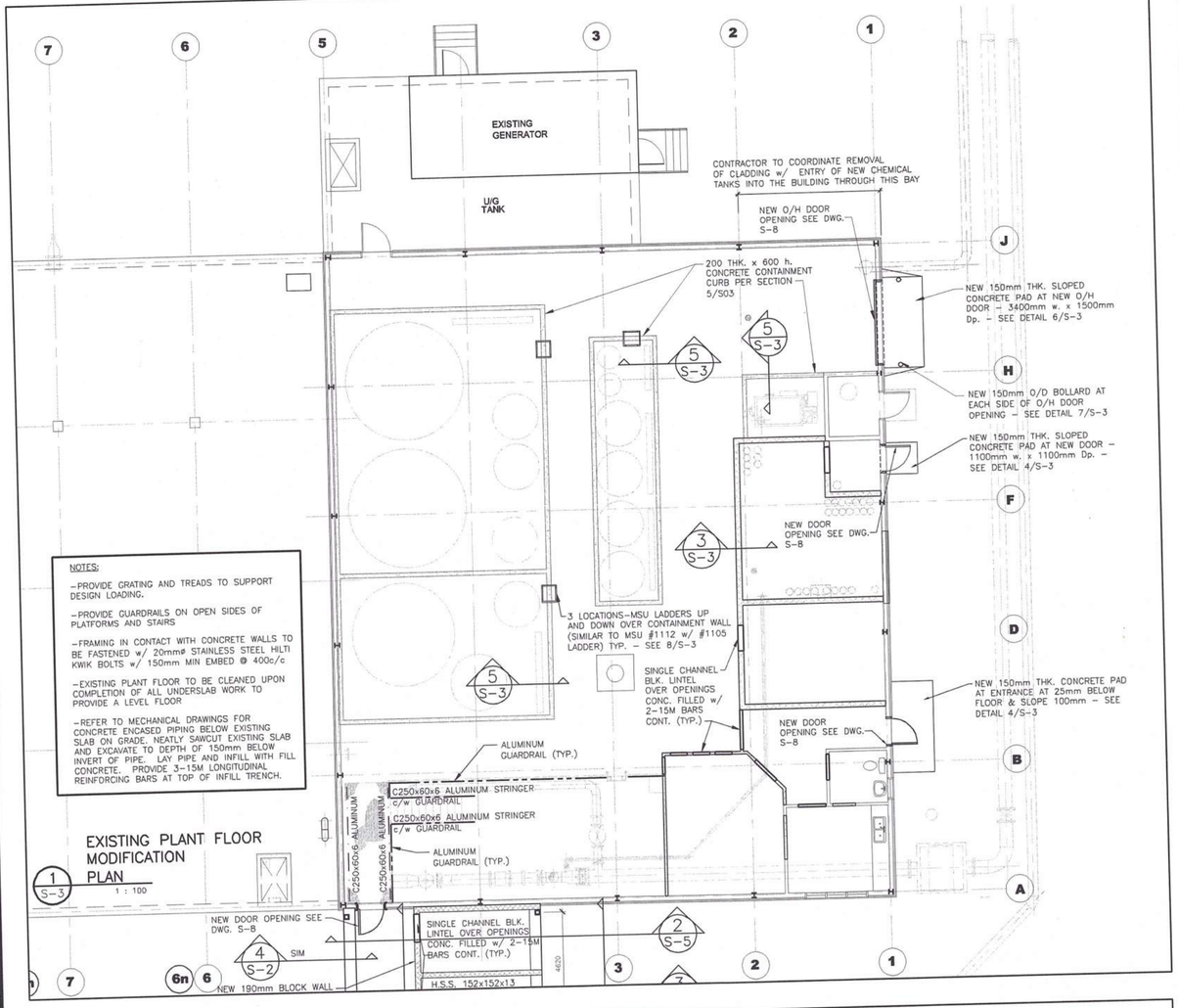
NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	A.E.E.	DATE	AUGUST 05
DRAWN	I.J.F. / M de R	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	
APPROVED		PLOT DATE	09/14/05
SCALE	AS SHOWN		

DRAWING

S-2A

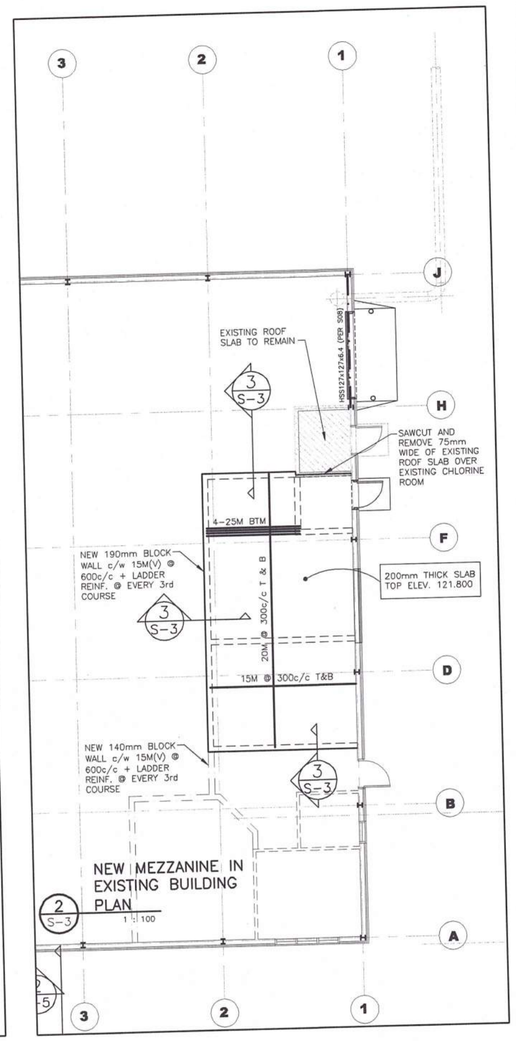


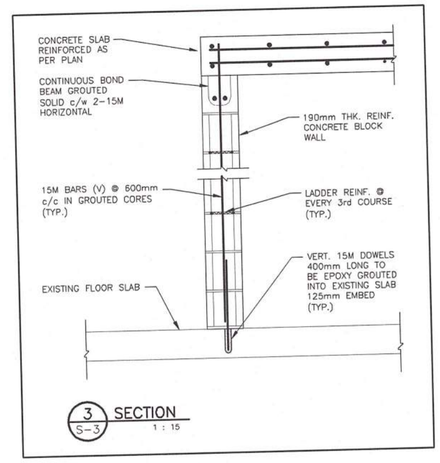
EXISTING PLANT FLOOR MODIFICATION PLAN

1 / S-3 — 1 : 100

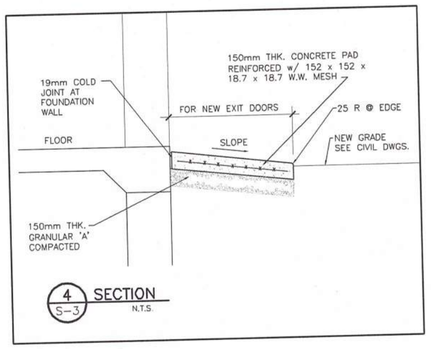
NOTES:

- PROVIDE GRATING AND TREADS TO SUPPORT DESIGN LOADING.
- PROVIDE GUARDRAILS ON OPEN SIDES OF PLATFORMS AND STAIRS
- FRAMING IN CONTACT WITH CONCRETE WALLS TO BE FASTENED w/ 20mmø STAINLESS STEEL HILTI KWIK BOLTS w/ 150mm MIN EMBED @ 400c/c
- EXISTING PLANT FLOOR TO BE CLEANED UPON COMPLETION OF ALL UNDERSLAB WORK TO PROVIDE A LEVEL FLOOR
- REFER TO MECHANICAL DRAWINGS FOR CONCRETE ENCASED PIPING BELOW EXISTING SLAB ON GRADE. NEATLY SAWCUT EXISTING SLAB AND EXCAVATE TO DEPTH OF 150mm BELOW INVERT OF PIPE. LAY PIPE AND INFILL WITH FILL CONCRETE. PROVIDE 3-15M LONGITUDINAL REINFORCING BARS AT TOP OF INFILL TRENCH.

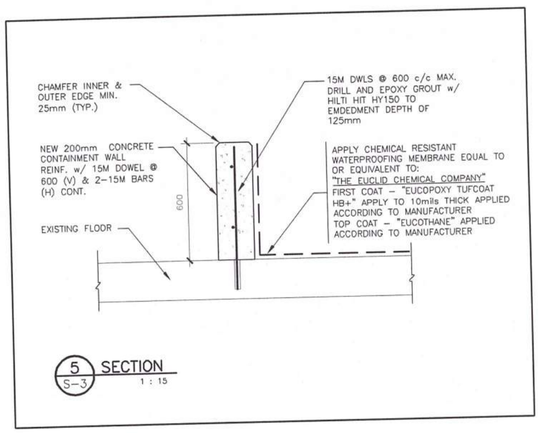




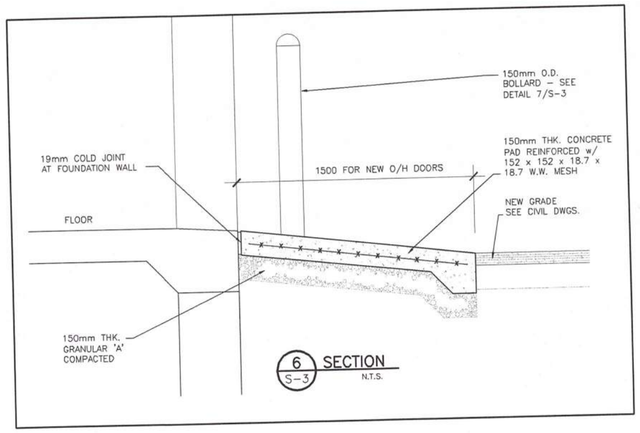
3 / S-3 SECTION — 1 : 15



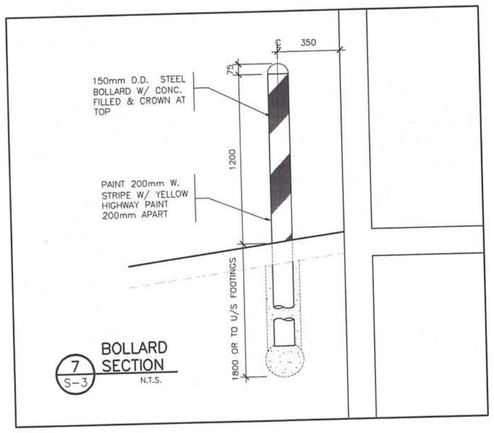
4 / S-3 SECTION — N.T.S.



5 / S-3 SECTION — 1 : 15



6 / S-3 SECTION — N.T.S.



7 / S-3 BOLLARD SECTION — N.T.S.

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

EXISTING PLANT STRUCTURAL MODIFICATIONS

STAMP

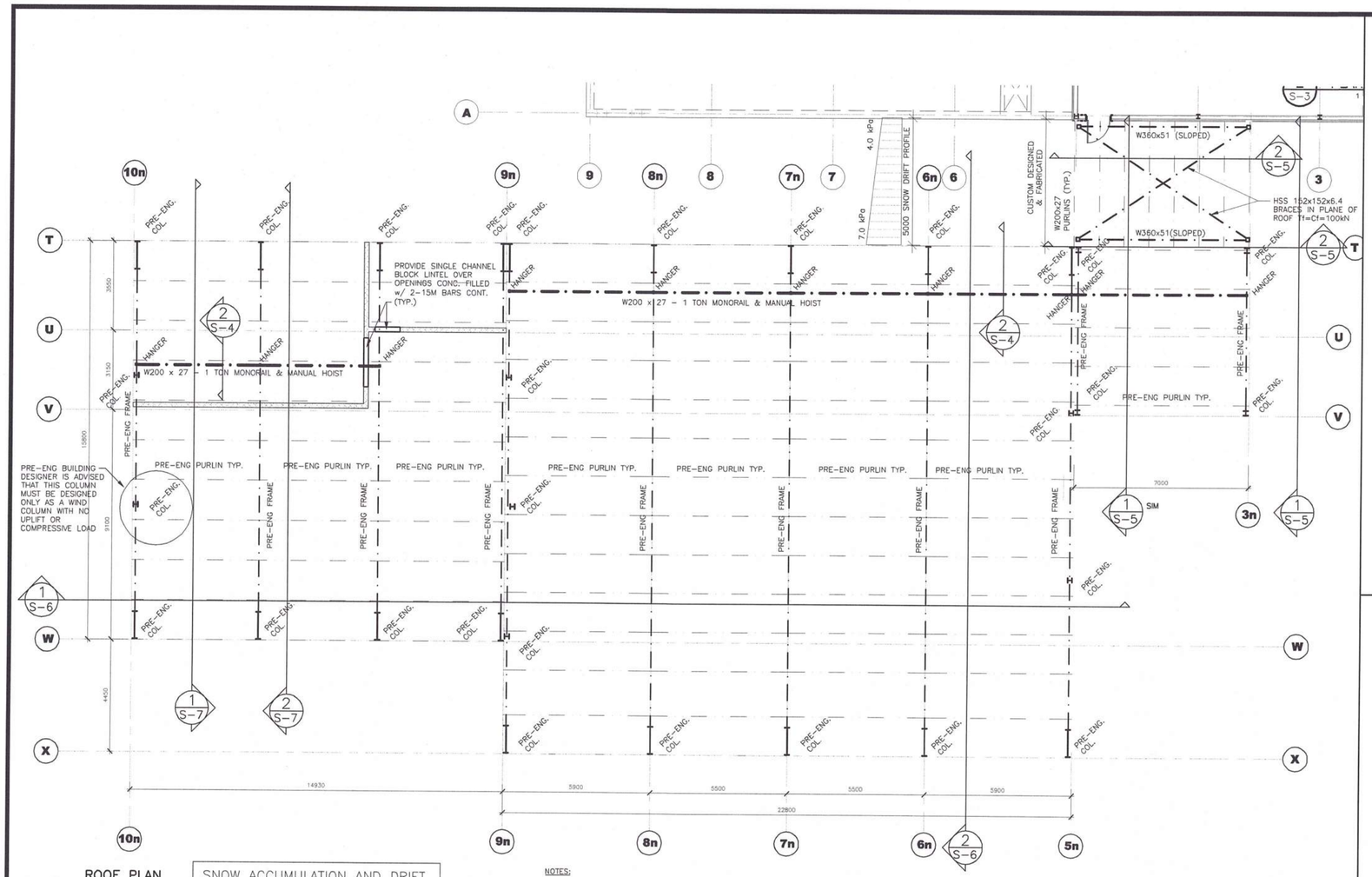
NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	A.E.E.	DATE	AUGUST 05
DRAWN	I.J.F. / M de R	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	
APPROVED		PLOT DATE	09/14/05
SCALE	AS SHOWN		

DRAWING

S-3

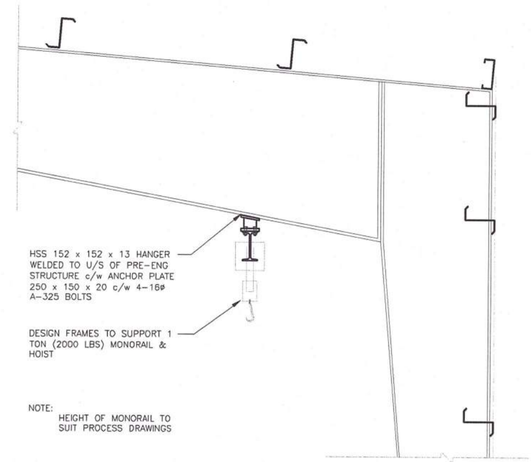


1 / S-4 ROOF PLAN PLAN
1 : 100

SNOW ACCUMULATION AND DRIFT LOADS AS PER O.B.C. FOR DEEP RIVER AREA

NOTES:

1. MONORAIL BEAMS TO BE COMPLETE WITH DROP BRACKETS, STOPS AND CLAMP ASSEMBLIES TO ATTACH TO PRE-ENG. BUILDING BEAMS. (BUILDING DESIGN BY PRE-ENG. BUILDING SUPPLIER TO SUPPORT THE MONORAILS & HOISTS)
2. TROLLEY - MANUAL, GEARED, CHAIN TO REACH FLOOR, 1 TON CAPACITY TENAQUIP MODEL CPT-1 OR EQUAL
3. CHAIN HOIST, 1 TON CAPACITY, CHAIN TO REACH FLOOR, 6.1m LIFT, TENAQUIP MODEL CCH-1 OR EQUAL

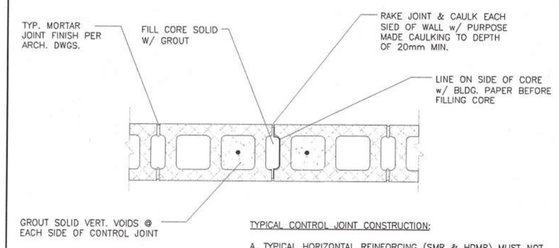


NOTE:
HEIGHT OF MONORAIL TO SUIT PROCESS DRAWINGS

2 / S-4 MONORAIL SECTION
1 : 20

3 / S-4 TYPICAL MONORAIL TO HANGER DETAIL
1 : 10

NOTE:
HEIGHT OF MONORAIL TO SUIT PROCESS DRAWINGS



TYPICAL CONTROL JOINT CONSTRUCTION:

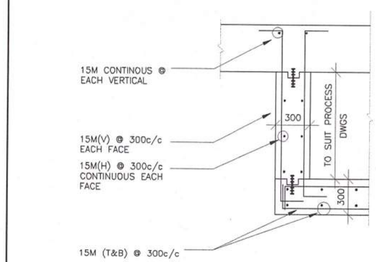
A. TYPICAL HORIZONTAL REINFORCING (SMR & HDMR) MUST NOT RUN THROUGH THE CONTROL JOINT.

B. CONTRATOR MAY SUBMIT ALTERNATIVE CONTROL JOINT CONFIGURATION FOR APPROVAL.

C. CONTROL JOINTS TO OCCUR AT 5000c/c MAX + @ 2000 FROM INTERSECTIONS.

D. BOND BEAM REINFORCING MUST RUN THROUGH THE CONTROL JOINT.

5 / S-4 SECTION
1 : 10



6 / S-4 RESEVOIR OVERFLOW SECTION
1 : 25

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

ROOF PLAN & DETAILS

STAMP

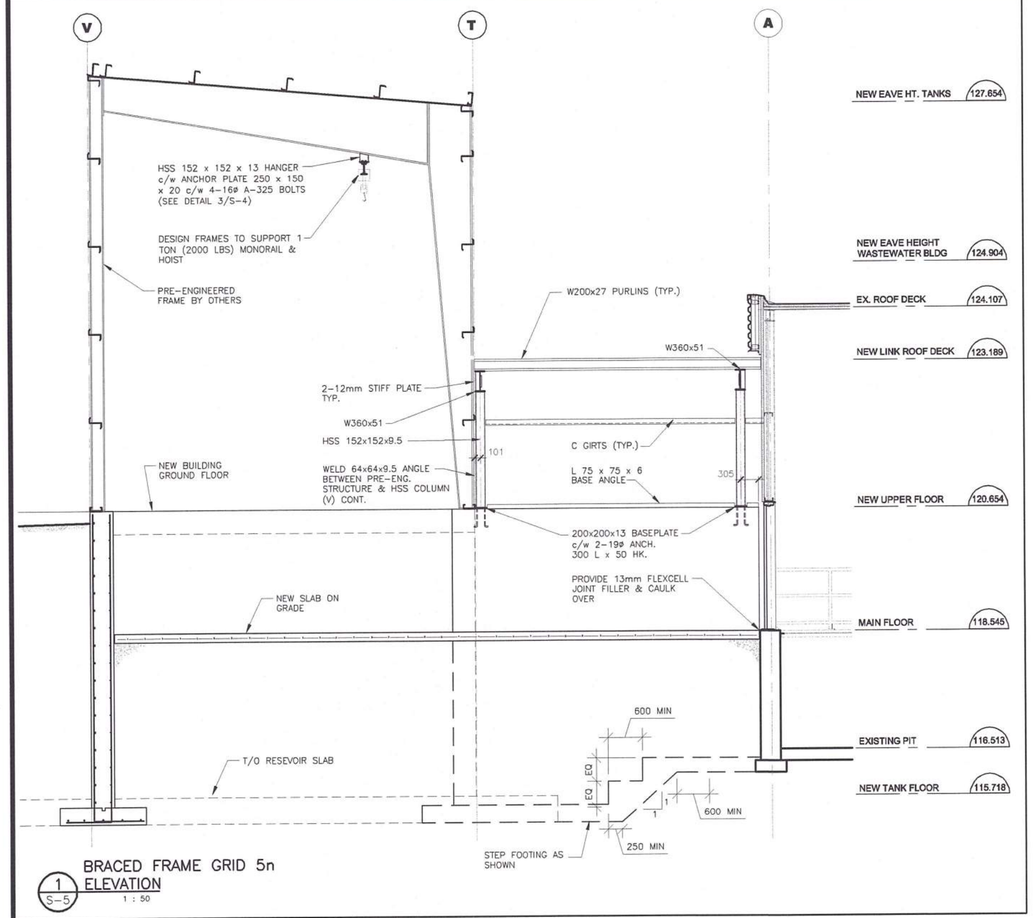
NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

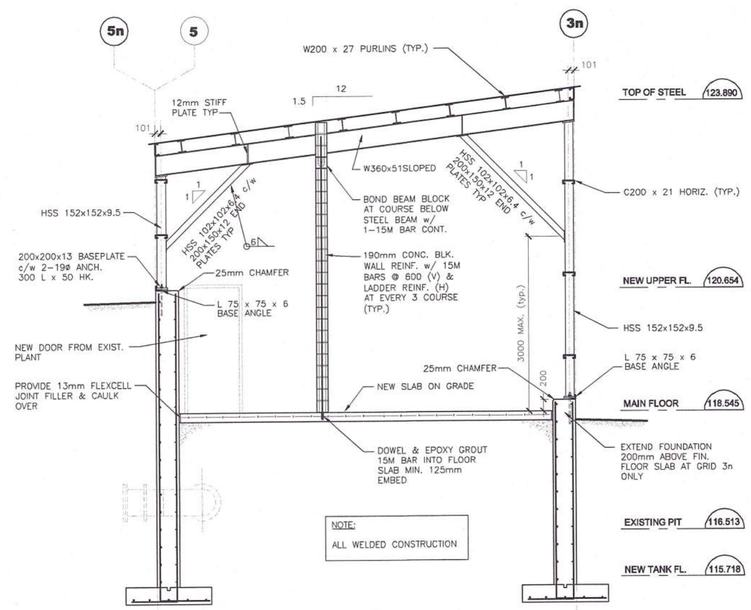
DESIGNED	A.E.E.	DATE	AUGUST 05
DRAWN	I.J.F. / M de R	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	
APPROVED		PLOT DATE	09/14/05
SCALE	AS SHOWN		

DRAWING

S-4



1 S-5 BRACED FRAME GRID 5n ELEVATION 1 : 50



2 S-5 BRACED FRAME GRID A & AT GRID V ELEVATION 1 : 50

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

FRAME DETAILS

STAMP

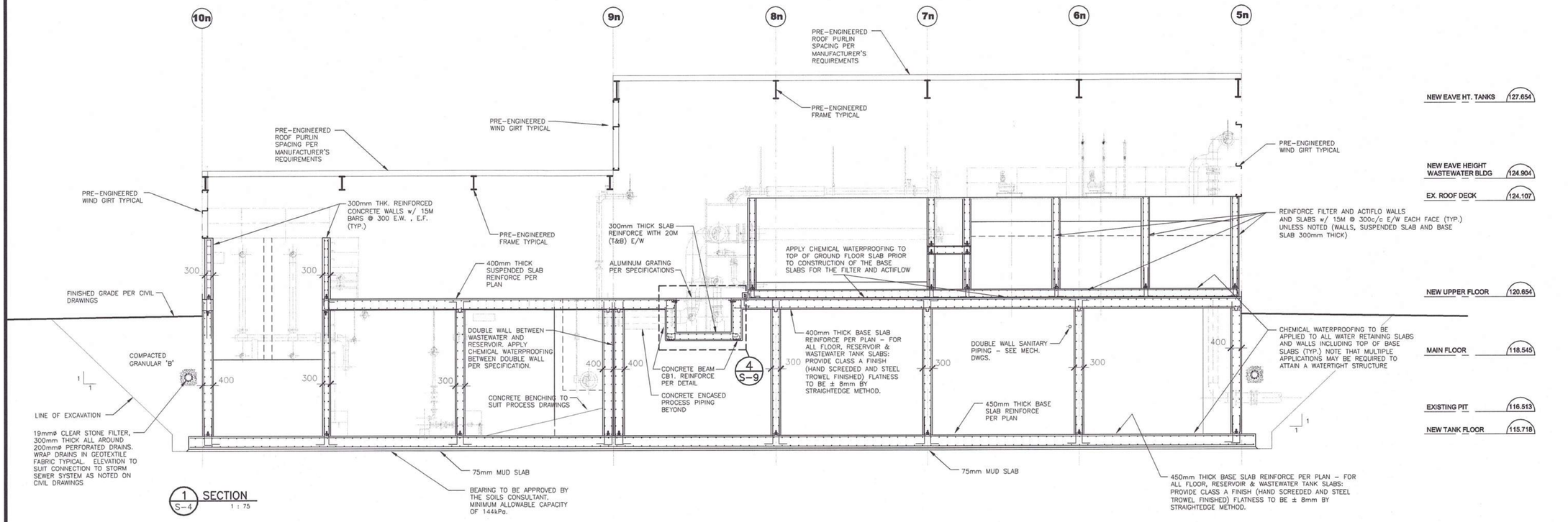
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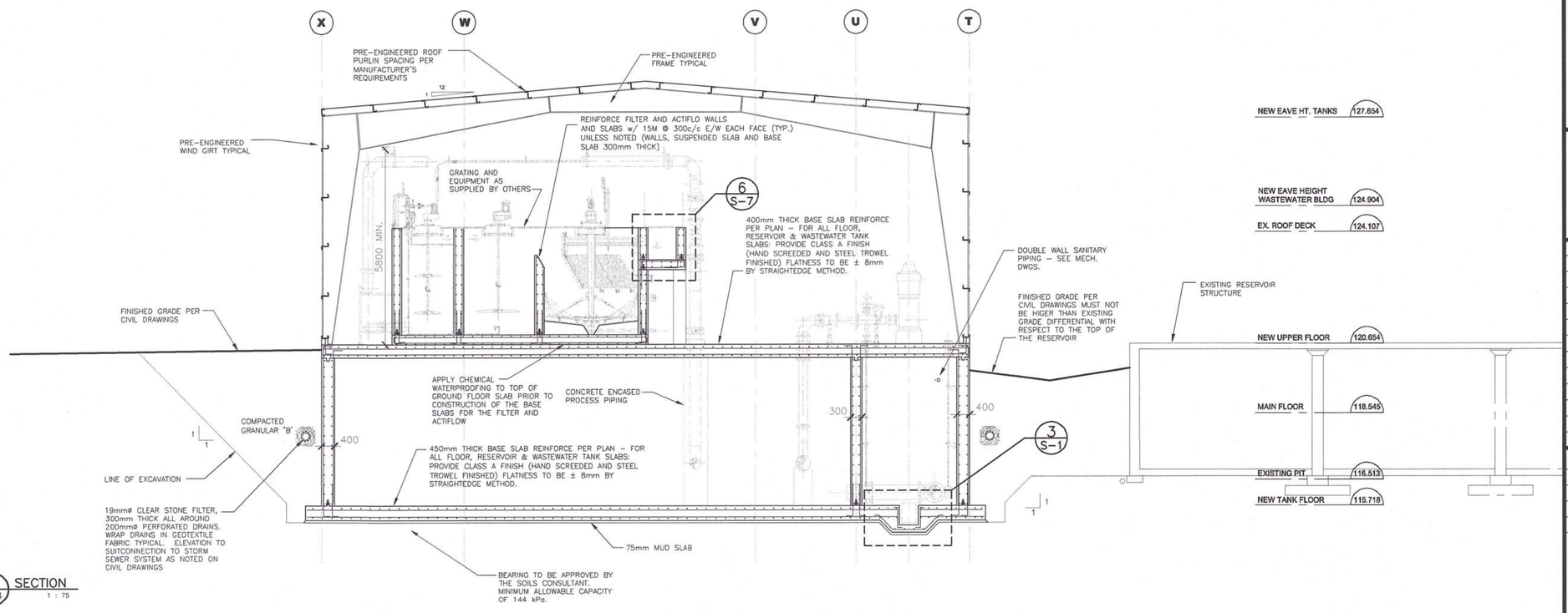
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DRAWING

S-5





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PLANT UPGRADES

Deep River, Ontario

DRAWING

BUILDING SECTIONS

STAMP

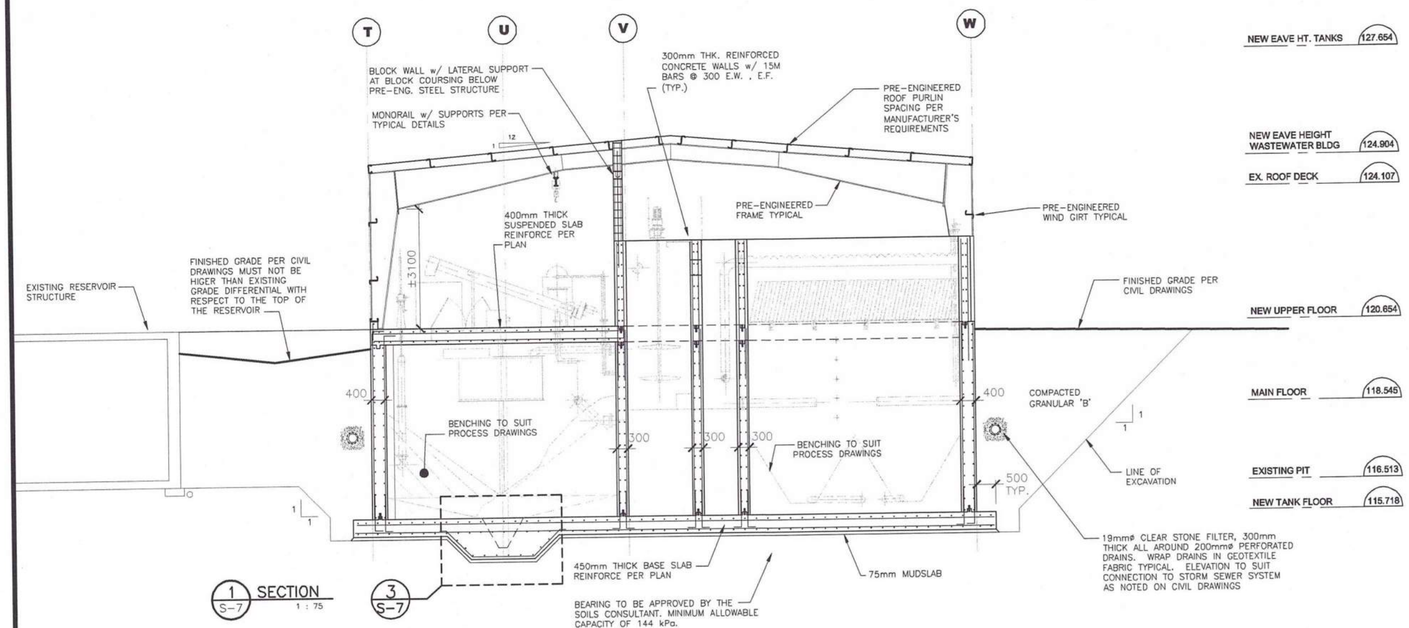
NORTH POINT

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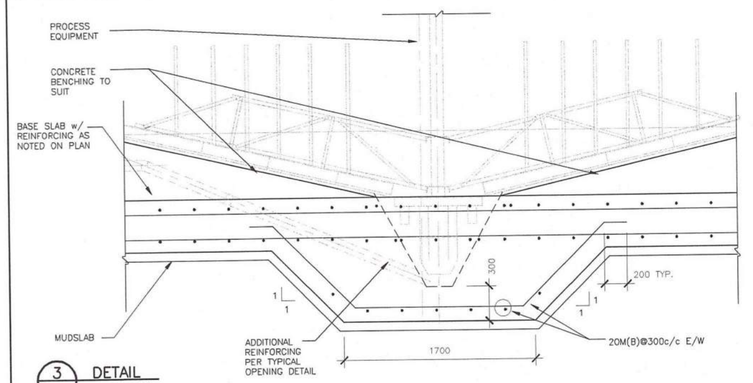
DRAWING

S-6

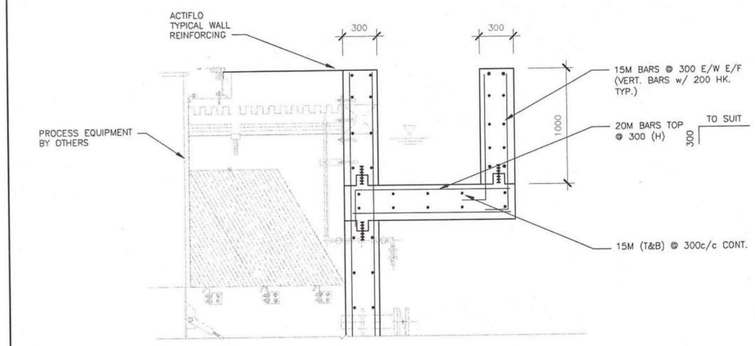


1 S-7 SECTION 1 : 75

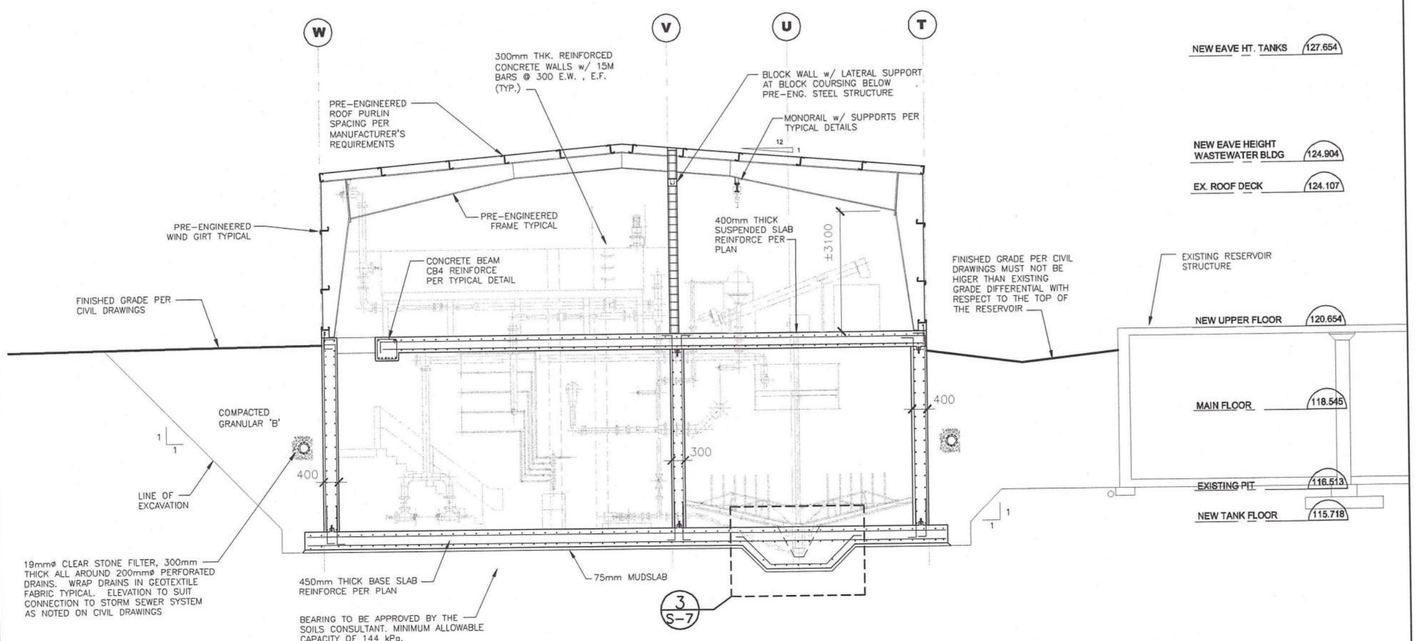
3 S-7



3 S-7 DETAIL 1 : 25



6 S-7 DETAIL 1 : 25



2 S-7 SECTION 1 : 75

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BUILDING SECTIONS

STAMP

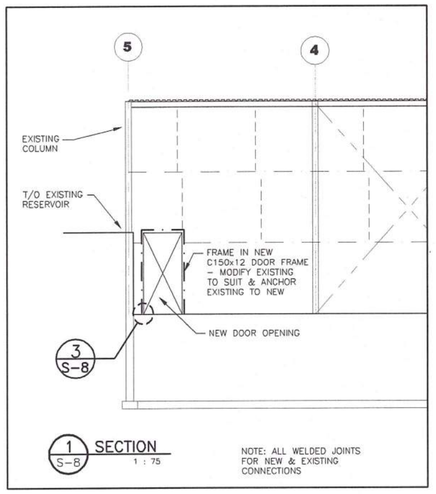
NORTH POINT

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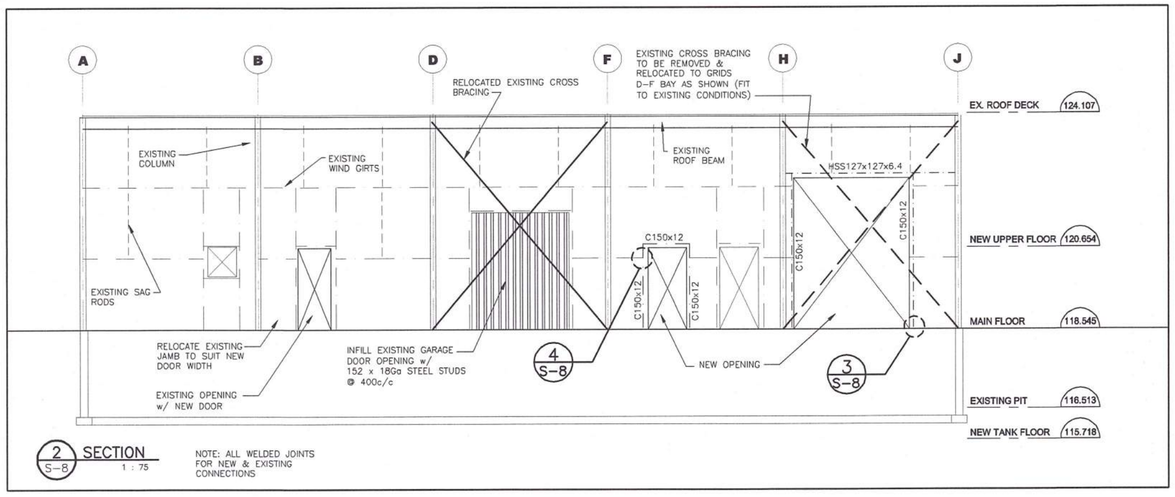
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S-7



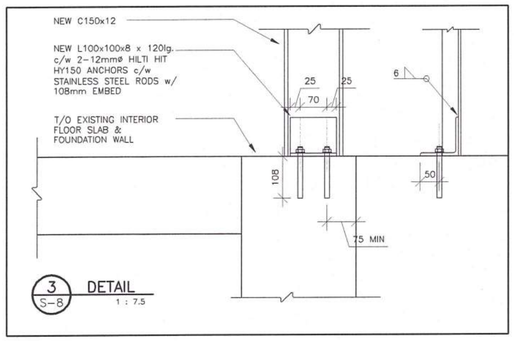
1 S-8 SECTION 1 : 75

NOTE: ALL WELDED JOINTS FOR NEW & EXISTING CONNECTIONS

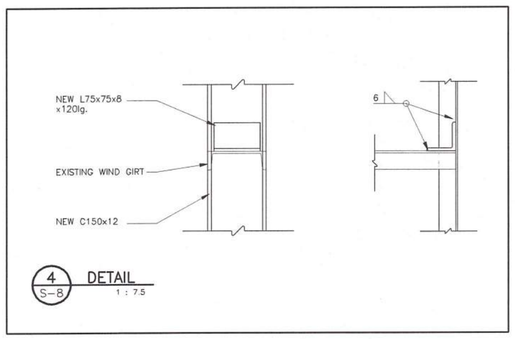


2 S-8 SECTION 1 : 75

NOTE: ALL WELDED JOINTS FOR NEW & EXISTING CONNECTIONS



3 S-8 DETAIL 1 : 7.5



4 S-8 DETAIL 1 : 7.5

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Deep River, Ontario

DRAWING

EXISTING BUILDING FRAME MODIFICATIONS

STAMP

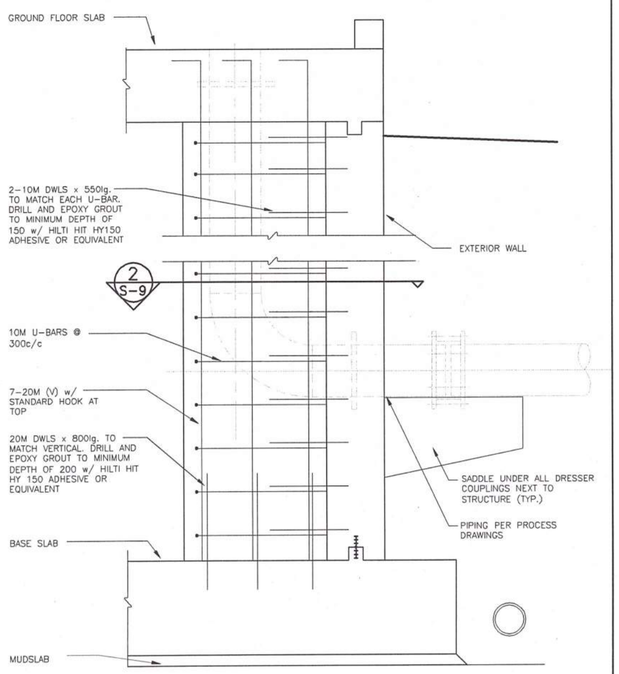
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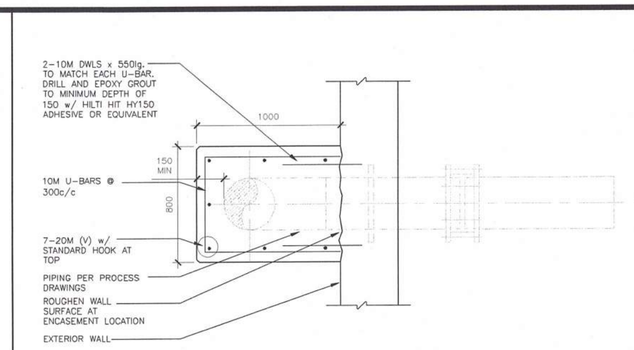
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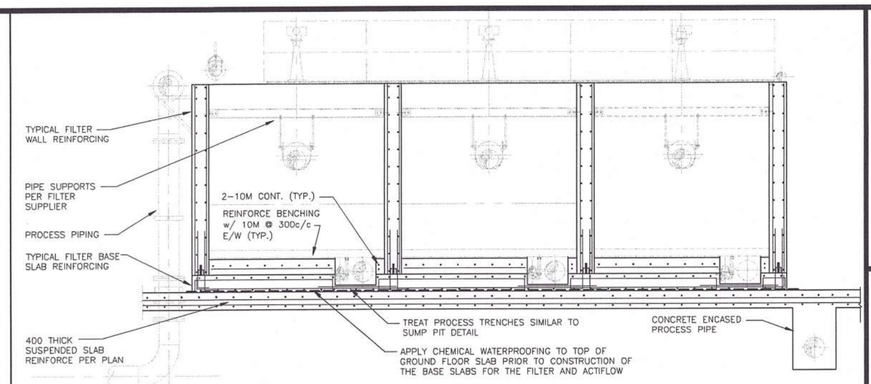
S-8



1 S-9 SECTION 1 : 20

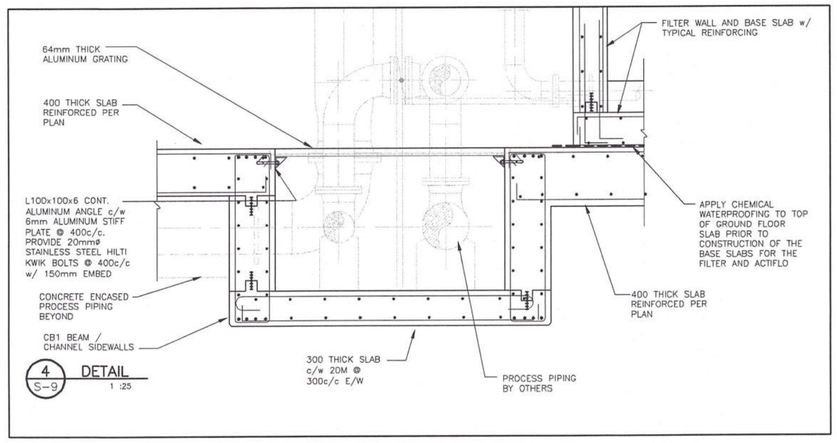


2 S-9 SECTION 1 : 20

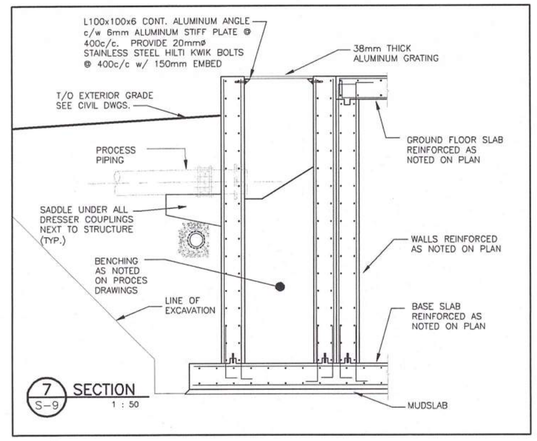


6 S-9 SECTION 1 : 50

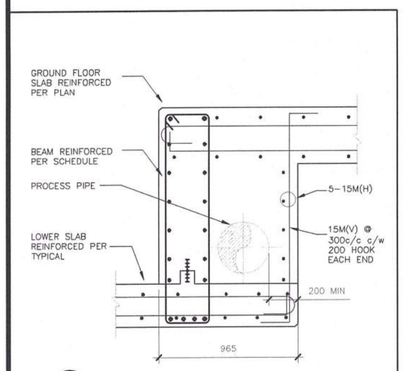
CHEMICAL WATERPROOFING TO BE APPLIED TO ALL WATER RETAINING SLABS AND WALLS INCLUDING TOP OF BASE SLABS (TYP.) NOTE THAT MULTIPLE APPLICATIONS MAY BE REQUIRED TO ATTAIN A WATERTIGHT STRUCTURE



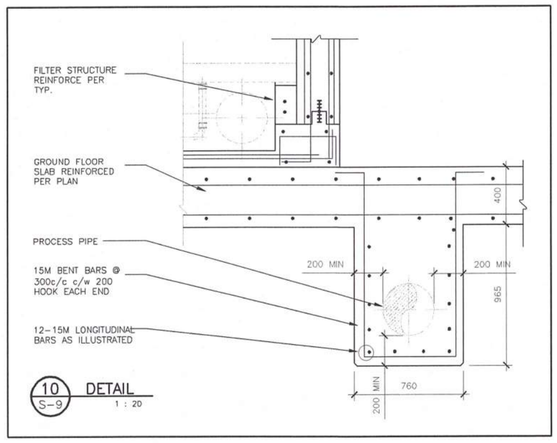
4 S-9 DETAIL 1 :25



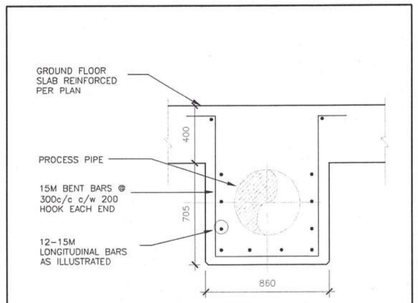
7 S-9 SECTION 1 : 50



9 S-9 DETAIL 1 : 20

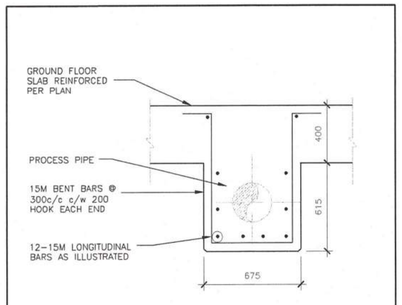


10 S-9 DETAIL 1 : 20



ENSURE 200mm CONCRETE COVER ALL SIDES OF PIPE IS MAINTAINED

11 S-9 DETAIL 1 : 20



ENSURE 200mm CONCRETE COVER ALL SIDES OF PIPE IS MAINTAINED

12 S-9 DETAIL 1 : 20

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PLANT UPGRADES

Deep River, Ontario

DRAWING

DETAILS

STAMP

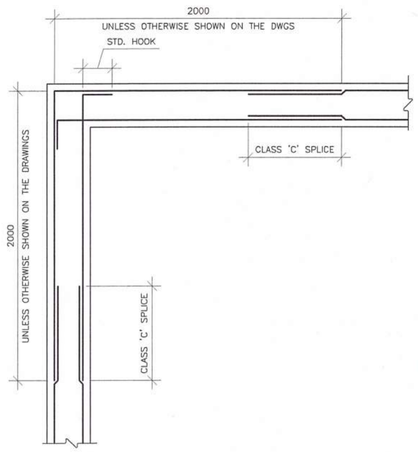
NORTH POINT

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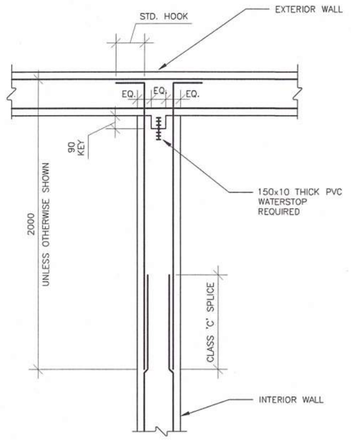
DRAWING

S-9



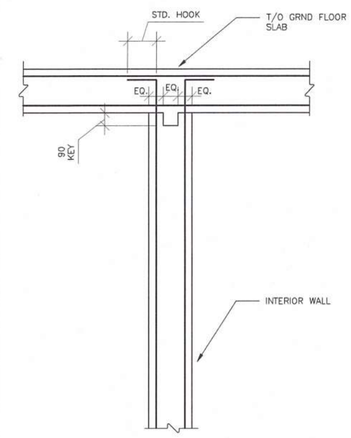
CORNER INTERSECTION OF EXTERIOR WALLS PLAN

1 / S-10 — 1 : 20



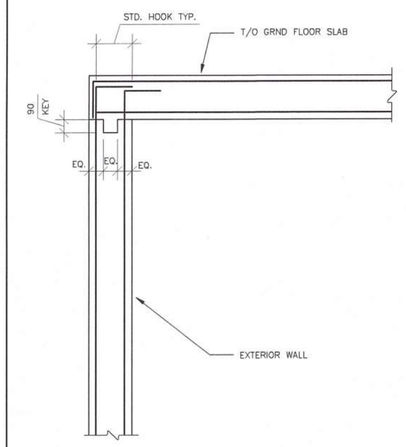
INTERSECTION OF EXTERIOR & INTERIOR WALLS PLAN

2 / S-10 — 1 : 20



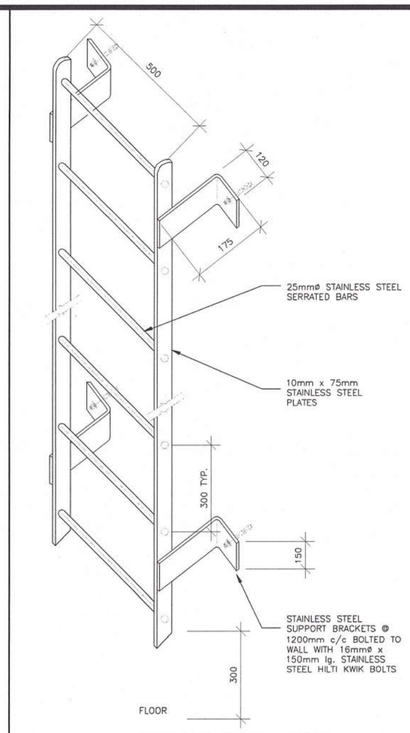
INTERIOR WALL AND GRND FLOOR SLAB SECTION

3 / S-10 — 1 : 20



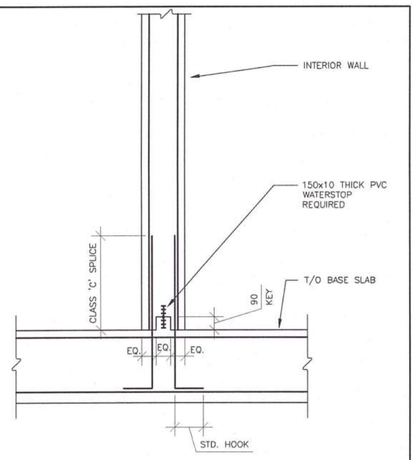
EXTERIOR WALL AND GRND FLOOR SLAB SECTION

5 / S-10 — 1 : 20



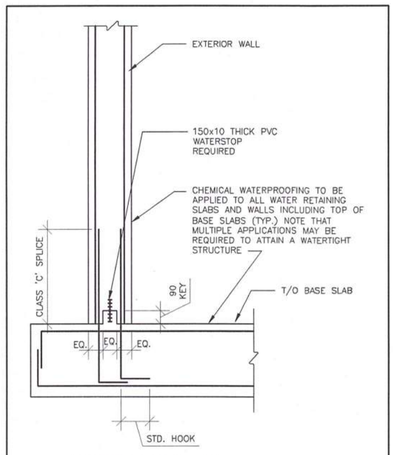
STAINLESS STEEL LADDER DETAIL

A / S-10 — 1 : 10



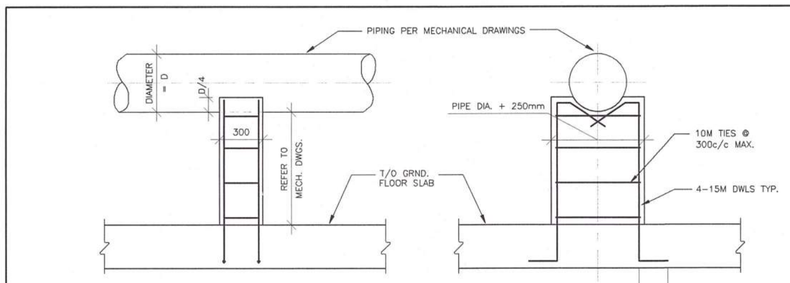
INTERIOR WALL AND BASE SLAB SECTION

6 / S-10 — 1 : 20



EXTERIOR WALL AND BASE SLAB SECTION

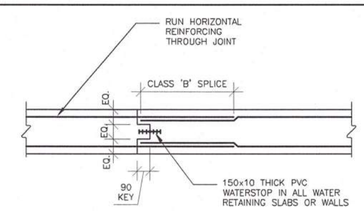
7 / S-10 — 1 : 20



PIPE SUPPORTS (& THRUST BLOCKS) SECTION

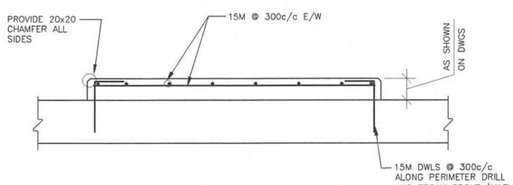
10 / S-10 — 1 : 20

NOTE:
- PROVIDE 20x20 CHAMFER @ ALL VERTICAL CORNERS OF PIPE SUPPORTS.
- AT EXISTING SLAB ON GRADE LOCATIONS DRILL AND EPOXY GROUT DOWELS (HILTI HIT HY150 OR EQUIV) TO DEPTH OF 200mm)
- PROVIDE SIMILAR CONFIGURATION FOR THRUST BLOCKS PER PROCESS DRAWINGS c/w VERTICAL DOWELS AT 200x200 GRID. DIMENSION OF THRUST BLOCKS TO SUIT THOSE ILLUSTRATED ON PROCESS DRAWINGS



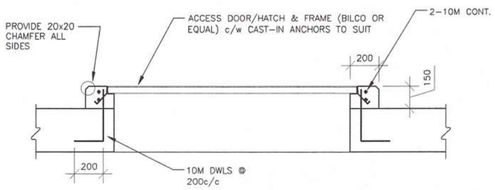
CONSTRUCTION JOINTS (WALLS AND SLABS) SECTION

4 / S-10 — 1 : 20



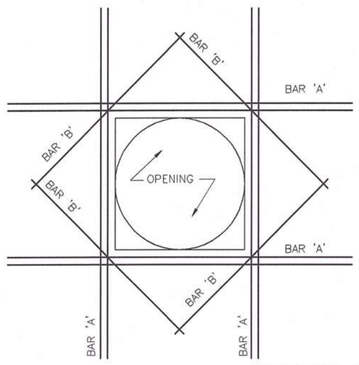
EQUIPMENT BASES/HOUSEKEEPING PADS SECTION

8 / S-10 — 1 : 20



ADDITIONAL REINFORCING @ ACCESS OPENINGS SECTION

9 / S-10 — 1 : 20



1) BAR 'A' PROVIDE AS MANY BARS AS INTERRUPTED BY THE OPENING ON EACH SIDE OF THE OPENING.
MIN BAR LENGTH:
15M – OPENING SIZE (OR DIAMETER) + 1300
20M – OPENING SIZE (OR DIAMETER) + 1800
25M – OPENING SIZE (OR DIAMETER) + 2900

2) BAR 'B' 1–20M EACH FACE (OR TOP & BOTTOM) 1500 LONG.

TOTAL AREA OF BAR 'A' IN EACH DIRECTION = 1/2 OF TOTAL REINFORCED AREA INTERRUPTED BY THE OPENING IN THE SAME DIRECTION

OPENINGS THROUGH WALLS AND SLABS PLAN

12 / S-10 — 1 : 25

CONCRETE COVER & SPLICE (LAP) LENGTHS

CLASS 'B' BAR SPLICE (LAP) fy=400MPa		
	f'c=30MPa	f'c=20MPa
10M	450	450
15M	630	630
20M	770	870
25M	1180	1450
30M	1650	2020
35M	2360	2890

CONCRETE COVER		
BAR LOCATION	BAR DIAMETER	COVER
IN CONCRETE CAST AGAINST & PERMINANTLY EXPOSED TO EARTH	ALL BARS	75mm
IN CONCRETE EXPOSED TO EARTH, LIQUID OR WEATHER	20M OR LARGER 10M & 15M	50mm 40mm
IN FLOOR SLABS, WALLS, JOISTS NOT EXPOSED TO WEATHER OR CONTACT WITH EARTH, LIQUID OR HUMID ENVIRONMENT.	45M & 55M 35M OR SMALLER	40mm 20mm
IN COLUMNS, BEAMS OR GIRDERS NOT EXPOSED TO EARTH OR WEATHER, COVER TO PRINCIPAL BARS, STIRRUPS OR SPIRALS	ALL BARS	40mm

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Deep River, Ontario

DRAWING

TYPICAL DETAILS

STAMP

NORTH POINT

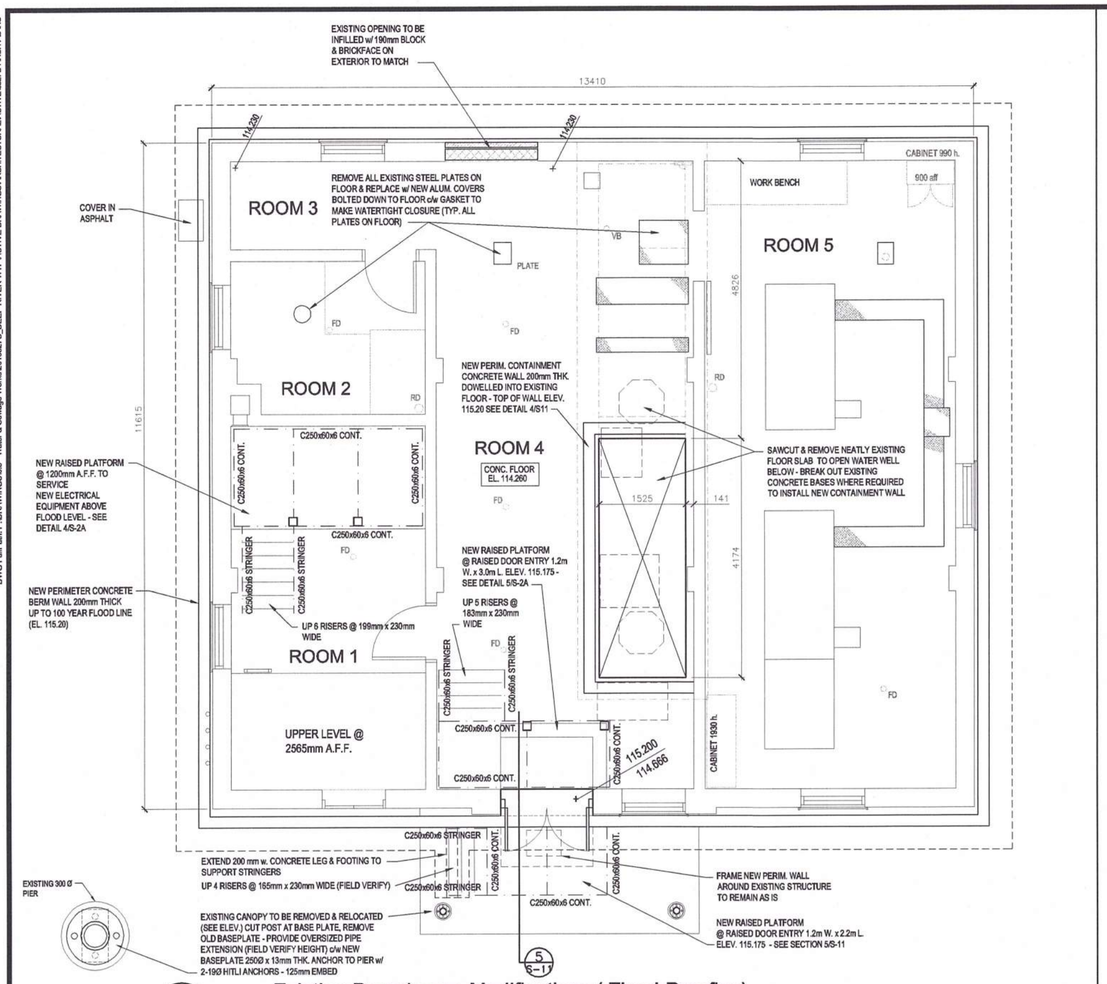
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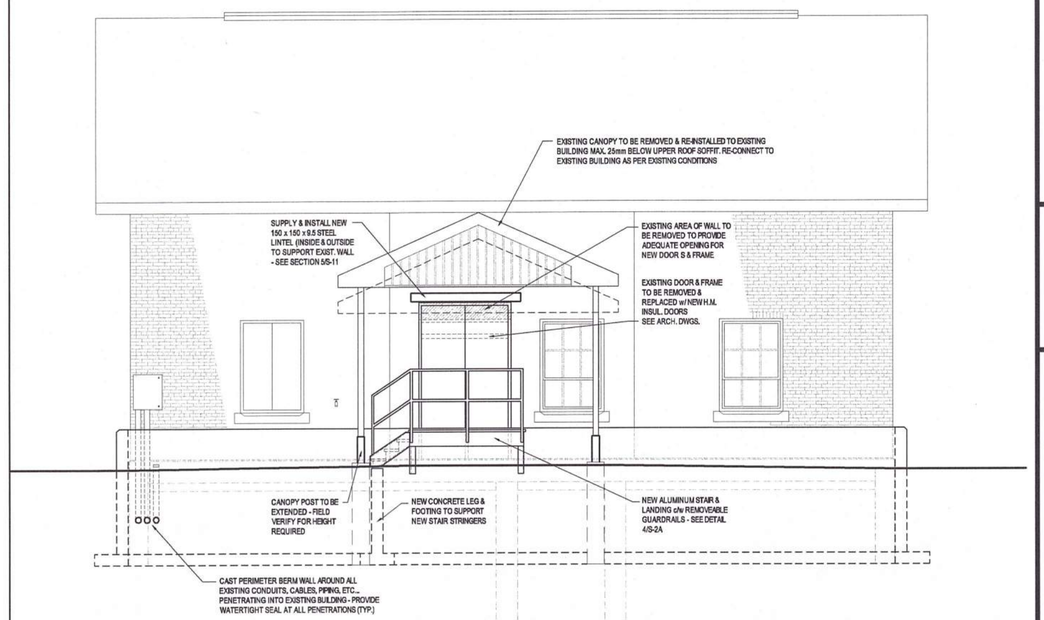
S-10

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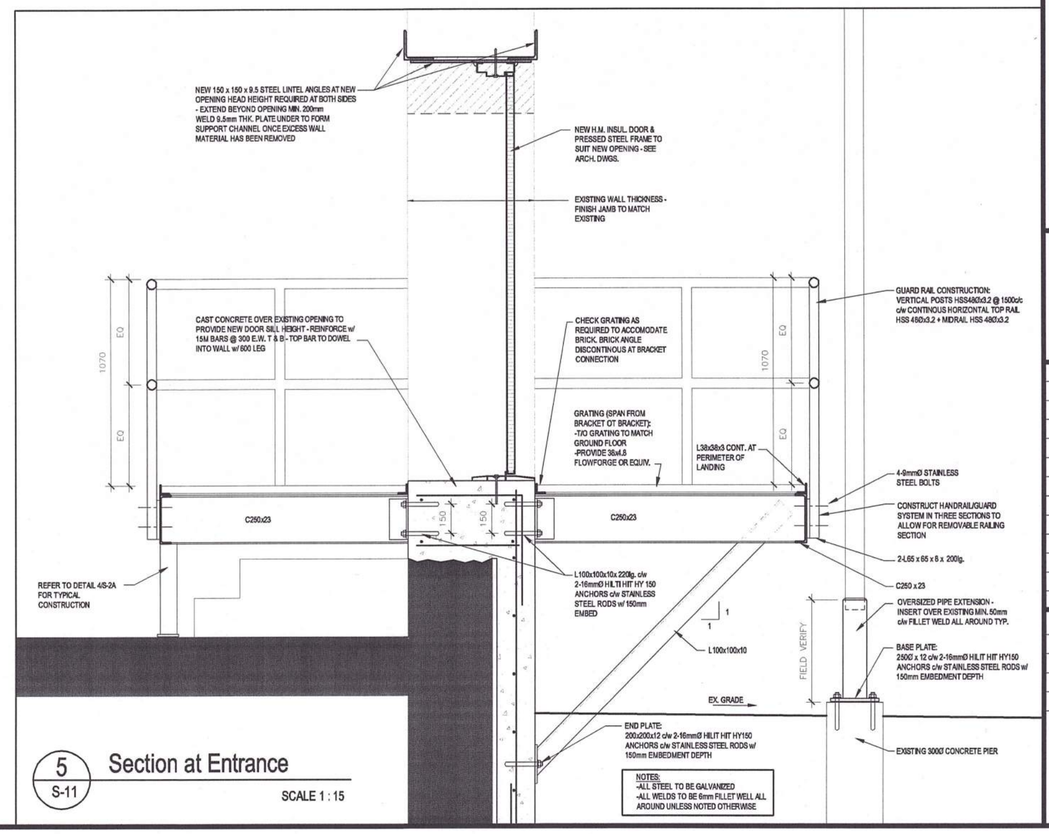
1 S-11 **Existing Pumphouse Modifications (Flood-Proofing)**

SCALE 1 : 50



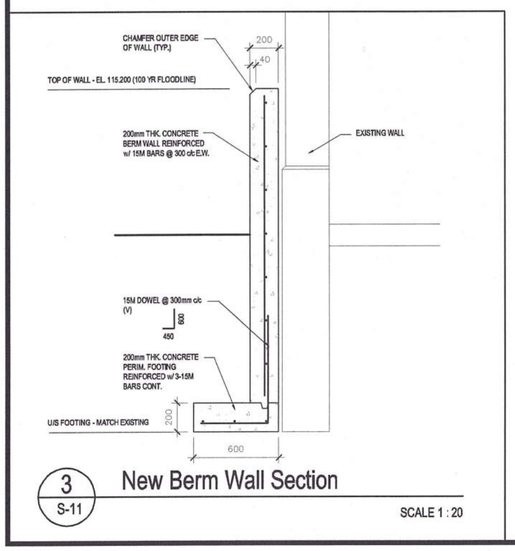
2 S-11 **Existing Pumphouse Modifications - Elevation**

SCALE 1 : 50



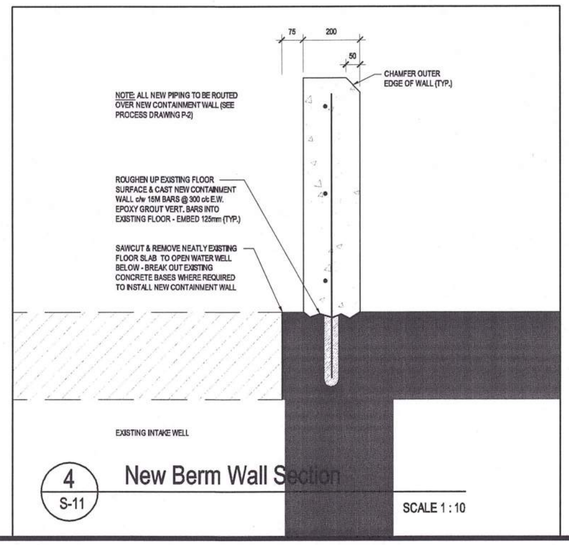
5 S-11 **Section at Entrance**

SCALE 1 : 15



3 S-11 **New Berm Wall Section**

SCALE 1 : 20



4 S-11 **New Berm Wall Section**

SCALE 1 : 10

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

EXISTING PUMPHOUSE PLANS, ELEVATIONS & DETAILS

STAMP

NORTH POINT

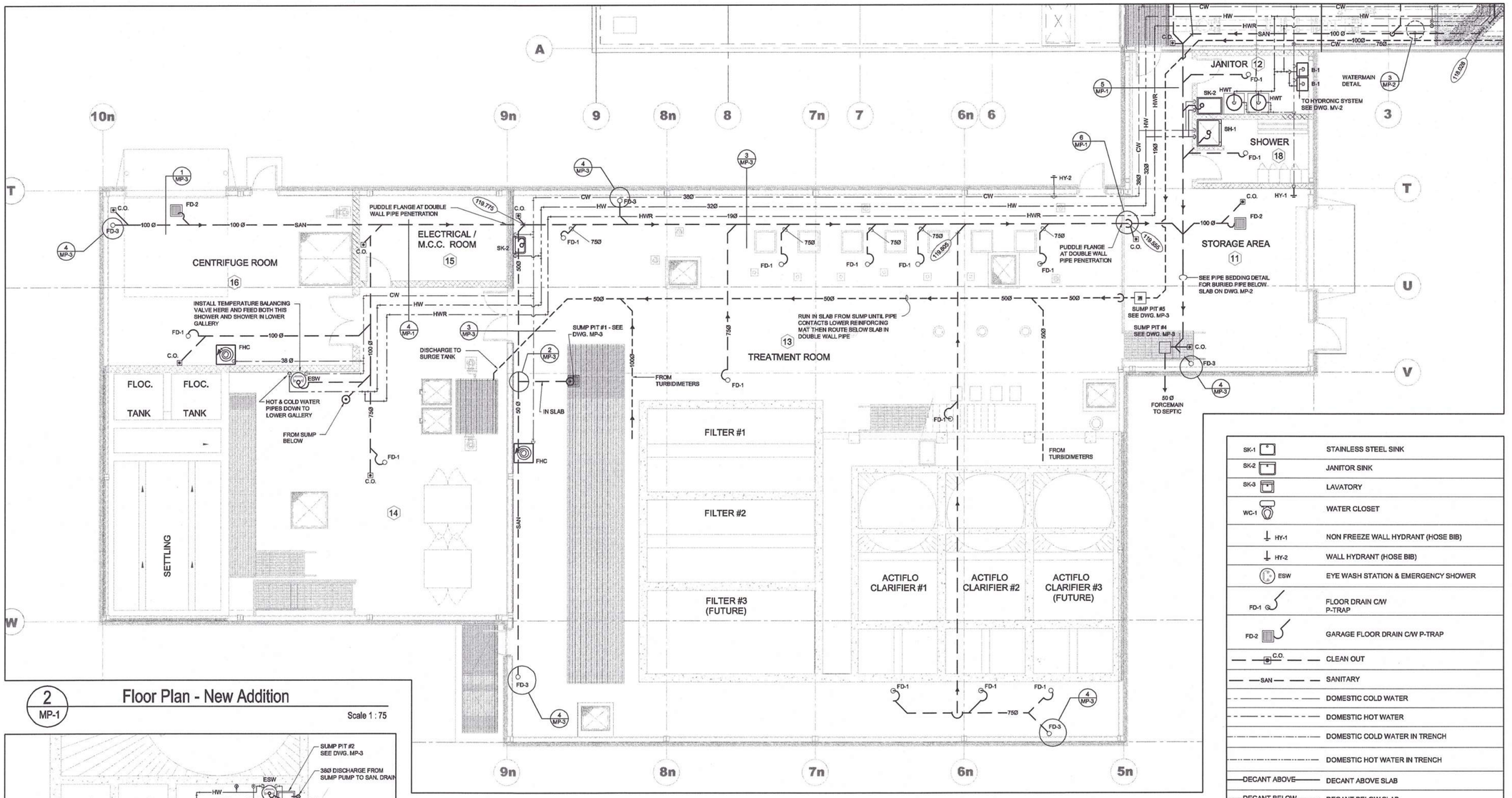
No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	A.E.E.	DATE	AUGUST 2005
DRAWN	M de R	PROJECT	2016527C
CHECKED	A.E.E.	ACAD #	SITEPLAN
APPROVED		PLOT DATE	06/29/05
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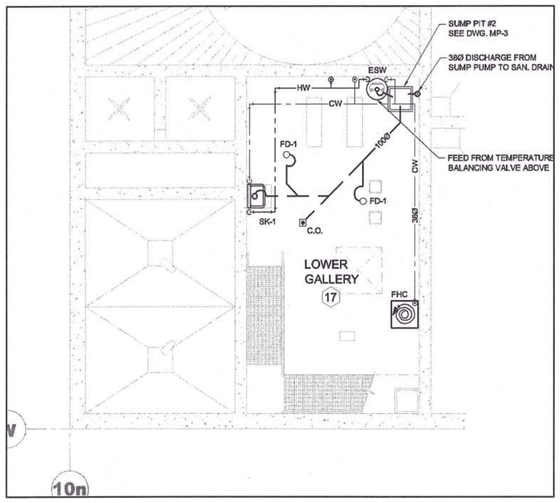
DRAWING

S-11

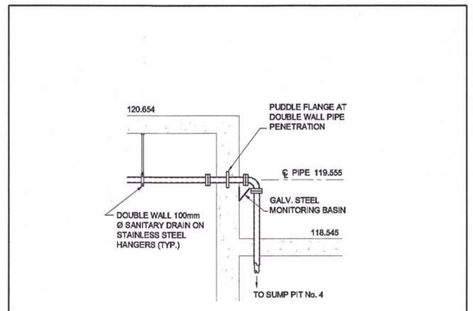
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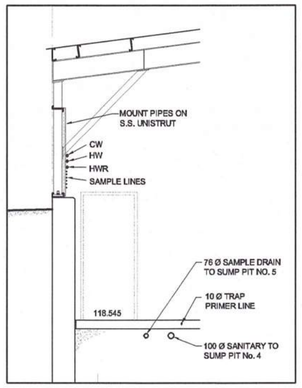
2 MP-1 Floor Plan - New Addition
Scale 1 : 75



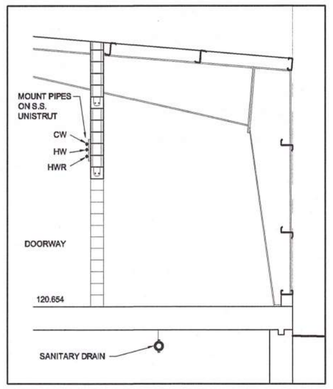
1 MP-1 Lower Gallery Floor Plan - New Addition
Scale 1 : 75



6 MP-1 Double Wall Sanitary Drain Penetration
Scale N.T.S.



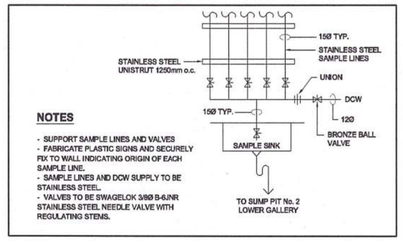
5 MP-1 Domestic Pipe Installation Storage Area
Scale N.T.S.



4 MP-1 Domestic Pipe Installation Wastewater Area
Scale N.T.S.

SK-1	STAINLESS STEEL SINK
SK-2	JANITOR SINK
SK-3	LAVATORY
WC-1	WATER CLOSET
HY-1	NON FREEZE WALL HYDRANT (HOSE BIB)
HY-2	WALL HYDRANT (HOSE BIB)
ESW	EYE WASH STATION & EMERGENCY SHOWER
FD-1	FLOOR DRAIN C/W P-TRAP
FD-2	GARAGE FLOOR DRAIN C/W P-TRAP
C.O.	CLEAN OUT
SAN	SANITARY
	DOMESTIC COLD WATER
	DOMESTIC HOT WATER
	DOMESTIC COLD WATER IN TRENCH
	DOMESTIC HOT WATER IN TRENCH
DECANT ABOVE	DECANT ABOVE SLAB
DECANT BELOW	DECANT BELOW SLAB
FHC	FIRE HOSE CABINET
9	ROOM NUMBER

7 MP-1 Legend



NOTES
- SUPPORT SAMPLE LINES AND VALVES FABRICATE PLASTIC SIGNS AND SECURELY FIX TO WALL INDICATING ORIGIN OF EACH SAMPLE LINE.
- SAMPLE LINES AND DCW SUPPLY TO BE STAINLESS STEEL.
- VALVES TO BE SWAGELOK 3/8Ø B-6JNR STAINLESS STEEL NEEDLE VALVE WITH REGULATING STEMS.

3 MP-1 Lower Gallery Wastewater Sample Station
Scale N.T.S.

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

PLUMBING
FLOOR PLANS - NEW ADDITION

STAMP

NORTH POINT

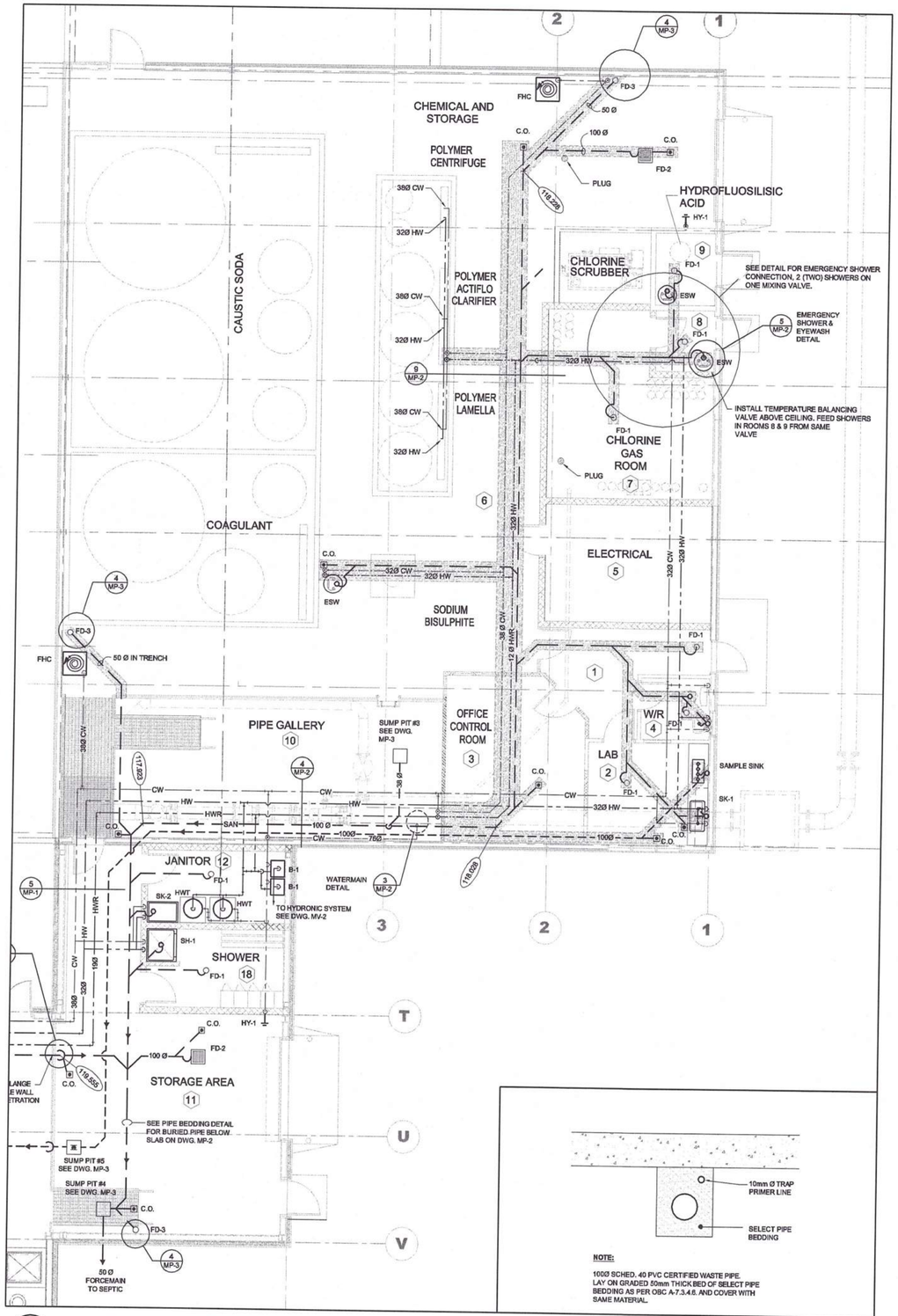
No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	O.D.	DATE	DEC 6. 2004
DRAWN	J.E.	PROJECT	2016527B
CHECKED	O.D.	ACAD #	6527-M1-M2.DWG
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

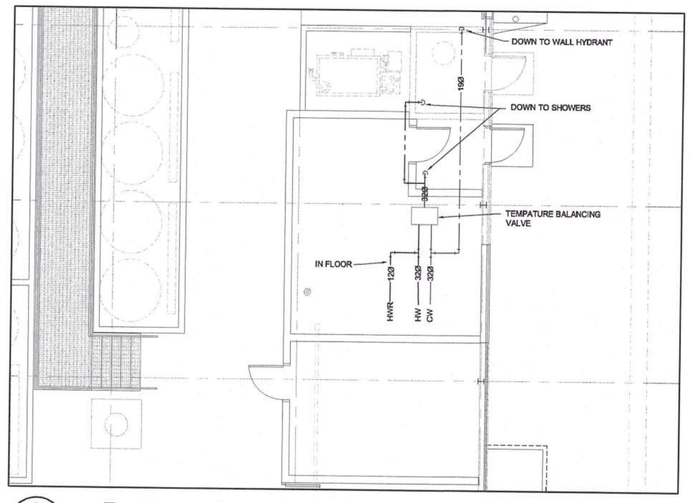
DRAWING

MP-1

Plot Date/Time: 06/21/05 02:05pm
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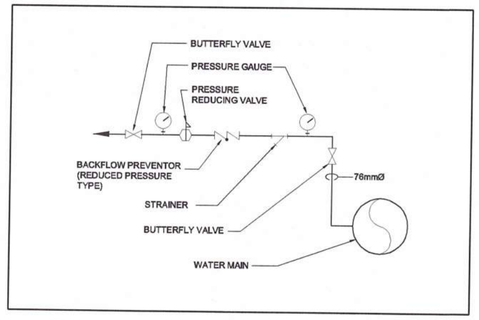
1 MP-2 **Plumbing - Floor Plan**
Scale 1 : 75



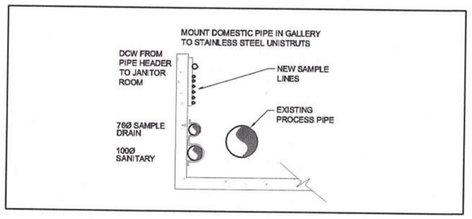
2 MP-2 **Emergency Shower Supply Plan**
Scale 1 : 75

SK-1	STAINLESS STEEL SINK
SK-2	JANITOR SINK
SK-3	LAVATORY
WC-1	WATER CLOSET
HY-1	NON FREEZE WALL HYDRANT (HOSE BIB)
HY-2	WALL HYDRANT (HOSE BIB)
ESW	EYE WASH STATION & EMERGENCY SHOWER
FD-1	FLOOR DRAIN C/W P-TRAP
FD-2	GARAGE FLOOR DRAIN C/W P-TRAP
C.O.	CLEAN OUT
SAN	SANITARY
	DOMESTIC COLD WATER
	DOMESTIC HOT WATER
	DOMESTIC COLD WATER IN TRENCH
	DOMESTIC HOT WATER IN TRENCH
DECANT ABOVE	DECANT ABOVE SLAB
DECANT BELOW	DECANT BELOW SLAB
FHC	FIRE HOSE CABINET
9	ROOM NUMBER

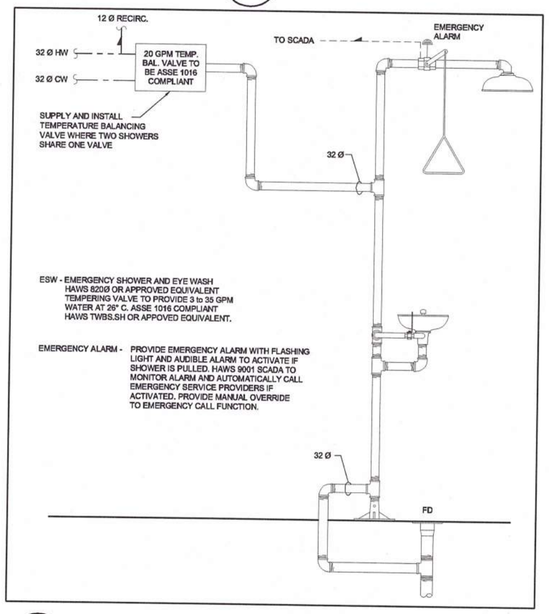
7 MP-2 **Legend**



3 MP-2 **Watermain Detail**
n.t.s.

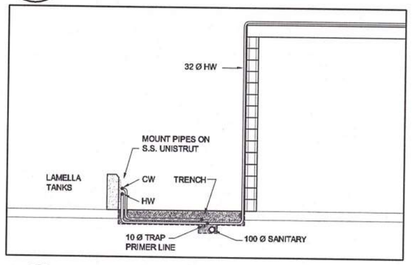


4 MP-2 **Section 1-1 Domestic Pipe Mounting Detail**
Scale N.T.S.

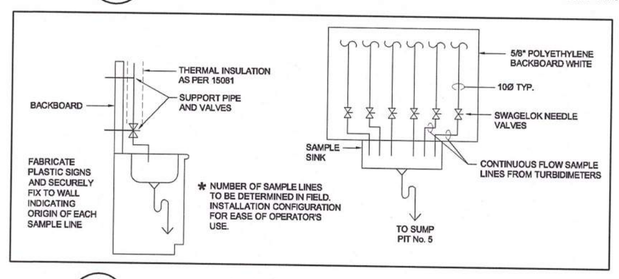


5 MP-2 **Emergency Shower & Eyewash Installation Detail**
Scale 1 : 20

8 MP-2 **Pipe Bedding Detail**
Scale N.T.S.



9 MP-2 **Piping Schematic**
Scale N.T.S.



6 MP-2 **Lab Sample Station**
Scale N.T.S.

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

PLUMBING
FLOOR PLAN - EXIST. MODIFIED

STAMP

NORTH POINT

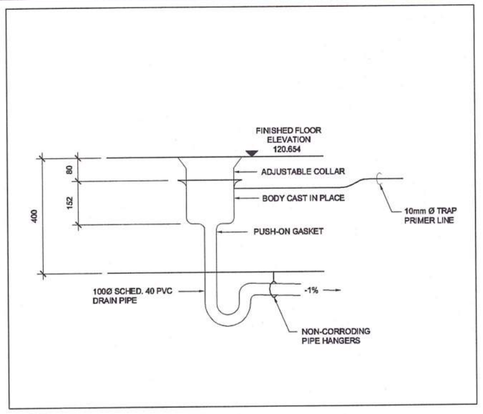
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1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	J.V.	DATE	DEC. 6 2004
DRAWN	J.E.	PROJECT	2016527B
CHECKED	J.V.	ACAD #	6527-M1-M2.DWG
APPROVED		PLOT DATE	
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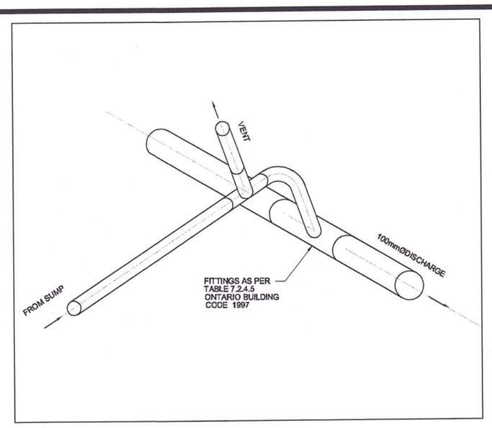
DRAWING

MP-2

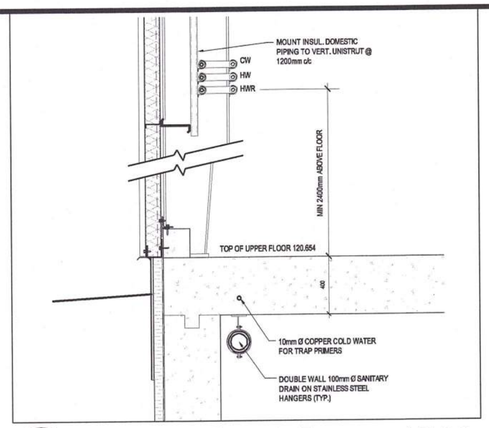
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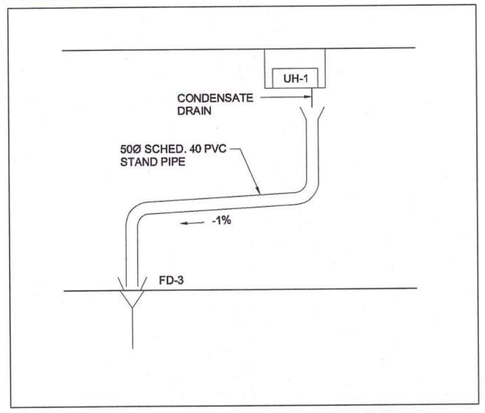
1 MP-3 **FD-2 Installation - Centrifuge Room**
Scale 1 : 10



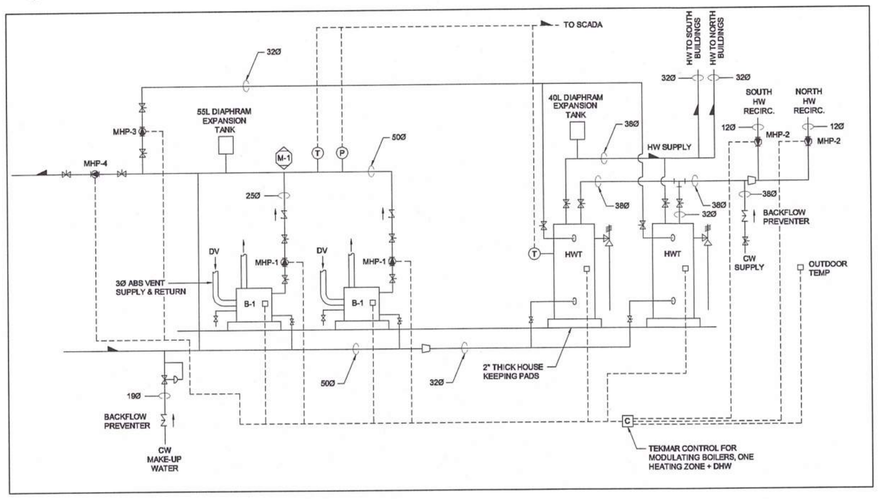
2 MP-3 **Drainage - Vented 'Y' Connector Detail**
Scale 1 : 10



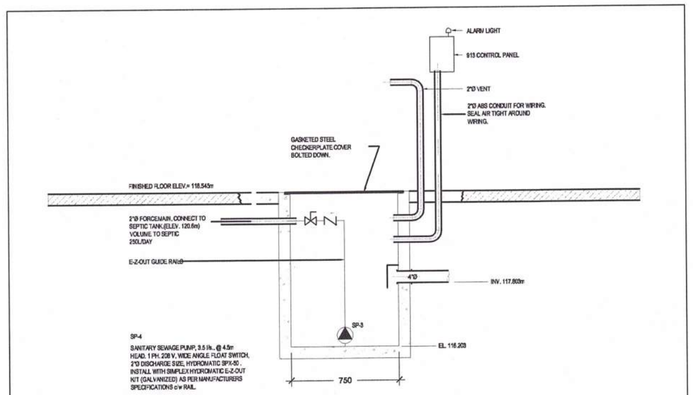
3 MP-3 **Drainage - Concrete Encasement Detail**
Scale 1 : 10



4 MP-3 **Condensate Drainage from Unit Heaters**
Scale N.T.S.



5 MP-3 **Hydronic + DHW Boiler Connection Schematic**
Scale N.T.S.



6 MP-3 **Sanitary Sewage Sump - Sump Pit No. 4**
Scale - 1 : 10

LEGEND + GENERAL NOTES

1. DRAINS AT ALL LOW POINTS, AUTOMATIC VENTS AT HIGH POINTS
2. B-1 - GAS FIRED, DIRECT VENTED, HIGH EFFICIENCY (90% AFUE OR BETTER) BOILER FOR HYDRONIC HEATING SYSTEM AND HOT WATER. D.O.E. HEATING CAPACITY MODULATING 30-110 MBH. WALL MOUNTED ACCEPTABLE EQUIPMENT: TRIANGLE TUBE PRESTIGE, C/W 10 YEAR WARRANTY.
3. HWT - INDIRECT FIRED DOMESTIC HOT WATER HEATER. 120 US GAL CAPACITY. ACCEPTABLE EQUIPMENT: TRIANGLE TUBE TR-120, C/W 15 YEAR WARRANTY.
4. C - TEKMAR CONTROLLER OR EQUIVALENT
5. SCADATO MONITOR MANIFOLD TEMP AND PRESSURE AND HWT TEMP
6. M-1 - MANIFOLD
7. DV - DIRECT VENT OUTDOOR AIR
8. MHP-1 - 110 MBH MAX. @ 1.5 ft./sec IN 1Ø PIPE = 4 GPM @ 6' HEAD GRUNDFOS UPS 15-42 F (SPD-1) 1/25 hp CAST IRON CIRCULATOR POWER - 115V/1/60, 0.40A
9. MHP-2 - HW RECIRCULATOR 1 GPM Min. 8' HEAD GRUNDFOS UP 15-18 B5 1/25 hp BRONZE OR SS CIRCULATOR POWER 115V/1/60, 0.74A
10. MHP-3 - 220 MBH MAX. @ 1.5 ft./sec IN 1 1/4Ø PIPE = 7 GPM @ 1.3' HEAD GRUNDFOS UPS 15-42 F (SPD-1) 1/25 hp CAST IRON CIRCULATOR POWER 115/1/60 0.40A
11. MHP-4 - 55 MBH 7.5 GPM @ 8' HEAD IN 1 1/4Ø PIPE, 1.5 ft./sec GRUNDFOS UPS 15-42 F (SPD-2) 1/25 hp CAST IRON CIRCULATOR POWER 115/1/60 0.57A

SUMP PIT No. 1 PUMP INSTALLATION

SP-1: 1.8 l/s @ 2m HYDRAULIC HEAD, 38Ø DISCHARGE, CLEAN WATER SUMP PUMP WITH WIDE ANGLE FLOAT SWITCH, 115V/1/60, 0.30 hp, 1550 rpm HYDROMATIC SW-33 c/w EZ-OUT INSTALLATION RIG. c/w RAIL

SUMP PIT No. 2 PUMP INSTALLATION

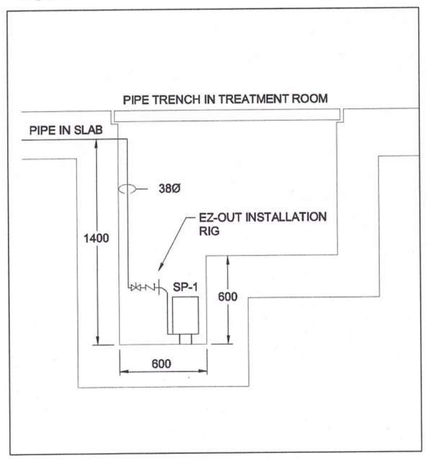
SP-2: 1.8 l/s @ 7m HYDRAULIC HEAD, 38Ø DISCHARGE, CLEAN WATER SUMP PUMP WITH WIDE ANGLE FLOAT SWITCH, 115V/1/60, 12 FLA, 1/2 hp, 1550 rpm HYDROMATIC SHEF 40A1 c/w EZ-OUT INSTALLATION RIG. c/w RAIL

SUMP PIT No. 3 PUMP INSTALLATION

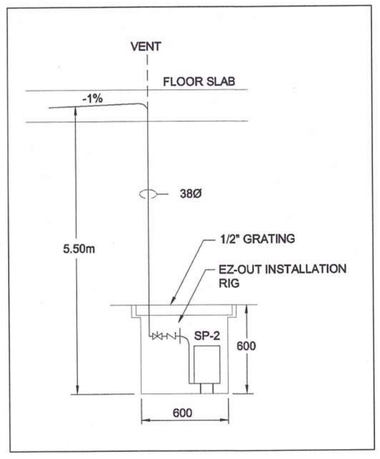
SP-1: 1.8 l/s @ 2m HYDRAULIC HEAD, 38Ø DISCHARGE, CLEAN WATER SUMP PUMP WITH WIDE ANGLE FLOAT SWITCH, 115V/1/60, 0.30 hp, 1550 rpm HYDROMATIC SW-33 c/w EZ-OUT INSTALLATION RIG. c/w RAIL

SUMP PIT No. 4 PUMP INSTALLATION

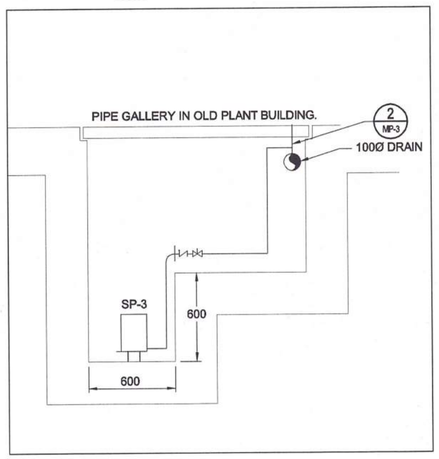
SP-3: 3.5 l/s @ 4.5m HYDRAULIC HEAD, 1 ph. 208V/1/2 hp WITH WIDE ANGLE FLOAT SWITCH, 2Ø DISCHARGE SIZE HYDROMATIC SPX-50 c/w 913 CONTROL PANEL. INSTALL WITH E-Z-OUT KIT c/w RAIL AS PER MANUFACTURER'S INSTRUCTIONS.



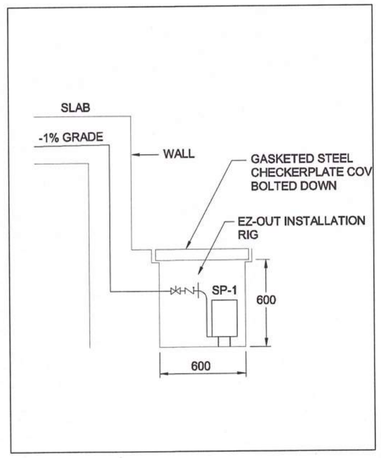
7 MP-3 **Sump Pit No.1 Pump Installation**
Scale N.T.S.



8 MP-3 **Sump Pit No.2 Pump Installation**
Scale N.T.S.



9 MP-3 **Sump Pit No.3 Pump Installation**
Scale N.T.S.



10 MP-3 **Sump Pit No.5 Pump Installation**
Scale N.T.S.

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

PLUMBING DETAILS

STAMP | NORTH POINT

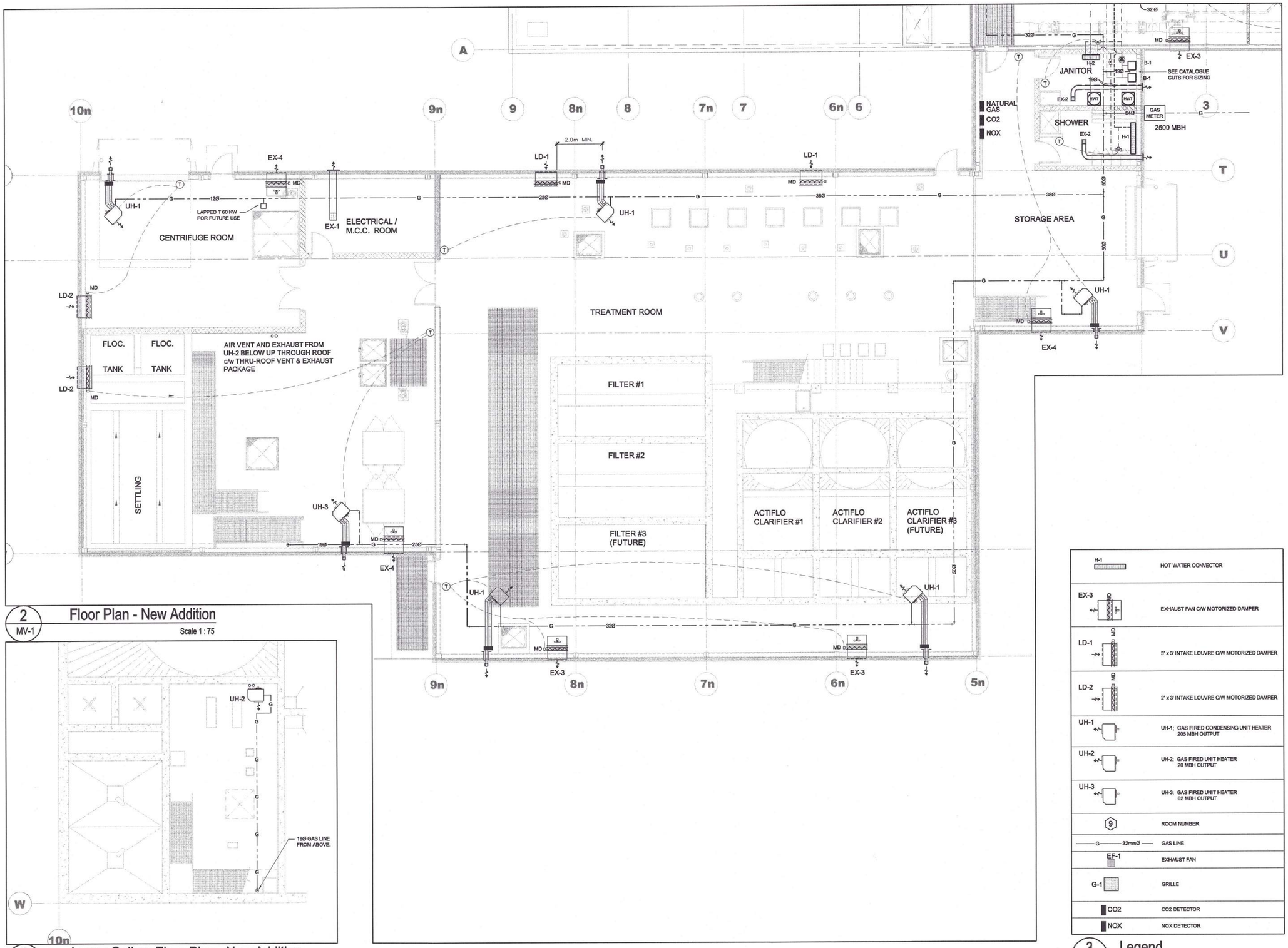
No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	O.D.	DATE	DEC 6. 2004
DRAWN	JKB	PROJECT	2016527B
CHECKED	O.D.	ACAD #	6527-M1-M2.DWG
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

DRAWING

MP-3

Plot Date/Time: 10/06/04 08:37am
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2 MV-1 Floor Plan - New Addition
Scale 1 : 75

1 MV-1 Lower Gallery Floor Plan - New Addition
Scale 1 : 75

H-1	HOT WATER CONVECTOR
EX-3	EXHAUST FAN C/W MOTORIZED DAMPER
LD-1	3' x 3' INTAKE LOUVRE C/W MOTORIZED DAMPER
LD-2	2' x 3' INTAKE LOUVRE C/W MOTORIZED DAMPER
UH-1	UH-1; GAS FIRED CONDENSING UNIT HEATER 205 MBH OUTPUT
UH-2	UH-2; GAS FIRED UNIT HEATER 20 MBH OUTPUT
UH-3	UH-3; GAS FIRED UNIT HEATER 62 MBH OUTPUT
9	ROOM NUMBER
G — 32mmØ —	GAS LINE
EF-1	EXHAUST FAN
G-1	GRILLE
CO2	CO2 DETECTOR
NOX	NOX DETECTOR

3 MV-1 Legend

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

HVAC FLOOR PLANS - NEW ADDITION

STAMP

NORTH POINT

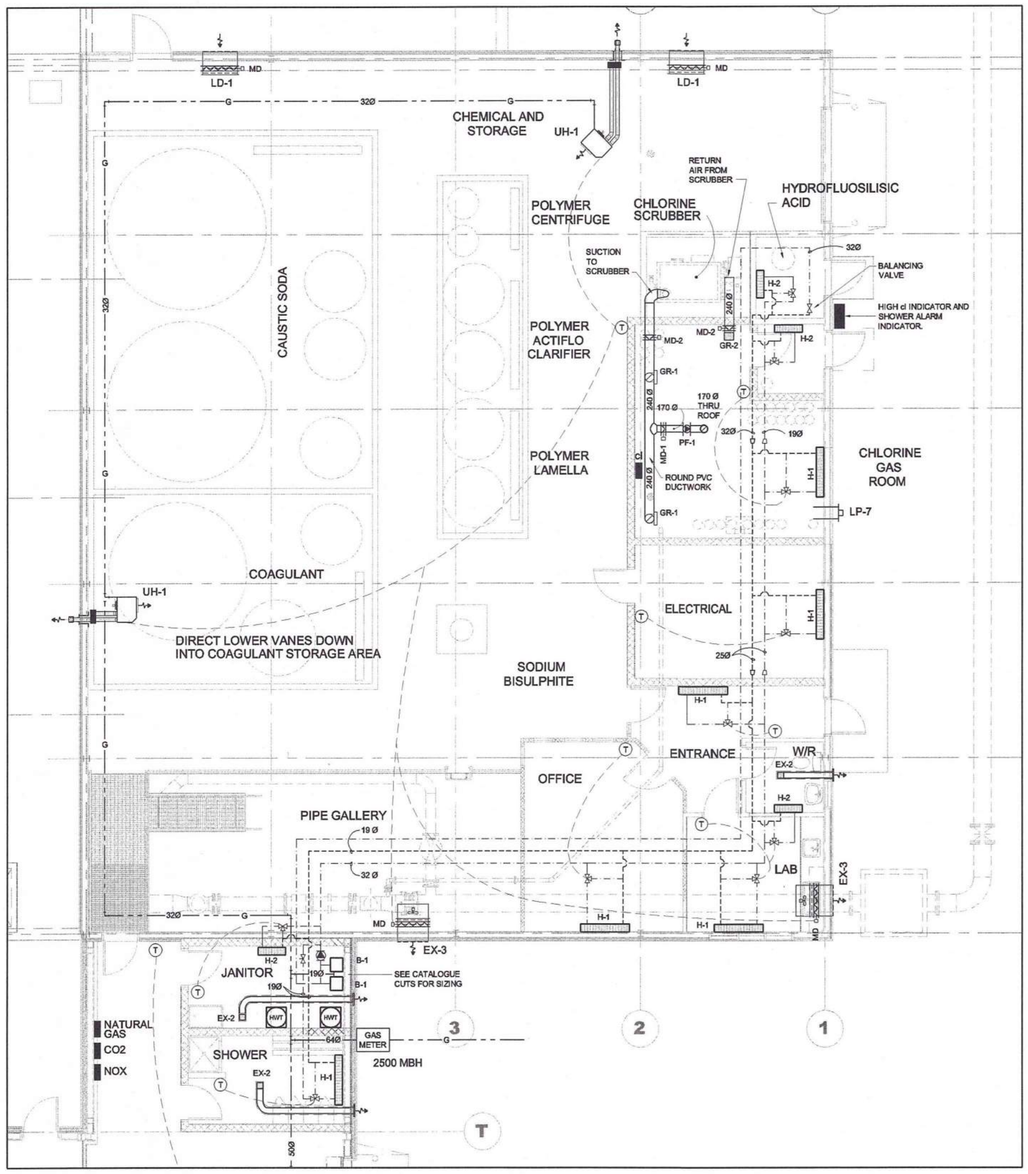
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1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	J.V.	DATE	AUGUST 2005
DRAWN	J.E.	PROJECT	2016527C
CHECKED	J.V.	ACAD #	6527-M3-M4.DWG
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

DRAWING

MV-1

Plot Date/Time: 10/08/04 08:37am
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1 MV-2 **Floor Plan - Existing Modified**

Scale 1 : 75

H-1 FINNED TUBE HOT-WATER CONVECTOR 1270mm LONG, 203mm DEEP, 813mm HIGH, 3.3 KW @ 7° TEMP DROP AT 82° INPUT TEMPERATURE. 2 ROWS OF ELEMENTS, 300mm SPACING

H-2 FINNED TUBE HOT-WATER CONVECTOR 528mm LONG, 203mm DEEP, 813mm HIGH, 1.3 KW @ 7° TEMP DROP AT 82° INPUT TEMPERATURE. 2 ROWS OF ELEMENTS, 300mm SPACING

B-1 GAS-FIRED, DIRECT VENTED, INDUCED DRAFT BOILER, DOE HEATING CAPACITY. 9 - 30 KW MODULATING.

HWT INDIRECT FIRED DOMESTIC HOT WATER HEATER. 120 US GAL. CAPACITY.

PF-1 PLASTIC UTILITY FAN - 50 L/S @ 15Pa. NORMALLY ON

MD-1 SPRING OPEN, POWER CLOSED PLASTIC MOTORIZED DAMPER

MD-2 POWER OPEN, SPRING CLOSED PLASTIC MOTORIZED DAMPER

GR-1 PLASTIC GRILLE AT FLOOR - 65 L/S (150mm x 200mm)

GR-2 PLASTIC GRILLE AT FLOOR - 125 L/S (250mm x 200mm)

LP-7 FIBRE REINFORCED PLASTIC AIR INTAKE - CEILING LEVEL - 50 L/S - 150mm Ø c/w RAIN CAP & BIRD SCREEN

EX-3 - WALL MOUNT PROPELLER EXHAUST FAN
- 5990 cfm @ 0.28 w.g.
- 30" FAN DIAMETER, 208/3/60, 1/2 hp, DIRECT DRIVE
- SUPPLY AND INSTALL c/w ALUMINUM WALL SHUTTER, WALL SLEEVE wt. REAR GUARD AND WEATHER SHIELD wt. FRONT GUARD.
- PROVIDE FRAMING TO SUPPORT UNIT
- ACCEPTABLE EQUIPMENT - PENN BREEZEWAY BC 30W2
- CONTROL FROM SCADA SYSTEM:

EX-4 - WALL MOUNT PROPELLER EXHAUST FAN
- 2100 cfm @ 0.23 w.g.
- 30" FAN DIAMETER, 208/3/60, 1/2 hp, DIRECT DRIVE
- SUPPLY AND INSTALL c/w ALUMINUM WALL SHUTTER, WALL SLEEVE wt. REAR GUARD AND WEATHER SHIELD wt. FRONT GUARD.
- PROVIDE FRAMING TO SUPPORT UNIT
- ACCEPTABLE EQUIPMENT - PENN BREEZEWAY BC 30W2
- CONTROL FROM SCADA SYSTEM:

LD-1 - 3'x3' INSULATED MOTORIZED DAMPER
- NORMALLY CLOSED, POWER OPEN, SPRING RETURN
- ACCEPTABLE EQUIPMENT - TAMCO 9000 DAMPER AND NF120-S SPRING RETURN ACTUATORS, c/w END SWITCH
- 3'x3' EXTERIOR INTAKE LOUVER
- ACCEPTABLE EQUIPMENT - TAMCO SERIES 3400
- PROVIDE FRAMING AND WALL SLEEVE TO SUPPORT EQUIPMENT
- CONTROL FROM SCADA SYSTEM
- UPON CALL FOR COOLING, OPEN DAMPER
- END SWITCH ON DAMPER TO ACTIVATE EX-3
- ACTUATOR 115/1/60

LD-2 - 2'x3' MOTORIZED DAMPER c/w LOUVRE
- NORMALLY CLOSED, POWER OPEN, SPRING RETURN
- ACCEPTABLE EQUIPMENT - TAMCO 9000 DAMPER AND NF120-S SPRING RETURN ACTUATORS, c/w END SWITCH
- 3'x3' EXTERIOR INTAKE LOUVER
- ACCEPTABLE EQUIPMENT - TAMCO SERIES 3400
- PROVIDE FRAMING AND WALL SLEEVE TO SUPPORT EQUIPMENT
- CONTROL FROM SCADA SYSTEM
- UPON CALL FOR COOLING, OPEN DAMPER
- END SWITCH ON DAMPER TO ACTIVATE EX-3
- ACTUATOR 115/1/60

2 MV-2 **Notes**

H-1	HOT WATER CONVECTOR
EX-3	EXHAUST FAN C/W MOTORIZED DAMPER
LD-1	3' x 3' INTAKE LOUVRE C/W MOTORIZED DAMPER
LD-2	2' x 3' INTAKE LOUVRE C/W MOTORIZED DAMPER
UH-1	UH-1; GAS FIRED CONDENSING UNIT HEATER 205 MBH OUTPUT
UH-2	UH-2; GAS FIRED UNIT HEATER 20 MBH OUTPUT
UH-3	UH-3; GAS FIRED UNIT HEATER 62 MBH OUTPUT
9	ROOM NUMBER
G — 32mmØ —	GAS LINE
EF-1	EXHAUST FAN
G-1	GRILLE
CO2	CO2 DETECTOR
NOX	NOX DETECTOR

3 MV-2 **Legend**

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

HVAC
FLOOR PLAN - EXIST. MODIFIED

STAMP

NORTH POINT

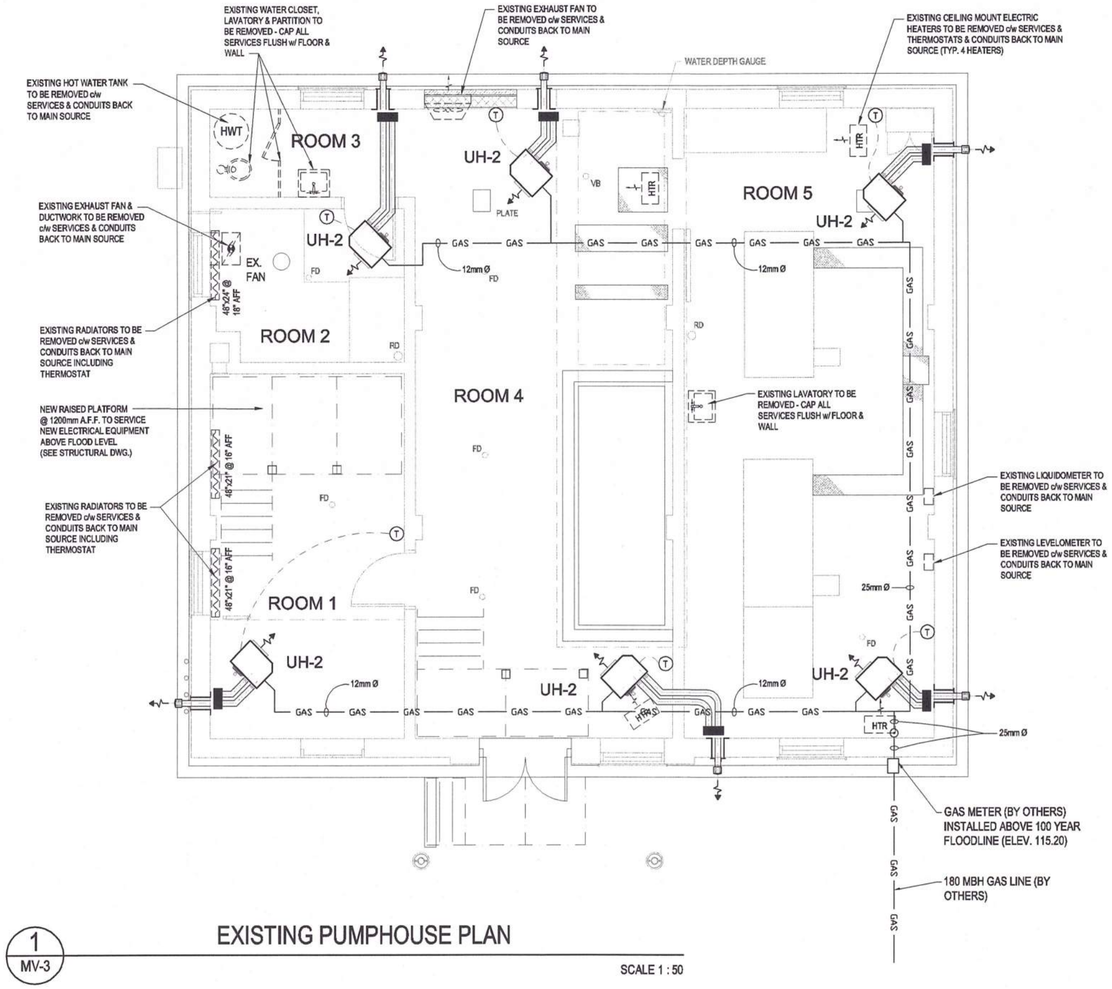
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1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

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DRAWN	J.E.	PROJECT	2016527C
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SCALE	AS SHOWN		

DRAWING

MV-2

DWG FullPath: P:\DRAWINGS\6.5 - Water & Sewage Works\2016527C_DEEP RIVER WTP\ACTIVE DRAWINGS\ARCHITECTURAL\ACTIVE\6527C-ARCH PLANS



1 / MV-3 EXISTING PUMPHOUSE PLAN

SCALE 1 : 50

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES
EXISTING PUMPHOUSE

Deep River, Ontario

DRAWING

EXISTING PUMPHOUSE MODIFICATIONS

STAMP

NORTH POINT

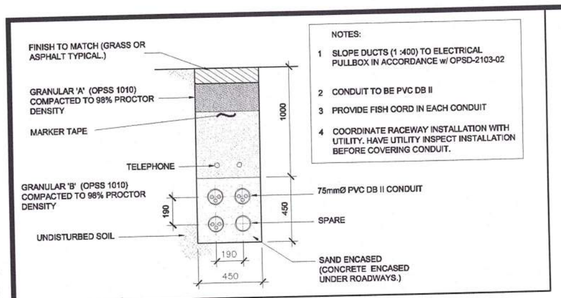
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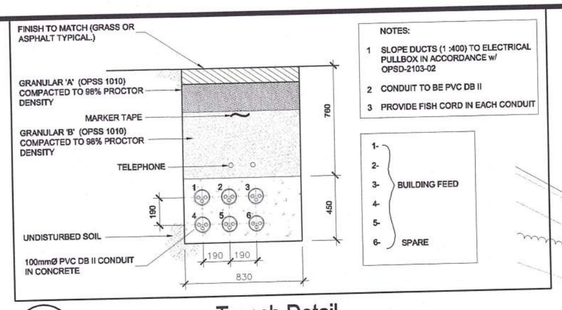
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MV-3

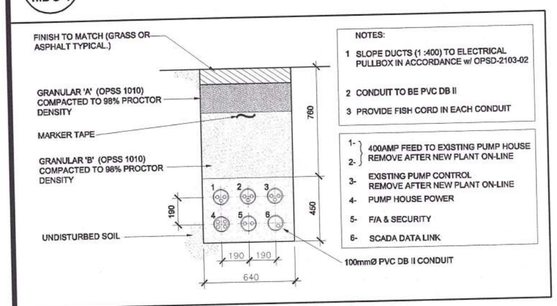
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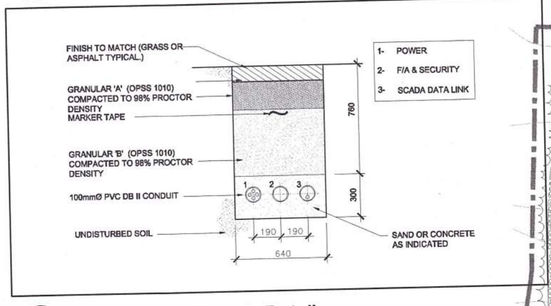
2 MDG-1 **Trench Detail (for reference only)** Scale 1 : 20



3 E-0 **Trench Detail** Scale 1 : 20



4 E-0 **Trench Detail (for reference only)** Scale 1 : 20



5 E-0 **Trench Detail** Scale 1 : 20

1 Work to conform to Ontario Electrical Safety Code, any other relevant standards and this specification and drawings; most stringent condition will apply. Obtain and pay for all permits, licenses, inspections and certificates required by this Division. Arrange for inspections as required.

2 Provide shop drawings of all products. Do not proceed with work until successful review of drawing has completed.

3 Use only new products, with approvals as required by appropriate standards such as CSA, EEMAC, NEMA etc.

4 Coordinate with all other Divisions. Review all mechanical and architectural information and specifications and allow for providing all electrical work for systems at or above 50 volts

5 Use only qualified personnel for work and work shall be to standards of excellence and good practice. Codes represent minimum standard to be met.

6 Cleanup after work each day and at of end of job.

7 Identify all circuits with labels and colour code voltage to CGBS Code 24-GP-3A and CSA-B53.

8 All wiring and outlets in furniture is responsiblity of this Division. Coordinate with furniture vendor installation of power and data wiring.

9 All wiring (low and high voltage) shall be in conduit unless noted. Wire to be copper, RW90, minimum #12 AWG, (RWU90 where required) unless specified otherwise elsewhere. Size wire as per code, minimum size to be code value, unless indicated larger on drawings. Allow for voltage drop.

10 Balance loads in panels to 10% at completion of job. Update panel directories.

11 Keep all data wiring minimum of 12 inches from power wiring in any direction.

12 Provide grounding as required by code, even if not shown.

13 Provide sleeves where conduit passes through walls and floors. Seal all sleeves after installation of conduit.

14 Provide ALL wiring for SCADA systems. Coordinate wiring and terminations with SCADA contractor.

15 Provide grounding at pad mount transformer as required by Code. As minimum, provide 4/0 ground loop minimum 3 ft from transformer, c/w (6) 3/4 inch dia x 10 ft long copper ground rods equally spaced around transformer. Connect to building ground.

16 Provide photocell and controllers/contactors. One contactor to control road and parking lot lighting and three to control wall packs on outside of buildings. One contactor for existing building, one for new building & one for the low lift pumping station.

17 Provide lightning protection as indicated in specification for both main buildings and raw water intake building.

18 Use variable frequency wire between VSD controller and related disconnects and pumps. Install wire as recommended by manufacturer.

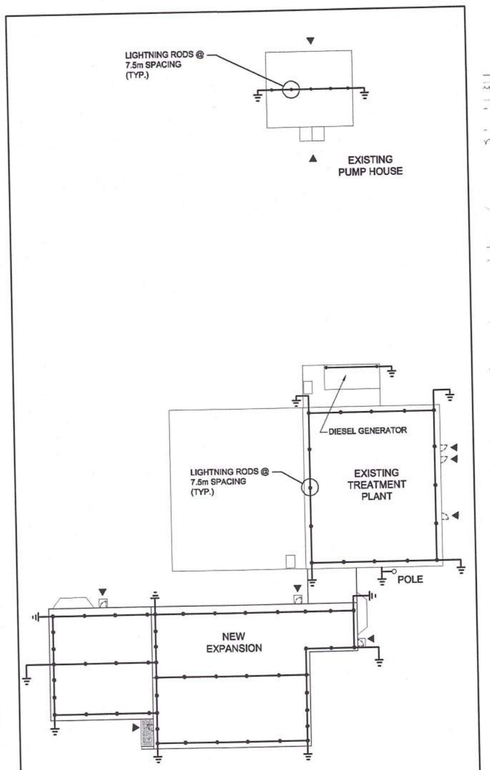
19 Where possible, conceal feeders conduit etc., i.e. run main feeders through concrete floor, walls etc. Obtain consultants approval before selecting alternate route. Coordinate with all other trades for installation of conduit, cable etc.

20 CLEARLY MARK LOCATION OF CONCEALED CONDUITS AND WIRES ON AS-BUILTS.

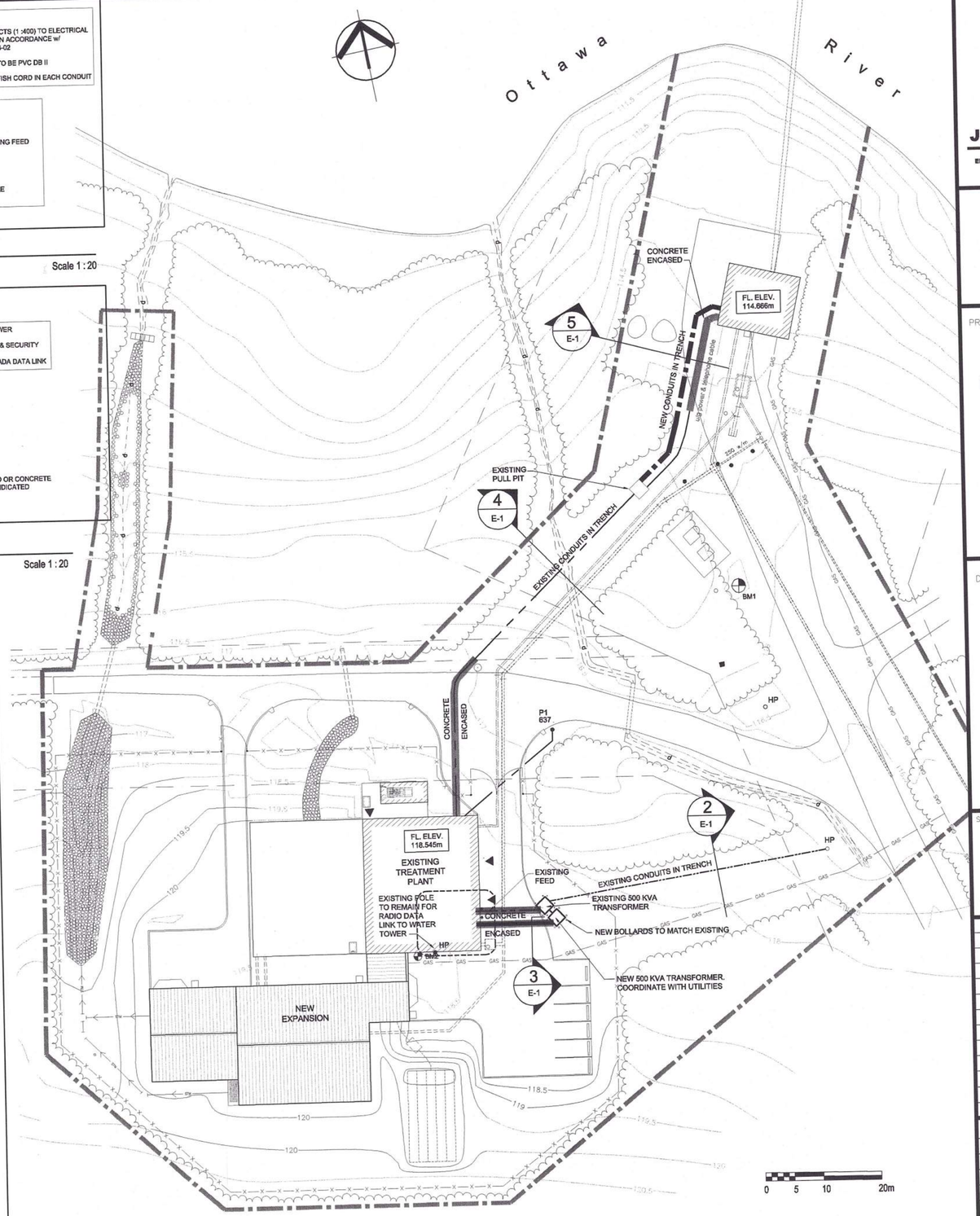
21 Run road and parking lot lighting power underground.

22 Electrical contractor to be responsible for all trenching and restoration for his own work.

7 E-0 **General Notes**



6 E-0 **Lightning Protection Roof Plans** Scale 1 : 20



1 E-0 **Site Plan** Scale 1 : 400

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

SITE PLAN and DETAILS

STAMP

NORTH POINT

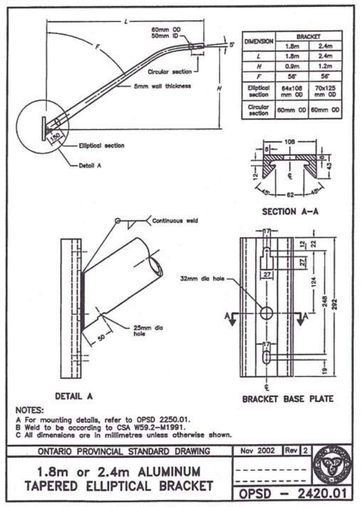
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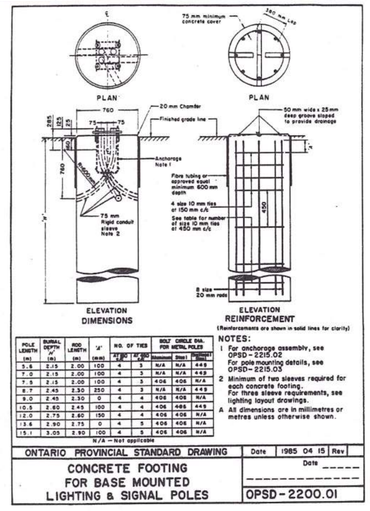
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DRAWN	J.E	PROJECT	2016527C
CHECKED	J.V	ACAD #	6527-E1.DWG
APPROVED		PLOT DATE	09/14/05
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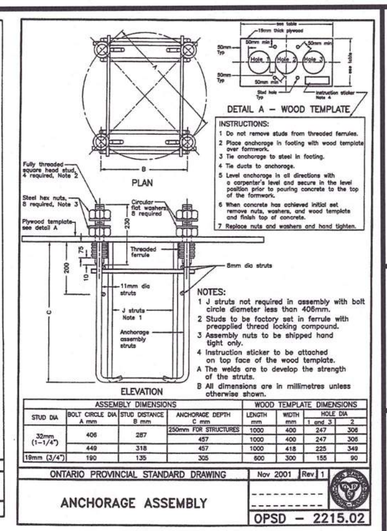
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E-0

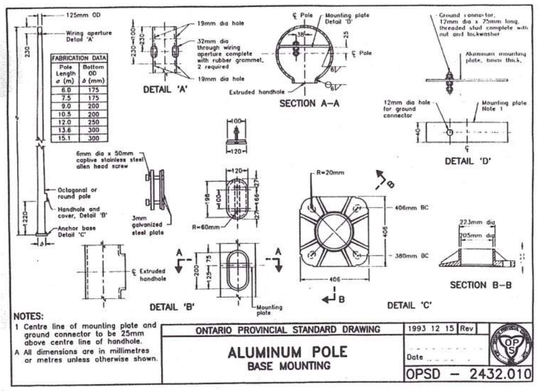
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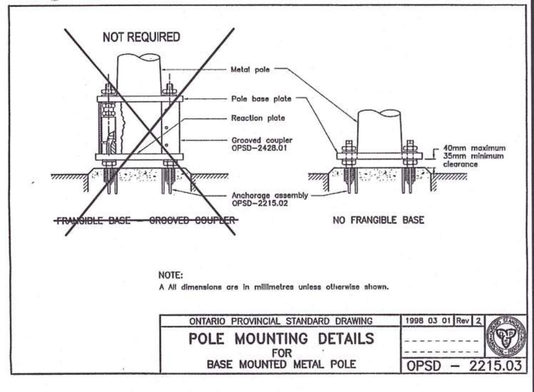


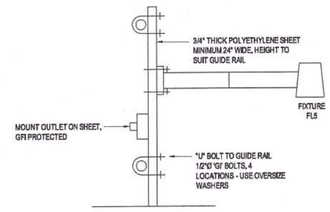


STUD DIA	ASSEMBLY DIMENSIONS A mm	STUD DISTANCE B mm	ANCHORAGE DEPTH C mm	WOOD TEMPLATE DIMENSIONS LENGTH mm	WIDTH mm	HOLE DIA 1 and 3	HOLE DIA 2
32mm (1-1/4")	406	287	250mm FOR STRUCTURES	1000	400	247	308
			457	1000	400	247	308
	449	318	457	1000	418	225	349
19mm (3/4")	190	135	305	600	300	155	90

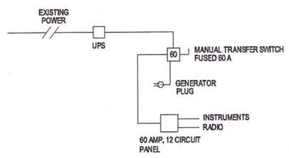


6 / E1 OPSD Details
NTS





5 / E1 Mounting Detail FL5
NTS



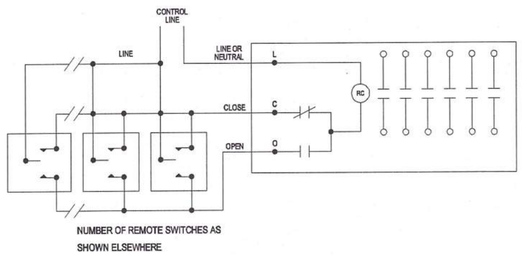
4 / E1 Wiring at Water Tower
NTS

MCC1

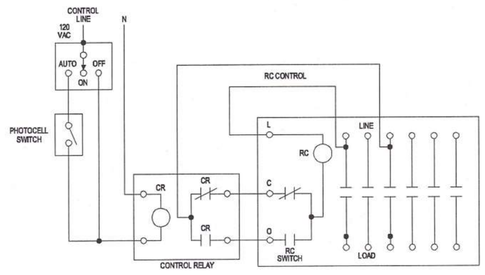
A 12	INCOMING POWER	BACKWASH 1	BACKWASH 2	SLDG PUMP 1	DATALINK POWER	HIGH LIFT 4	CLARIFIER FLOC No 1	LAMELLA FLASH MIXER
B 11		VFD	VFD	SLDG PUMP 2			VFD	LAMELLA FLASH MIXER
C 10				BLOWER No 1 FAN	PLC			SPARE 60 A DISC BLANK
D 9				BLOWER No 2 FAN	SLDG COND 1		CLARIFIER FLOC No 2	DATALINK BLANK
E 8				THICKENER SCRAPER 1	SRG PMP 1		VFD	EMPTY
F 7				BLANK	SRG PMP 2			
G 6								
H 5	AIR BLOWER 1							
I 4	AIR BLOWER 2							
J 3	BLANK							
K 2								
L 1								
	1	2	3	4	5	6	7	8

MCC2

SIZE	INCOMING					
A 12	INCOMING POWER	HIGH LIFT 1	HIGH LIFT 2	HIGH LIFT 3	HIGH LIFT 6 EMPTY	DATA LINK POWER
B 11						PLC
C 10						DATA LINK PORT
D 9						EMPTY
E 8						
F 7						
G 6						
H 5	SPARE 30 A DISC					
I 4						
J 3	SPARE 60 A DISC					
K 2						
L 1						
	1	2	3	4	5	6



3 / E1 Multiple Toggle Control Stations for Operating the RC Switch - Interior Lights
NTS



2 / E1 Schematic for Photocell Outdoor Light
NTS

1 / E1 MCC Layouts
NTS

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

OPSD STANDARDS AND ELECTRICAL SCHEMATICS

STAMP

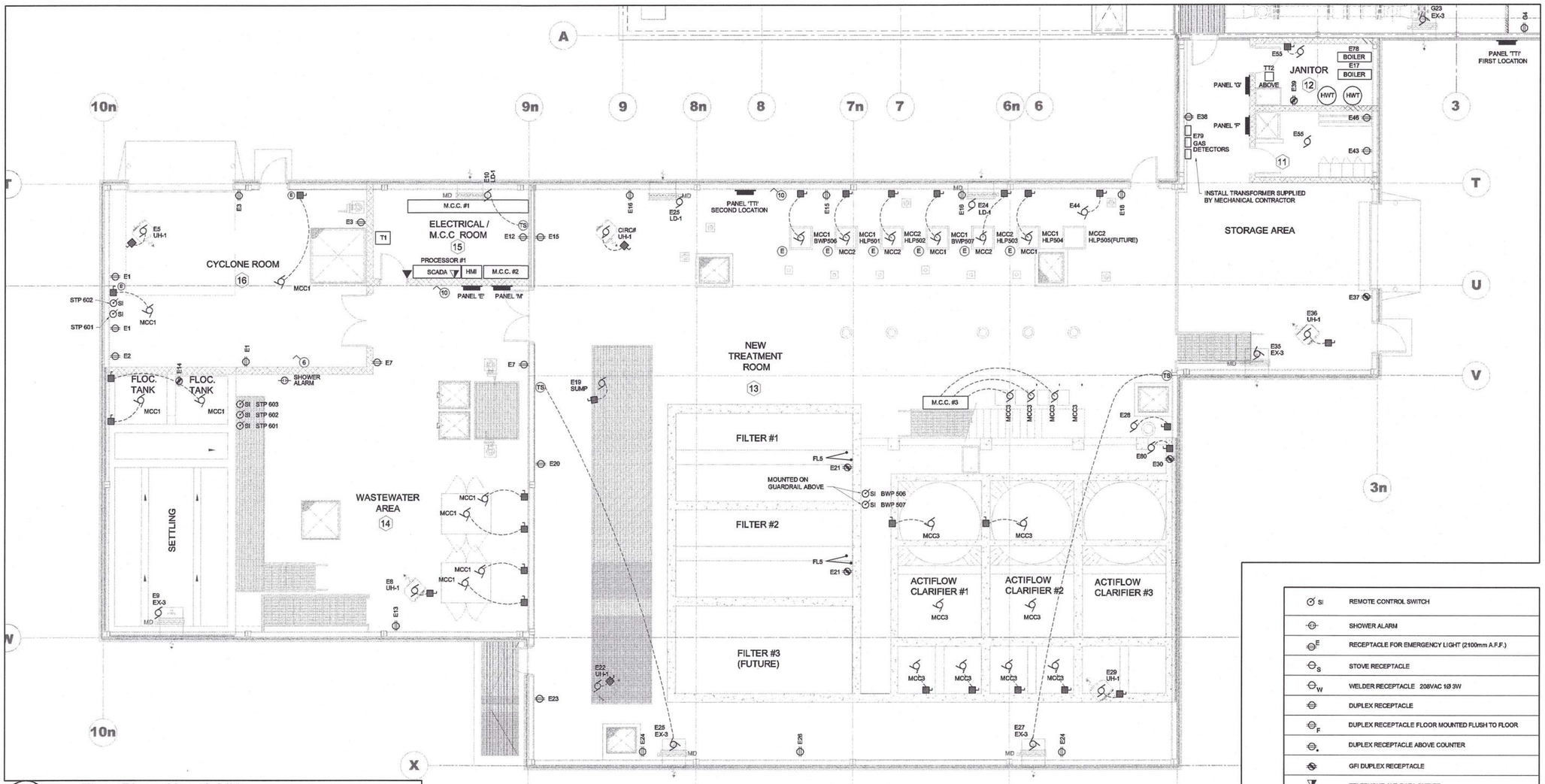
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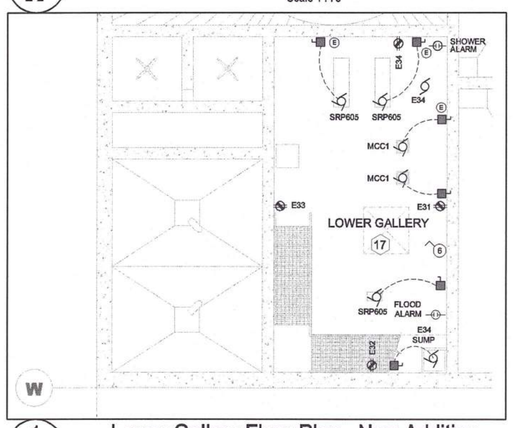
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DRAWN	J.E.	PROJECT	2016527C
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APPROVED		PLOT DATE	09/21/05
SCALE	AS SHOWN		
DRAWING			

E-1

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2 E-2 **Floor Plan - New Addition**
Scale 1 : 75



1 E-2 **Lower Gallery Floor Plan - New Addition**
Scale 1 : 75

SI	REMOTE CONTROL SWITCH
	SHOWER ALARM
E	RECEPTACLE FOR EMERGENCY LIGHT (2100mm A.F.F.)
S	STOVE RECEPTACLE
W	WELDER RECEPTACLE 208VAC 1Ø 3W
	DUPLEX RECEPTACLE
F	DUPLEX RECEPTACLE FLOOR MOUNTED FLUSH TO FLOOR
	DUPLEX RECEPTACLE ABOVE COUNTER
	GFI DUPLEX RECEPTACLE
	TELEPHONE AND DATA OUTLET
	DUPLEX TELEPHONE OUTLET D - DEDICATED OUTLET FOR METER
	3 PHASE MOTOR
	SINGLE PHASE MOTOR
	DISCONNECT
4	NEMA 4 DISCONNECT
	STARTER
	STOP / START STATION
	ELECTRICAL PANEL
JB	JUNCTION BOX
	1 KW BASEBOARD HEATER - OUELLET MODELOPR1002 C/W TAMPER PROOF THERMOSTAT.
1 3	HEATERS 1 - SINGLE PHASE 3 - THREE PHASE
T	THERMOSTAT
T#	TRANSFORMER MOUNT AT 4.0m A.F.F.
E	EMERGENCY STOP
#	PROCESS ALARM GONG

3 E-2 **Legend**

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Deep River, Ontario

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ELECTRICAL DISTRIBUTION FLOOR PLANS - NEW ADDITION

STAMP

NORTH POINT

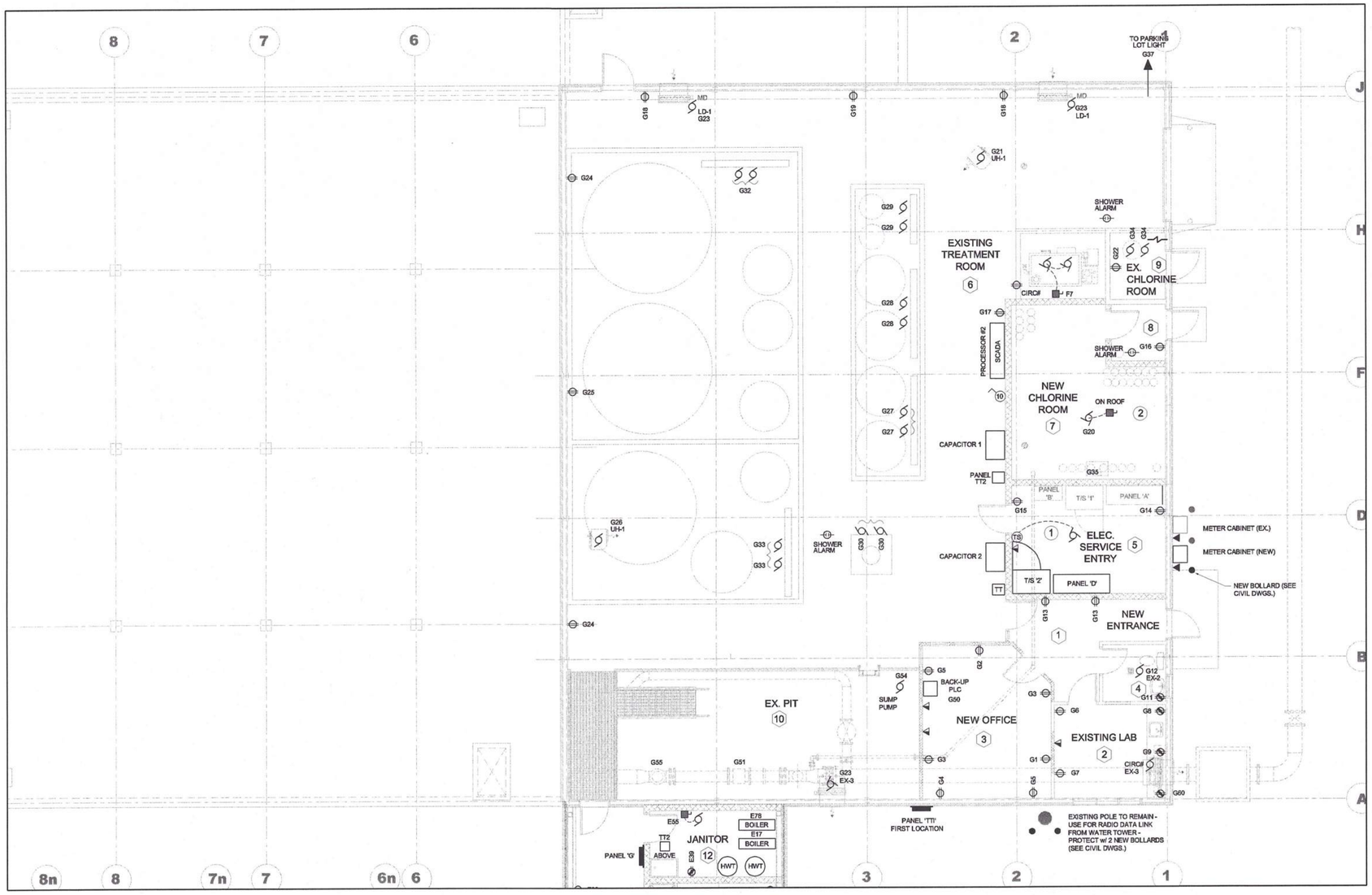
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1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

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DRAWN	J.E.	PROJECT	2016527C
CHECKED	J.V.	ACAD #	6527-E2-E7.DWG
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

DRAWING

E-2

Plot Date/Time: 10/06/04 08:37am
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1 E-3 **Floor Plan - Existing Modified**
Scale 1 : 75

SI	REMOTE CONTROL SWITCH
	SHOWER ALARM
E	RECEPTACLE FOR EMERGENCY LIGHT (2100mm A.F.F.)
S	STOVE RECEPTACLE
W	WELDER RECEPTACLE 208VAC 1Ø 3W
	DUPLEX RECEPTACLE
F	DUPLEX RECEPTACLE FLOOR MOUNTED FLUSH TO FLOOR
	DUPLEX RECEPTACLE ABOVE COUNTER
	GFI DUPLEX RECEPTACLE
	TELEPHONE AND DATA OUTLET
	DUPLEX TELEPHONE OUTLET D - DEDICATED OUTLET FOR METER
	3 PHASE MOTOR
	SINGLE PHASE MOTOR
	DISCONNECT
4	NEMA 4 DISCONNECT
	STARTER
	STOP / START STATION
	ELECTRICAL PANEL
JB	JUNCTION BOX
	1 KW BASEBOARD HEATER - OUELLET MODELOPR1002 C/W TAMPER PROOF THERMOSTAT.
1Ø 3	HEATERS 1 - SINGLE PHASE 3 - THREE PHASE
T	THERMOSTAT
T#	TRANSFORMER MOUNT AT 4.0m A.F.F.
E	EMERGENCY STOP
#	PROCESS ALARM GONG # - INDICATES SIZE 10 - 250mm DIA. 6 - 150mm DIA.

2 E-3 **Legend**

1. NO TRANSFORMERS IN THIS ROOM

   OUTSIDE LIGHTS AND PARKING LOT LIGHTS TO BE CONTROLLED BY PHOTO CELL

2. SEAL ALL ELECTRICAL PENETRATIONS IN AND OUT OF CHLORINE ROOM GAS TIGHT

   ALL CONDUITS AND BOXES IN THIS ROOM TO BE PVC

   ALL MATERIALS IN THIS ROOM TO BE CORROSION RESISTANT TO CHLORINE GAS

3 E-3 **Notes**

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

ELECTRICAL - DISTRIBUTION FLOOR PLAN - EXISTING MODIFIED

STAMP

NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	J.V.	DATE	AUGUST 2005
DRAWN	J.E.	PROJECT	2016527C
CHECKED	J.V.	ACAD #	6527-E2-E7.DWG
APPROVED		PLOT DATE	
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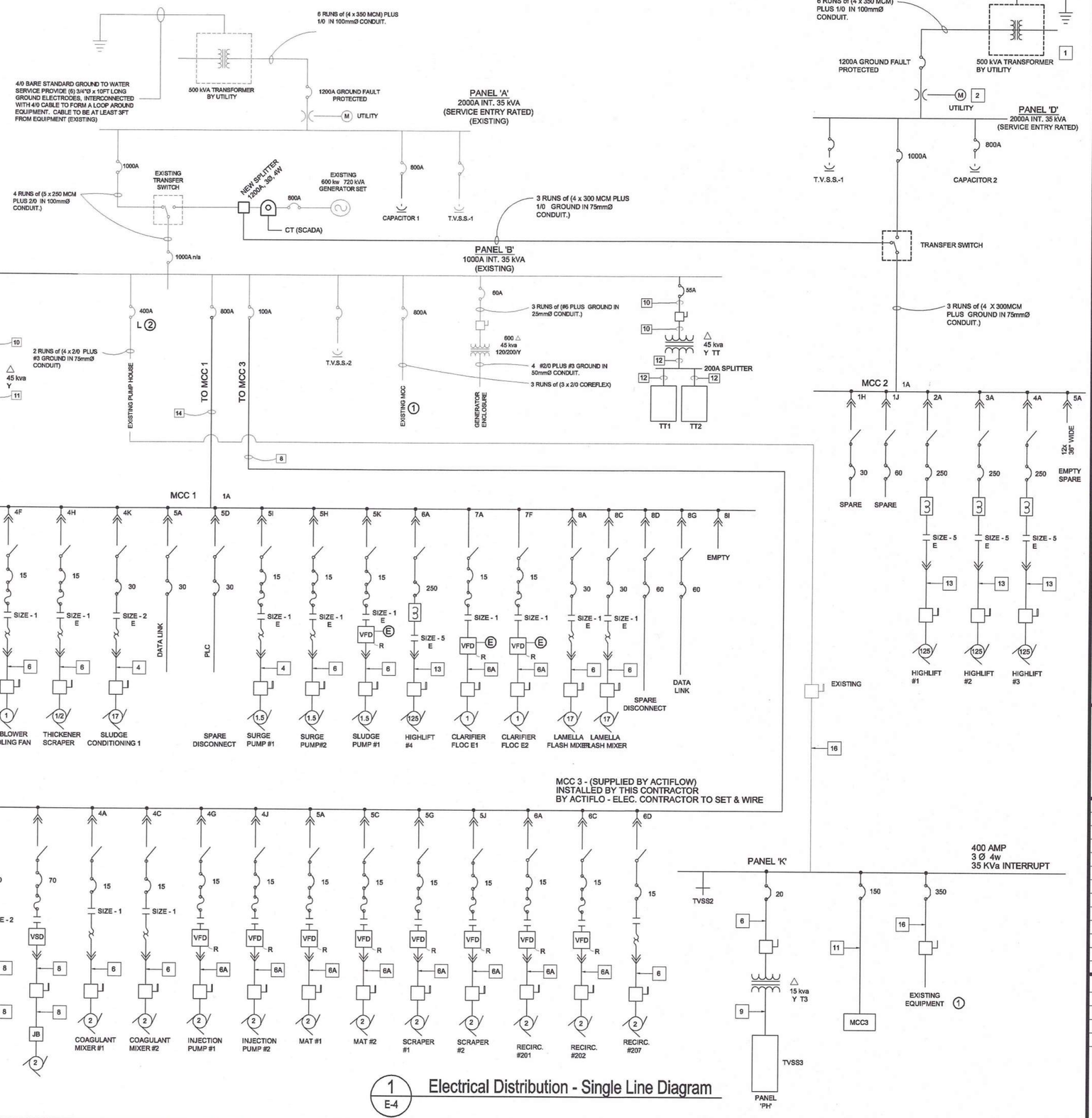
E-3

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1	COORDINATE WITH UTILITY PRIMARY SERVICE AND SWITCH GEAR. PROVIDE PRIMARY FEED DUCTS AS SHOWN AND TRANSFORMER PAD. UTILITY TO PROVIDE PRIMARY FEEDERS AND TRANSFORMERS . TRANSFORMER BASE AND PAD TO ' CITY OF OTTAWA STANDARD 5136-5'
2	CTS TO BE SUPPLIED BY UTILITY. MOUNT IN 36" x 36" x 18" METER BOX. PROVIDE DEDICATED TELEPHONE LINE.
3	2[(4 #3) PLUS GROUND IN 38mm Ø CONDUIT.]
4	(3) #10 PLUS GROUND IN 19mm Ø CONDUIT
5	(3) #4 PLUS GROUND (VFD WIRE)
6	(3) #12 PLUS GROUND IN 19mm Ø CONDUIT.
6A	(3) #12 PLUS GROUND (VFD WIRE)
7	(3) #2 PLUS GROUND IN 50mm Ø CONDUIT.
8	(3) #6 PLUS GROUND VFD WIRE
9	(4) #6 PLUS GROUND IN 41mm Ø CONDUIT.
10	(3) #6 PLUS GROUND IN 35mm Ø CONDUIT.
11	(5) 1/0 PLUS GROUND IN 78mm Ø CONDUIT.
12	(4) 1/0 PLUS GROUND IN 53mm Ø CONDUIT.
13	(3) 2/0 PLUS GROUND IN 53mm Ø CONDUIT.
14	(6) 250 MCM CORFLEX + (2) 500 MCM CORFLEX NEUTRAL + GROUND
15	(3) #8 PLUS GROUND IN 25mm Ø CONDUIT.
16	2 RUNS OF [(4) 2/0 PLUS GROUND IN 75mm Ø CONDUIT.]

3
E-4

Notes



Electrical Distribution - Single Line Diagram

1
E-4

VSD R	VARIABLE FREQUENCY DRIVE CONTROLER R - INDICATES AUTOLOCK SWITCH & CONTROL
3P, 60A	DISCONNECT
55A T.D.	FUSE
SIZE 2 E	STARTER C/W OVERLOAD EMERGENCY STOP AT DISCONNECT
	DISCONNECT
40	DISCONNECT FUSED AS INDICATED (ie: 40 amp)
50	3 PHASE MOTOR (ALL MOTOR SIZES SHOWN ARE IN HORSEPOWER UNLESS NOTED OTHERWISE)
2	SINGLE PHASE MOTOR (ALL MOTOR SIZES SHOWN ARE IN HORSEPOWER UNLESS NOTED OTHERWISE)
	PANEL
3	REDUCED VOLTAGE STARTER

2
E-4

Legend

1. DISCONNECT & REMOVE ALL OLD PLANT EQUIPMENT ONCE OLD PLANT HAS BEEN SHUT DOWN & DE-COMMISIONED. TURN OVER TO OWNER MCC, STARTERS, & LOW BAY LIGHTS
2. PROVIDE LOCKING DEVICE TO PERMIT BREAKER TO BE USED AS "DISCONNECT"
3. FUSE TO VSD DRIVE MANUFACTURER'S RECOMMENDATIONS

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

ELECTRICAL DISTRIBUTION SINGLE LINE DIAGRAM

STAMP

NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	J.V.	DATE	AUGUST 2005
DRAWN	J.E.	PROJECT	2016527C
CHECKED	J.V.	ACAD #	6527-E2-E7.DWG
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

DRAWING

E-4

Plot Date/Time: 10/06/04 08:37am
DWG FullPath: P:\DRAWINGS\6.5 - Water & Sewage Works\2016527B_DEEP RIVER WTP\ACTIVE DRAWINGS\MECHANICAL\mdg-diesel gen\6527-MDG-1.d

POWER DISTRIBUTION PANEL 'E'

CIRCUIT #	DESCRIPTION	200 N/A	DESCRIPTION	CIRCUIT #
1	OUTLET - ROOM 16	15 1 2 50		2
3	OUTLET - ROOM 16	15 3 4	SCADA (1)	
5	OUTLET - ROOM 16	15 5 6		
7	OUTLET - ROOM 14	15 7 8 15	HEATER - ROOM 14	8
9	EXHAUST FAN - ROOM 14	15 9 10 15	EXHAUST FAN - ROOM 15	10
11	OUTLET - ROOM 15	15 11 12 15	OUTLET - ROOM 15	12
13	OUTLET - ROOM 14	15 13 14 15	OUTLET - ROOM 14	14
15	OUTLET - ROOM 13	15 15 16 15	OUTLET - ROOM 13	16
17	BOILER 2	15 17 18 15	OUTLET - ROOM 13	18
19	SUMP PUMP - ROOM 13	15 19 20 15	OUTLET - ROOM 13	20
21		15 21 22 15	HEATER - ROOM 13	22
23	OUTLET - ROOM 13	15 23 24 15	OUTLET - ROOM 13	24
25	EXHAUST FAN - ROOM 13	15 25 26 15	OUTLET - ROOM 13	26
27	EXHAUST FAN - ROOM 13	15 27 28 15	SUMP PUMP - ROOM 13	28
29	HEATER - ROOM 13	15 29 30 15	OUTLET - ROOM 13	30
31	OUTLET - ROOM 17	15 31 32 15	SUMP PUMP - ROOM 17	32
33	OUTLET - ROOM 17	15 33 34 15	OUTLET - ROOM 17	34
35	EXHAUST FAN - ROOM 11	15 35 36 15	HEATER - ROOM 11	36
37	OUTLET - ROOM 11	15 37 38 15	OUTLET - ROOM 11	38
39	OUTLET - ROOM 12	15 39 40 15	OUTLET - SHOWER ROOM	40
41	OUTSIDE LIGHTS	20 41 42 20	HOT WATER RECIRC PUMP	42
43	OUTLET - ROOM 11	20 43 44 20	SAMPLE PUMP	44
45	NIGHT LIGHTS	15 45 46 20	LIGHTS - ROOM 14,15,16	46
47	LIGHTS - ROOM 14	20 47 48 20	LIGHTS - ROOM 14,17	48
49	LIGHTS - ROOM 13	20 49 50 20	LIGHTS - ROOM 13	50
51	LIGHTS - ROOM 13	20 51 52 20	LIGHTS - ROOM 13	52
53	LIGHTS - ROOM 13	20 53 54 15	EXIT LIGHTS	54
55	LIGHTS - ROOM 11	20 55 56 15		
57	OUTSIDE LIGHTS	20 57 58 20	OUTSIDE LIGHTS	58
59	OUTSIDE LIGHTS	20 59 60 15	OUTSIDE LIGHTS	60
61	METERS - ACTIFLOW 1	15 61 62 15	METERS - ACTIFLOW 2	62
63	FLOW METERS	15 63 64 15	INSTRUMENTS - CLEARWELL	64
65	INSTRUMENTS - WASTE WATER	15 65 66 15		66
67		15 67 68 15	VALVE OPERATION - ACTIFLOW 1 (2)	
	VALVE OPERATION - ACTIFLOW 2 (2)	69 70		
		71 72 15		72
73		15 73 74	VALVE OPERATION WASTE WATER (2)	
	VALVE OPERATION HIGH LIFT (2)	75 76		
		77 78 15	BOILER 1	78
79	GAS DETECTORS	15 79 80 15	SMAPLE PUMP	80
81	EMERGENCY SHOWER	15 81 82		82
83	SPARE	15 83 84 15	SPARE	84

MAIN BUS 225 AMP 450 AMP NEUTRAL 84 CIRCUIT
MAIN C/B OR SW/FUSE 10 KA
BRANCH C/B INT. CAP. 10 KA
SURFACE MOUNTED
EQUIPMENT GROUND BUS VOLTAGE 208/120/3Ø 4W
TVSS 3
LOCK ON *

(1) CONFIRM WITH SCADA SUBCONTRACTOR

(2) CO-ORDINATE BREAKER SIZE AND NUMBER OF POLES WITH PROCESS INSTALLER BEFORE ORDERING PANEL

CONFIRM MOTORIZED VALVE OPERATOR REQUIREMENTS

POWER DISTRIBUTION PANEL 'G'

CIRCUIT #	DESCRIPTION	200 N/A	DESCRIPTION	CIRCUIT #
1	EXIT LIGHTS *	* 20 1 2	15 OFFICE OUTLET	2
3	OFFICE OUTLET	15 3 4	15 OFFICE OUTLET	4
5	OFFICE OUTLET	15 5 6	15 LAB	6
7	LAB	15 7 8	15 LAB	8
9	LAB	15 9 10	LAB	10
11	WASHROOM OUTLET	15 11 12	15 WASHROOM LIGHTS/FAN	12
13	ENTRANCE OUTLET	15 13 14	15 OUTLET - ROOM 5	14
15	OUTLET - ROOM 5	15 15 16	15 OUTLET - ROOM 8	16
17	OUTLET - ROOM 6	15 17 18	15 OUTLET - ROOM 6	18
19	OUTLET - ROOM 6	15 19 20	15 CHLORINE ROOM - EXHAUST FAN	20
21	UNIT HEATER	15 21 22	15 OUTLET - ROOM 9	22
23	EXHAUST FAN - ROOM 6	15 23 24	15 OUTLET - ROOM 6	24
25	OUTLET - ROOM 6	15 25 26	15 HEATER - ROOM 6	26
27	CHEMICAL PUMP - POLYMER LAMELLA	15 27 28	15 CHEMICAL PUMP - POLYMER ACTIFLO CLARIFIER	28
29	CHEMICAL PUMP - CENTRIFUGE	15 29 30	15 CHEMICAL PUMP - SODIUM BISULPHATE	30
31	CHEMICAL PUMP - ALUM	15 31 32	15 CHEMICAL PUMP - CAUSTIC SODA	32
33	CHEMICAL PUMP - ALUM	15 33 34	15 CHEMICAL PUMP - FLOURIDE	34
35	SCALE - CHLORINE CYLINDERS	15 35 36	15 CHLORINE ANALYSER	36
37	PARKING LOT LIGHT	15 37 38	20 OUTSIDE LIGHTS	38
39	OUTSIDE LIGHTS	20 39 40	20 OUTSIDE LIGHTS	40
41	LIGHTS - OFFICE, LAB, ENTRANCE	20 41 42	20 NIGHT LIGHTS	42
43	LIGHTS - ROOMS 5, 6, 7	20 43 44	20 LIGHTS - ROOM 6	44
45	LIGHTS - ROOM 6	20 45 46	20 LIGHTS - ROOM 6	46
47	LIGHTS - ROOM 6	20 47 48	20 * FIRE ALARM	48
49	SECURITY	* 15 49 50	15 BACK-UP PLC	50
51	FLOW METER	20 51 52	20 INSTRUMENTS - CHLORINE ROOM	52
53	INSTRUMENTS	30 53 54	15 SUMP PUMP	54
55		20 55 56	15 EMERGENCY SHOWER	56
57	MOTORIZED VALVES (2)	57 58	15 SPARE	58
59		59 60	15 SPARE	60
61	SPARE	15 61 62	15 SPARE	62
63	SPARE	15 63 64	15 SPARE	64
65	SPARE	15 65 66	30 SPARE	66
67	SPARE	15 67 68	15 SPARE	68
69	SPARE	15 69 70	SPARE	70
71	SPARE	20 71 72	15 SPARE	72
73	SPARE	73 74	15 SPARE	74
75	SPARE	15 75 76	15 SPARE	76
77	TEMPORARY CHEMICAL PUMP	15 77 78	15 TEMPORARY CHEMICAL PUMP	78
79	TEMPORARY CHEMICAL PUMP	15 79 80	15 TEMPORARY CHEMICAL PUMP	80
81	TEMPORARY CHEMICAL PUMP	15 81 82	15 TEMPORARY CHEMICAL PUMP	82
83	TEMPORARY CHEMICAL PUMP	15 83 84	15 TEMPORARY CHEMICAL PUMP	84

MAIN BUS 225 AMP 450 AMP NEUTRAL 84 CIRCUIT
MAIN C/B OR SW/FUSE 10 KA
BRANCH C/B INT. CAP. 10 KA
SURFACE MOUNTED
EQUIPMENT GROUND BUS VOLTAGE 208/120/3Ø 4W
TVSS 3
LOCK ON *

POWER DISTRIBUTION PANEL 'M'

CIRCUIT #	DESCRIPTION	200 N/A	DESCRIPTION	CIRCUIT #
1	SPARE	30 1 2	20 SPARE	2
3	SPARE	3 4	SPARE	4
5	SPARE	5 6	SPARE	6
7	SPARE	30 7 8	20 SPARE	8
9	SPARE	9 10	SPARE	10
11	SPARE	11 12	SPARE	12
13	SPARE	30 13 14	20 SPARE	14
15	SPARE	15 16	SPARE	16
17	SPARE	17 18	SPARE	18
19	SPARE	30 19 20	20 SPARE	20
21	SPARE	21 22	SPARE	22
23	SPARE	23 24	SPARE	24
25	SPARE	20 25 26	20 SPARE	26
27	SPARE	27 28	SPARE	28
29	SPARE	20 29 30	20 SPARE	30
31	SPARE	31 32	SPARE	32
33	SPARE	15 33 34	15 SPARE	34
35	SPARE	15 35 36	15 SPARE	36
37	SPARE	15 37 38	15 SPARE	38
39	SPARE	15 39 40	15 SPARE	40
41	SPARE	15 41 42	15 SPARE	42
43	SPARE	15 43 44	15 SPARE	44
45	SPARE	15 45 46	15 SPARE	46
47	SPARE	15 47 48	15 SPARE	48
49	SPARE	15 49 50	15 SPARE	50
51	SPARE	15 51 52	15 SPARE	52
53	SPARE	15 53 54	15 SPARE	54
55	SPARE	15 55 56	15 SPARE	56
57	SPARE	15 57 58	15 SPARE	58
59	SPARE	15 59 60	15 SPARE	60
61	SPARE	15 61 62	15 SPARE	62
63	SPARE	15 63 64	15 SPARE	64
65	SPARE	15 65 66	15 SPARE	66
67	SPARE	15 67 68	15 SPARE	68
69	SPARE	15 69 70	15 SPARE	70
71	SPARE	15 71 72	15 SPARE	72
73	SPARE	15 73 74	15 SPARE	74
75	SPARE	15 75 76	15 SPARE	76
77	SPARE	15 77 78	15 SPARE	78
79	SPARE	15 79 80	15 SPARE	80
81	SPARE	15 81 82	15 SPARE	82
83	SPARE	15 83 84	15 SPARE	84

MAIN BUS 225 AMP 450 AMP NEUTRAL 84 CIRCUIT
MAIN C/B OR SW/FUSE 10 KA
BRANCH C/B INT. CAP. 10 KA
SURFACE MOUNTED
EQUIPMENT GROUND BUS VOLTAGE 208/120/3Ø 4W
TVSS 3
LOCK ON *

POWER DISTRIBUTION PANEL 'F'

CIRCUIT #	DESCRIPTION	600 N/A	DESCRIPTION	CIRCUIT #
1		55 1 2	55	2
	TRANSFORMER - T1 PANEL 'E'	3 4	TRANSFORMER T2 PANEL 'G'	
		5 6		
7		20 7 8	15	
	CHLORINE SCRUBBER	9 10	15	
		11 12	15	
		15 13 14	15	
		15 15 16	15	
		15 17 18	15	
		15 19 20	15	
		15 21 22	15	
		15 23 24	15	

600 VAC
MAIN BUS 200 AMP 200 AMP NEUTRAL 24 CIRCUIT
BRANCH C/B INT. CAP. 35 KA
SURFACE MOUNTED
EQUIPMENT GROUND BUS VOLTAGE 600/347/3Ø 4W
TVSS 2

POWER DISTRIBUTION PANEL 'PH'

CIRCUIT #	DESCRIPTION	600 N/A	DESCRIPTION	CIRCUIT #
1	LIGHTS ROOMS 1, 4	20 1 2	15 OUTLET ROOM 1	2
3	OUTLET ROOM 4	15 3 4	15 OUTLET ROOM 4	4
5	FIRE ALARM LOCK ON	15 5 6	15 SECURITY LOCK ON	6
7	UNIT HEATER ROOM 5	55 7 8	15 UNIT HEATERS ROOM 4	8
9	UNIT HEATER ROOM 1	15 9 10	15 OUTLET ROOM 5	10
11	INSTRUMENTS	15 11 12	15 SCADA PANEL	12
13	EXISTING LIGHTS ROOMS 2, 3, 5	20 13 14	15 CANOPY LIGHT	14
		15 15 16	15	
		15 17 18	15	
		15 19 20	15	
		15 21 22	15	
		15 23 24	15	

MAIN BUS 225 AMP 3Ø 4w 208 / 120 VAC 42 CIRCUIT
BRANCH C/B INT. CAP. 10 KA
SURFACE MOUNTED

1 E-5 Electrical Distribution Panels

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

ELECTRICAL DISTRIBUTION PANELS

STAMP

NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	J.V.	DATE	AUGUST 2005
DRAWN	J.E.	PROJECT	2016527C
CHECKED	J.V.	ACAD #	6527-E2-E7.DWG
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

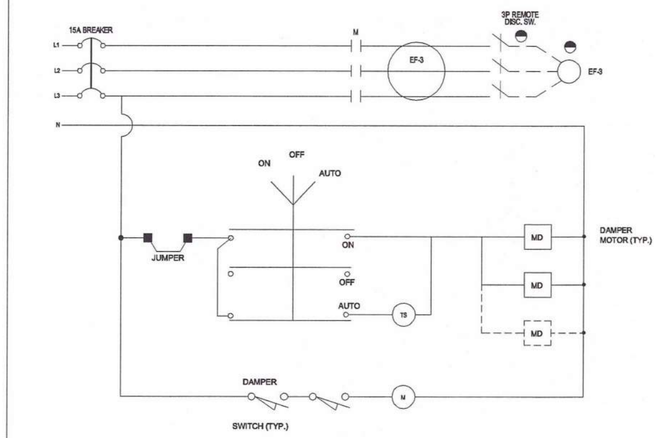
DRAWING

E-5

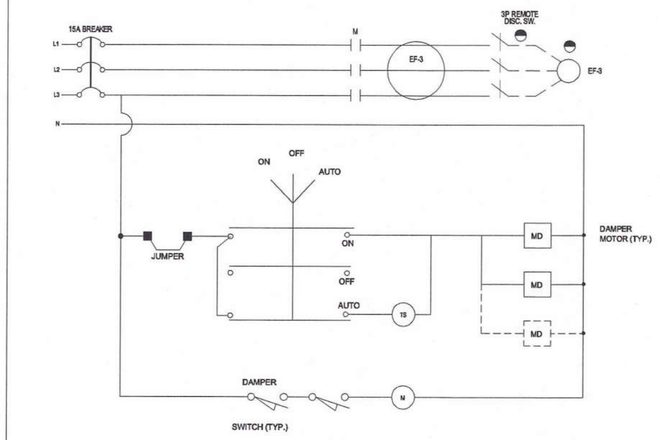
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1. SUPPLY AND INSTALL ONE M.C.C. STARTER COMPARTMENT WIRED AS SHOWN FOR EACH MOTOR OR LOAD IDENTIFIED ON THE PROCESS
2. REFER TO MOTOR CONTROL SCHEDULE FOR MOTOR SEQUENCE OF OPERATION CONTROL CONTACT "C" SOURCE, AND MOTOR DETAILS.
3. SELECTOR SWITCHES FOR EACH STARTER SHALL BE A 3 POSITION WITH AUX. CONTROL IN AUTO, KEY OPERATED, LOW SECURITY SWITCH. KEY REMOVABLE IN AUTO AND OFF POSITION. KEY CAPTURED IN HAND POSITION. PROVIDE TWO (2) KEYS FOR EACH SWITCH.
4. SIZE CONTROL TRANSFORMER TO SUIT ADDITIONAL LOADS SUCH AS DAMPERS WHERE APPLICABLE.
5. ES- EMERGENCY STOP BUTTOM LOCATED AT MOTOR.

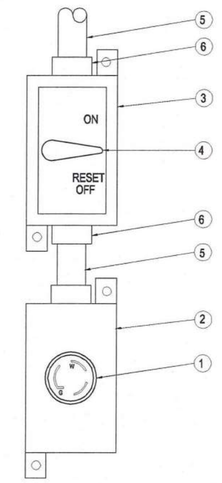
1 E6 **Notes**



3 E6 **EF-3 Exhaust Fan Control** NTS



4 E6 **M.C.C. F.V.N.R. Starter Wiring Detail** NTS



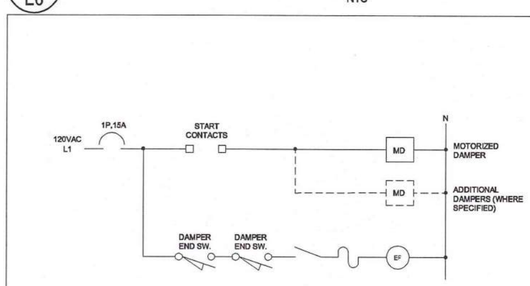
NOTES

1. MOUNT ON WALL ADJACENT TO CHEMICAL MIXER
2. PROVIDE ONE ASSEMBLY FOR EACH MIXER.
3. CHANGE LINE PLUG ON MIXER TO SUIT ITEM 1.

MATERIALS

1. SINGLE LOCKING FLUSH RECEPTACLE- LEVITON #70515-FR
2. PVC RECEPTACLE BOX C/W COVER (TO MATCH *1*) - SCEPTER #FSC 15 AND COVER
3. PVC DEEP RECEPTACLE BOX C/W WEATHERPROOF TOGGLE SWITCH COVER- SCEPTER #FD AND VSC-15
4. MANUAL MOTOR STARTER- A/B #600-T0X4
5. 19 mm PVC CONDUIT
6. PVC FITTINGS AS REQUIRED

5 E6 **Chemical Mixer Wiring Details** NTS



NOTE

1. DAMPER END SWITCHES TO BE RATED FOR LINE STARTING OF EXHAUST FAN.
2. MANUAL STARTER SHALL BE 1P, 120VAC, TYPE 1 ENCLOSURE -A/B #600-TAX4 OR APPROVED EQUAL.
3. REFER TO MOTOR CONTROL SCHEDULE FOR EXHAUST FAN START DEVICE (i.e: SWITCHES, THERMOSTAT ETC).

6 E6 **EF-4 Exhaust Fan Control - Line Voltage** NTS

- TERMINAL BLOCK
- CONNECTION POINT
- REMOTELY MOUNTED DEVICE
- S — SAFETY STOP CONTACT (SOFTWARE PROGRAM)
- ER — ENGINE RUN RELAY IN GENERATOR CONTROL PANEL
- ES — EMERGENCY STOP
- C — AUTO CONTROL CONTACT (AT MCC)
- M — AUX. STARTER CONTACT
- A — AUTO CONTROL CONTACT (SOFTWARE PROGRAM)

7 E6 **Control Legend** NTS

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PLANT UPGRADES

Deep River, Ontario

DRAWING

ELECTRICAL DISTRIBUTION DETAILS

STAMP

NORTH POINT

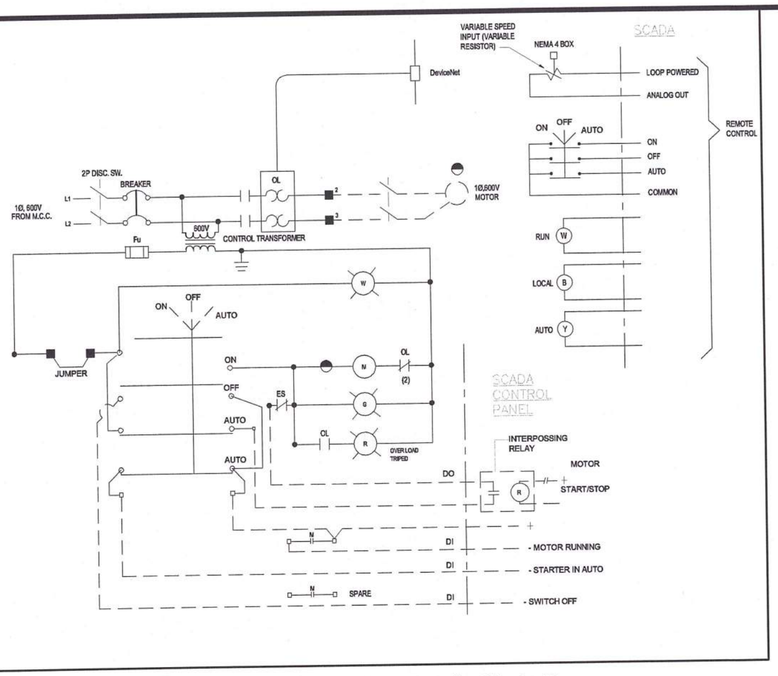
No.	DATE	BY	REVISIONS
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DRAWN	J.E.	PROJECT	2016527C
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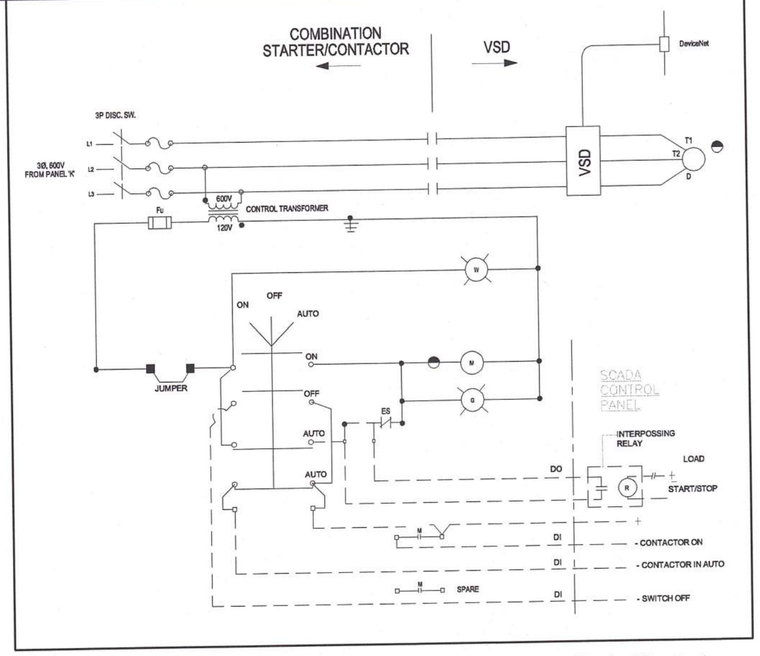
DRAWING

E-6

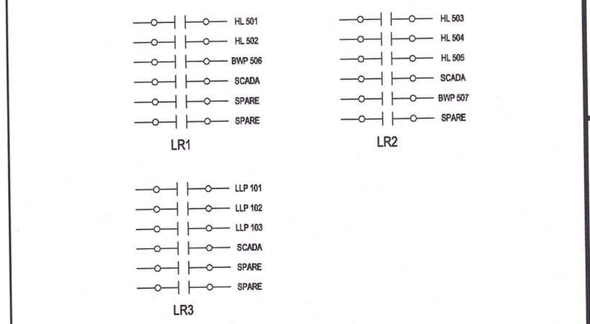
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1 / E7 — M.C.C. F.V.N.R. Starter Wiring Detail - Single Phase — NTS



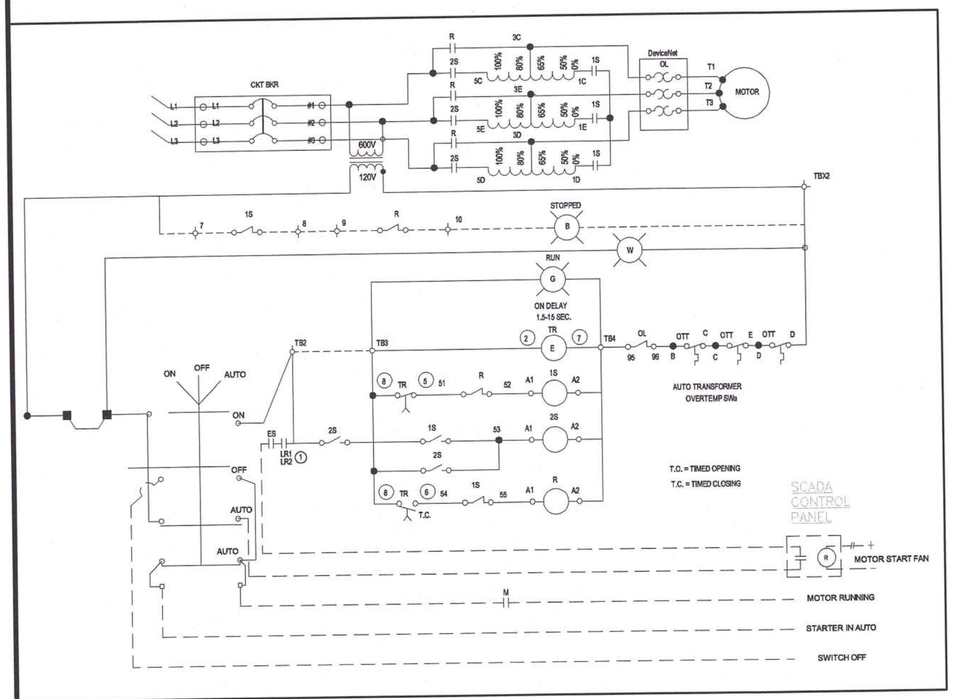
2 / E7 — Low Lift Pump VSD Wiring Detail - Combination Starter/Contactor — NTS



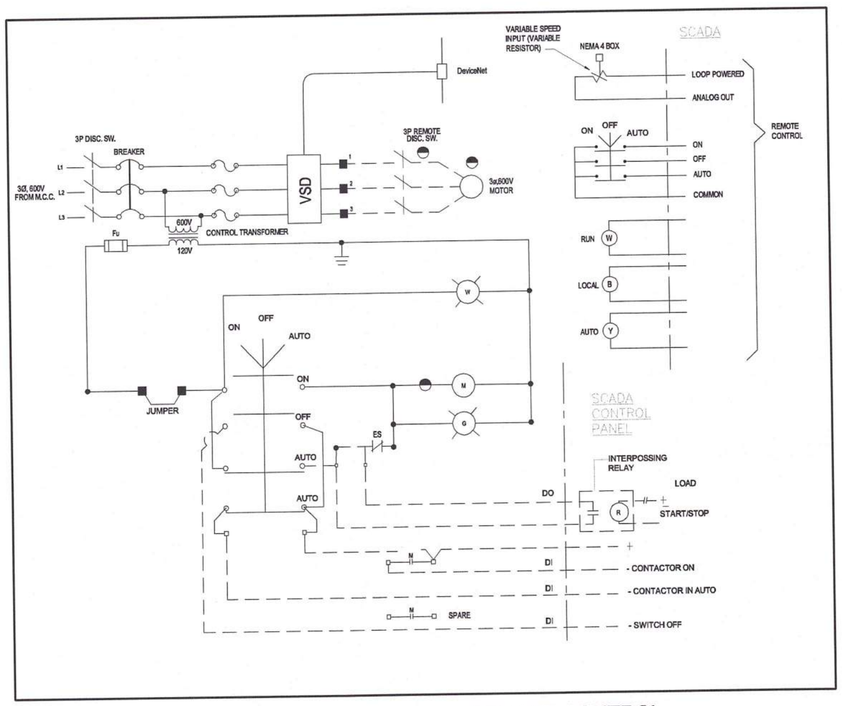
NOTE:

1. MOUNT RELAYS IN NEMA 1 TYPE BOX
2. RELAY TO BE CUTLER-HAMMER SERIES AR8A c/w SCREW TYPE TERMINALS
3. RELAYS LR1 & LR2 TO BE LOCATED IN MCC ROOM
4. RELAY LR3 TO BE LOCATED IN EXISTING PUMPHOUSE ROOM #1

5 / E7 — Pump Cut-out Relay Schematic — NTS



3 / E7 — Typical Schematic Diagram - Auto Transformer Starter — NTS



4 / E7 — M.C.C. VSD Drive Wiring Detail - c/w REMOTE CONTROL — NTS

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

ELECTRICAL SCHEMATICS

STAMP

NORTH POINT

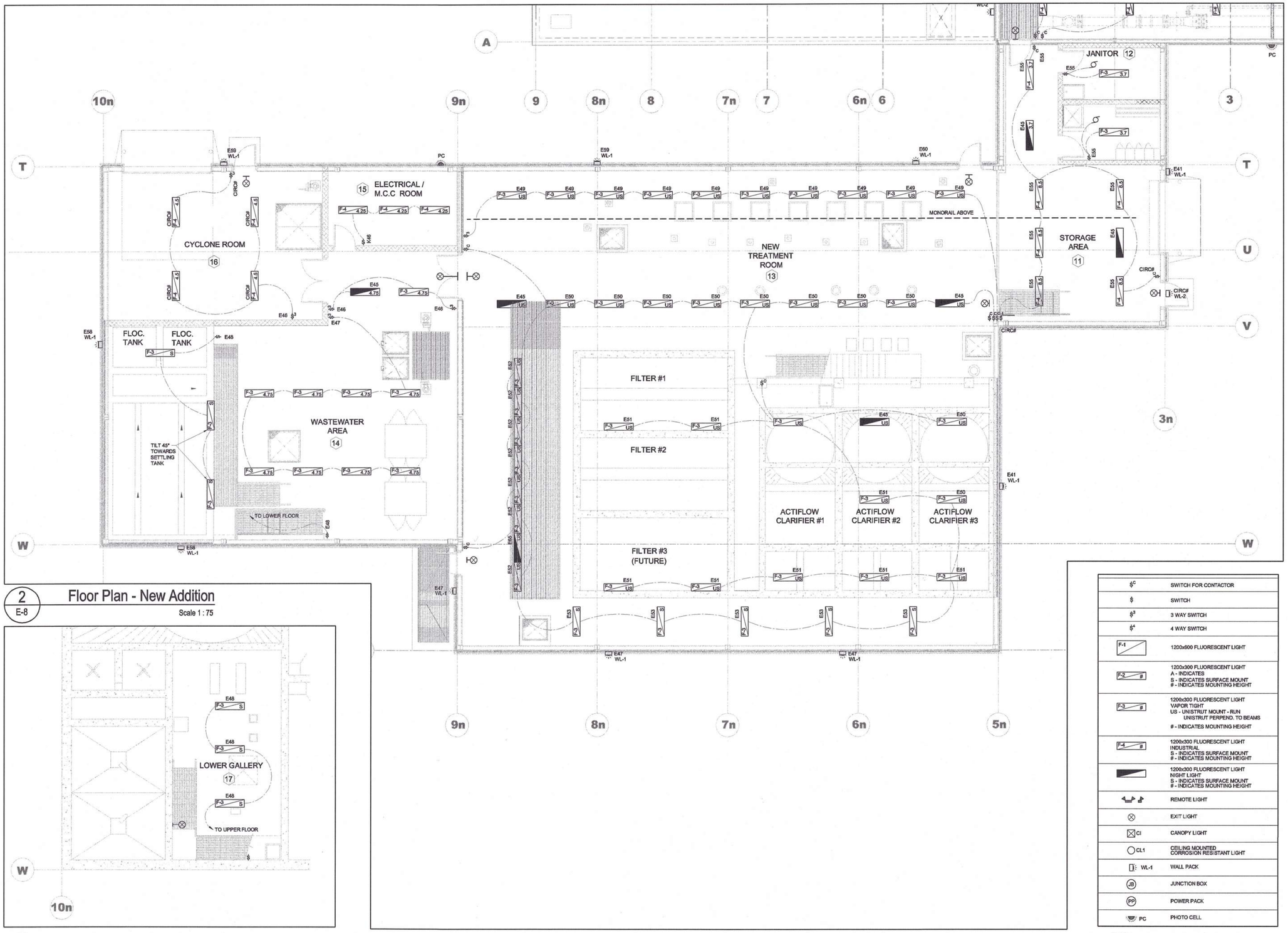
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SCALE	AS SHOWN		

DRAWING

E-7

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2 / E-8 Floor Plan - New Addition
Scale 1 : 75

1 / E-8 Lower Gallery Floor Plan - New Addition
Scale 1 : 75

$^C	SWITCH FOR CONTACTOR
$	SWITCH
$^3	3 WAY SWITCH
$^4	4 WAY SWITCH
F-1	1200x600 FLUORESCENT LIGHT
F-2 #	1200x300 FLUORESCENT LIGHT A - INDICATES S - INDICATES SURFACE MOUNT # - INDICATES MOUNTING HEIGHT
F-3 #	1200x300 FLUORESCENT LIGHT VAPOR TIGHT US - UNISTRUT MOUNT - RUN UNISTRUT PERPEND. TO BEAMS # - INDICATES MOUNTING HEIGHT
F-4 #	1200x300 FLUORESCENT LIGHT INDUSTRIAL S - INDICATES SURFACE MOUNT # - INDICATES MOUNTING HEIGHT
	1200x300 FLUORESCENT LIGHT NIGHT LIGHT S - INDICATES SURFACE MOUNT # - INDICATES MOUNTING HEIGHT
	REMOTE LIGHT
	EXIT LIGHT
CI	CANOPY LIGHT
CL1	CEILING MOUNTED CORROSION RESISTANT LIGHT
WL-1	WALL PACK
JB	JUNCTION BOX
PP	POWER PACK
PC	PHOTO CELL

3 / E-8 Legend

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

ELECTRICAL - LIGHTING
FLOOR PLANS - NEW ADDITION

STAMP

NORTH POINT

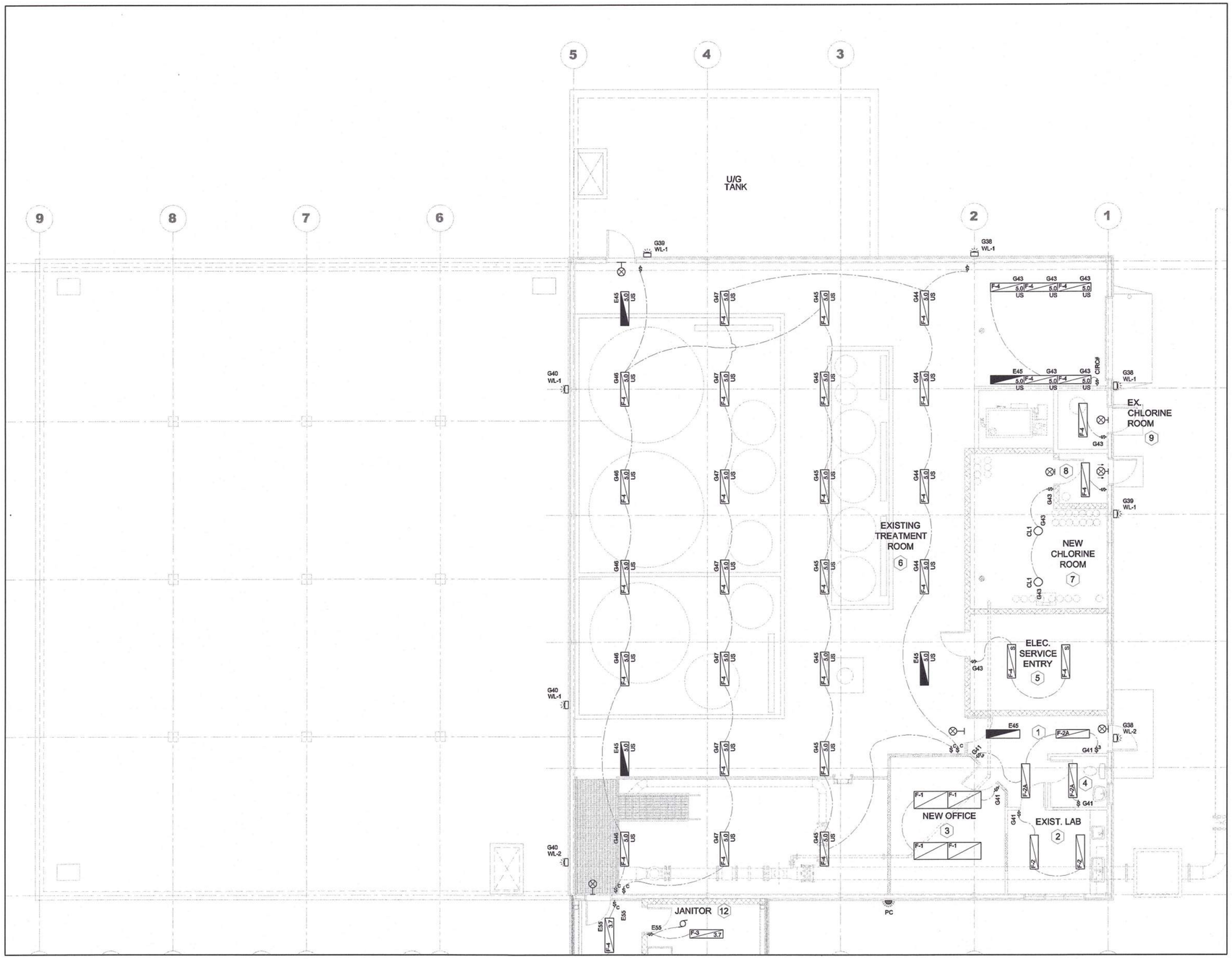
No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	J.V.	DATE	DEC. 6 2004
DRAWN	J.E.	PROJECT	2016527B
CHECKED	J.V.	ACAD #	6527-E8-E9.DWG
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

DRAWING

E-8

Plot Date/Time: 10/06/04 08:37am
DWG FullPath: P:\DRAWINGS\6.5 - Water & Sewage Works\2016527B_DEEP RIVER WTP\ACTIVE DRAWINGS\ELECTRICAL\E8-E9-Rgfitting\6527-E8-E9.dwg



1 / E-9 Floor Plan - Existing Modified
Scale 1 : 75

$^C	SWITCH FOR CONTACTOR
$	SWITCH
$^3	3 WAY SWITCH
$^4	4 WAY SWITCH
F-1	1200x600 FLUORESCENT LIGHT
F-2 #	1200x300 FLUORESCENT LIGHT A - INDICATES S - INDICATES SURFACE MOUNT # - INDICATES MOUNTING HEIGHT
F-3 #	1200x300 FLUORESCENT LIGHT VAPOR TIGHT US - UNISTRUT MOUNT - RUN UNISTRUT PERPEND. TO BEAMS # - INDICATES MOUNTING HEIGHT
F-4 #	1200x300 FLUORESCENT LIGHT INDUSTRIAL S - INDICATES SURFACE MOUNT # - INDICATES MOUNTING HEIGHT
	1200x300 FLUORESCENT LIGHT NIGHT LIGHT S - INDICATES SURFACE MOUNT # - INDICATES MOUNTING HEIGHT
	REMOTE LIGHT
⊗	EXIT LIGHT
⊠ CI	CANOPY LIGHT
○ CL1	CEILING MOUNTED CORROSION RESISTANT LIGHT
WL-1	WALL PACK
JB	JUNCTION BOX
PP	POWER PACK
PC	PHOTO CELL

2 / E-9 Legend

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

ELECTRICAL - LIGHTING
FLOOR PLAN - EXIST. MODIFIED

STAMP

NORTH POINT

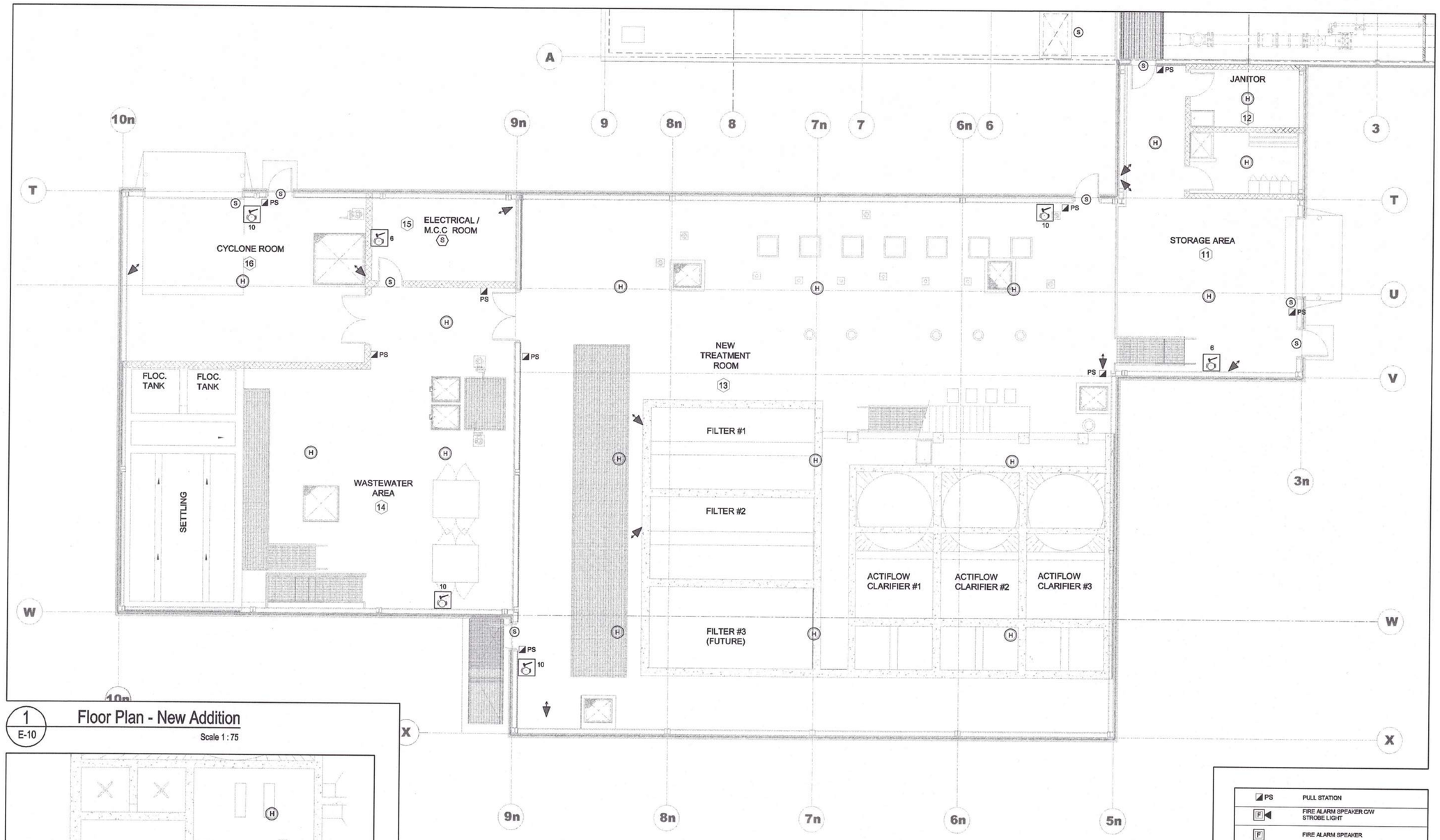
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DRAWN	J.E.	PROJECT	2016527C
CHECKED	J.V.	ACAD #	6527-E8-E9.DWG
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

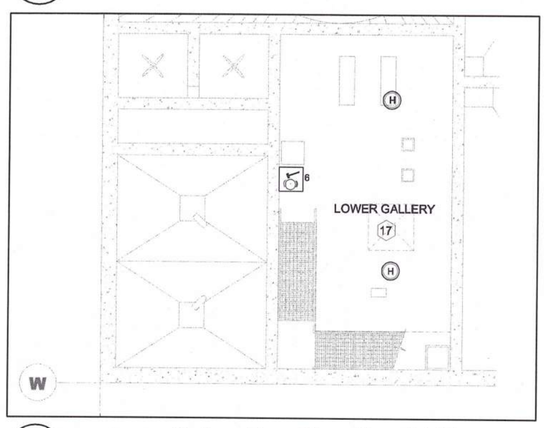
DRAWING

E-9

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1 E-10 Floor Plan - New Addition
Scale 1 : 75



2 E-10 Lower Gallery Floor Plan - New Addition
Scale 1 : 75

PS	PULL STATION
F	FIRE ALARM SPEAKER C/W STROBE LIGHT
F	FIRE ALARM SPEAKER
S	SMOKE DETECTOR
S d	DUCT TYPE SMOKE DETECTOR
V	RELAY FOR HVAC SHUTDOWN
H	HEAT DETECTOR
H	HIGH TEMPERATURE HEAT DETECTOR
F-PANEL	FIRE ALARM PANEL
S-PANEL	SECURITY PANEL
10	FIRE ALARM GONG 10 - INDICATES BELL SIZE IN INCHES
	OCCUPANCY SENSORS
S	DOOR SWITCH FOR SECURITY

2 E-10 Legend

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

ELECTRICAL
FIRE ALARM - SECURITY
FLOOR PLANS - NEW ADDITION

STAMP

NORTH POINT

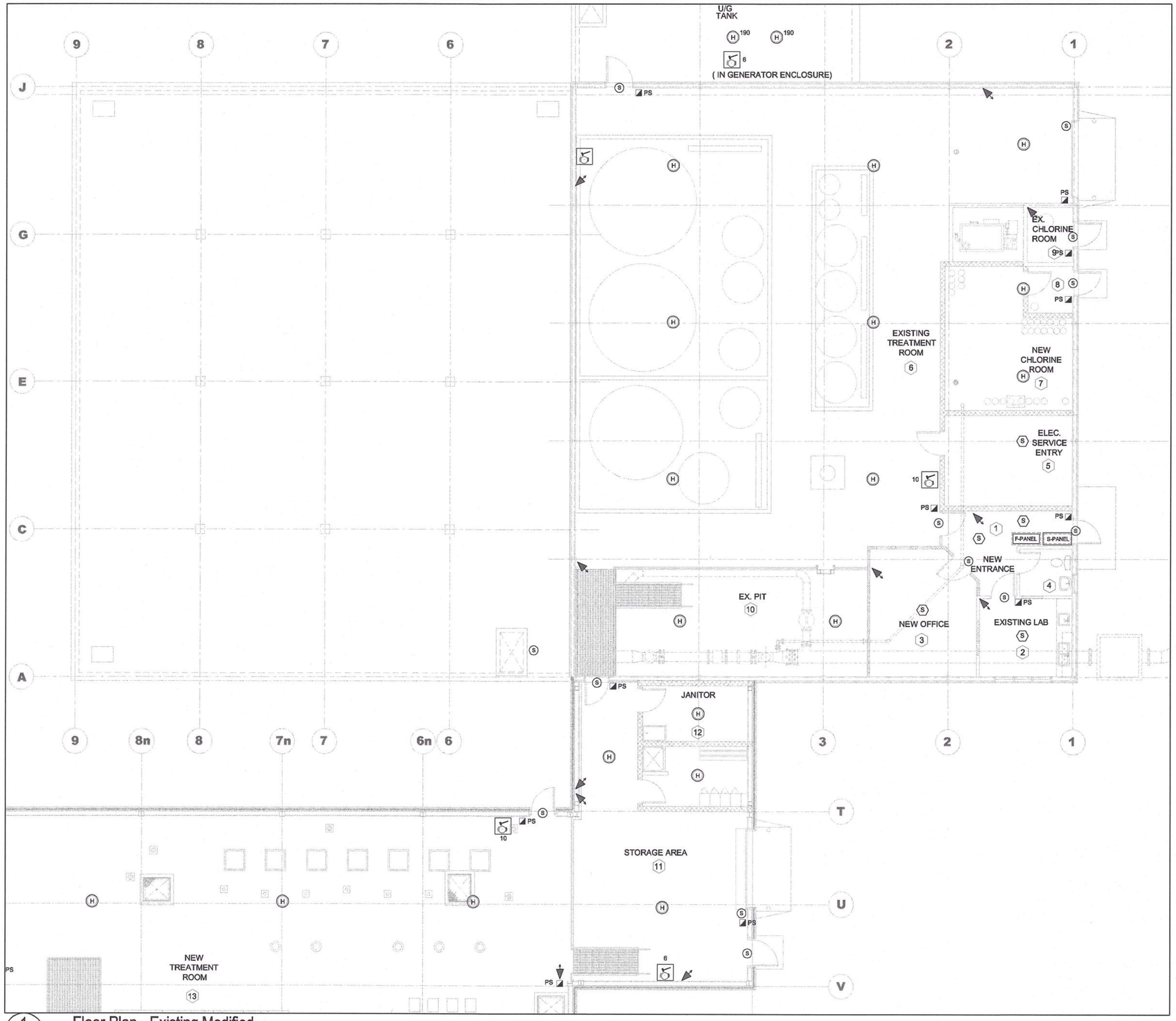
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CHECKED	J.V.	ACAD #	6527-E10-E11.DWG
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

DRAWING

E-10

Plot Date/Time: 10/08/04 08:37am
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1 E-11 Floor Plan - Existing Modified
Scale 1 : 75

PS	PULL STATION
F	FIRE ALARM SPEAKER C/W STROBE LIGHT
F	FIRE ALARM SPEAKER
S	SMOKE DETECTOR
S d	DUCT TYPE SMOKE DETECTOR
V	RELAY FOR HVAC SHUTDOWN
H	HEAT DETECTOR
H	HIGH TEMPERATURE HEAT DETECTOR
F-PANEL	FIRE ALARM PANEL
S-PANEL	SECURITY PANEL
10	FIRE ALARM GONG 10 - INDICATES BELL SIZE IN INCHES
	OCCUPANCY SENSORS
S	DOOR SWITCH FOR SECURITY
H 190	FIXED TEMP. HEAT DETECTOR 190°F

2 E-11 Legend

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES

Deep River, Ontario

DRAWING

ELECTRICAL
FIRE ALARM - SECURITY
FLOOR PLAN - EXIST. MODIFIED

STAMP

NORTH POINT

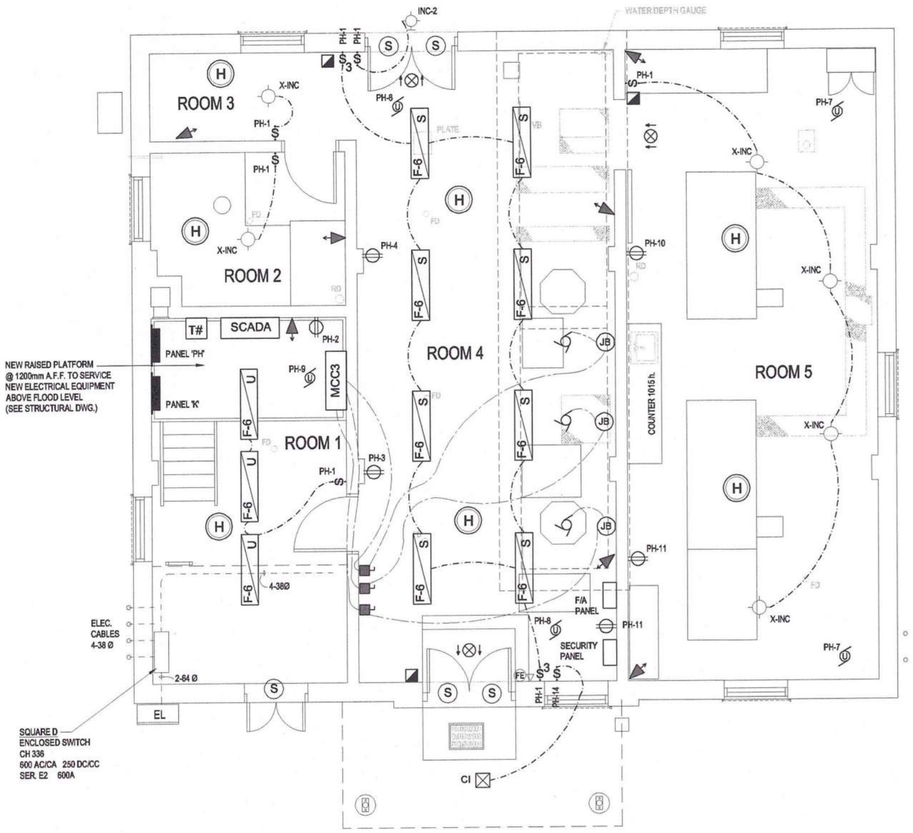
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1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	J.V.	DATE	AUGUST 2005
DRAWN	J.E.	PROJECT	2016527C
CHECKED	J.V.	ACAD #	6527-E10-E11.DWG
APPROVED		PLOT DATE	
SCALE	AS SHOWN		

DRAWING

E-11

DWG FullPath: P:\DRAWINGS\6.5 - Water & Sewage Works\2016527C_DEEP RIVER WTP\ACTIVE DRAWINGS\ARCHITECTURAL\ACTIVE\6527C-ARCH PLANS



1 / E-12 EXISTING PUMPHOUSE PLAN

SCALE 1 : 50

Notes:

1 **Remove and dispose of all electrical equipment related to existing pumps, heaters etc (i.e. panels, MCC, starters, recorders, air compressor). Turn over to owner any equipment owner marks as to be kept. Truck such equipment to owners work's yard near sewage plant.**

2 **Reuse lighting in Rooms 2, 3 and 5. Replace switches and bulbs (use 30 W compact flourescent). Replace switches and repair wiring as needed to get lighting equipment working. Instead for repairing lighting, contractor may at his cost replace wiring and lights with F6 type fixtures, (1) in each of rooms 2 and 3 and (4 in one row) in room 5.**

3 **Remove any un-used outlets, conduits, light fixtures etc. through out building.**

4 **Remove unused lights in Rooms 1 and 4**

5 **Building is to be flood proofed by owner to prevent water raising above floor level.**

6 **Opening for pumps will be surrounded by wall. Mount junction boxes for pump power above surrounding wall.**

7 **Where possible, mount electrical equipment so that bottom of equipment is 1.2 m aff. Mounting heights to meet requirements of ESA. 1:100 year flood level is 115.2 m or 1 m aff.**

	PULL STATION
	ELECTRICAL PANEL
T#	TRANSFORMER MOUNT AT 4.0m A.F.F.
^{3}	2 WAY SWITCH
$	SWITCH
F-6 / U	1200x300 FLUORESCENT LIGHT U - INDICATES HUNG MOUNTED w/ UNISTRUT @ 3000mm A.F.F.
	3 PHASE MOTOR
	SINGLE PHASE MOTOR
	EXIT LIGHT
CI	CANOPY LIGHT
	DUPLEX RECEPTACLE
	OCCUPANCY SENSORS
H	HEAT DETECTOR
JB	JUNCTION BOX
	DISCONNECT

2 / E-12 LEGEND

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DEEP RIVER WATER TREATMENT PLANT

PLANT UPGRADES
EXISTING PUMPHOUSE

Deep River, Ontario

DRAWING

EXISTING PUMPHOUSE
PLANS, SECTIONS & DETAILS

STAMP

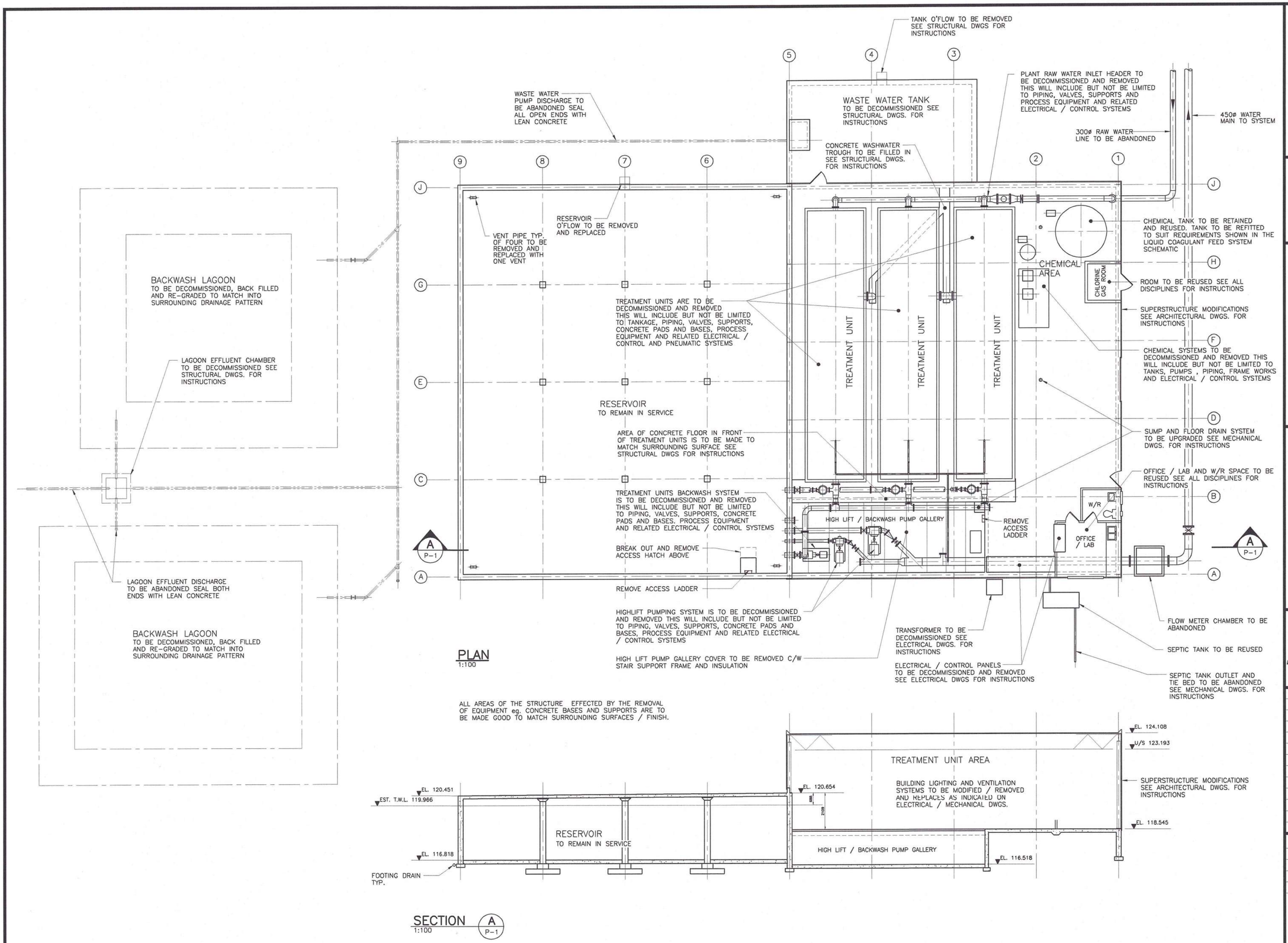
NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	J.V.	DATE	AUGUST 2005
DRAWN	M de R	PROJECT	2016527C
CHECKED	J.V.	ACAD #	6527_EX. PUMPHOUSE
APPROVED		PLOT DATE	06/29/05
SCALE	AS SHOWN		

DRAWING

E-12



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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

REMOVALS-OVERVIEW OF WORKS IN EXISTING STRUCTURE PLAN AND SECTION

STAMP

PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

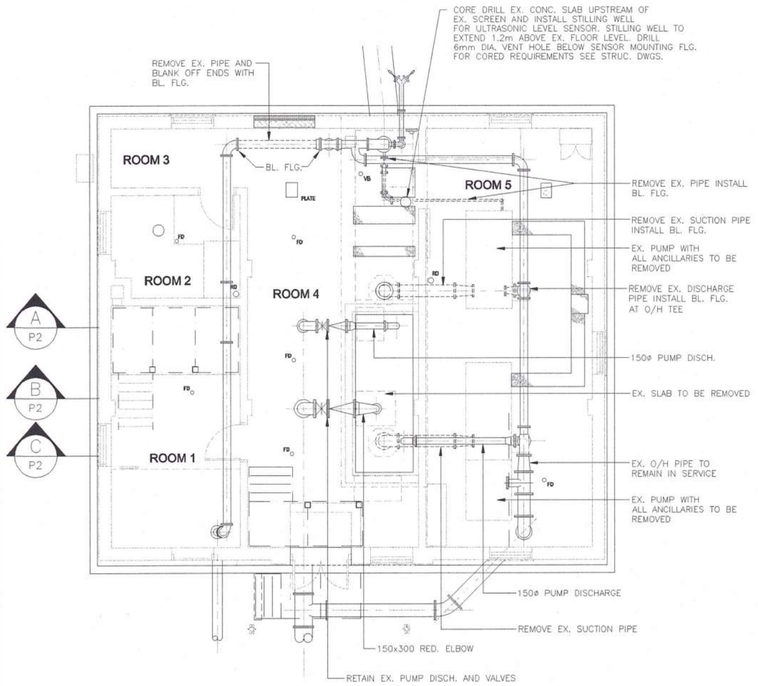
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CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

DRAWING

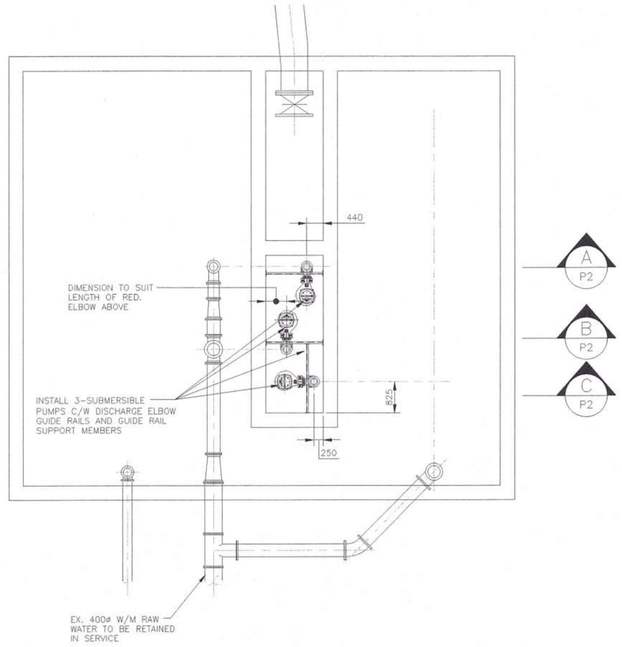
P-1

RAL PROJECT No. 04-103

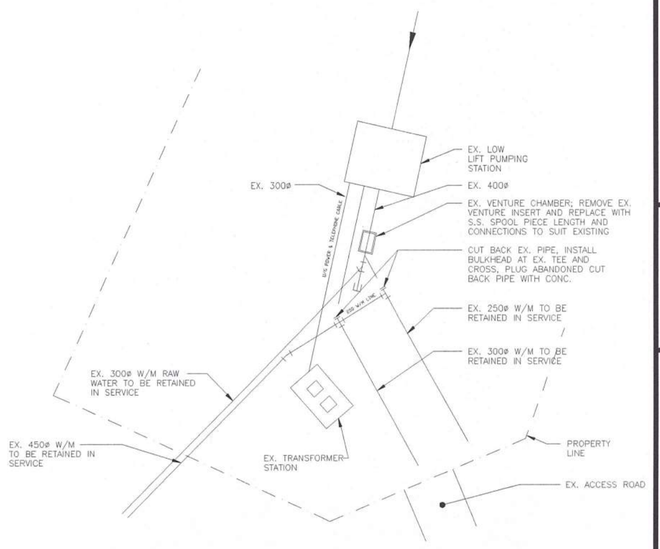


PLAN ABOVE GRADE
1:75

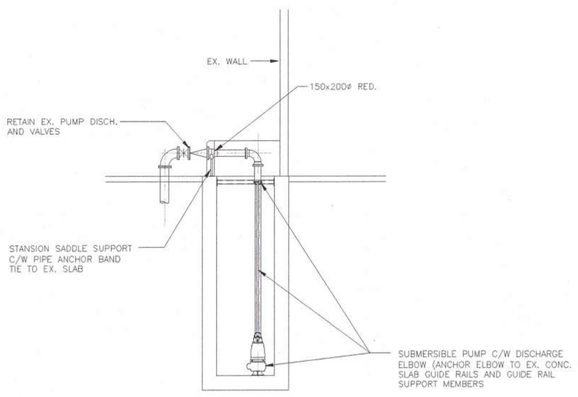
NOTE: REMOVE ALL EXISTING RE-USEABLE PARTS & MOTORS NOT REQUIRED & DELIVER TO TOWN MAINTENANCE BUILDING ON CEDAR ROAD



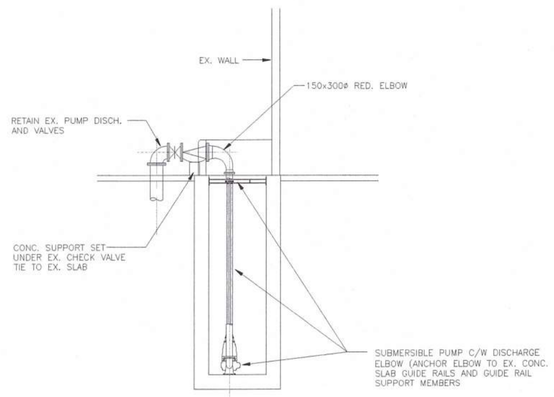
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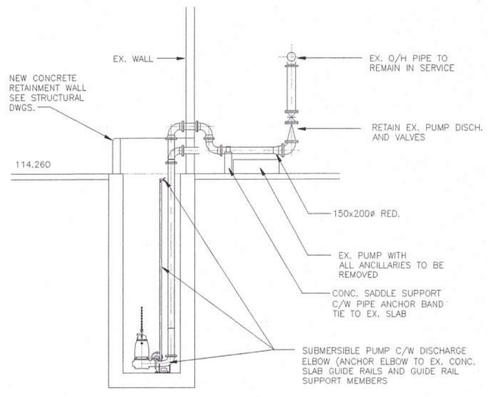
PART PLAN @ EX. LOW LIFT PUMPING STATION SITE



SECTION A P-2
1:75



SECTION B P-2
1:75



SECTION C P-2
1:75

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

LOW LIFT PUMPING STATION PLANS AND SECTIONS

STAMP

REGISTERED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
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NORTH POINT

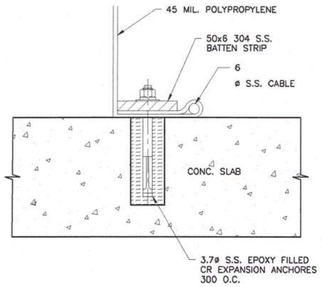
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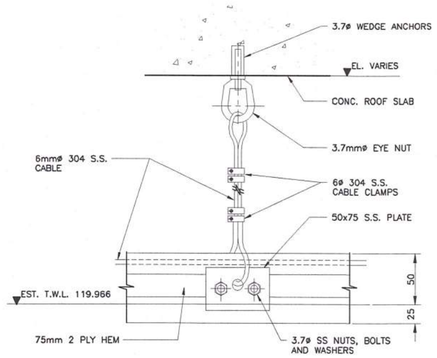
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P-2

RAL PROJECT No. 04-103



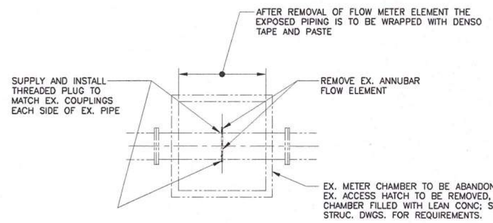
FLOOR/WALL ANCHOR DETAIL



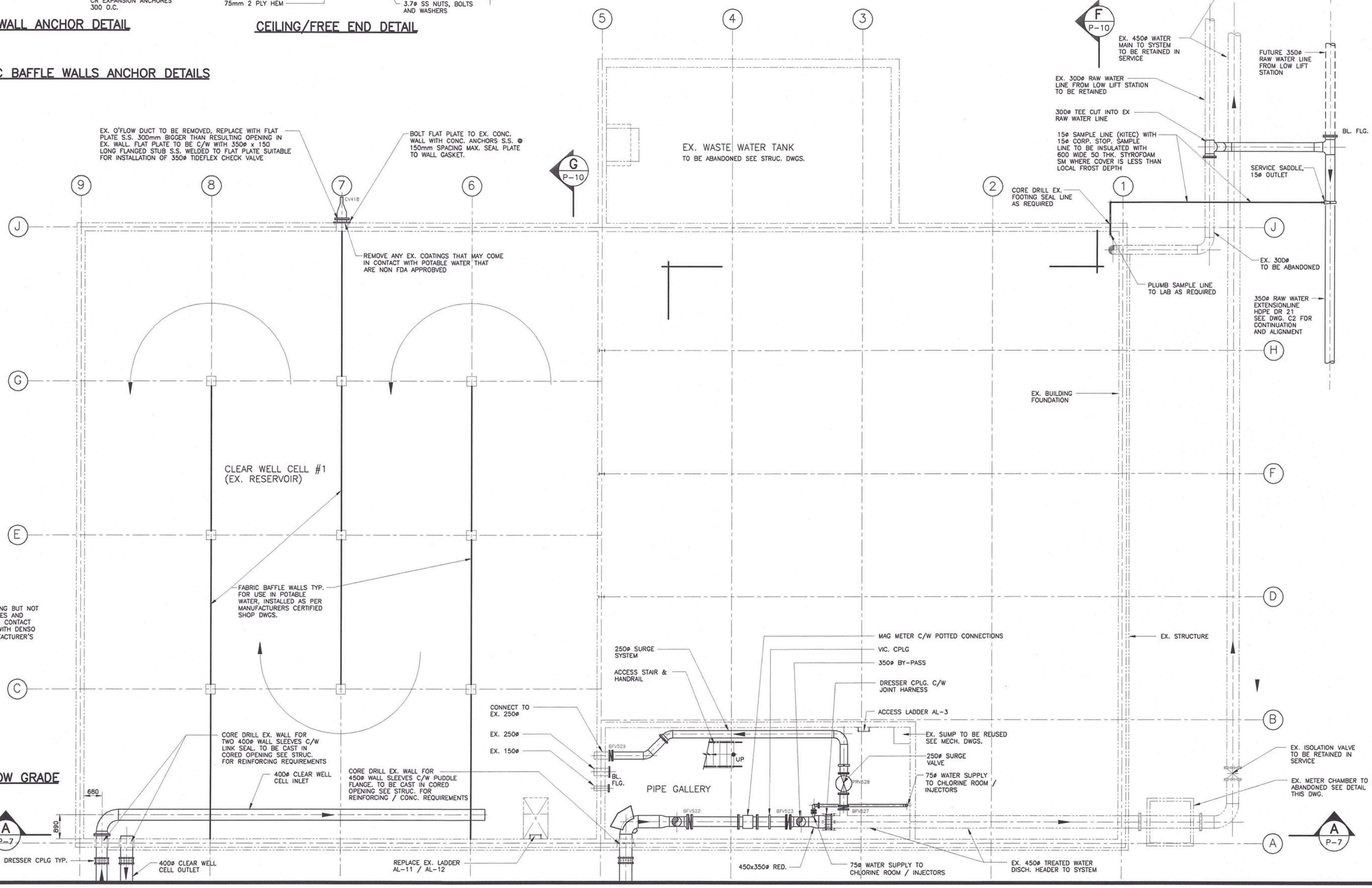
CEILING/FREE END DETAIL

NOTE: 1. A MARINE SHACKLE MAY BE USED BETWEEN THE EYE NUT IN THE CEILING AND THE S.S. PLATE IN THE CURTAIN, INSTEAD OF USING S.S. CABLE.
2. THE FREE END CONNECTION WILL BE MADE AT THE TOP OF THE BAFFLE. THE BOTTOM OF THE BAFFLE WILL BE ANCHORED BY THE FLOOR DETAIL. NO ANCHORING BETWEEN THE FREE END BAFFLE CONNECTION AND THE WALL.

FABRIC BAFFLE WALLS ANCHOR DETAILS
N.T.S.



EX. CONC. METER CHAMBER



PART PLAN BELOW GRADE
1:75

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

EXISTING PLANT PLAN BELOW GRADE

STAMP
REGISTERED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

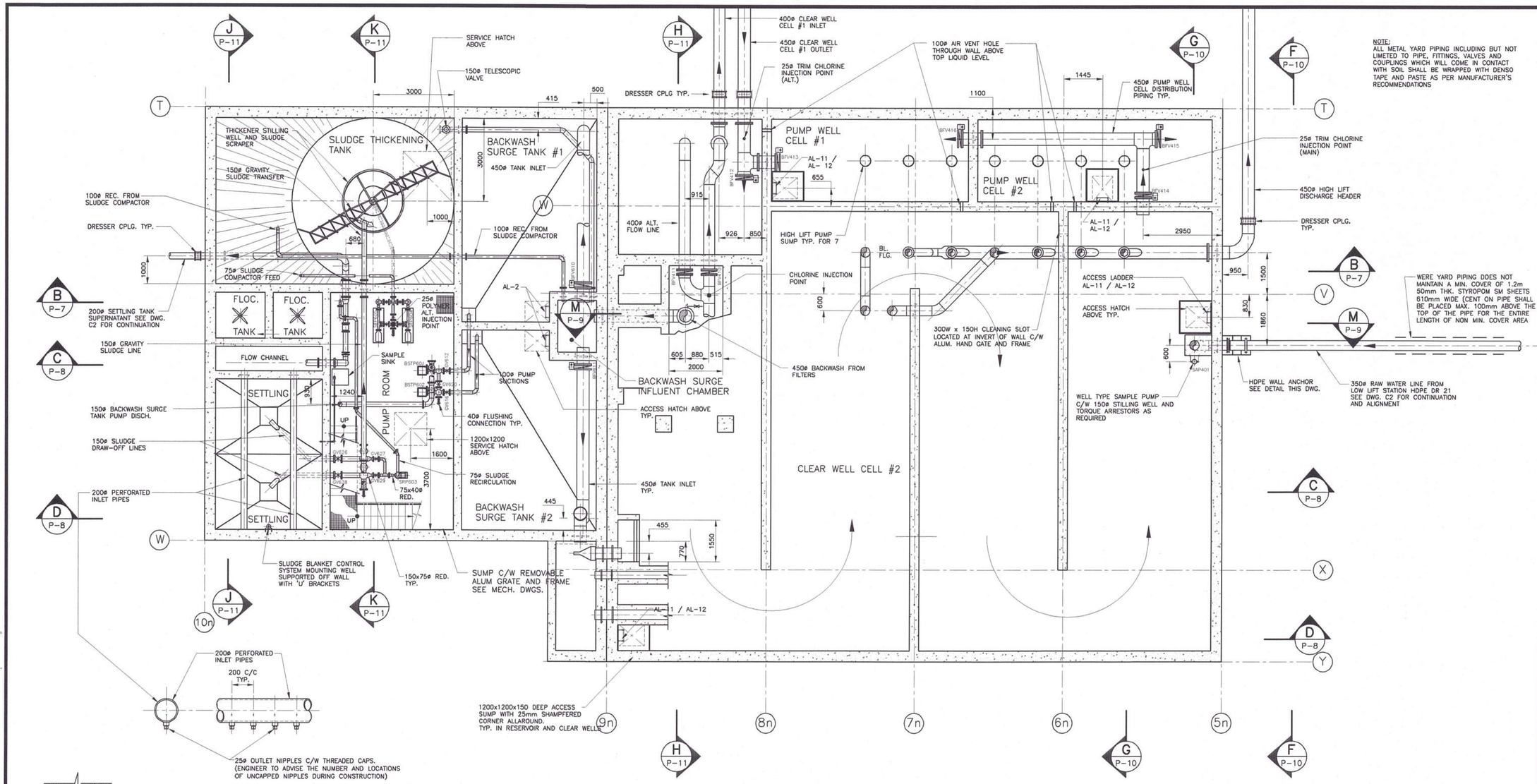
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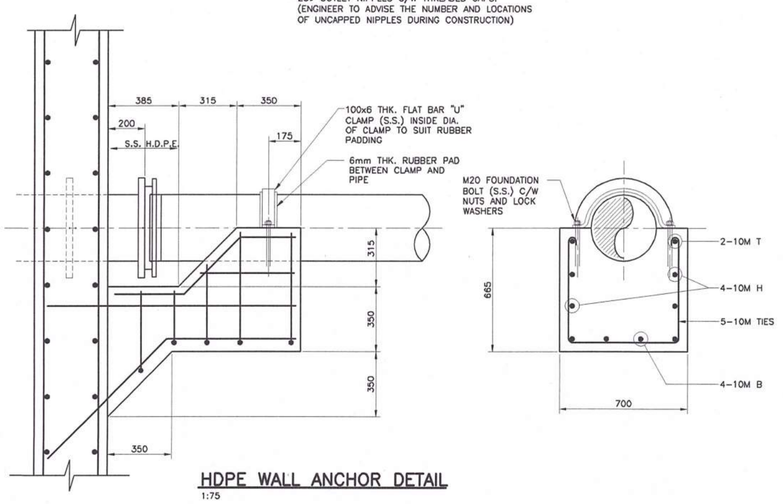
DRAWING

P-3

RAL PROJECT No. 04-103



PART PLAN BELOW GRADE
1:75



HDPE WALL ANCHOR DETAIL
1:75

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PLANT EXPANSION PLAN BELOW GRADE

STAMP

REGISTERED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

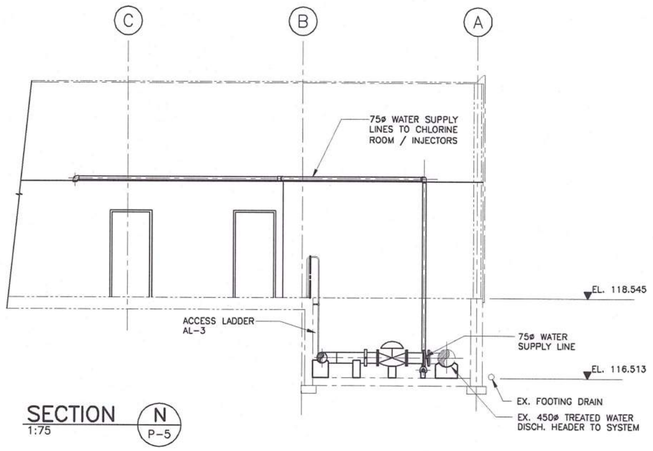
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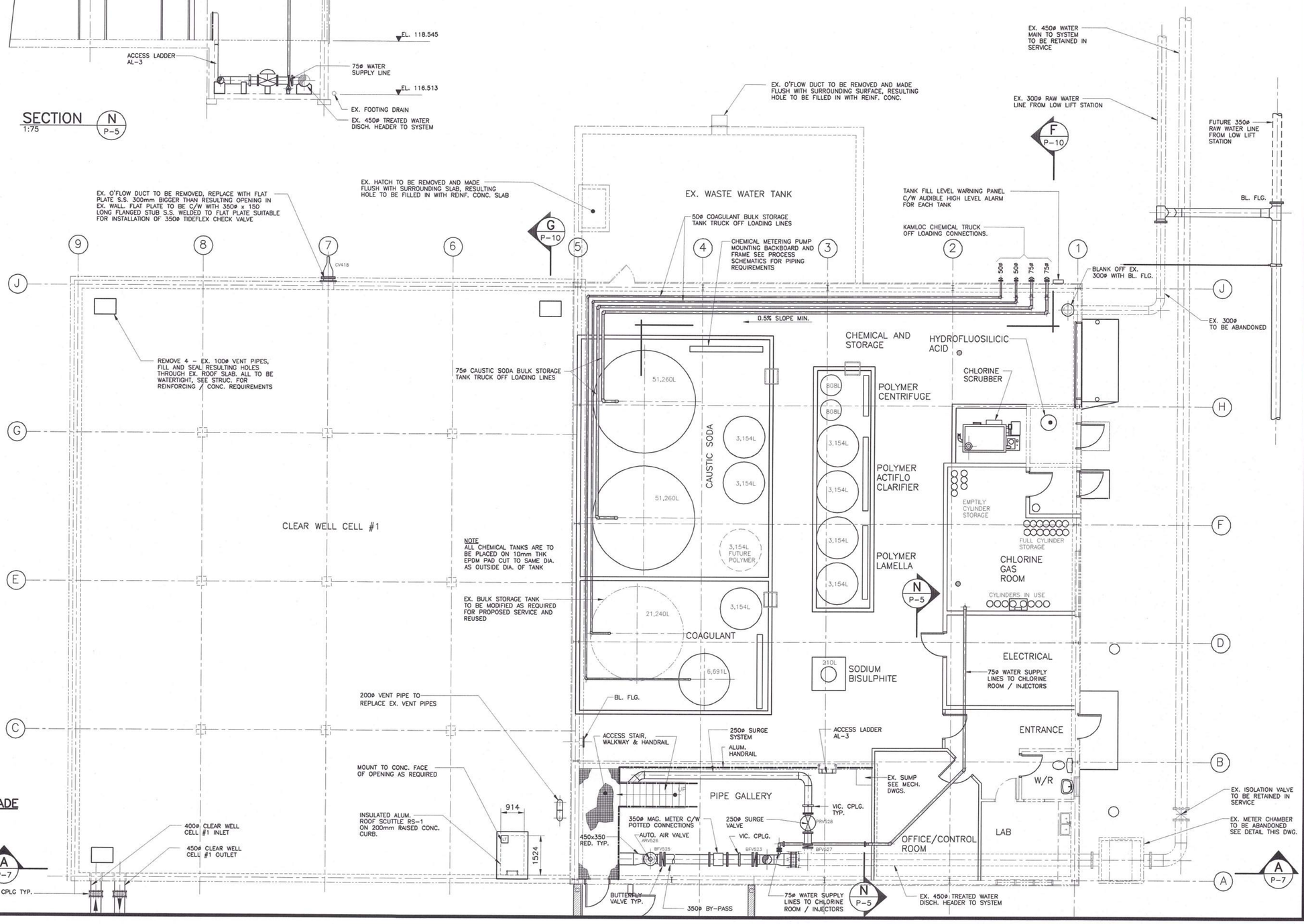
DRAWING

P-4

RAL PROJECT No. 04-103



SECTION N P-5
1:75



PART PLAN ABOVE GRADE
1:75

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

EXISTING PLANT PLAN ABOVE GRADE

STAMP

PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

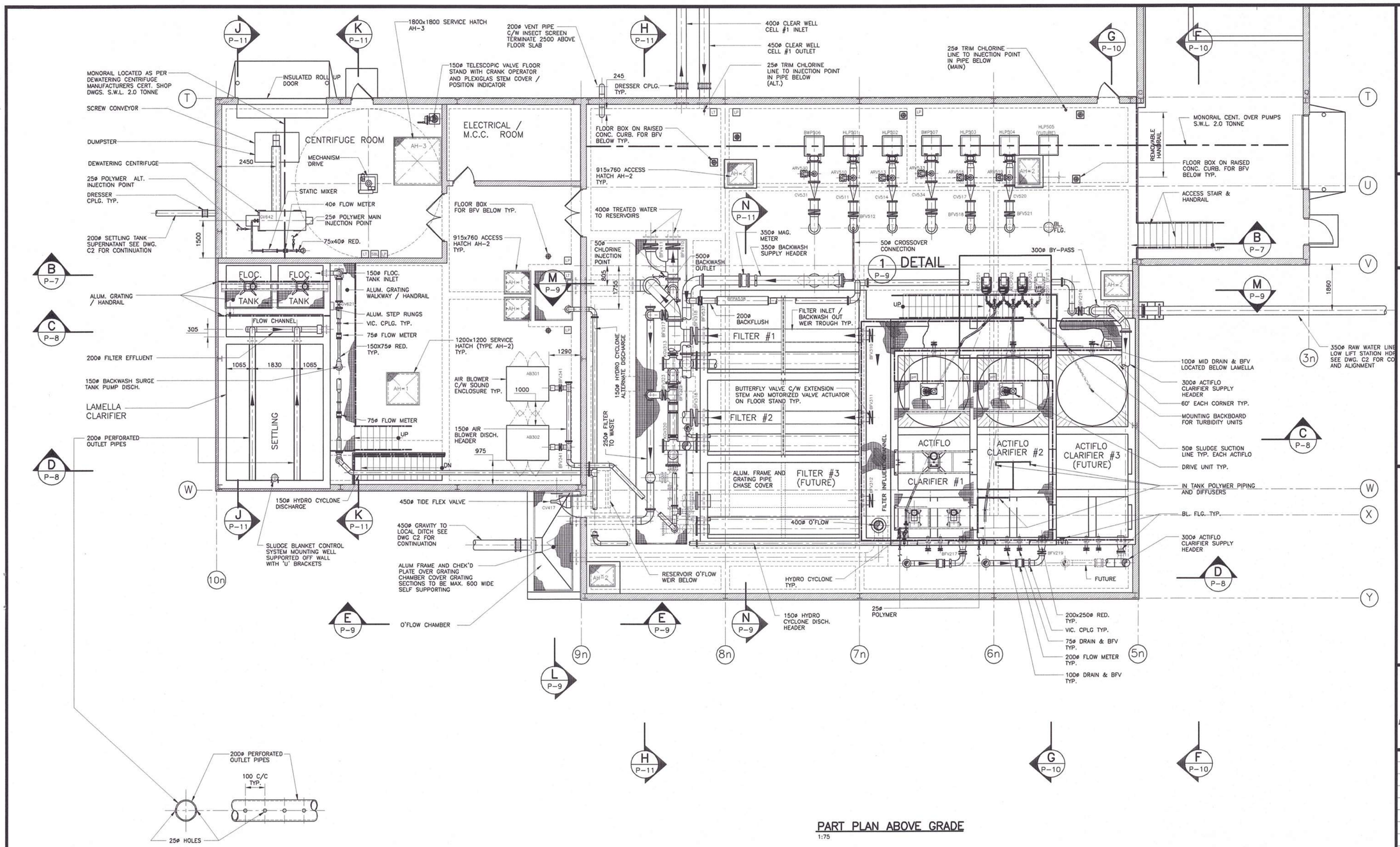
No.	DATE	BY	REVISIONS

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DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
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SCALE	AS SHOWN		

DRAWING

P-5

RAL PROJECT No. 04-103



PART PLAN ABOVE GRADE
1:75

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PLANT EXPANSION PLAN ABOVE GRADE

STAMP

REGISTERED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

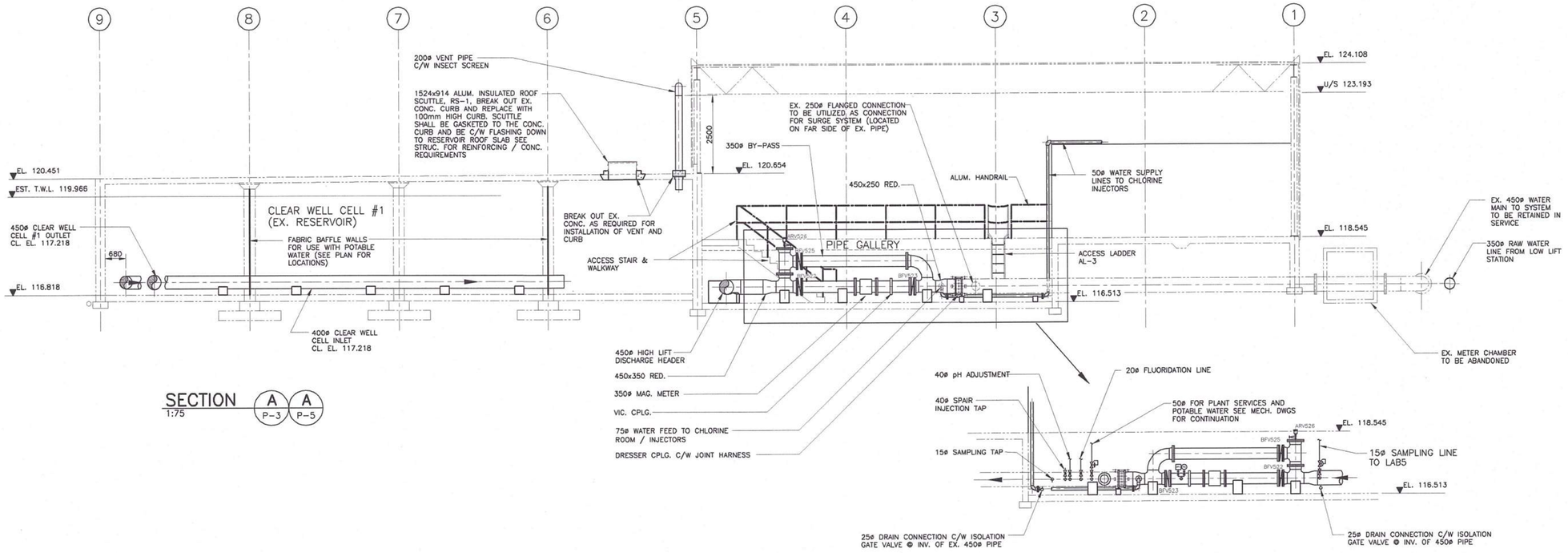
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DRAWN	M.J.G./AutoCAD	PROJECT	.
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SCALE	AS SHOWN		

DRAWING

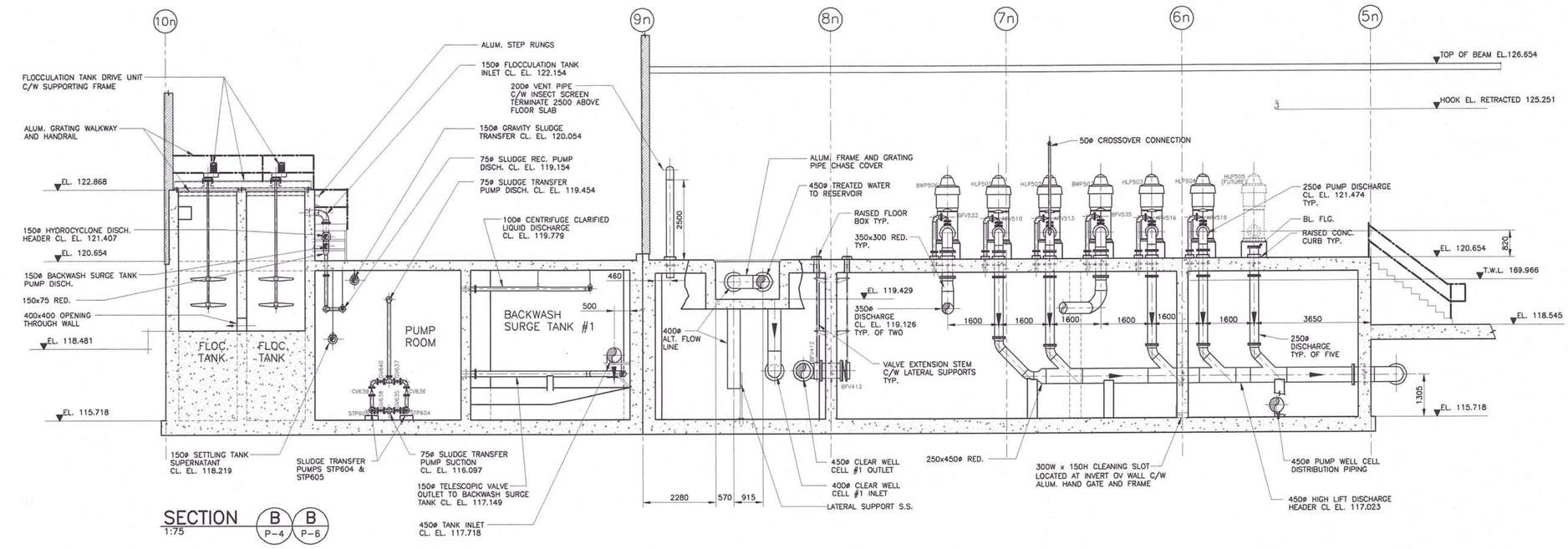
P-6

RAL PROJECT No. 04-103



SECTION A / A (P-3 / P-5)
1:75

MIRROR IMAGE PLANT DISCHARGE HEADER
1:50 (INSTRUMENTATION CALL OUTS)



SECTION B / B (P-4 / P-6)
1:75

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

SECTION A & B

STAMP

LICENSED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

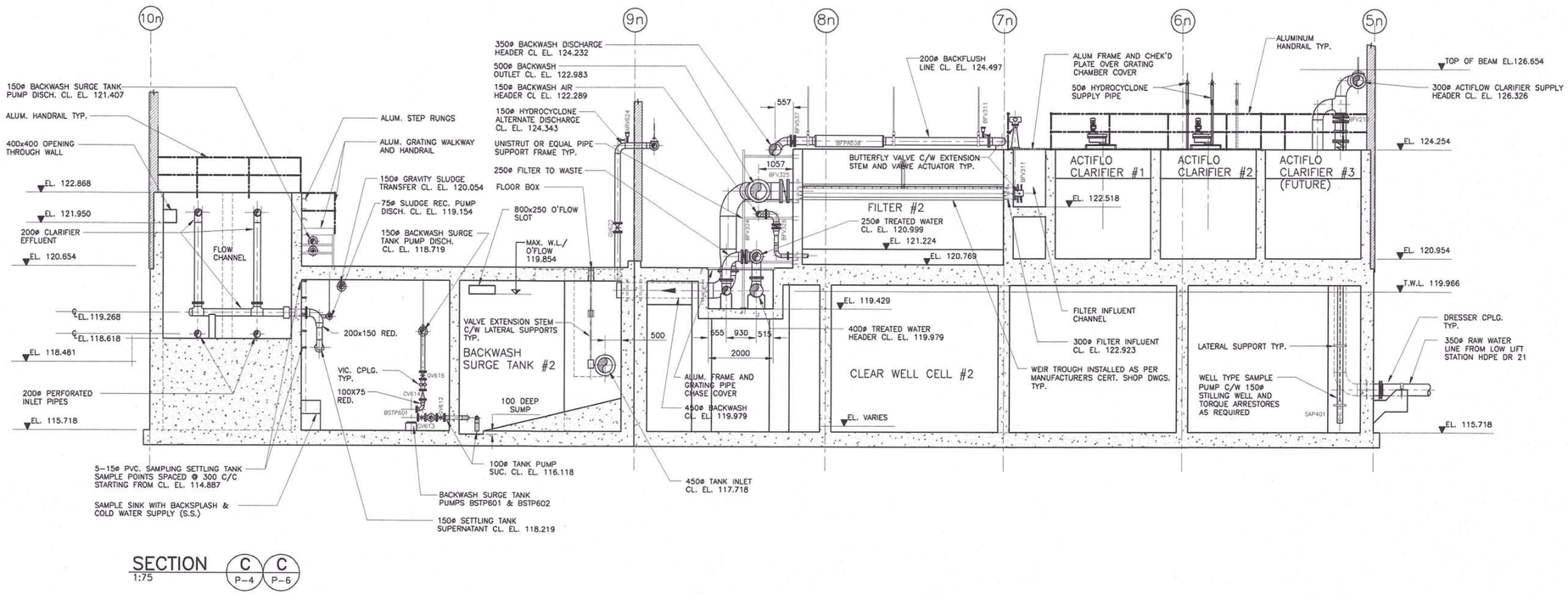
No.	DATE	BY	REVISIONS

DESIGNED	F.A./M.J.G.	DATE	12-9-4
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CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

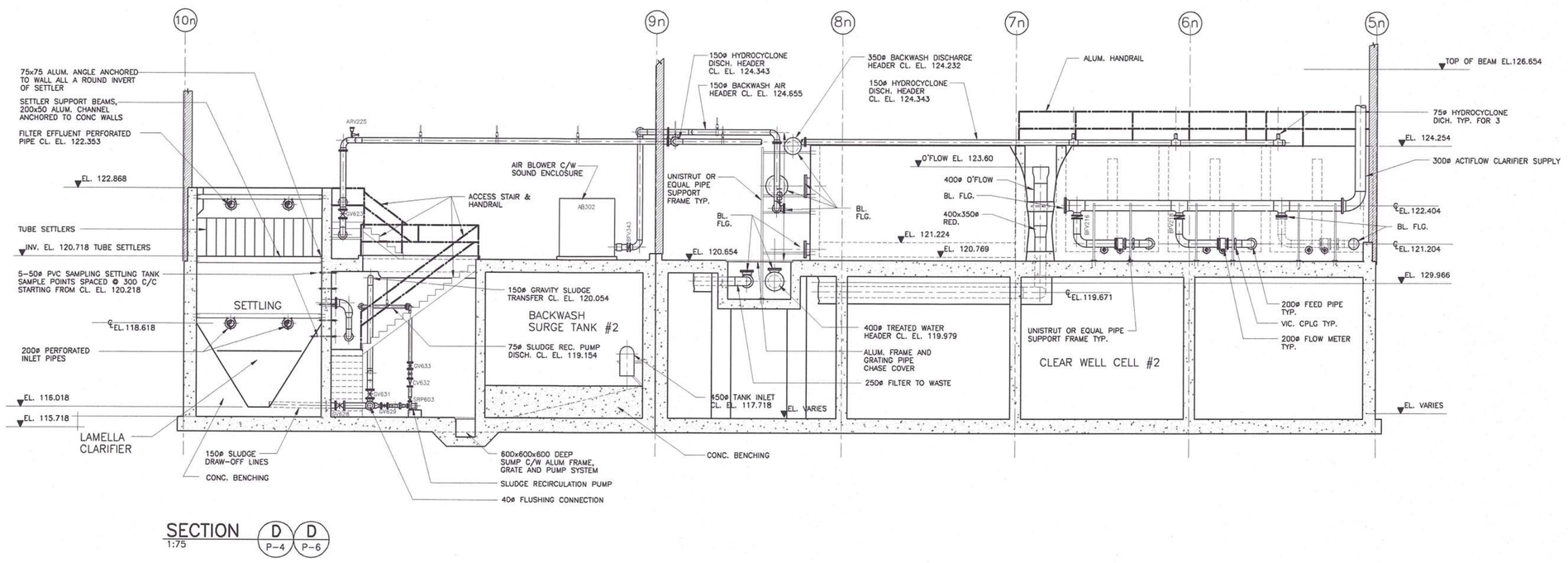
DRAWING

P-7

RAL PROJECT No. 04-103



SECTION C (P-4) C (P-6)
1:75



SECTION D (P-4) D (P-6)
1:75

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

SECTION C & D

STAMP

PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO — REGISTERED — 7-10-05 — R. A. LeCRAW

NORTH POINT

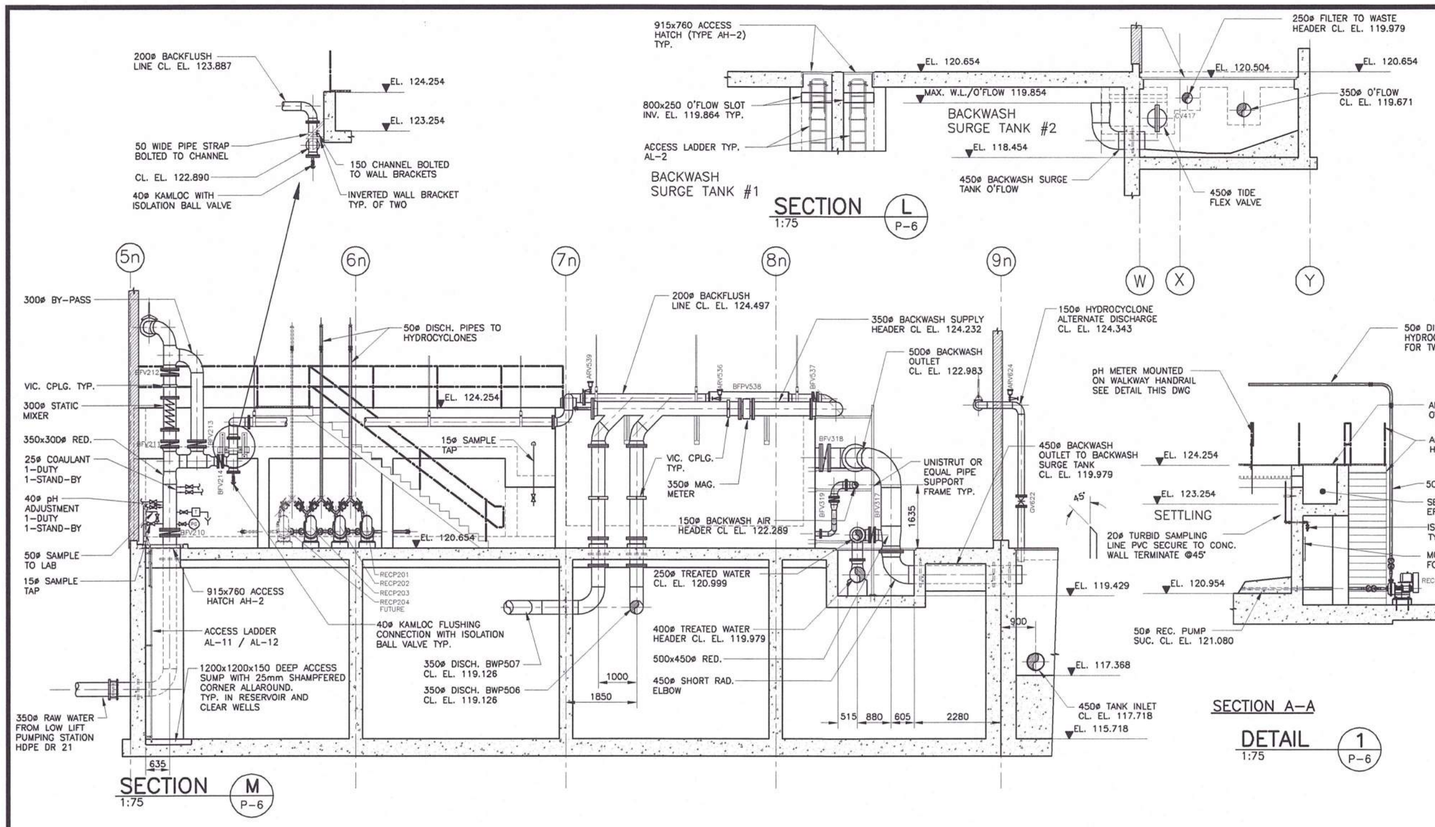
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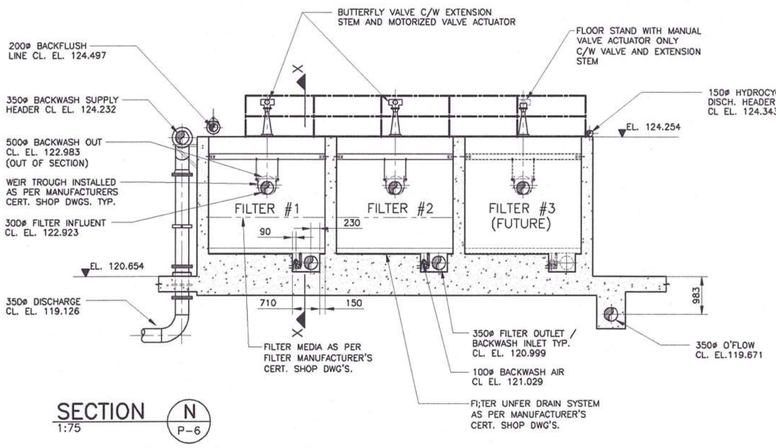
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DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

DRAWING

P-8

RAL PROJECT No. 04-103





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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

SECTION E L & DETAIL 1

STAMP

REGISTERED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

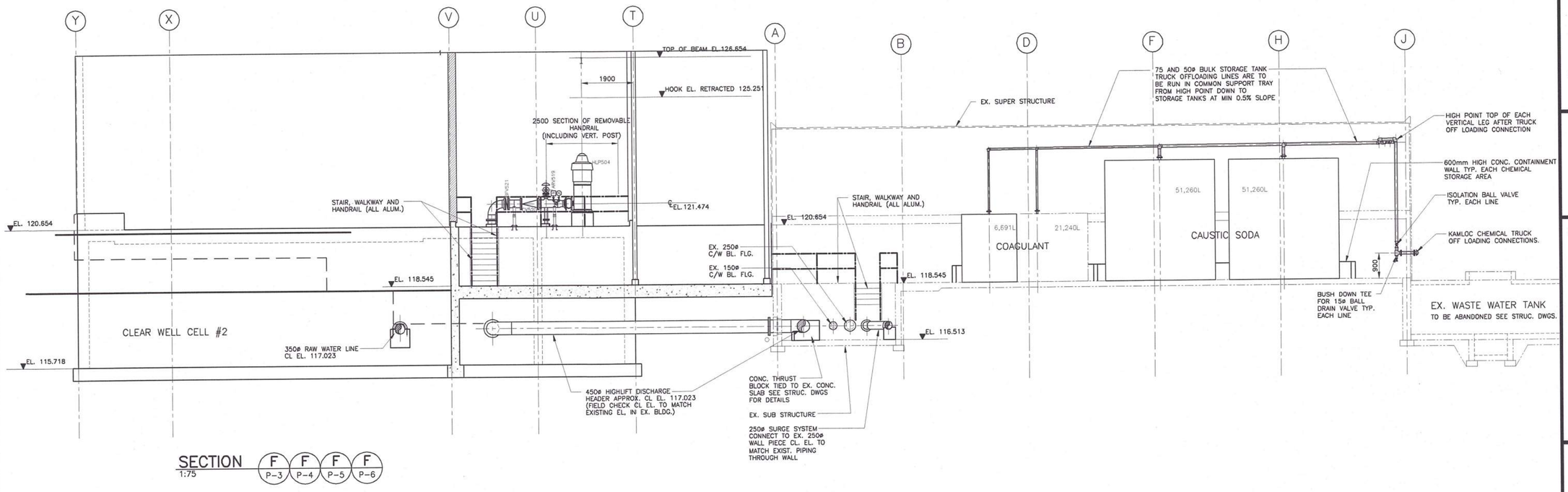
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SCALE	AS SHOWN		

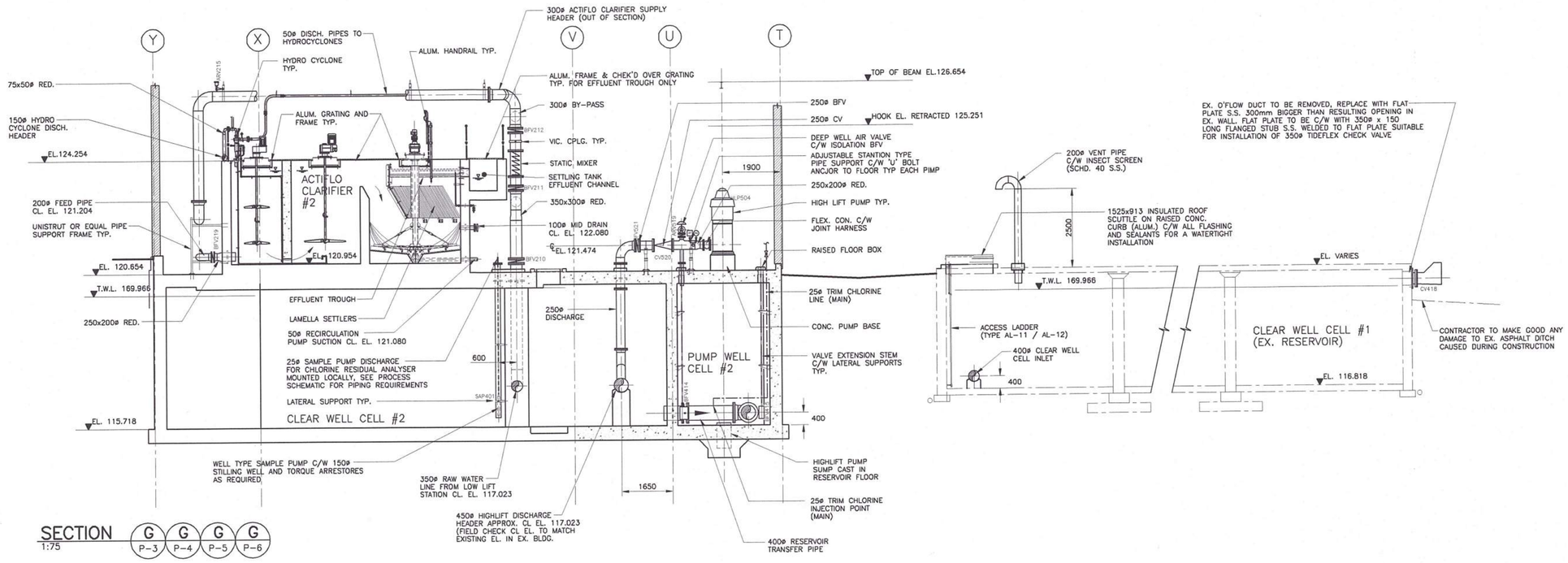
DRAWING

P-9

RAL PROJECT No. 04-103



SECTION 1:75 — F (P-3) F (P-4) F (P-5) F (P-6)



SECTION 1:75 — G (P-3) G (P-4) G (P-5) G (P-6)

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

SECTION F & G

STAMP — PROFESSIONAL ENGINEER — 7-10-05 — R. A. LeCRAW — PROVINCE OF ONTARIO

NORTH POINT

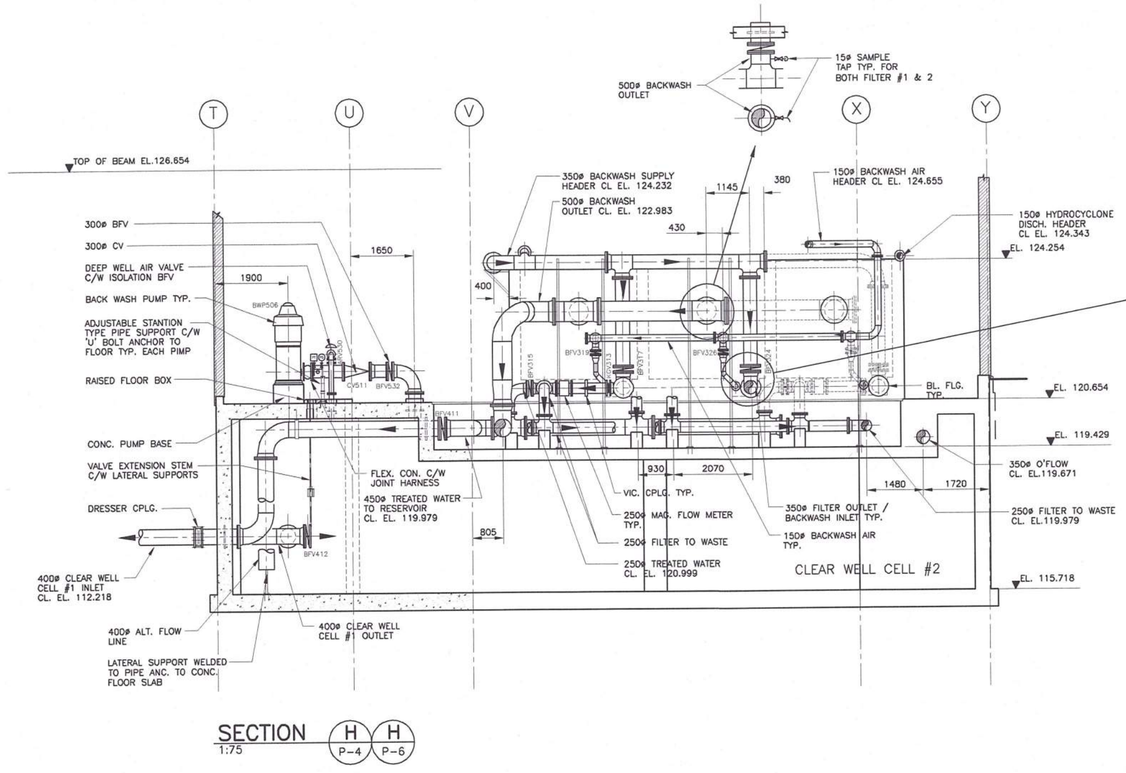
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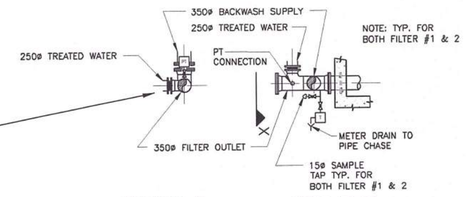
DRAWING

P-10

RAL PROJECT No. 04-103

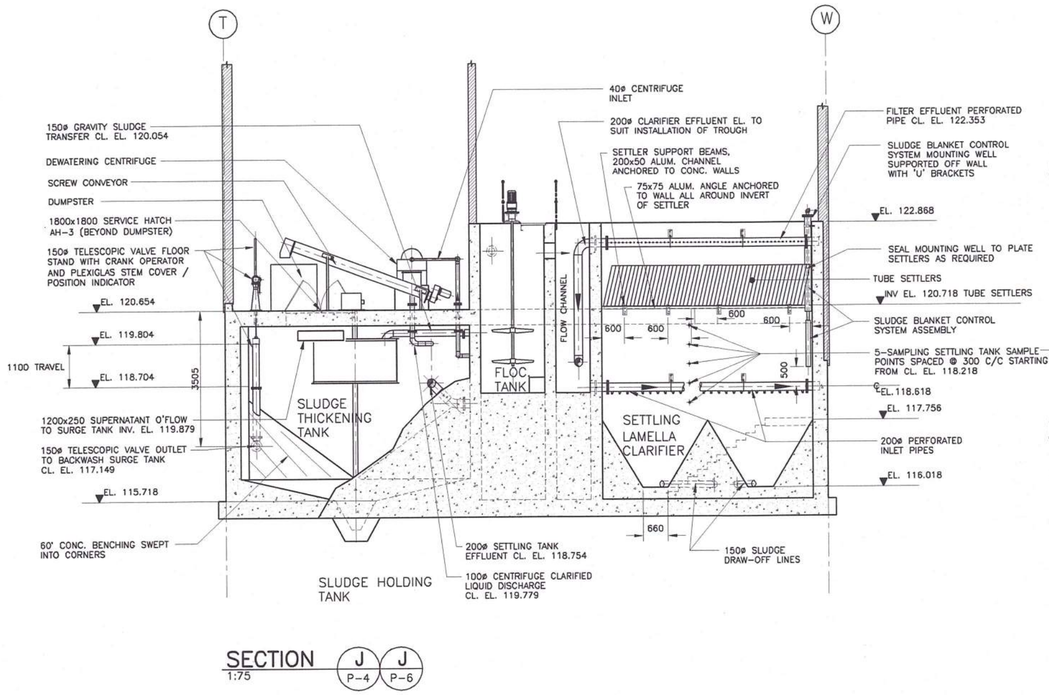


SECTION H (P-4 / P-6)
1:75

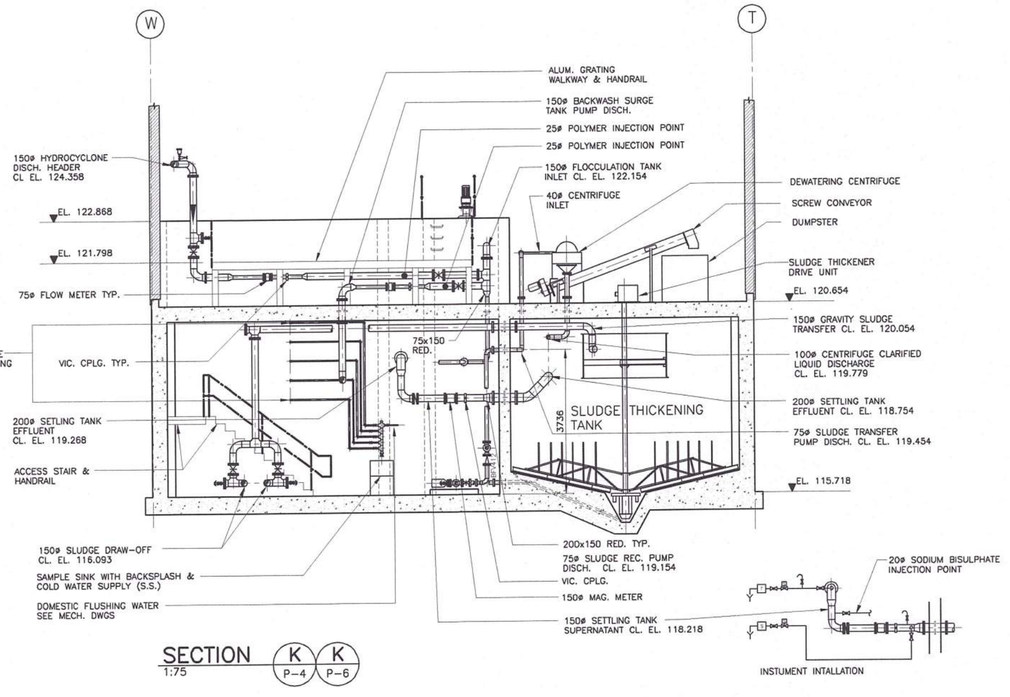


SECTION X

PART PLAN



SECTION J (P-4 / P-6)
1:75



SECTION K (P-4 / P-6)
1:75

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

SECTION H, J & K

STAMP

REGISTERED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

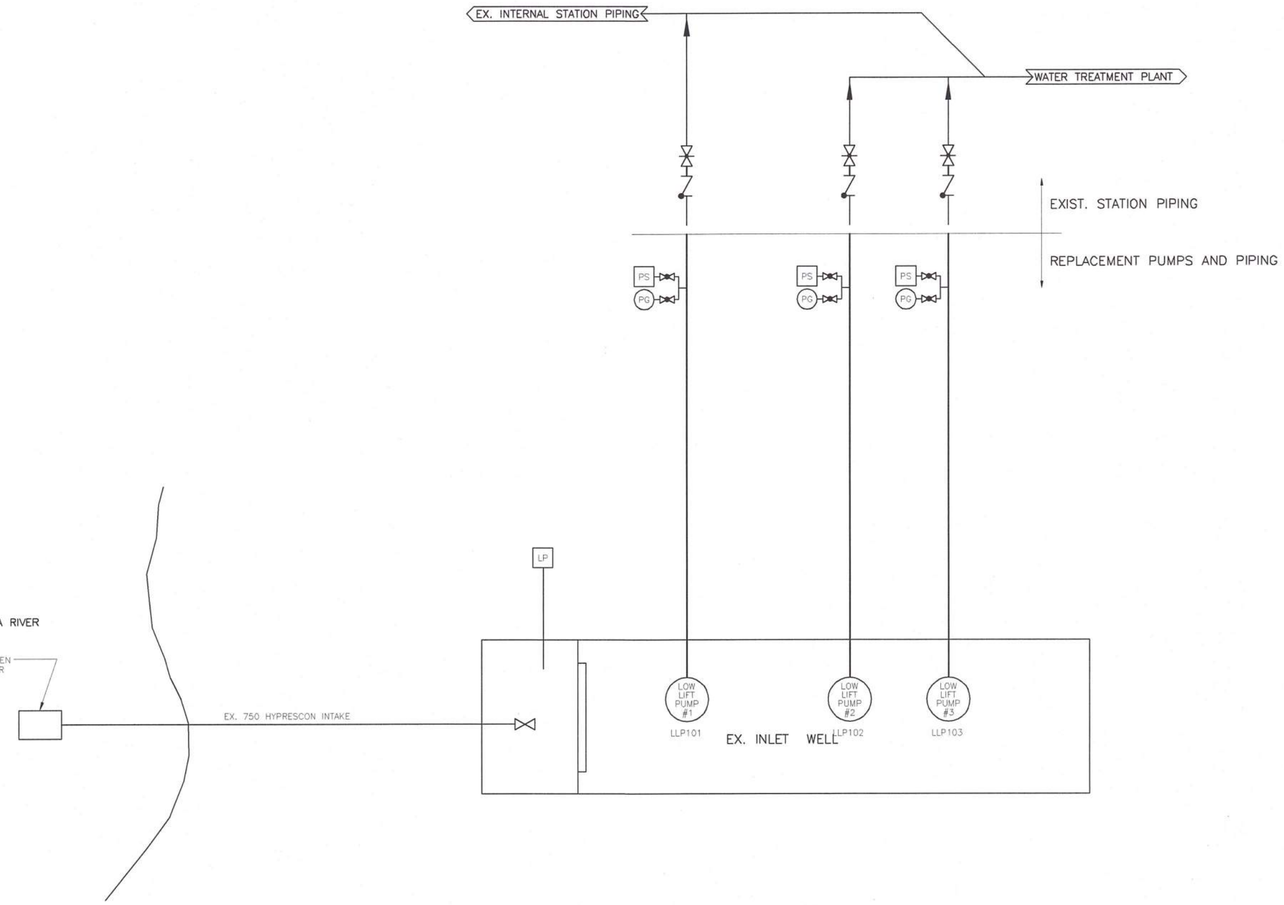
No.	DATE	BY	REVISIONS

DESIGNED	F.A./M.J.G.	DATE	12-04
DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

DRAWING

P-11

RAL PROJECT No. 04-103



LEGEND:

- DENOTES GATE VALVE
- DENOTES KNIFE GATE VALVE
- DENOTES BUTTERFLY VALVE
- DENOTES BUTTERFLY VALVE MOTORIZED
- DENOTES BALL VALVE
- DENOTES SOLENOID VALVE
- DENOTES CHECK VALVE
- DENOTES PLUG VALVE
- PRV/SA — DENOTES PRESSURE RELIEF/SURGE ANTICIPATOR VALVE
- BPV — DENOTES BACK PRESSURE VALVE
- PRDV — DENOTES PRESSURE REDUCING VALVE
- FCV — DENOTES FLOW CONTROL VALVE
- NV — DENOTES NEEDLE VALVE
- DENOTES 15ø SAMPLING TAP C/W SPRING RETURN BALL VALVE (S.S.)
- DENOTES AIR RELEASE VALVE
- DENOTES MOTORIZED PLUG VALVE
- DENOTES SLIDE GATE
- KL — DENOTES KAMLOK QUICK COUPLING WITH ISOLATION VALVE
- M — DENOTES MAGNETIC FLOWMETER
- I — DENOTES INSERT FLOWMETER
- DENOTES ROTAMETER
- T — DENOTES TURBIDIMETER
- C — DENOTES CHLORINE RESIDUAL ANALYSER
- PS — DENOTES PRESSURE SWITCH
- PT — DENOTES PRESSURE TRANSMITTER
- PG — DENOTES PRESSURE GAUGE
- FS — DENOTES FLOAT SWITCH
- LT — DENOTES LEVEL TRANSMITTER (ULTRASONIC)
- LP — DENOTES LEVEL PROBE
- LS — DENOTES LEVEL SWITCH
- TI — DENOTES TEMPERATURE INDICATOR
- pH — DENOTES PH PROBE
- PC — DENOTES PARTICAL COUNTER
- F — DENOTES FLUORIDE MEASUREMENT PROBE
- SBL — DENOTES SLUDGE BLANKET LEVEL
- FSM — DENOTES FLOW SWITCH / MONITOR
- S — DENOTES SULPHIDE ION MONITOR
- DENOTES ACCUMULATOR
- DENOTES SIGHT GLASS
- DENOTES METERING PUMP
- DENOTES MIXER
- DENOTES HOSE REEL WITH 15.25 (50') OF 40 (1-1/2")ø HOSE REEL

BY BUILDING MECH.

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS SCHEMATIC LOW LIFT PUMPING STATION

STAMP

REGISTERED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

No.	DATE	BY	REVISIONS

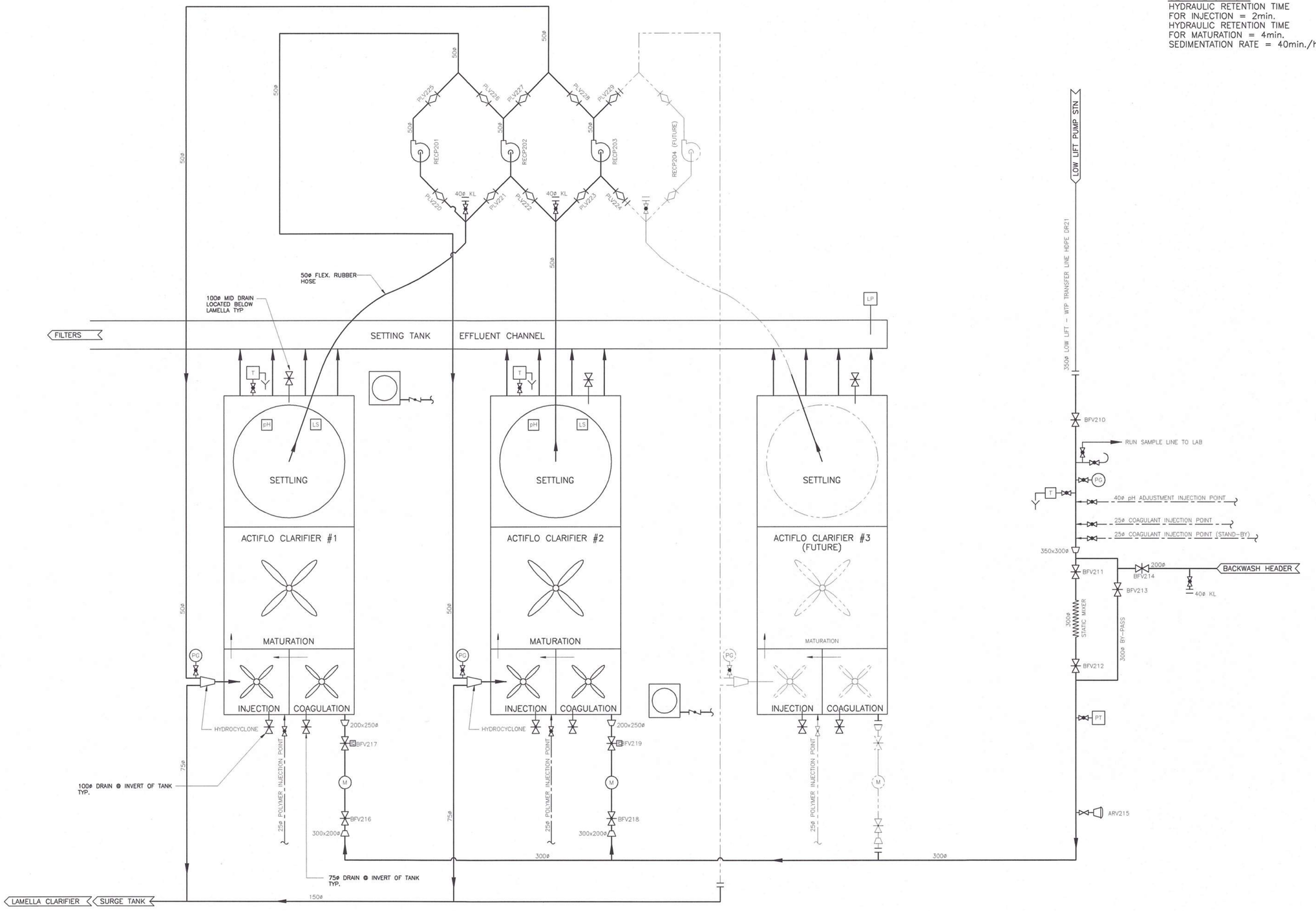
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DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

DRAWING

G-1

RAL PROJECT No. 04-103

ACTIFLO CLARIFIERS
ULTIMATE CAPACITY
HYDRAULIC RETENTION TIME
FOR INJECTION = 2min.
HYDRAULIC RETENTION TIME
FOR MATURATION = 4min.
SEDIMENTATION RATE = 40min./hr.



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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS SCHEMATIC CLARIFIERS #1 & #2

STAMP

REGISTERED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

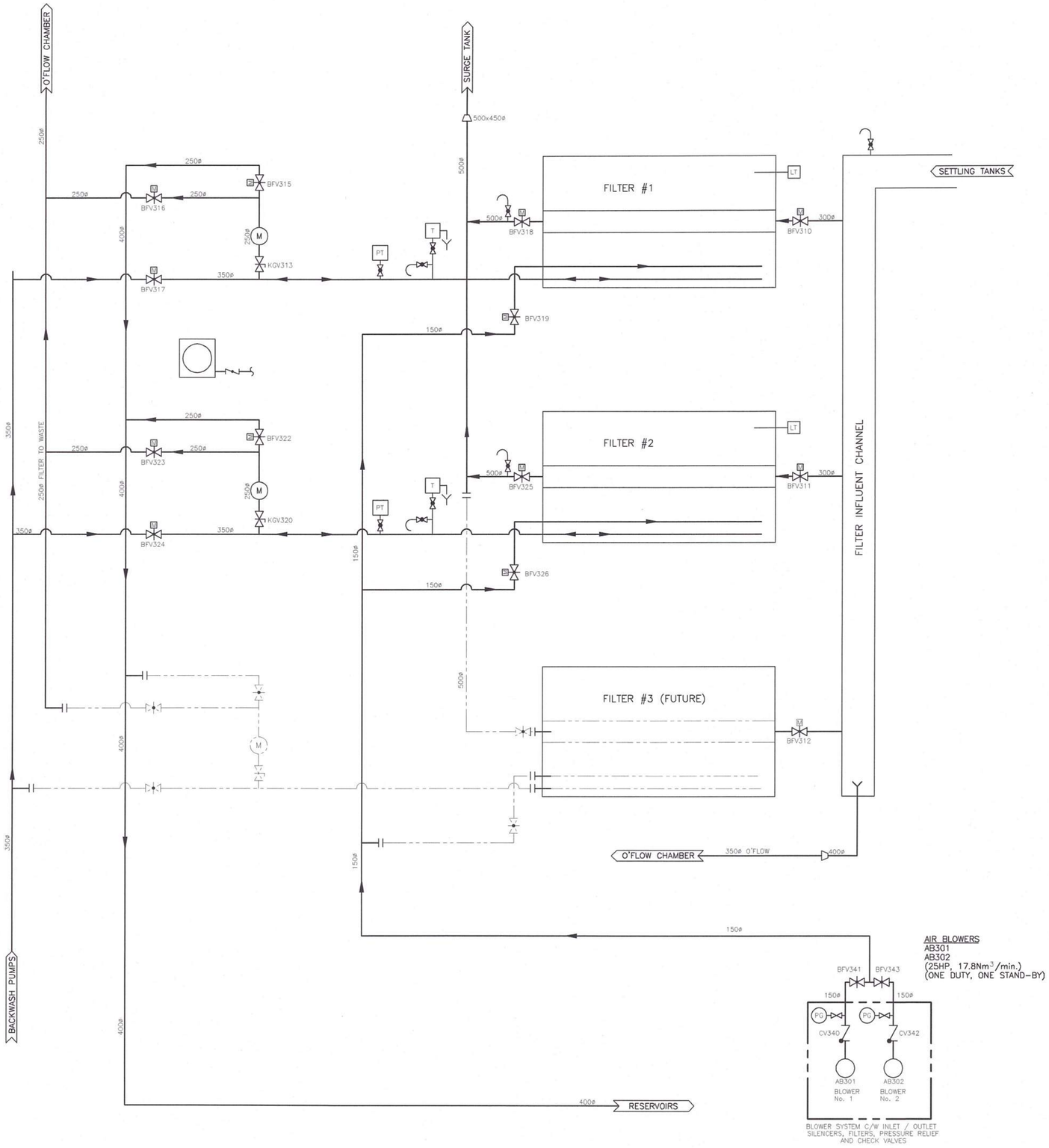
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DESIGNED	F.A./M.J.G.	DATE	12-9-4
DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

DRAWING

G-2

RAL PROJECT No. 04-103



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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS SCHEMATIC RAPID SAND FILTERS

STAMP

REGISTERED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

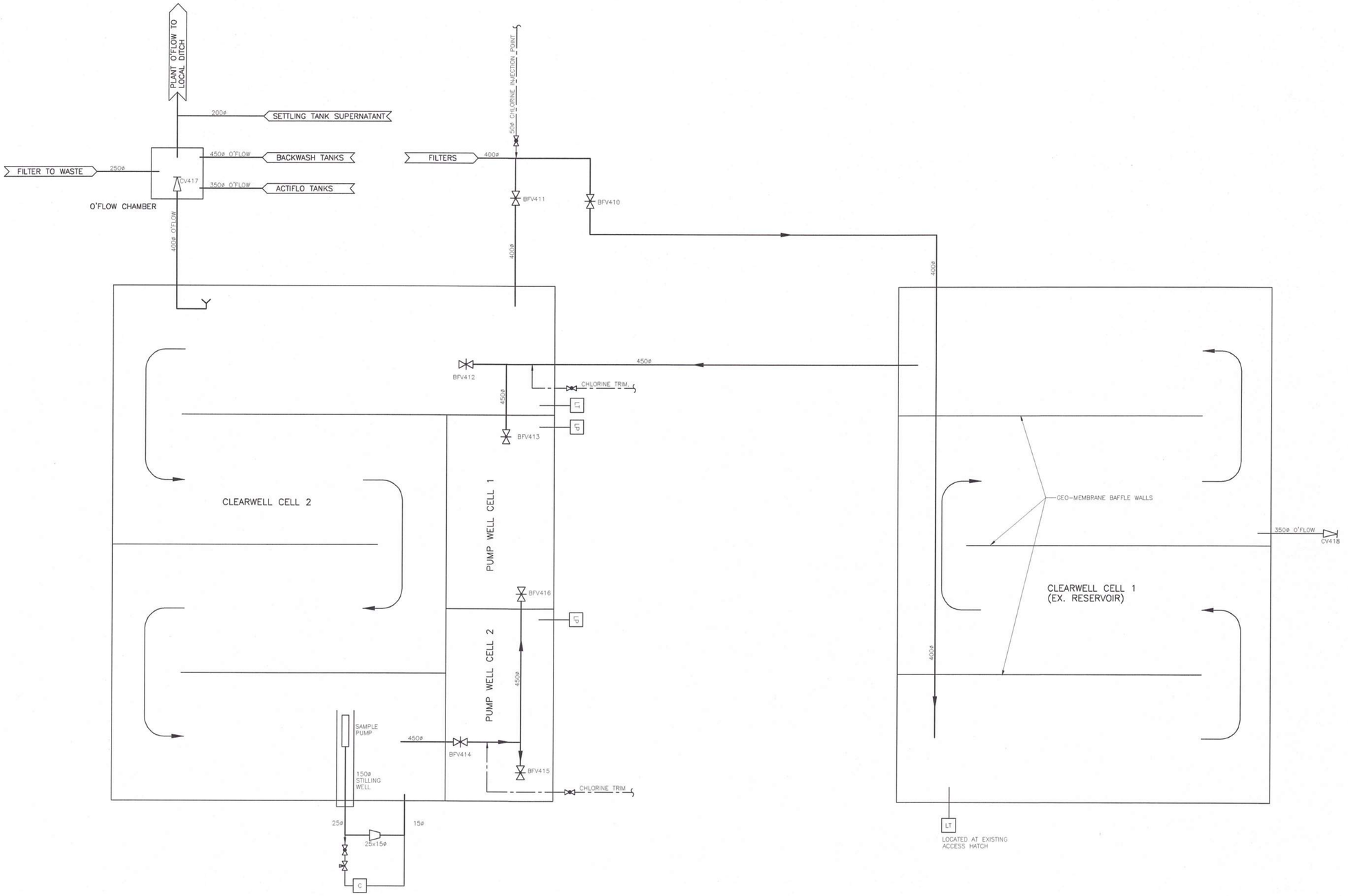
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DESIGNED	F.A./M.J.G.	DATE	12-9-4
DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

DRAWING

G-3

RAL PROJECT No. 04-103



SAMPLING PUMP
SAP501
(1 DUTY)

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS SCHEMATIC RESERVOIR CELLS #1 & #2, PUMP WELL CELLS #1 & 2,

STAMP

NORTH POINT

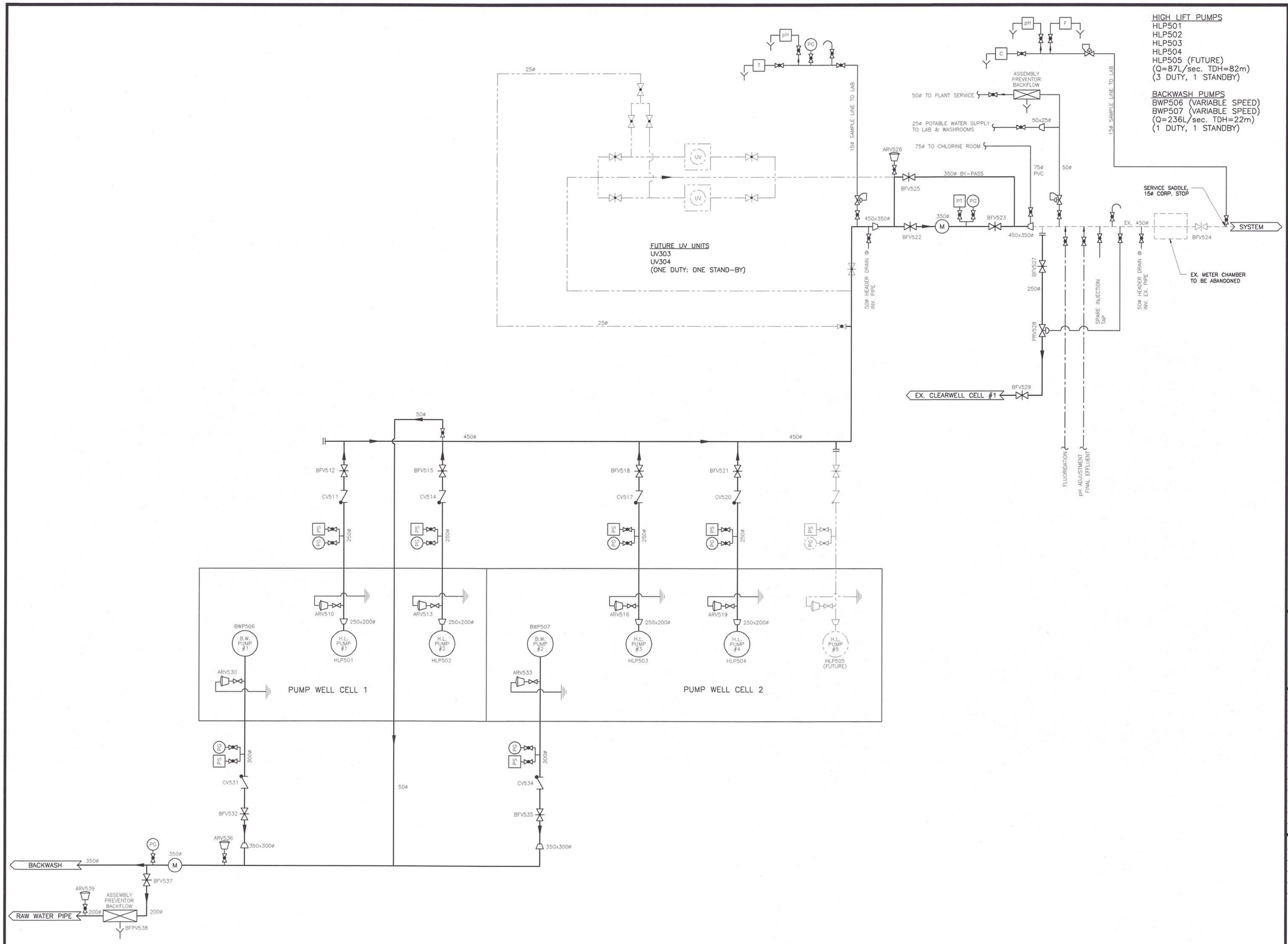
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DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

DRAWING

G-4

RAL PROJECT No. 04-103



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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS SCHEMATIC HIGH LIFT PUMPS AND BACKWASH PUMPS

STAMP

PROFESSIONAL ENGINEER — REGISTERED — 7-10-05 — R. A. LeCRAW — PROVINCE OF ONTARIO

NORTH POINT

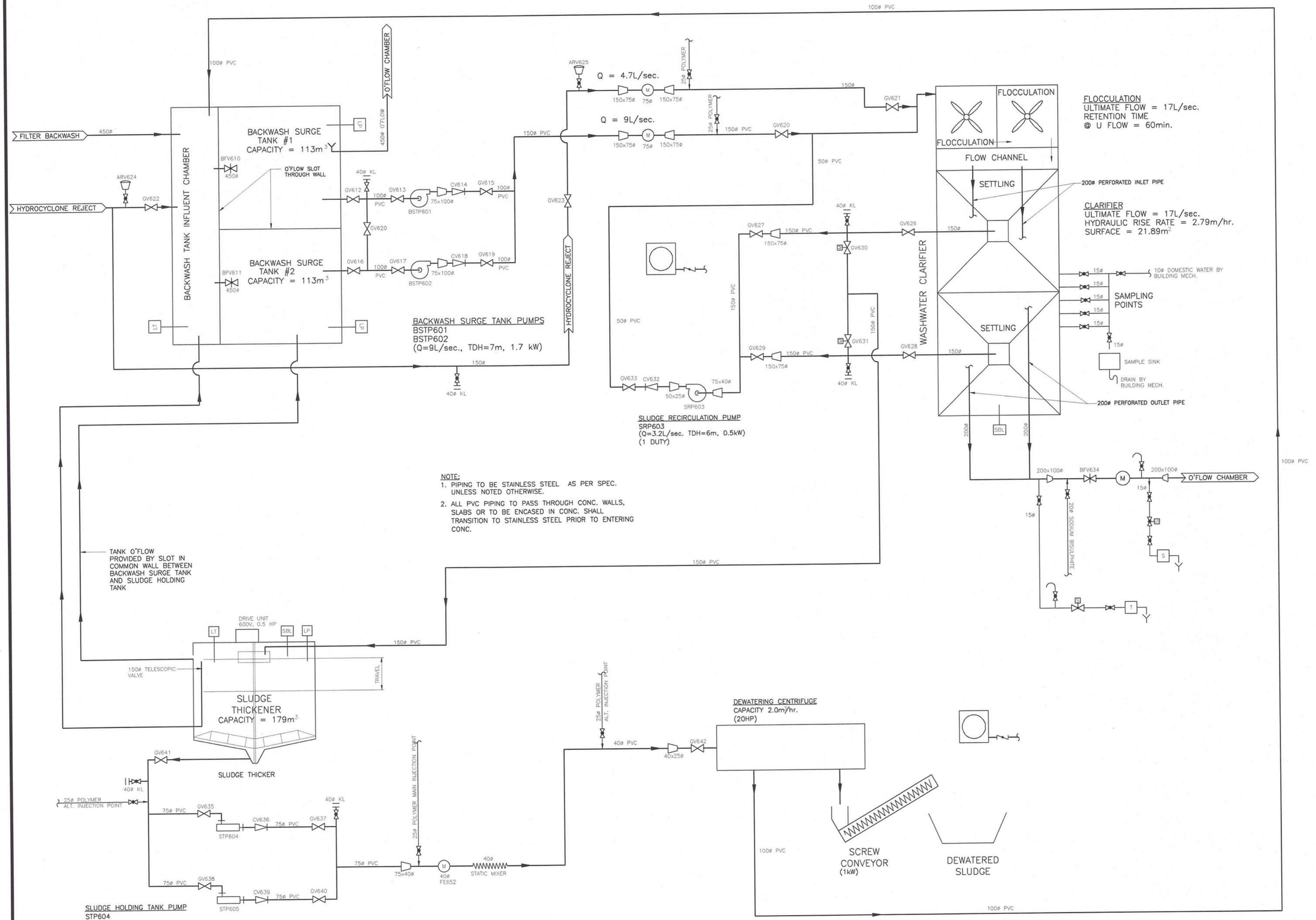
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SCALE	AS SHOWN		

DRAWING

G-5

RAL PROJECT No. 04-103



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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS SCHEMATIC WASTE WATER SURGE TANK & SLUDGE HANDLING SYSTEMS

STAMP

REGISTERED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

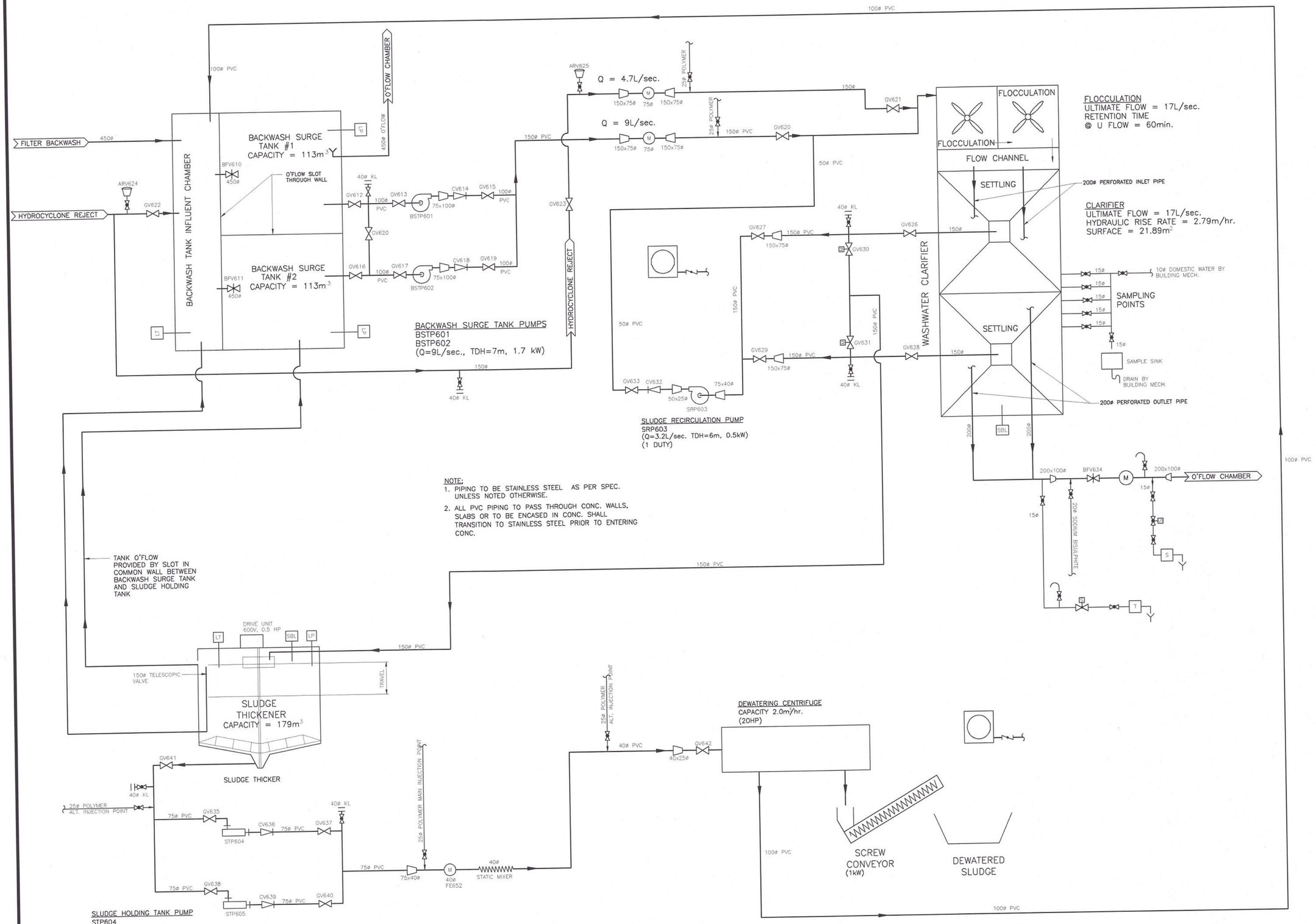
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APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

DRAWING

G-6

RAL PROJECT No. 04-103



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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS SCHEMATIC WASTE WATER SURGE TANK & SLUDGE HANDLING SYSTEMS

STAMP

REGISTERED PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

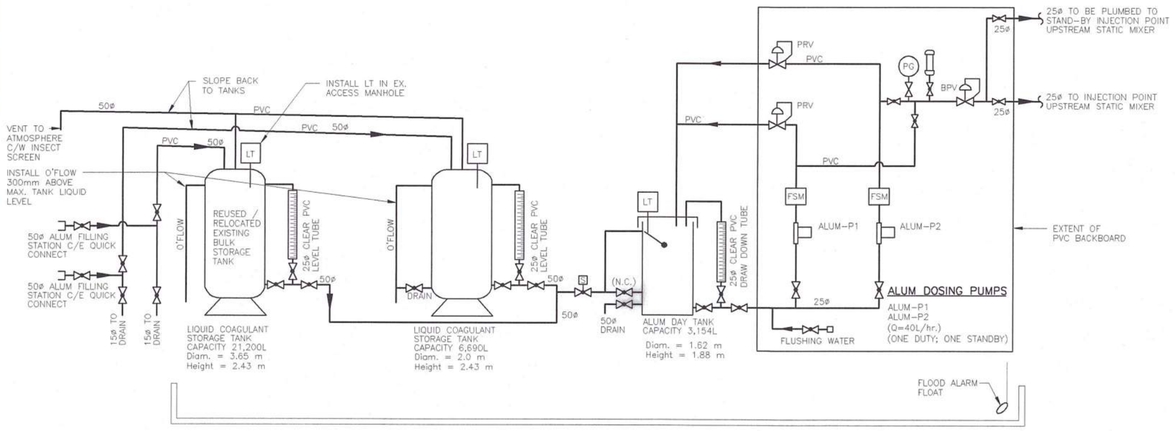
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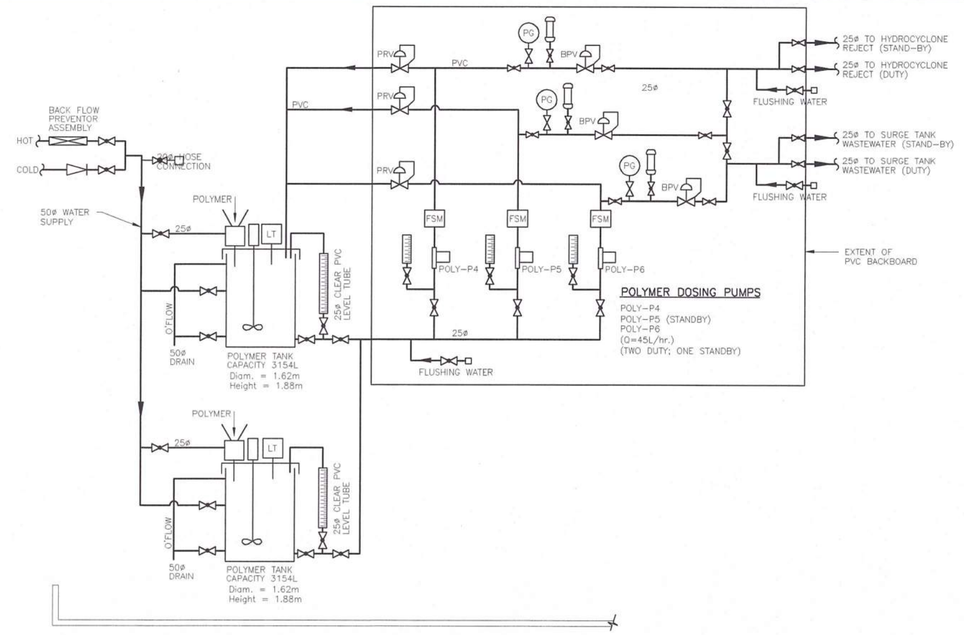
DRAWING

G-6

RAL PROJECT No. 04-103



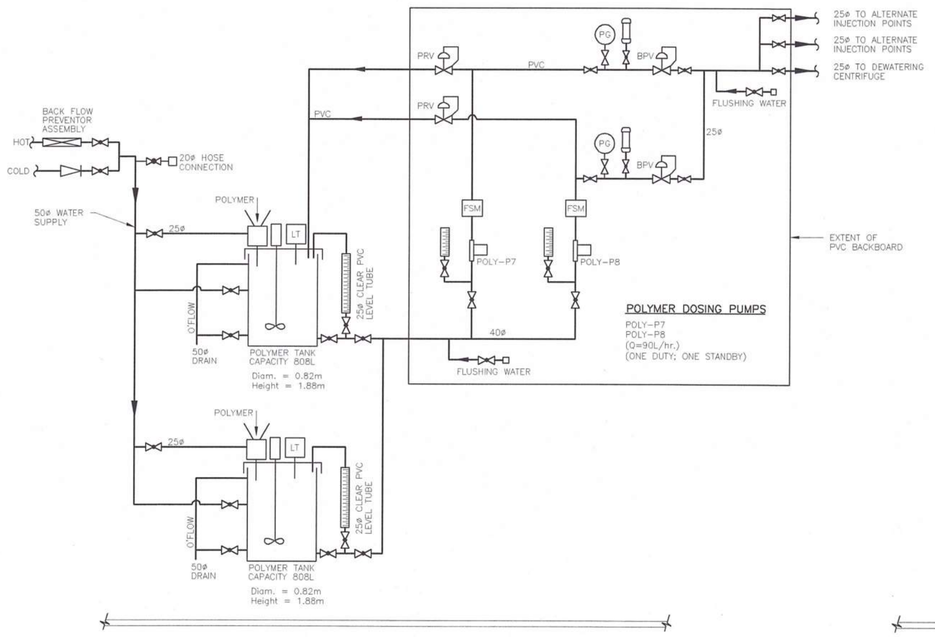
LIQUID COAGULANT FEED SYSTEM



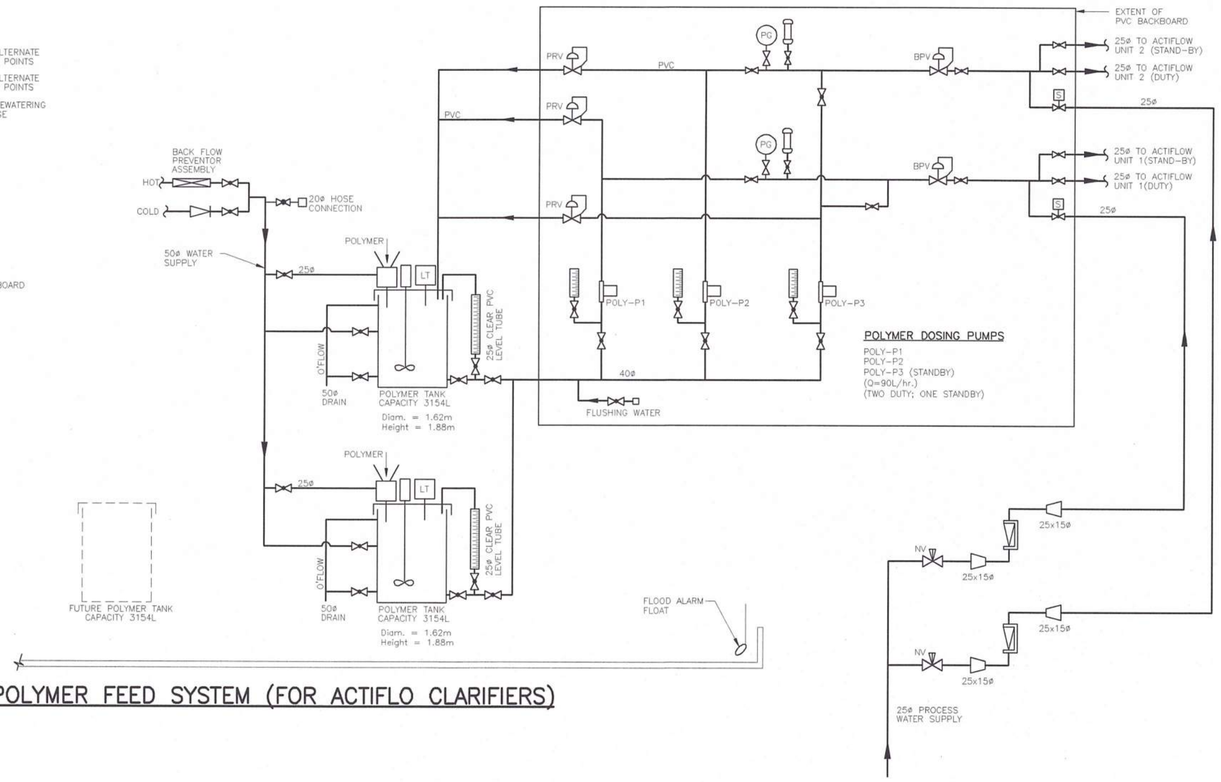
POLYMER FEED SYSTEM (FOR LAMELLA CLARIFIER)

NOTE

PVC BACKBOARDS FOR MOUNTING OF CHEMICAL PUMPING SYSTEMS ARE TO BE FRAMED AND BRACED WITH 25x25x6 HSS MEMBERS. THE COMPLETE BACKBOARD ASSEMBLY IS TO BE SUPPORTED BY MIN. 75mm UNISTRUT CHANNELS OR AS RECOMMENDED BY BACKBOARD ASSEMBLY FABRICATOR.



POLYMER FEED SYSTEM (FOR DEWATERING CENTRIFUGE)



POLYMER FEED SYSTEM (FOR ACTIFLO CLARIFIERS)

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS SCHEMATIC CHEMICAL SYSTEMS

STAMP: REGISTERED PROFESSIONAL ENGINEER, 7-10-05, R. A. LeCRAW, PROVINCE OF ONTARIO

NORTH POINT

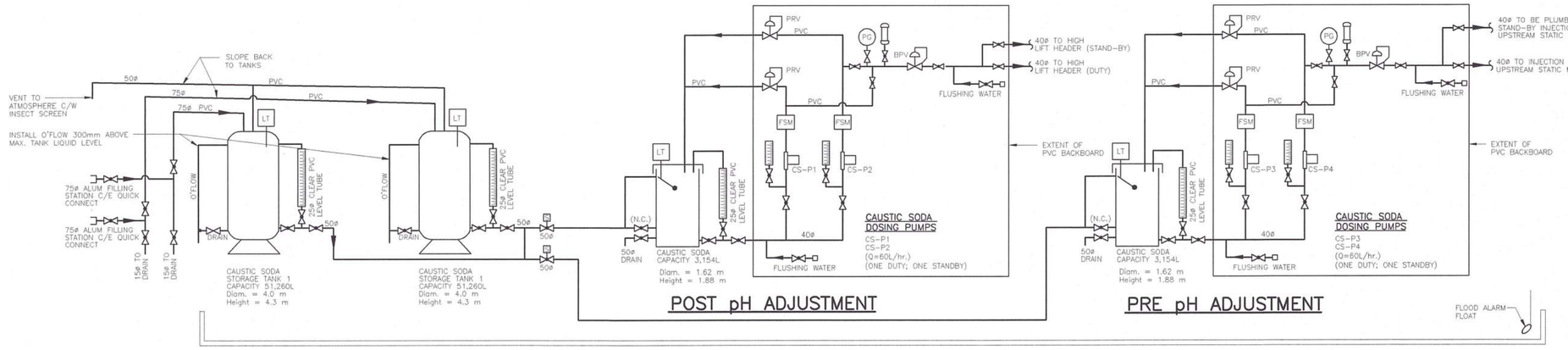
No.	DATE	BY	REVISIONS

DESIGNED	F.A./M.J.G.	DATE	12-9-4
DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

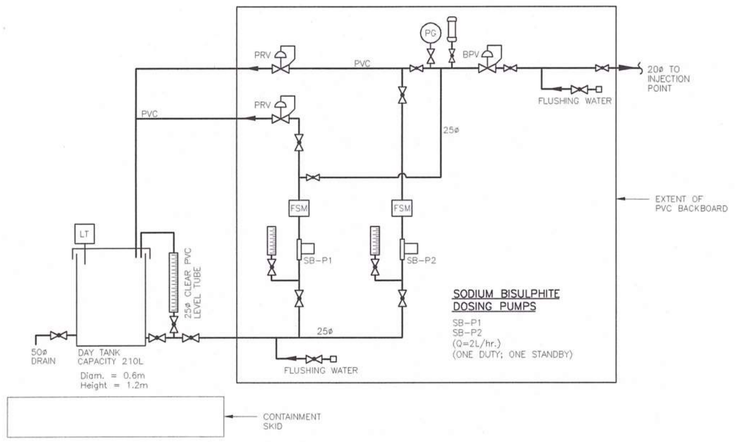
DRAWING

G-7

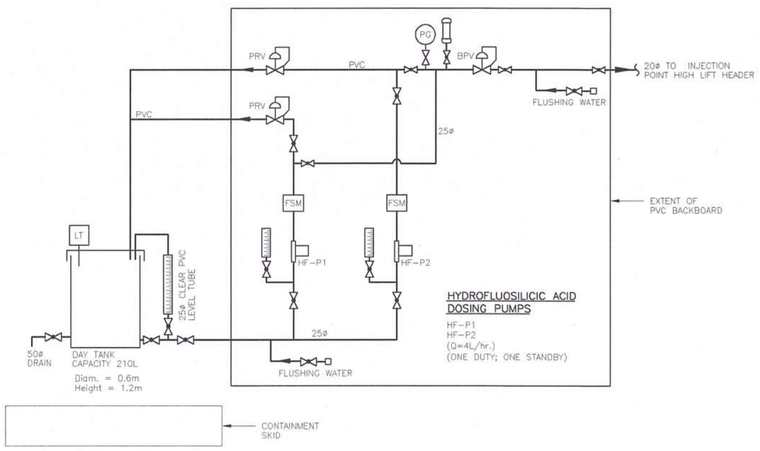
RAL PROJECT No. 04-103



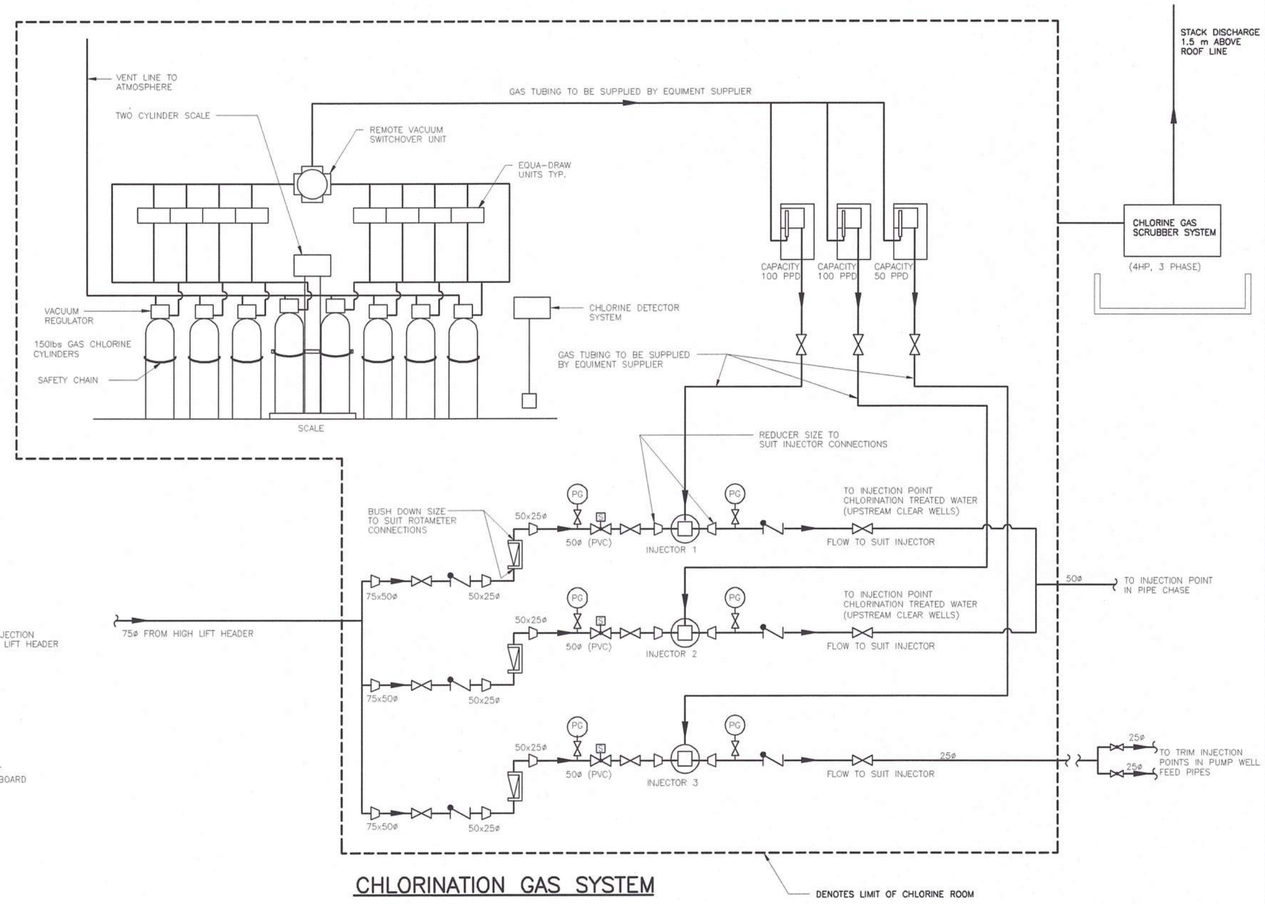
CAUSTIC SODA FEED SYSTEM (pH ADJUSTMENT)



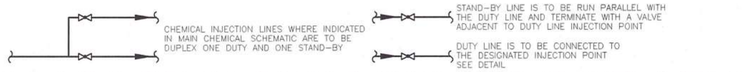
SODIUM BISULPHITE FEED SYSTEM



HYDROFLUOSILICIC ACID FEED SYSTEM



CHLORINATION GAS SYSTEM



TYPICAL PIPING RUN FOR INJECTION PIPING NOTED AS DUTY / STAND-BY

NOTE:THIS DETAIL IS TYPICAL FOR POLYMER FEED SYSTEM; (LAMELLA CLARIFIER, ACTIFO CLARIFIER); CAUSTIC SODA POST pH AND HYDROFLUOSILICIC ACID SYSTEMS. THE DUTY / STAND-BY LINES FOR THE LIQUID COAGULANT AND CAUSTIC SODA PRE pH FEED SYSTEMS ARE TO BE RUN TO INDIVIDUAL BAYONET INJECTION POINTS AS INDICATED ON PROCESS DWG's. ALL OTHERS ARE TO BE RUN AS A SINGLE LINE TO THE INJECTION BAYONET AS INDICATED ON PROCESS DWGS.

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ral@raleng.com www.raleng.com

PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS SCHEMATIC CHEMICAL SYSTEMS

STAMP

PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO — 7-10-05 — R. A. LeCRAW

NORTH POINT

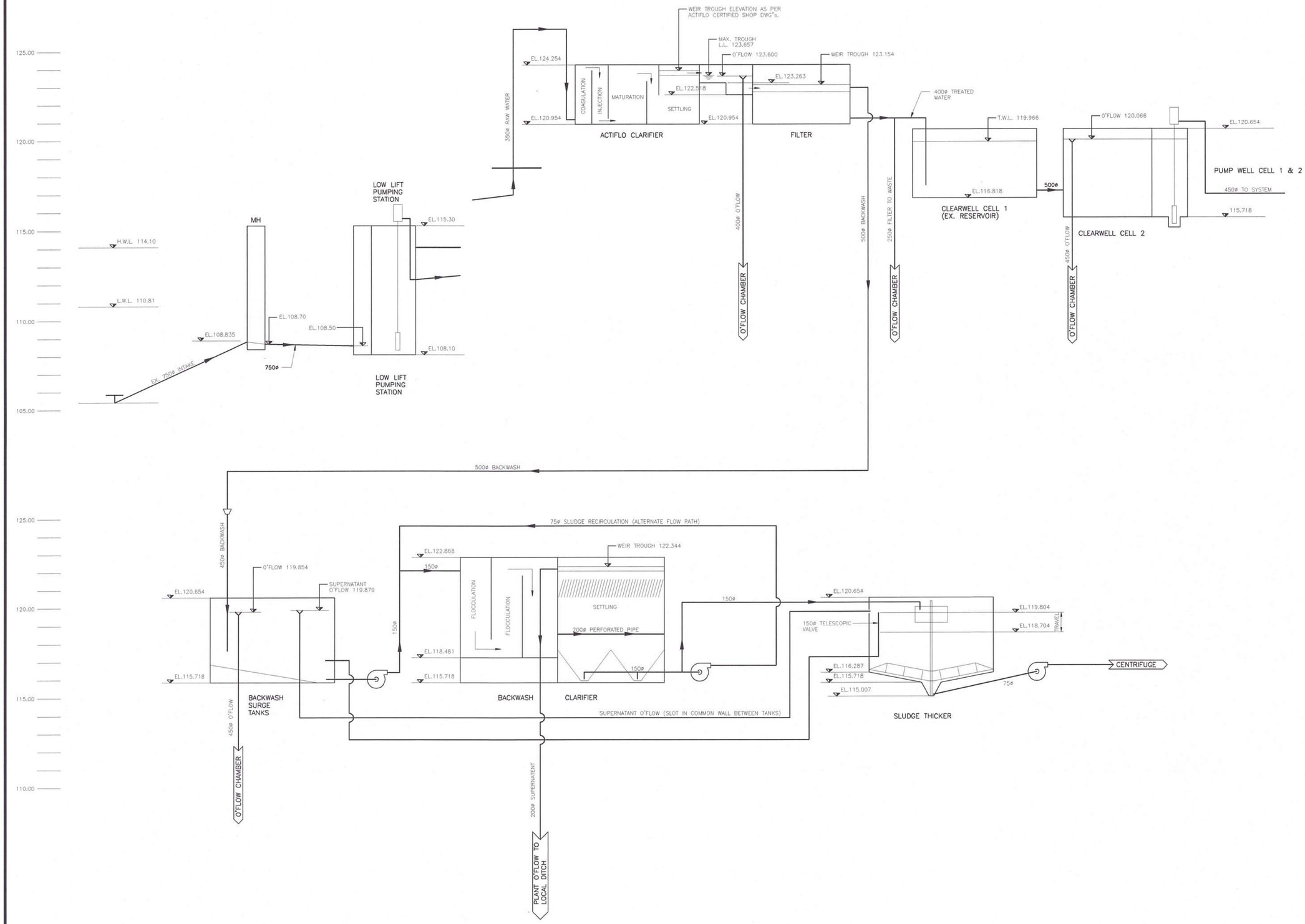
No.	DATE	BY	REVISIONS

DESIGNED	F.A./M.J.G.	DATE	12-9-4
DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

DRAWING

G-8

RAL PROJECT No. 04-103



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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS HYDRAULIC PROFILE

STAMP

PROFESSIONAL ENGINEER
7-10-05
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

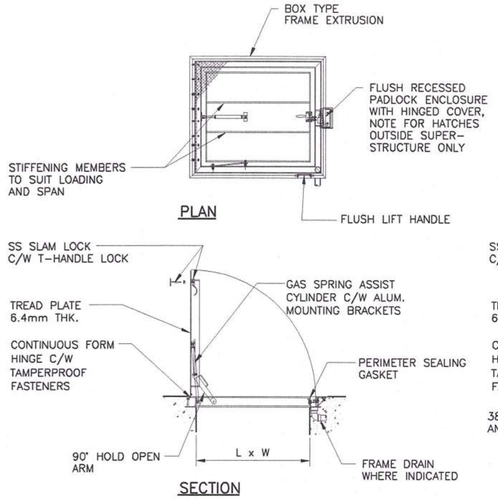
No.	DATE	BY	REVISIONS

DESIGNED	F.A./M.J.G.	DATE	12-9-4
DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

DRAWING

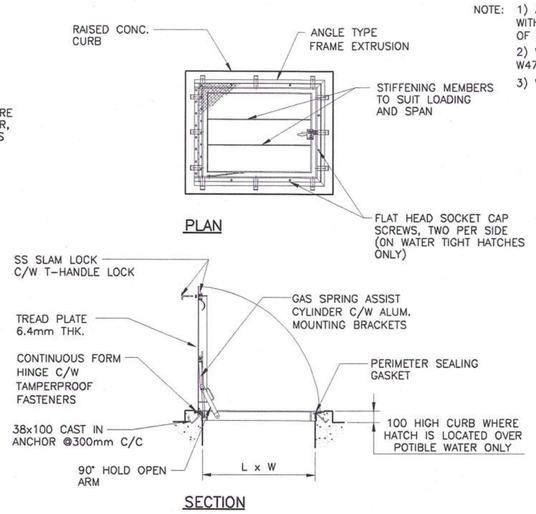
G-9

RAL PROJECT No. 04-103



ALUMINIUM ACCESS HATCH 'M' STYLE (TYPE AH-1) AS SUPPLIED BY MSU MISSISSAUGA

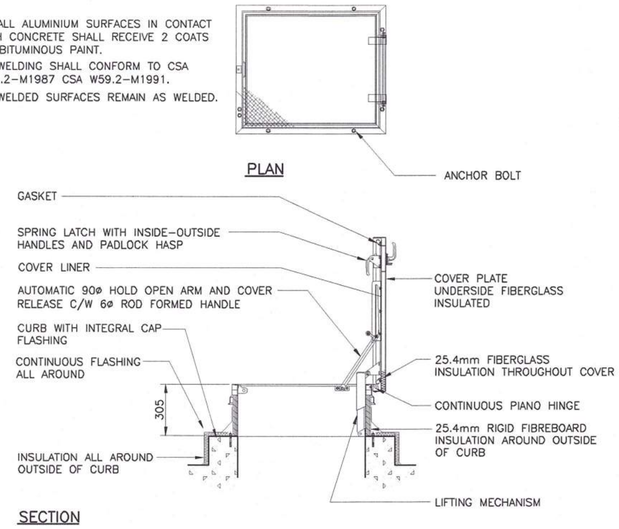
N.T.S. (DESIGN FOR 14.4 kPa MAX. DEFLECTION 1/150 OF SPAN)



ALUMINIUM ACCESS HATCH 'C' STYLE (TYPE AH-2) AS SUPPLIED BY MSU MISSISSAUGA

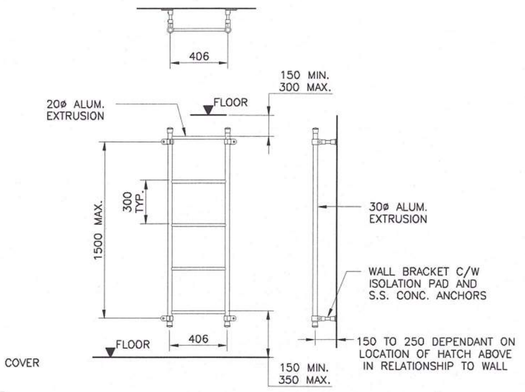
N.T.S. (DESIGN FOR 14.4 kPa MAX. DEFLECTION 1/150 OF SPAN)

NOTE:
1) ALL ALUMINIUM SURFACES IN CONTACT WITH CONCRETE SHALL RECEIVE 2 COATS OF BITUMINOUS PAINT.
2) WELDING SHALL CONFORM TO CSA W47.2-M1987 CSA W59.2-M1991.
3) WELDED SURFACES REMAIN AS WELDED.



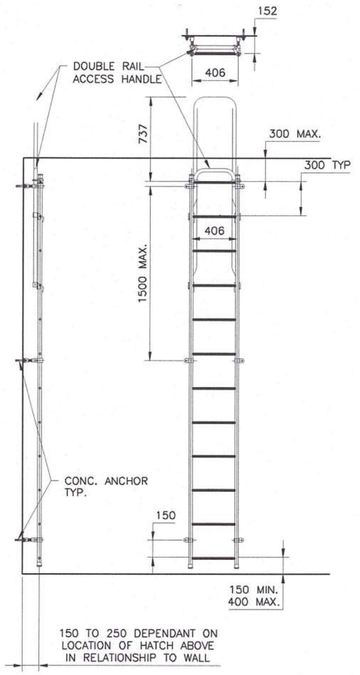
ROOF SCUTTLE TYPE (TYPE RS-1)

N.T.S.



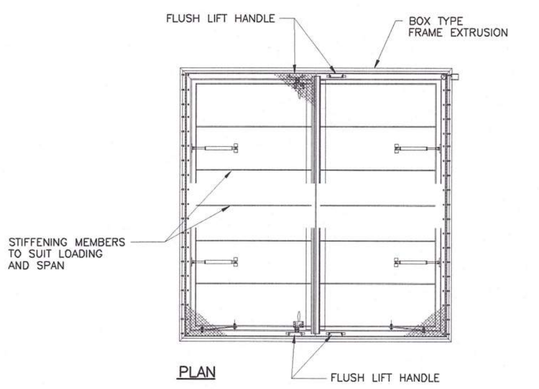
ALUMINIUM ACCESS LADDER (TYPE AL-1)

N.T.S.



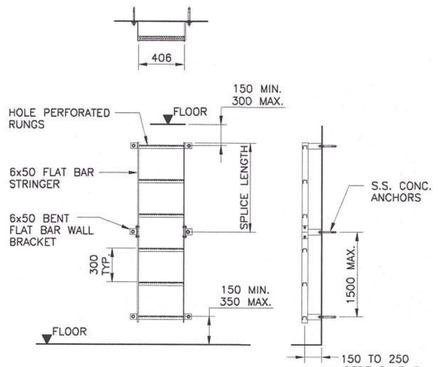
ALUMINIUM ACCESS LADDER (TYPE AL-2) AS SUPPLIED BY MSU MISSISSAUGA

N.T.S. (ALL MEMBERS AS PER AL-1)



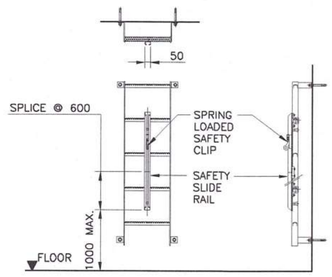
ALUMINIUM DOUBLE LEAF SERVICE HATCH 'MD' STYLE (TYPE AH-3) AS SUPPLIED BY MSU MISSISSAUGA

N.T.S. (DESIGN FOR AXIAL LOAD OF 5400 kg MAX. DEFLECTION 1/150 OF SPAN)



STAINLESS STEEL ACCESS LADDER (TYPE AL-10) AS SUPPLIED BY MSU MISSISSAUGA

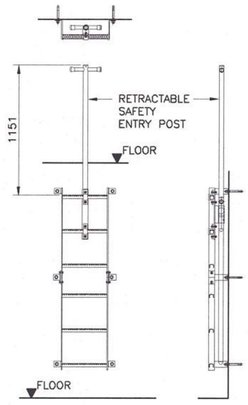
N.T.S.



NOTES:
ALL LADDERS OVER 3.0m NOT INDICATED TO BE INSTALLED WITH A SAFETY CAGE SHALL BE SUPPLIED AND INSTALLED WITH SAFETY RAIL ASSEMBLY

STAILESS STEEL ACCESS LADDER (TYPE AL-11) AS SUPPLIED BY MSU MISSISSAUGA

N.T.S. (MEMBERS SAME AS TYPE AL-10)

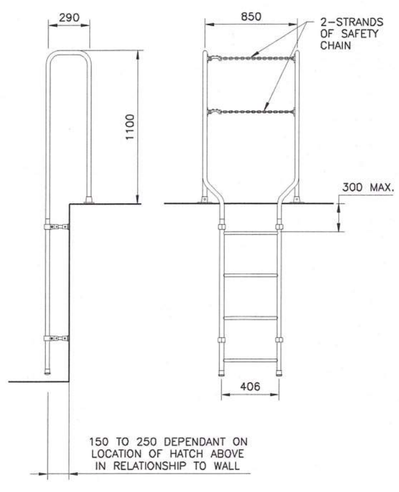


STAINLESS STEEL ACCESS LADDER (TYPE AL-12) AS SUPPLIED BY MSU MISSISSAUGA

N.T.S. (MEMBERS SAME AS TYPE AL-10)

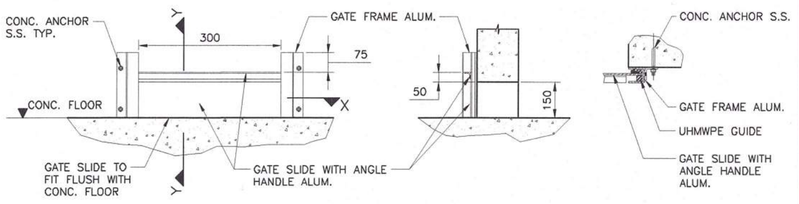
NOTES

1) ALL ALUMINIUM SURFACES IN CONTACT WITH CONCRETE SHALL RECEIVE 2 COATS OF BITUMINOUS PAINT.
2) WELDING SHALL CONFORM TO CSA W47.2-M1987 CSA W59.2-M1991 SEE DWG #W-STD-1 FOR DETAILS.
3) GROUND ROUGH EDGES SMOOTH. WELDED SURFACES REMAIN AS WELDED.
4) DETAILS SHOWN APPLY TO BOTH COCHENOUR T.P. AND BALMERTOWN RESERVOIR



ALUMINIUM ACCESS LADDER (TYPE AL-3) AS SUPPLIED BY MSU MISSISSAUGA

N.T.S. (ALL MEMBERS AS PER AL-1)



CLEANING SLOT ALUM. HAND GATE

N.T.S.

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

DETAIL SHEET #1

STAMP

REGISTERED PROFESSIONAL ENGINEER
7-10-02
R. A. LeCRAW
PROVINCE OF ONTARIO

NORTH POINT

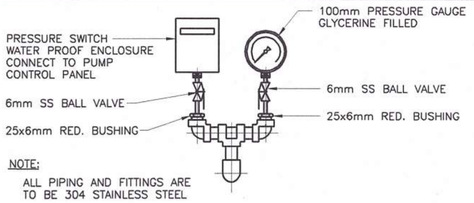
No.	DATE	BY	REVISIONS

DESIGNED	F.A./M.J.G.	DATE	12-9-4
DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

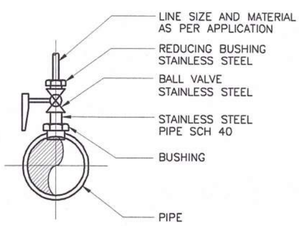
DRAWING

G-10

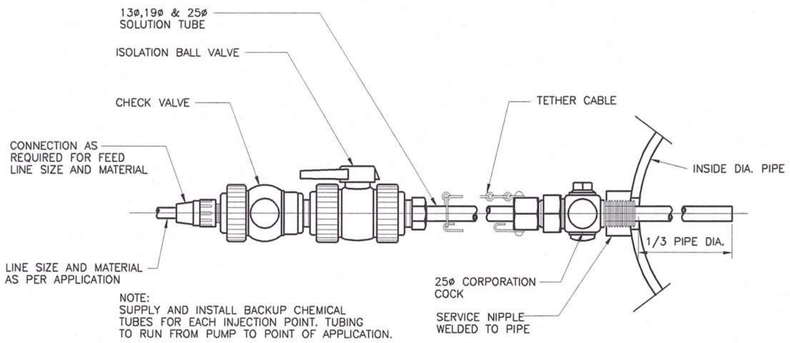
RAL PROJECT No. 04-103



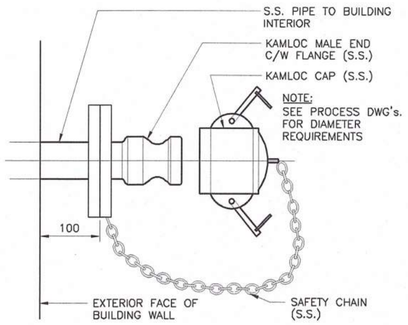
PRESSURE GAUGE / SWITCH INSTALLATION
N.T.S.



TYPICAL LINE CONNECTION FOR TAKE OFF POINTS



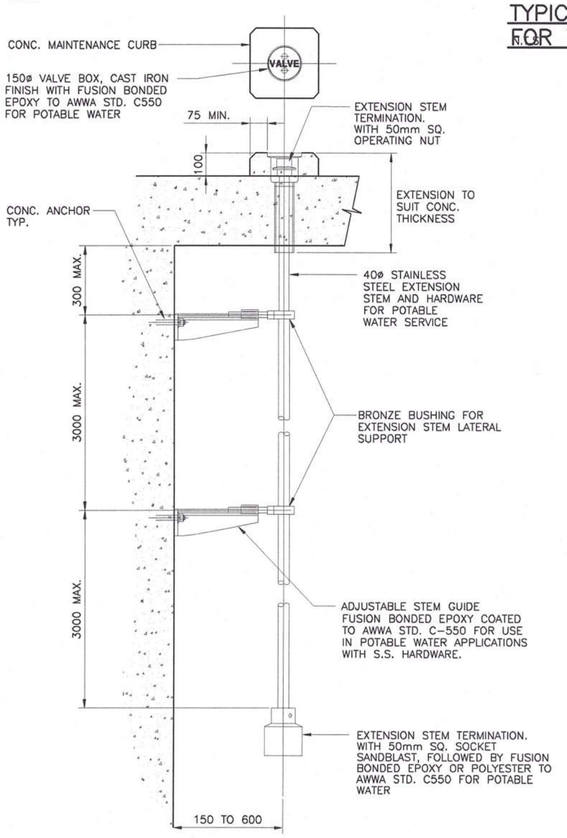
TYPICAL LINE CONNECTION FOR INJECTION POINTS
N.T.S.



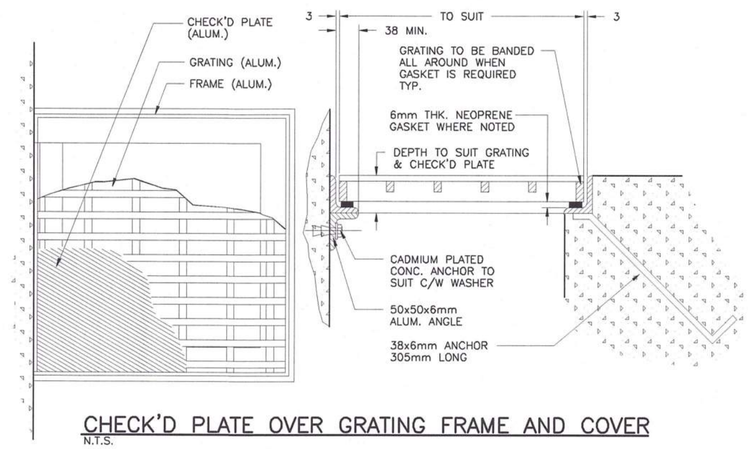
TRUCK FILL CONNECTION
N.T.S (SIMILAR FOR FLUSHING CONNECTIONS)

NOTES

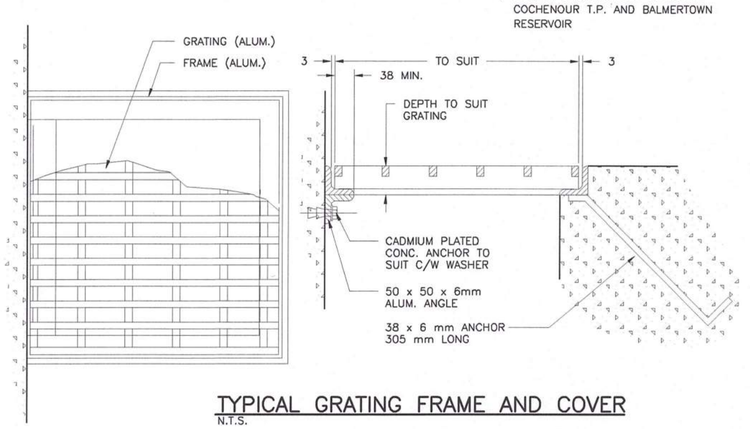
1) ALL ALUMINIUM SURFACES IN CONTACT WITH CONCRETE SHALL RECEIVE 2 COATS OF BITUMINOUS PAINT.
2) WELDING SHALL CONFORM TO CSA W47.2–M1987 CSA W59.2–M1991 SEE DWG #W–STD–1 FOR DETAILS.
3) GROUND ROUGH EDGES SMOOTH. WELDED SURFACES REMAIN AS WELDED.
4) DETAILS SHOWN APPLY TO BOTH COCHENOUR T.P. AND BALMERTOWN RESERVOIR



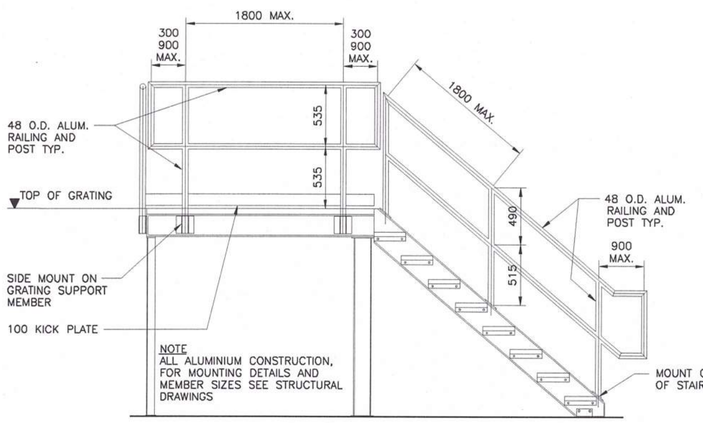
TYPICAL VALVE BOX & EXTENSION STEM INSTALLATION
N.T.S.



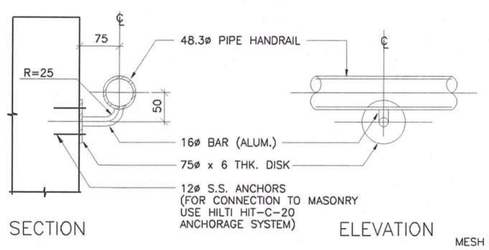
CHECK'D PLATE OVER GRATING FRAME AND COVER
N.T.S.



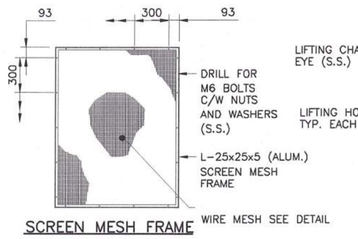
TYPICAL GRATING FRAME AND COVER
N.T.S.



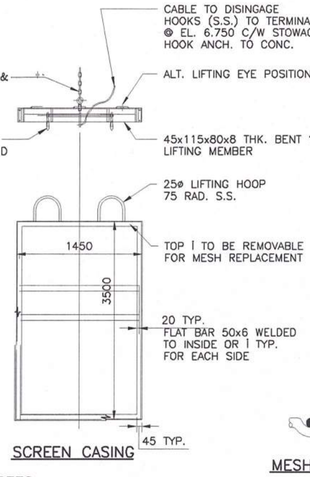
TYPICAL HANDRAIL DETAILS



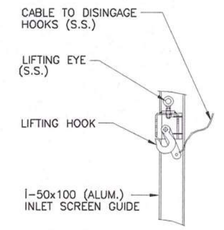
TYPICAL HANDRAIL ON WALL SUPPORT
N.T.S.



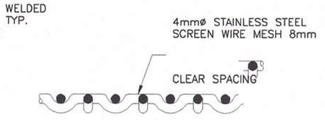
SCREEN MESH FRAME



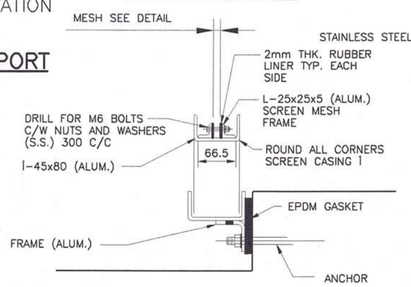
SCREEN CASING



SECTION THROUGH LIFTING MEMBER



MESH DETAIL



INLET SCREEN DETAILS
N.T.S.

NOTES:

1. LIFTING CHAIN TO BE HOOKED AT TOP AND KEPT TAUGHT AT ALL TIMES TO AVOID CONTACT WITH ALUM.
2. ALL ALUM. IN CONTACT WITH S.S. TO RECEIVE TWO (2) COATS OF ZINC CHROMATE OR BITUMASTIC PAINT.
3. ALL ALUM. IN CONTACT WITH CONC. TO RECEIVE TWO (2) COATS OF BITUMASTIC PAINT.

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

DETAIL SHEET #2

STAMP

PROFESSIONAL ENGINEER 7-10-05 R. A. LeCRAW PROVINCE OF ONTARIO

NORTH POINT

No.	DATE	BY	REVISIONS
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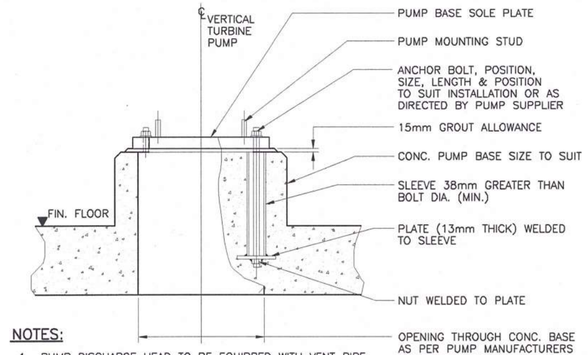
DESIGNED	MJ.G	DATE	12-9-4
DRAWN	MJ.G/AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

DRAWING

DETAILS

G-11

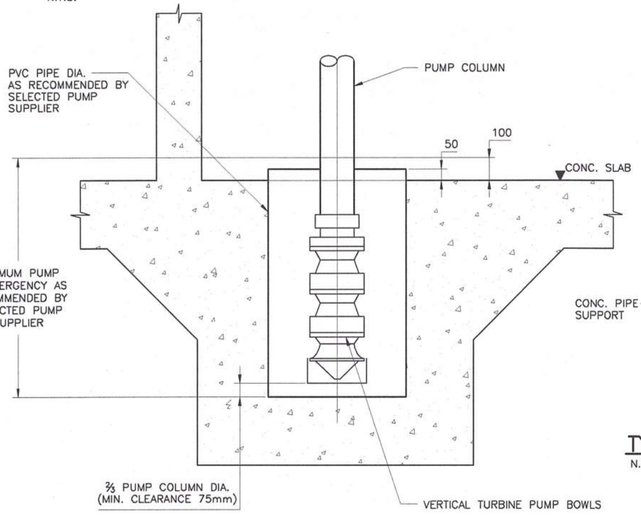
RAL PROJECT 04-103



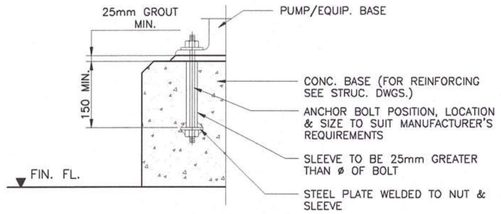
NOTES:

1. PUMP DISCHARGE HEAD TO BE EQUIPPED WITH VENT PIPE TO MATCH VENT SIZE, VENT PIPE TO EXTEND MIN. 150mm AND TERMINATE IN GOOSENECK WITH INSECT SCREEN
2. SEE STRUC. DWG's. FOR FURTHER DETAILS

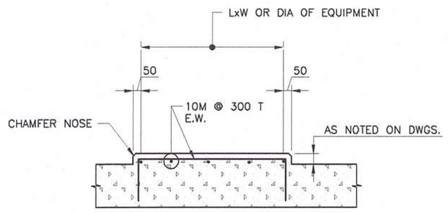
TYPICAL CONC. PUMP BASE
N.T.S.



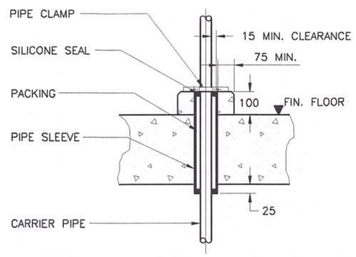
VERTICAL TURBINE PUMP SUMP DETAIL
N.T.S.



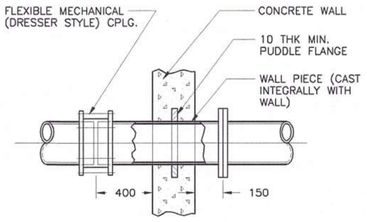
TYPICAL PUMP/EQUIPMENT BASE
N.T.S.



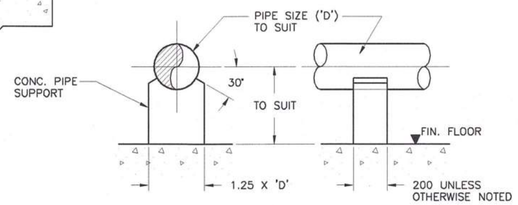
TYPICAL MAINTENANCE PAD
N.T.S.



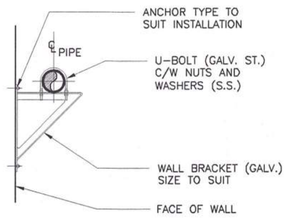
TYPICAL VERTICAL PIPE SLEEVE
N.T.S.



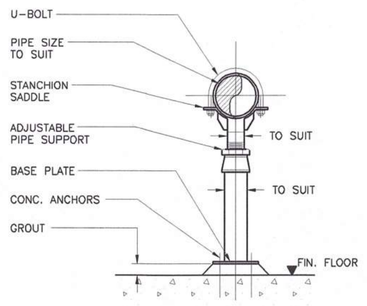
TYPICAL WALL PIECE
N.T.S. (FLEXIBLE MECHANICAL CPLG.)



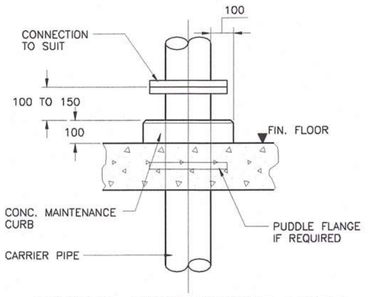
TYPICAL CONC. SADDLE SUPPORT
N.T.S.



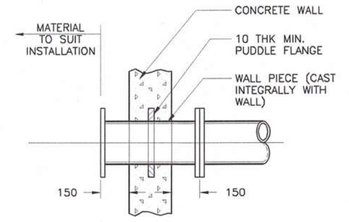
TYPICAL PIPE SUPPORT (WALL BRACKET)
N.T.S.



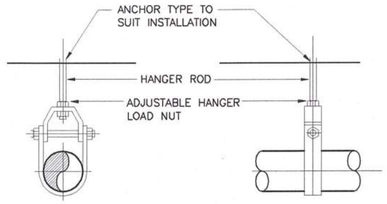
TYPICAL PIPE STANCHION SUPPORT
N.T.S.



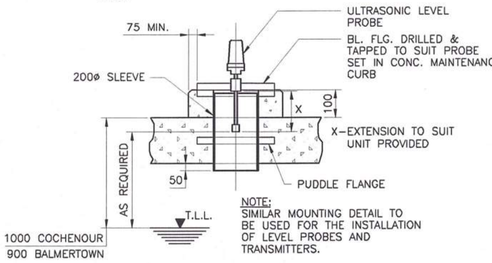
TYPICAL MAINTENANCE CURB
N.T.S.



TYPICAL WALL PIECE
N.T.S. (S.S.)

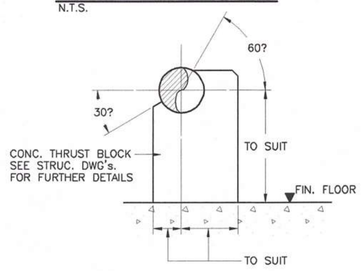


TYPICAL CLEVIS HANGER
N.T.S.

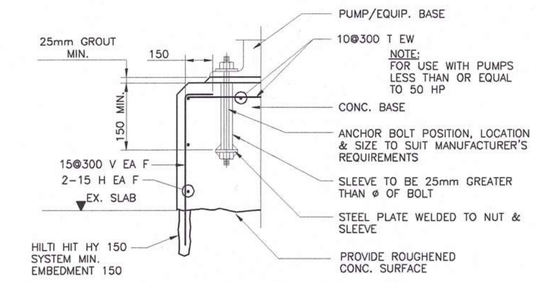


NOTE:
SIMILAR MOUNTING DETAIL TO BE USED FOR THE INSTALLATION OF LEVEL PROBES AND TRANSMITTERS.

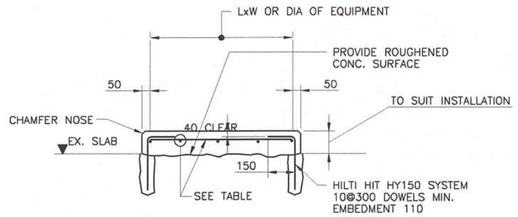
ULTRASONIC LEVEL PROBE INSTALLATION DETAIL
N.T.S.



CONC. THRUST BLOCK
N.T.S.



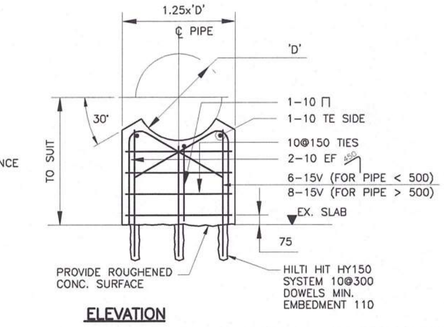
TYPICAL SMALL PUMP / EQUIPMENT BASE
N.T.S. (TO EXISTING CONC. SLAB)



PAD THK.	REINFORCEMANT
75	10@300 T EW
100	10@400 T&B EW
150	10@400 T&B EW
200	10@400 T&B EW

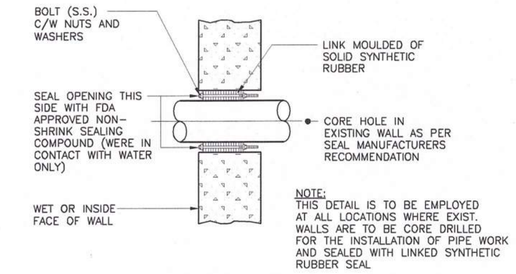
NOTE:
THE DIMENSION AND HEIGHT OF THE PAD IS TO BE CO-ORDINATED BY THE CONTRACTOR TO SUIT THE EQUIPMENT BEING INSTALLED AND THE ELEVATIONS TO BE MET

TYPICAL MAINTENANCE PAD
N.T.S. (TO EXISTING CONC. SLAB)



ELEVATION

CONCRETE SADDLE SUPPORT
N.T.S. (FIXING TO EX. CONC. FLOOR SLAB)



NOTE:
THIS DETAIL IS TO BE EMPLOYED AT ALL LOCATIONS WHERE EXIST. WALLS ARE TO BE CORE DRILLED FOR THE INSTALLATION OF PIPE WORK AND SEALED WITH LINKED SYNTHETIC RUBBER SEAL

LINKED SYNTHETIC RUBBER SEAL
N.T.S. (WATERTIGHT JOINT)

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PEMBROKE · OTTAWA

RAL ENGINEERING LTD.
WATER SUPPLY & WASTEWATER ENGINEERING
17665 Leslie St, Suite 47, Newmarket, Ont. L3Y 3E3
ph. (905) 853-0626 fax (905) 853-8807
ral@raleng.com www.raleng.com

PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

DETAIL SHEET #3

STAMP

PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO — 7-10-05 — R. A. LeCRAW

NORTH POINT

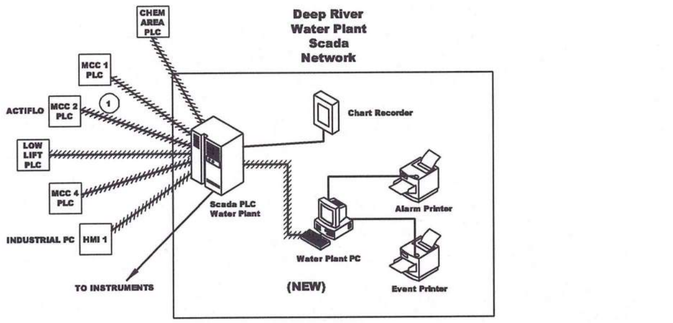
No.	DATE	BY	REVISIONS

DESIGNED	F.A./M.J.G.	DATE	12-9-4
DRAWN	M.J.G./AutoCAD	PROJECT	.
CHECKED	.	ACAD #	.
APPROVED	.	PLOT DATE	.
SCALE	AS SHOWN		

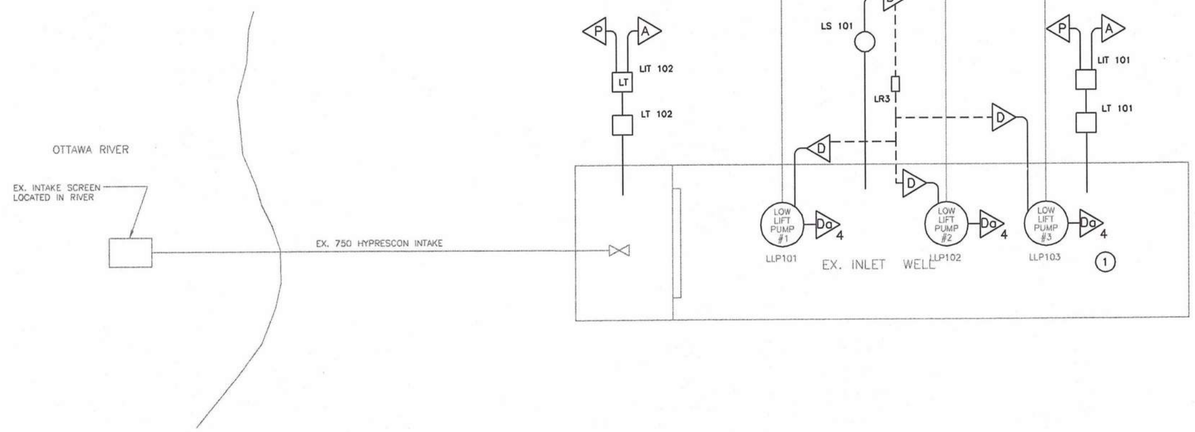
DRAWING

G-12

RAL PROJECT No. 04-103



1 / PI-1 Scada Network NTS



LEGEND:

- DENOTES GATE VALVE
- DENOTES KNIFE GATE VALVE
- DENOTES BUTTERFLY VALVE
- DENOTES BUTTERFLY VALVE MOTORIZED
- DENOTES BALL VALVE
- DENOTES SOLENOID VALVE
- DENOTES CHECK VALVE
- DENOTES PLUG VALVE
- PRV/SA DENOTES PRESSURE RELIEF/SURGE ANTICIPATOR VALVE
- BPV DENOTES BACK PRESSURE VALVE
- PRDV DENOTES PRESSURE REDUCING VALVE
- FCV DENOTES FLOW CONTROL VALVE
- NV DENOTES NEEDLE VALVE
- DENOTES 15# SAMPLING TAP C/W SPRING RETURN BALL VALVE (S.S.)
- DENOTES AIR RELEASE VALVE
- DENOTES MOTORIZED PLUG VALVE
- DENOTES SLIDE GATE
- KL DENOTES KAMLOK QUICK COUPLING WITH ISOLATION VALVE
- M DENOTES MAGNETIC FLOWMETER
- F DENOTES INSERT FLOWMETER
- DENOTES ROTAMETER
- T DENOTES TURBIDIMETER
- C DENOTES CHLORINE RESIDUAL ANALYSER
- PS DENOTES PRESSURE SWITCH
- PT DENOTES PRESSURE TRANSMITTER
- PG DENOTES PRESSURE GAUGE
- FS DENOTES FLOAT SWITCH
- LT DENOTES LEVEL TRANSMITTER (ULTRASONIC)
- LP DENOTES LEVEL PROBE
- LS DENOTES LEVEL SWITCH
- TI DENOTES TEMPERATURE INDICATOR
- pH DENOTES PH PROBE
- PC DENOTES PARTICAL COUNTER
- F DENOTES FLUORIDE MEASUREMENT PROBE
- SBL DENOTES SLUDGE BLANKET LEVEL
- FSM DENOTES FLOW SWITCH / MONITOR
- S DENOTES SULPHIDE ION MONITOR
- DENOTES ACCUMULATOR
- DENOTES SIGHT GLASS
- DENOTES METERING PUMP
- DENOTES MIXER
- DENOTES HOSE REEL WITH 15.25 (50') OF 40 (1-1/2")ø HOSE REEL

BY BUILDING MECH.

- Dq 4 DeviceNet LOW LIFT PLC
- A ANALOGUE OUT
- D DIGITAL OUT
- P 110 VAC IN FROM PANEL
- S EMERGENCY SHOWER CONTACT
- B REMOTE PUSH BUTTON
- 1 INTERLOCK PUMP – SEE DETAIL ON DWG. E-7
- S1 REMOTE CONTROL SWITCH LOCAL/AUTO/SPEED SEE DETAIL 4/E-7

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS INSTRUMENTATION SCHEMATIC LOW LIFT PUMPING STATION

STAMP

NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	JV	DATE	APRIL 22 2005
DRAWN	MG/JE	PROJECT	2016527C
CHECKED	JV	ACAD #	PI SCHEMATICS.DWG
APPROVED	JV	PLOT DATE	09/22/05
SCALE	AS SHOWN		

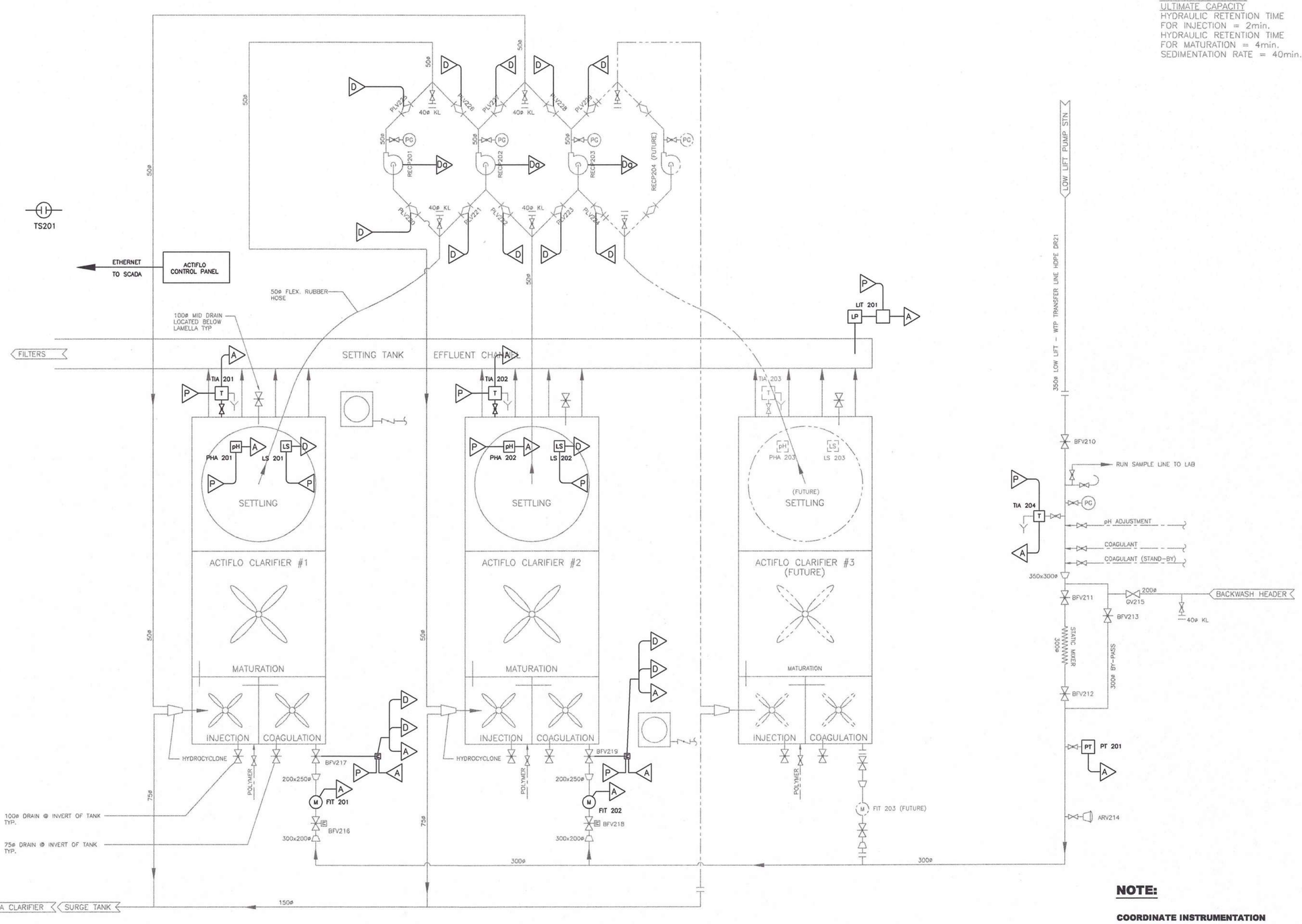
DRAWING

PI-1

DWG FullPath: P:\DRAWINGS\9.5 - Water & Sewage Works\2016527B_DEEP RIVER WTP\ACTIVE DRAWINGS\INSTRUMENTATION\PI-1 TO P&.dwg

DWG FullPath: P:\DRAWINGS\9.5 - Water & Sewage Works\2016527B_DEEP RIVER WTP\ACTIVE DRAWINGS\INSTRUMENTATION\PI-1 TO PI-3.dwg

ACTIFLO CLARIFIERS
ULTIMATE CAPACITY
HYDRAULIC RETENTION TIME
FOR INJECTION = 2min.
HYDRAULIC RETENTION TIME
FOR MATURATION = 4min.
SEDIMENTATION RATE = 40min./hr.



NOTE:

COORDINATE INSTRUMENTATION WITH ACTIFLOW

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS INSTRUMENTATION SCHEMATIC CLARIFIERS #1 & #2

STAMP

NORTH POINT

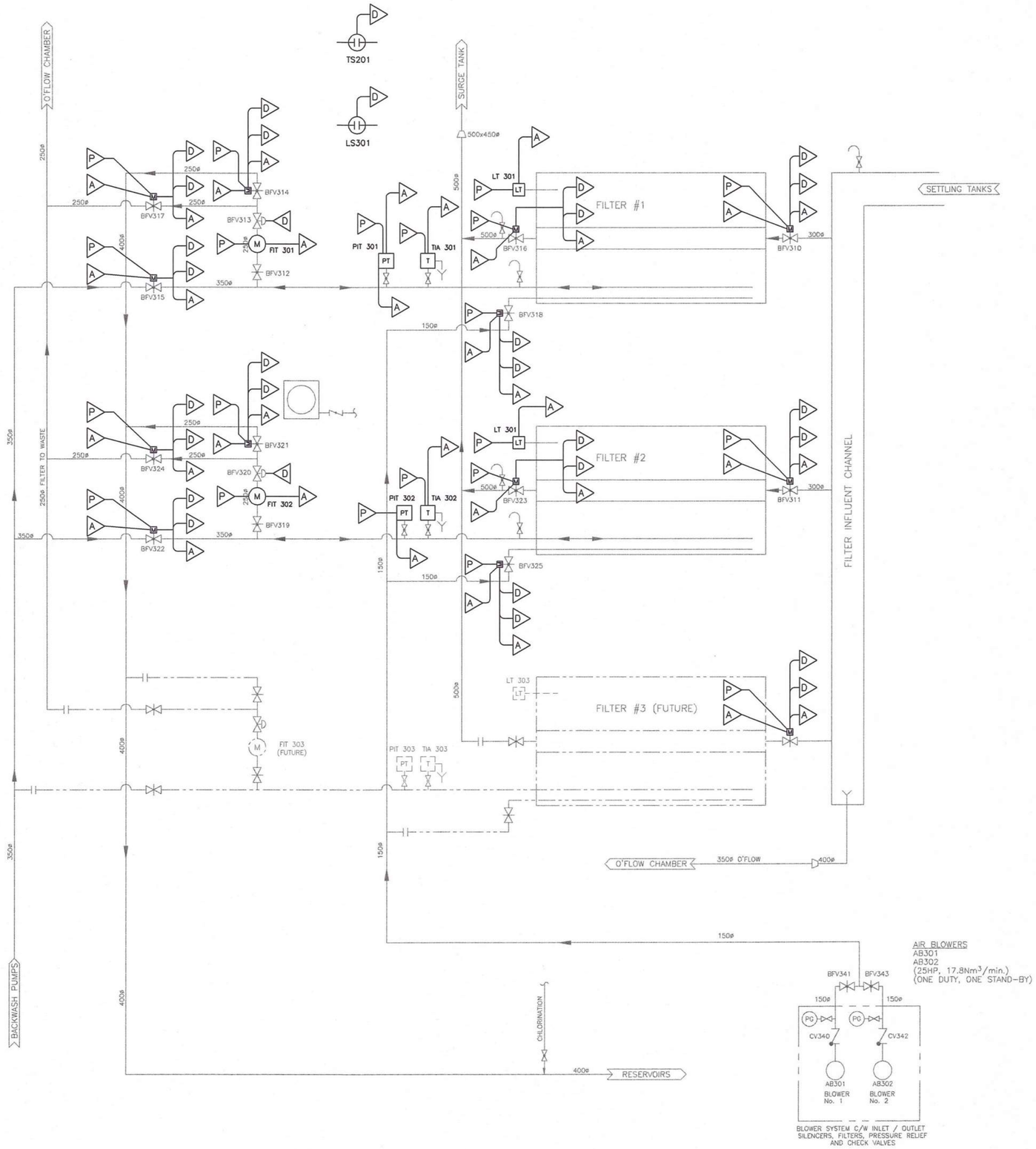
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1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

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DRAWN	MG/JE	PROJECT	2016527C
CHECKED	JV	ACAD #	PI SCHEMATICS.DWG
APPROVED	JV	PLOT DATE	09/22/05
SCALE	AS SHOWN		

DRAWING

PI-2

DWG FullPath: P:\DRAWINGS\6.5 - Water & Sewage Work\2016527B_DEEP RIVER WTP\ACTIVE DRAWINGS\INSTRUMENTATION\PI-1 TO PI-5.dwg



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DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS INSTRUMENTATION SCHEMATIC RAPID SAND FILTERS

STAMP

NORTH POINT

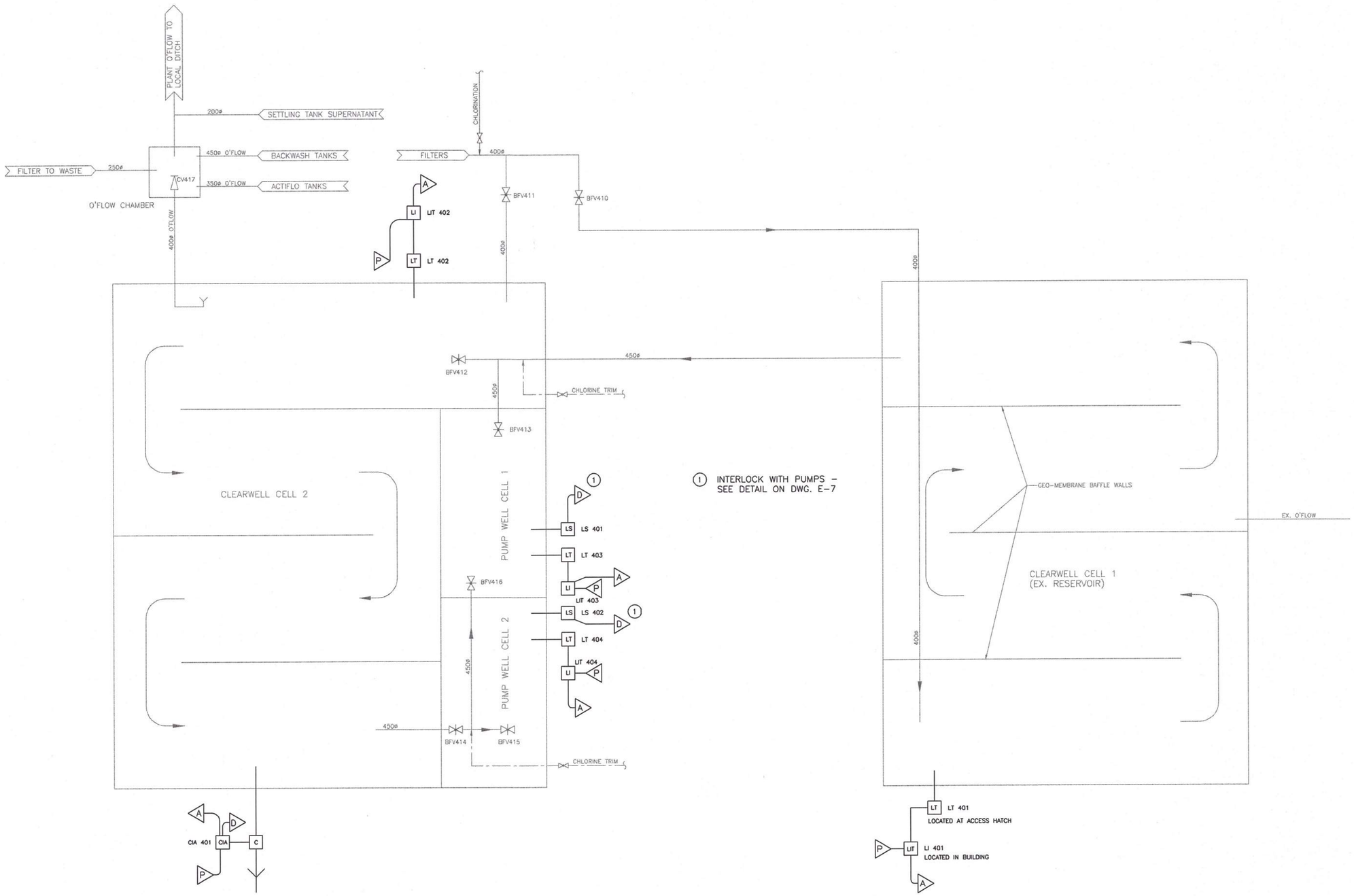
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1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

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DRAWN	MG/JE	PROJECT	2016527C
CHECKED	JV	ACAD #	PI SCHEMATICS.DWG
APPROVED	JV	PLOT DATE	09/22/05
SCALE	AS SHOWN		

DRAWING

PI-3

DWG FullPath: P:\DRAWINGS\8.5 - Water & Sewage Works\2016527B_DEEP RIVER WTP\ACTIVE DRAWINGS\INSTRUMENTATION\PI-1 TO PI-8.dwg



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DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS INSTRUMENTATION SCHEMATIC RESERVOIR CELLS #1 & #2, PUMP WELL CELLS #1 & 2,

STAMP

NORTH POINT

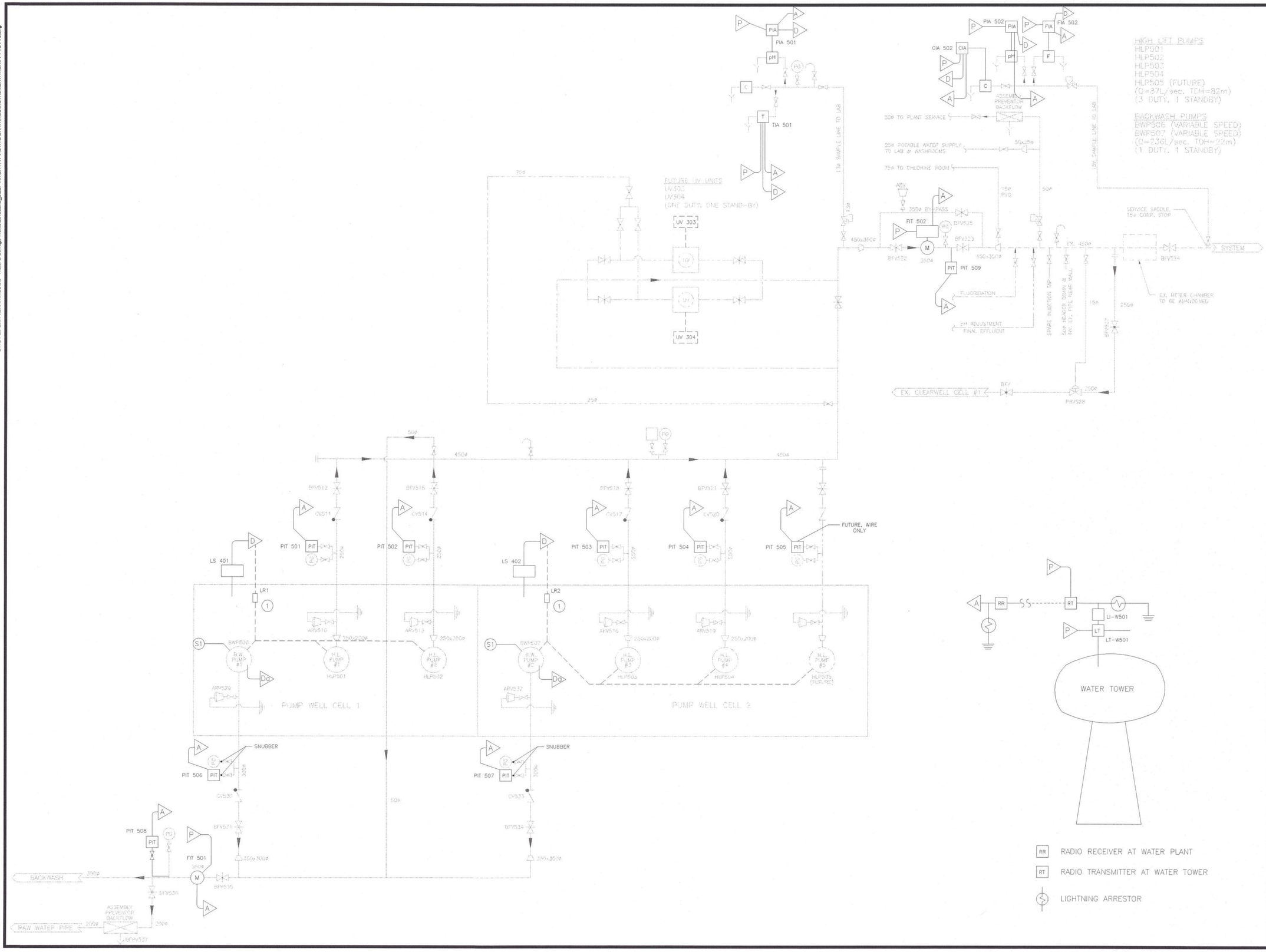
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CHECKED	JV	ACAD #	PI SCHEMATICS.DWG
APPROVED	JV	PLOT DATE	09/22/05
SCALE	AS SHOWN		

DRAWING

PI-4

DWG FullPath: P:\DRAWINGS\8.0 - Water & Sewage Work\2016\2016527B_DEEP RIVER WTP\ACTIVE DRAWINGS\INSTRUMENTATION\PI-1 TO PI-8.dwg



RR RADIO RECEIVER AT WATER PLANT

RT RADIO TRANSMITTER AT WATER TOWER

LIGHTNING ARRESTOR

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS INSTRUMENTATION SCHEMATIC HIGH LIFT PUMPS AND BACKWASH PUMPS

STAMP

NORTH POINT

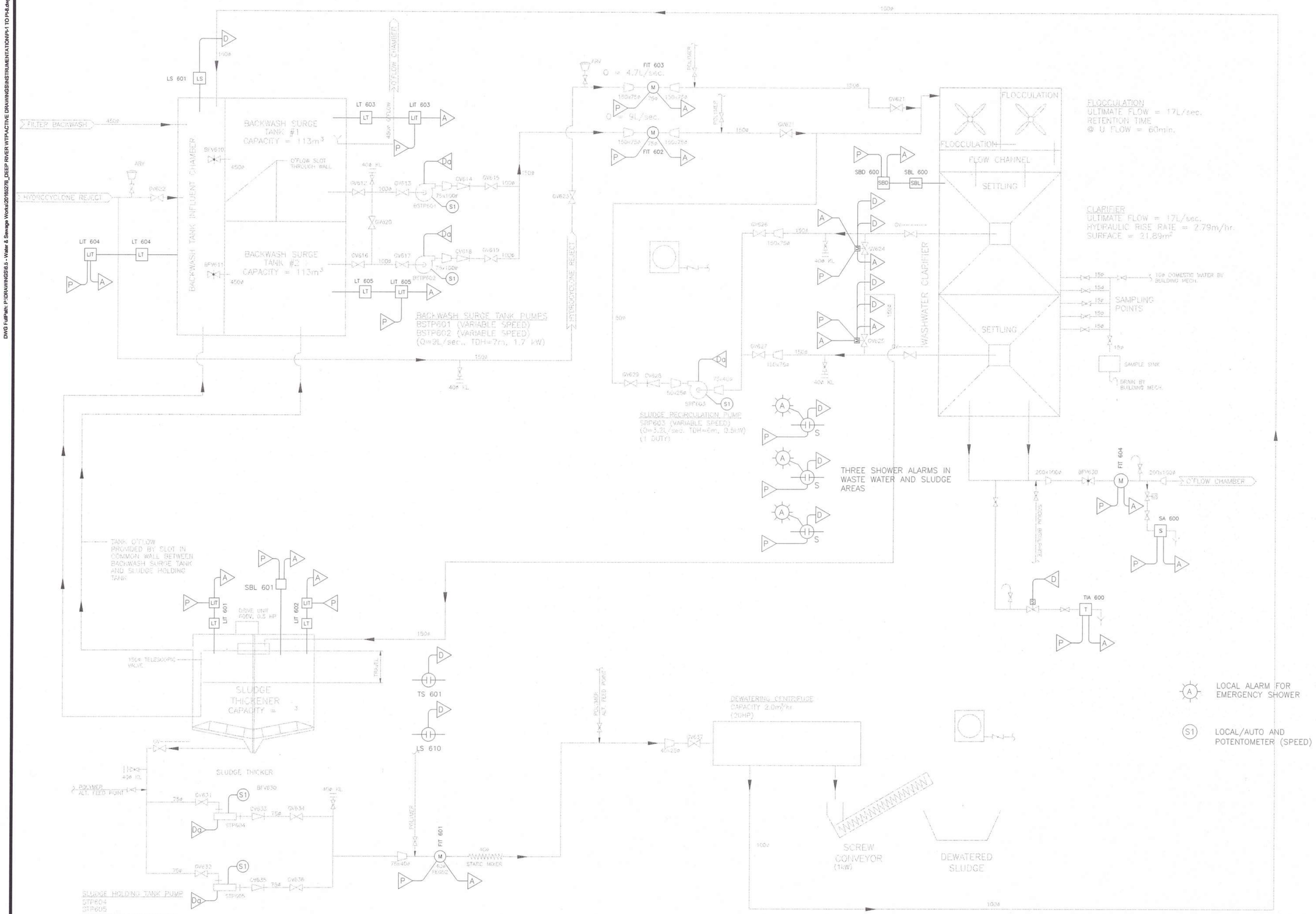
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1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

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DRAWN	MG/JE	PROJECT	2016527C
CHECKED	JV	ACAD #	PI SCHEMATICS.DWG
APPROVED	JV	PLOT DATE	09/22/05
SCALE	AS SHOWN		

DRAWING

PI-5

DWG FullPath: P:\DRAWINGS\9.5 - Water & Sewage Work\2016527B_DEEP RIVER WTP\ACTIVE DRAWINGS\INSTRUMENTATION\PI-1 TO PI-6.dwg



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DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS INSTRUMENTATION SCHEMATIC WASTE WATER SURGE TANK & SLUDGE HANDLING SYSTEMS

STAMP

NORTH POINT

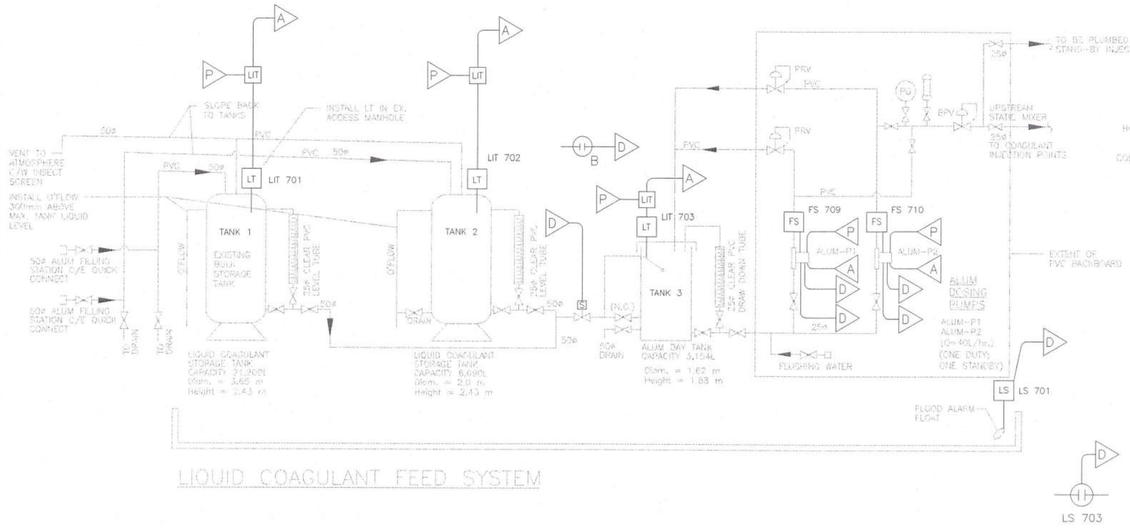
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CHECKED	JV	ACAD #	PI SCHEMATICS.DWG
APPROVED	JV	PLOT DATE	09/22/05
SCALE	AS SHOWN		

DRAWING

PI-6

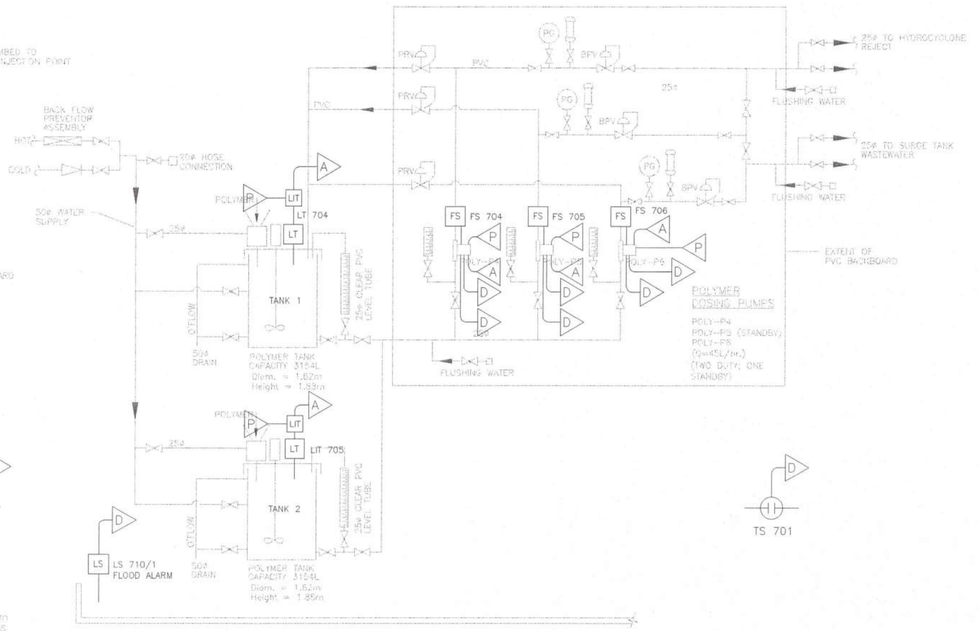
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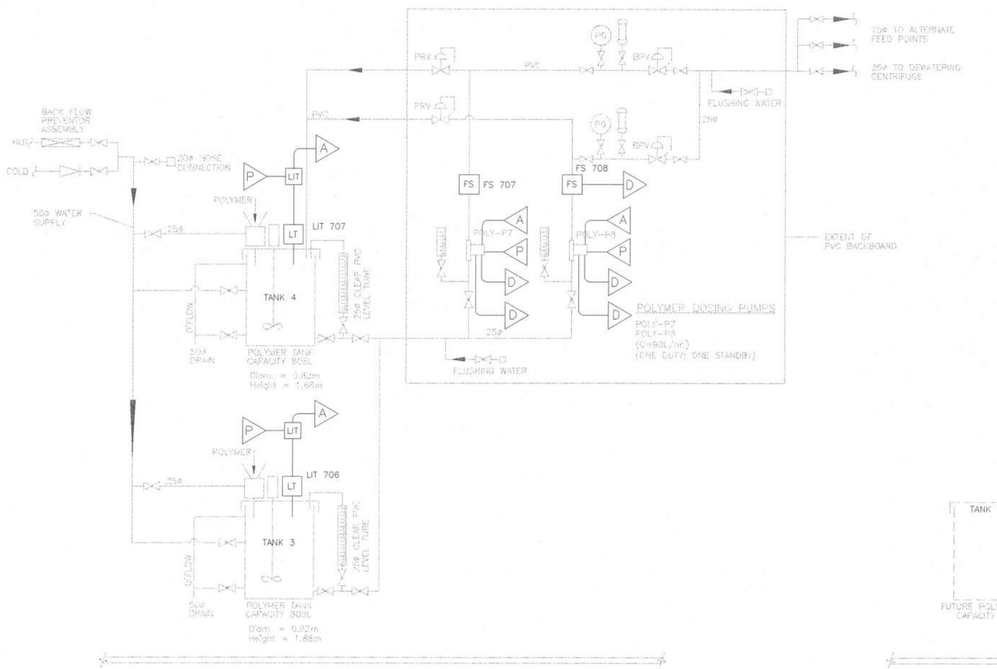
LIQUID COAGULANT FEED SYSTEM

NOTE

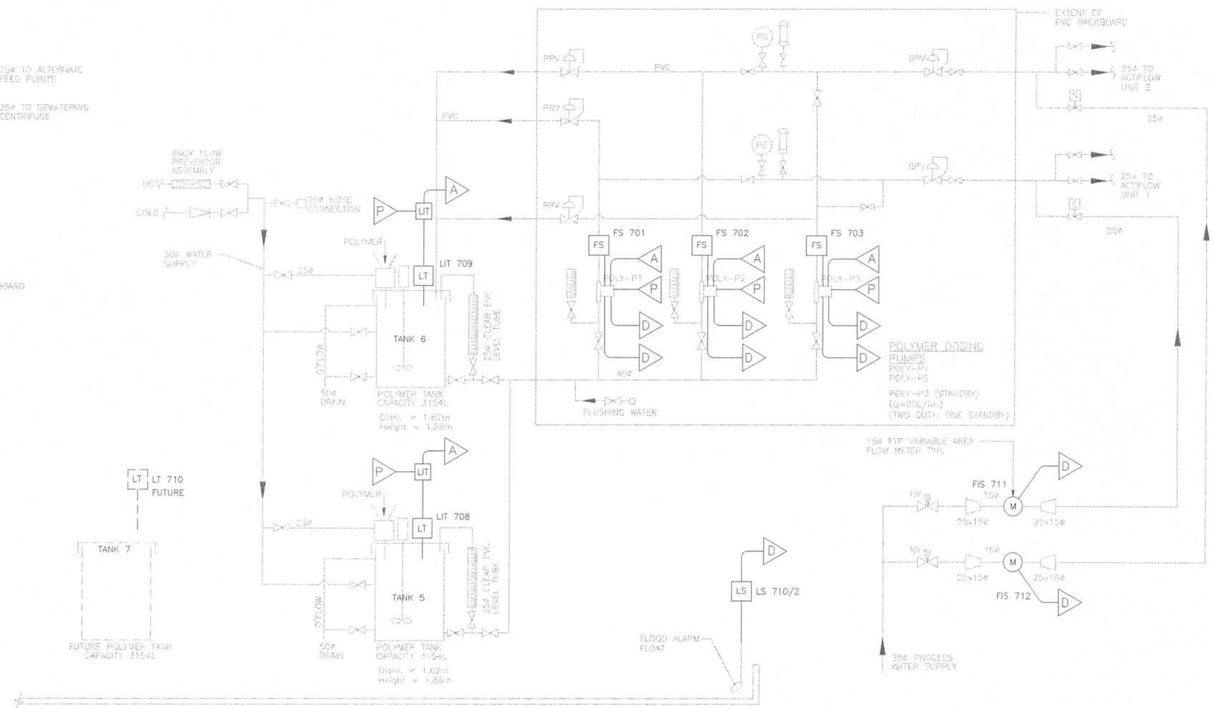
PVC BACKBOARDS FOR MOUNTING OF CHEMICAL PUMPING SYSTEMS ARE TO BE FRAMED AND BRACED WITH 25x25Ø HSS MEMBERS. THE COMPLETE BACKBOARD ASSEMBLY IS TO BE SUPPORTED BY MIN. 75mm UNISTRUT CHANNELS OR AS RECOMMENDED BY BACKBOARD ASSEMBLY FABRICATOR.



POLYMER FEED SYSTEM (FOR LAMELLA CLARIFIER)



POLYMER FEED SYSTEM (FOR DEWATERING CENTRIFUGE)



POLYMER FEED SYSTEM (FOR ACTIFLO CLARIFIERS)

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DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS INSTRUMENTATION SCHEMATIC CHEMICAL SYSTEMS

STAMP

NORTH POINT

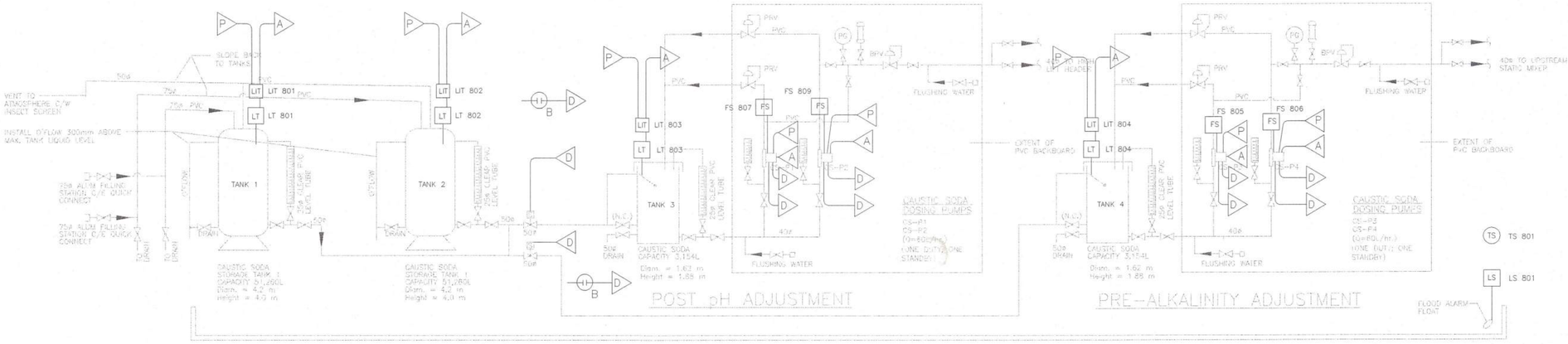
No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

DESIGNED	JV	DATE	APRIL 22 2005
DRAWN	MG/JE	PROJECT	2016527C
CHECKED	JV	ACAD #	PI SCHEMATICS.DWG
APPROVED	JV	PLOT DATE	09/22/05
SCALE	AS SHOWN		

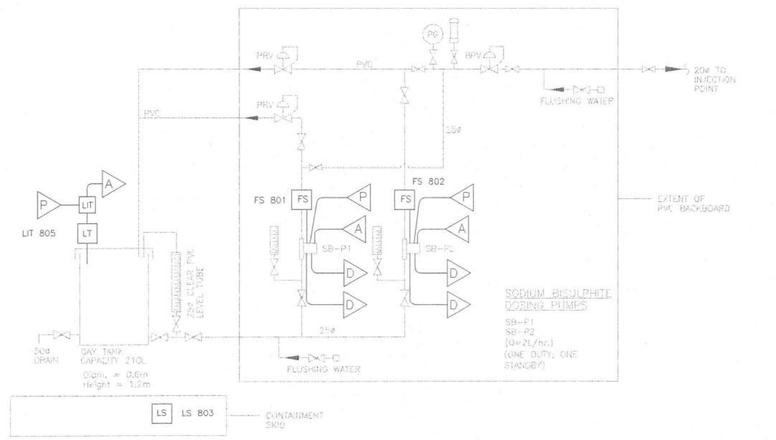
DRAWING

PI-7

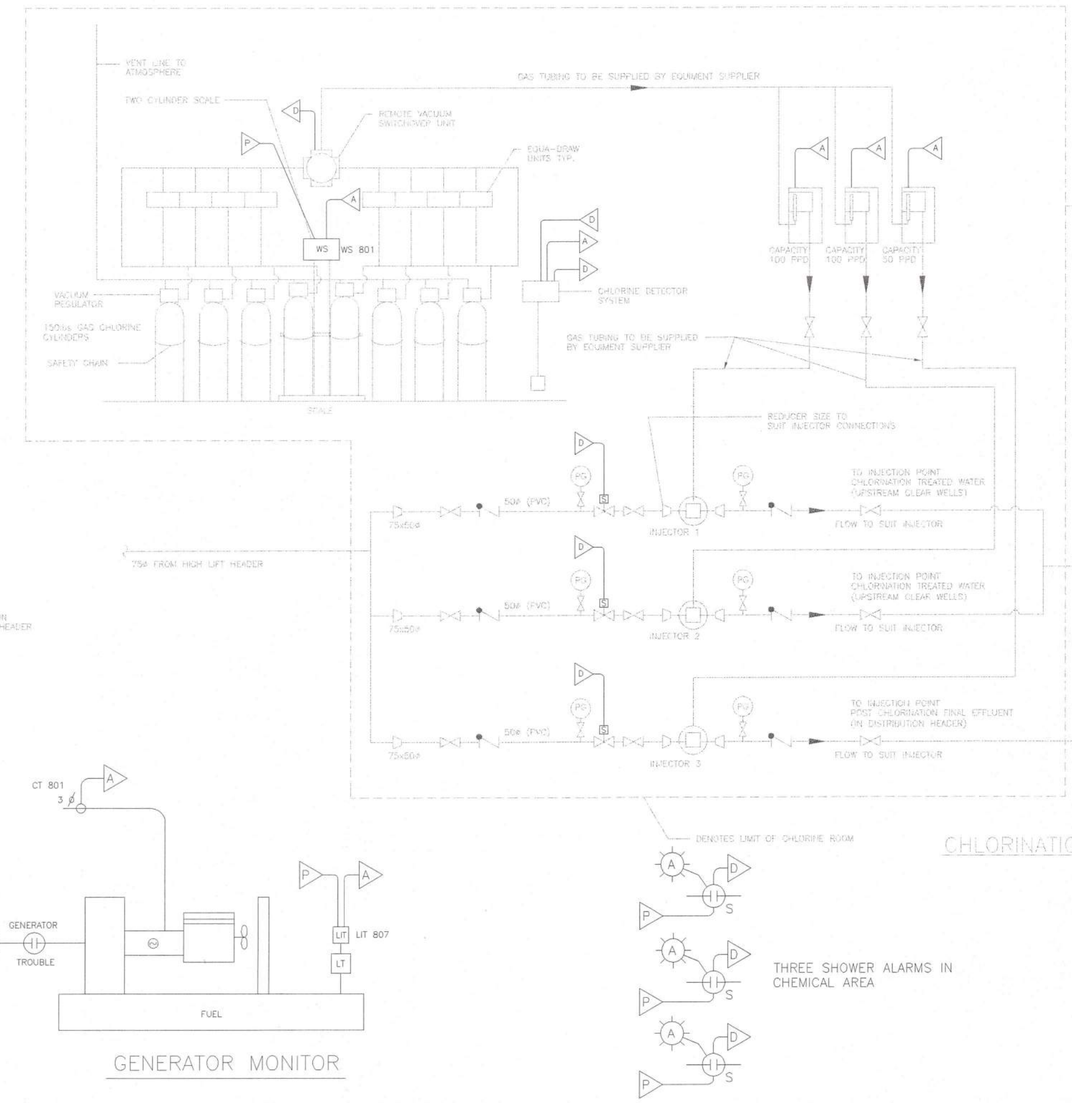
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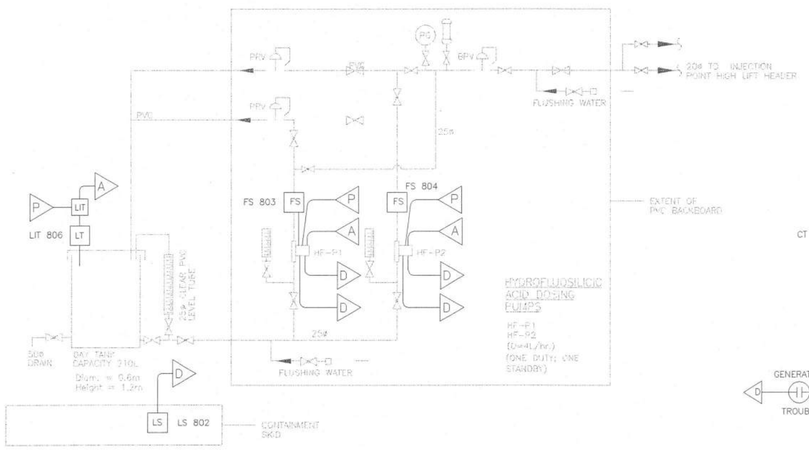
CAUSTIC SODA FEED SYSTEM



SODIUM BISULPHITE FEED SYSTEM



CHLORINATION GAS SYSTEM



HYDROFLUOSILICIC ACID FEED SYSTEM

GENERATOR MONITOR

THREE SHOWER ALARMS IN CHEMICAL AREA

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PROJECT

DEEP RIVER WATER TREATMENT PLANT EXPANSION

DEEP RIVER, Ontario

DRAWING

PROCESS INSTRUMENTATION SCHEMATIC CHEMICAL SYSTEMS

STAMP

NORTH POINT

No.	DATE	BY	REVISIONS
1	AUG. 22-05	M de R	DESIGN MODIFICATIONS

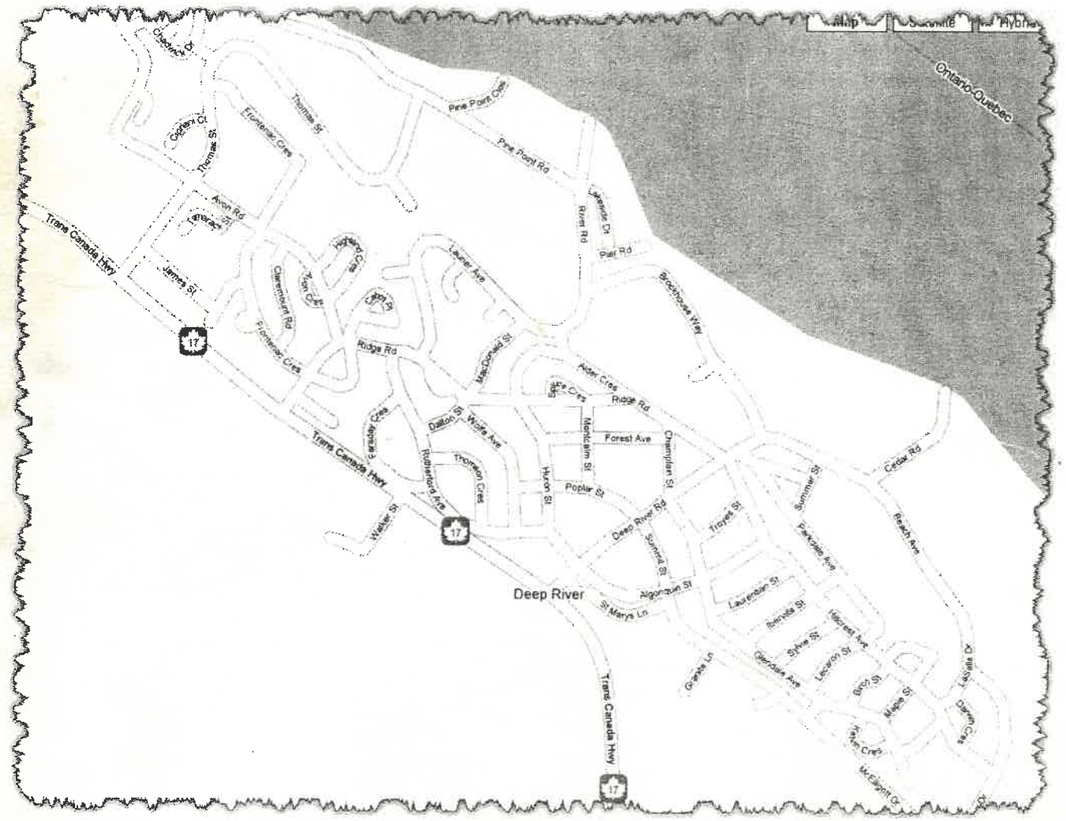
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DRAWN	MG/JE	PROJECT	2016527C
CHECKED	JV	ACAD #	PI SCHEMATICS.DWG
APPROVED	JV	PLOT DATE	09/22/05
SCALE	AS SHOWN		

DRAWING

PI-8

Deep River
Water Treatment Plant
Upgrades

705-497-9193



LOCATION PLAN

CONTRACT NO: *35206*

PLC's
I/O LOOP DRAWINGS

Engineering
Stroma

19 Legault St
PO Box 22040
North Bay, Ontario
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04 20 2007 2:37:48 PM, claudel.leveille

INDEX DRAWING SHEET

TOWN OF DEEP RIVER — WATER PLANT UPGRADES — PROJECT: 35206

GENERAL

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E108 – ANALOG INPUT MODULE #2–B
E109 – ANALOG OUTPUT MODULE #1
E110 – ANALOG OUTPUT MODULE #2
E111 – ANALOG OUTPUT MODULE #3
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E113 – DIGITAL INPUT MODULE #2
E114 – DIGITAL INPUT MODULE #3
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E116 – DIGITAL OUTPUT MODULE #1
E117 – DIGITAL 24V DC INPUT MODULE #1

LOWLIFT PLC

E205 – ANALOG INPUT MODULE #1
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E207 – DIGITAL INPUT MODULE #1
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REF. DWG. NO.	REV.	DESCRIPTION (THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED)	DATE	BY	DSGN. VRFD. / CHECK	DRWN. CHK. / PRJMGR
	1	REMOVAL OF CARDS	03/30/07	CL		

FILE NO. 35206–PLCS
DWG. NO. L00A

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PROJECT NAME: DEEP RIVER WTP UPGRADES CONTRACT #352	CLIENT: TOWN OF DEEP RIVER
	LOCATION: WATER TREATMENT PLANT
DESCRIPTION: DRAWING INDEX	DATE: 04/19/2006 — FILE NO. 35206–PLCS–L00A
	SCALE: NOT TO SCALE — DWG. NO. L00A — REV. NO. 1

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ABBREVIATIONS

A	AUTO
ACK	ACKNOWLEGDE
AS	AIR SUPPLY
C	CLOSE
CRT	COMPUTER
D	DISPLAY
DAS	DATA ACQUISTION SYSTEM
DCS	DISTRIBUTED CONTROL SYSTEM
ES	ENABLE EMERGENCY STOP
FC	FAIL CLOSE/FLUSH CONNECTION
FO	FAIL OPEN
H	HAND/HOLD
K	KEY
L	LOCAL/LOCK
LOS	LOCK-OFF-STOP
MAN	MANUAL
MMI	MAN-MACHINE INTERFACE
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
O	OPEN/OFF
PLC	PROGRAMMABLE LOGIC CONTROLLER
POT	POTENTIOMETER
PWS	POWER SUPPLY
R	REMOTE
REV	REVERSE
RTU	REMOTE TERMINAL UNIT
SP	STOP
SST	STAINLESS STEEL
STR	START

IDENTIFICATION-INSTRUMENTATION

	FIRST LETTER MEASURED VARIABLE/MODIFIER	SUCCEEDING LETTERS DISPLAY OR OUTPUT FUNCTION
A	ANALYSIS	ALARM
B	BURNER, COMBUSTION	–
C	–	CONTROL
D	DENSITY	DIFFERENTIAL
E	VOLTAGE	SENSOR (PRIMARY ELEMENT)
F	FLOW RATE	–
G	–	GLASS
H	HAND	HIGH
I	CURRENT	INDICATE
J	POWER/SCAN	SCAN
K	TIME	CONTROL SYSTEM
L	LEVEL	LOW/LIGHT
M	MOISTURE	MIDDLE
N	TURBIDITY	–
O	–	ORIFICE
P	PRESSURE, VACUUM	–
Q	QUANTITY	INTEGRATE RECORD/PRINT
R	–	SWITCH
S	SPEED, FREQUENCY/SAFETY	TRANSMITTER
T	TEMPERATURE	MULTIFUNCTION
U	MULTIVARIABLE	VALVE
V	VIBRATION	
W	WEIGHT	
X	AS DEFINED	X
Y	STATUS	COMPUTE/CONVERT/RELAY DRIVE/ACTUATE
Z	POSITION	

SINGLE LINE AND RISER DIAGRAM

SYMBOL	DESCRIPTIONS
	TRANSFORMER 2 WINDING
	CAPACITOR
	THERMAL ELEMENT
	FUSE, WITH HOLDER
	FUSE
	CIRCUIT BREAKER
	TERMINAL BLOCK
	TERMINAL BLOCK WITH SWITCH
	GROUND CONNECTION
	DELTA
	LIGHTNING ARRESTOR

CONTROL SCHEMATICS AND WIRING DIAGRAMS

SYMBOL	DESIGNATIONS
CR 1	STARTER/CONTACTORS: M STARTER/CONTACTOR COIL O OPEN COIL C CLOSE COIL S SLOW F FAST RELAY COILS: CR CONTROL RELAY LR LATCHING RELAY TR TIME DELAY RELAY
MD 1	FRACTIONAL HORSEPOWER MOTOR OR MOTORIZED OPERATOR MD MOTORIZED DAMPER EF EXHUAST FAN SF SUPPLY FAN
CR1 11 14	NORMALLY OPEN CONTACT, WITH TERMINAL NUMBERS
CR1 11 12	NORMALLY CLOSED CONTACT, WITH TERMINAL NUMBERS
ES	EMERGENCY PUSHBUTTON (MUSHROOM HEAD)
	NORMALLY OPEN PUSHBUTTON
	NORMALLY CLOSED PUSHBUTTON
R	INDICATING LIGHT A AMBER W WHITE G GREEN B BLUE Y YELLOW R RED
R	INDICATING LIGHT (PUSH TO TEST)
	MANUAL MOTOR STARTER
	CIRCUIT CONNECTION
	NO CIRCUIT CONNECTION
	DUPLEX OUTLET
1	DEVICE LOCATION REFERENCE IN CONTROL PANEL CP1 IN MOTOR CONTROL CENTER FIELD DEVICE MOUNTED LOCAL TO MOTOR

TIME DELAY RELAY CONTACTS AFTER COIL IS:

ENERGIZED:		DE-ENERGIZED:	
NO	NC	NO	NC
TD	TD	TD	TD

PILOT DEVICE CONTACT SCHEDULE

CONTROL DEVICE	OPEN ON RISE	CLOSE ON RISE	OPEN ON FALL	CLOSE ON FALL
THERMOSTAT	PD	PD	PD	PD
LEVEL SWITCH	PD	PD	PD	PD
PRESSURE SWITCH	PD	PD	PD	PD
FLOW SWITCH	PD	PD	PD	PD

CONTROL DEVICE	N.O.	N.O.(HELD CLOSED)	N.C.	N.C.(HELD OPEN)
LIMIT SWITCH	PD	PD	PD	PD

Tag Acronyms

Tag	Description	Field Devices	I/O
ST	Status	Field Contact	DI
PS	Pressure Switch	Field Contact	DI
LS	Level Switch	Field Contact	DI
FS	Flow Switch	Field Contact	DI
TS	Temperature Switch	Field Contact	DI
VP	Valve Position	Field Contact	DI
OP	Open Position	Field Contact	DI
CP	Close Position	Field Contact	DI
PB	Push Button	Field Contact	DI
XA	General Alarm	Contact Condition	DI
XMJ	Major Alarm	Contact Condition	DI
XMN	Minor Alarm	Contact Condition	DI
XCA	Common Alarm	Contact Condition	DI
HHA	High High Alarm	Contact Condition	DI
HA	High Alarm	Contact Condition	DI
LA	Low Alarm	Contact Condition	DI
LLA	Low Low Alarm	Contact Condition	DI
I	Interlock	Contact Condition	DI
VPC	Valve Position Command (Modulating)	Command to a Device	AO
VPI	Valve Position Indication (Modulating)	Indication from a Device	AI
PSC	Pump Speed Command (VFD)	Command to a Device	AO
PSI	Pump Speed Indication (VFD)	Indication from a Device	AI
OVC	Open Valve Command (not Modulating)	Command to a Device	DO
CVC	Close Valve Command (not Modulating)	Command to a Device	DO
STC	Start Command (Pumps)	Command to a Device	DO
SPC	EStop Command (Pumps)	Command to a Device	DO

Tag		Tag		
AIT	Analog Current Transmission	AI	Field Analog Indication	AI
LIT	Level Current Transmission	LI	Field Level Indication	AI
FIT	Flow Current Transmission	FI	Field Flow Indication	AI
PIT	Pressure Current Transmission	PI	Field Pressure Indication	AI
TIT	Temperature Current Transmission	TI	Field Temperature Indication	AI
CHIT	Chlorine Current Transmission	CHI	Field Chlorine Indicator	AI
SIT	Sulphide Current Transmission	SI	Sulphide Indicator	AI
TUIT	Turbidity Current Transmission	TUI	Field Turbidity Indicator	AI
PHIT	pH Current Transmission	PHI	Field pH Indicator	AI

FILE NO. 35206-PLCS
DWG. NO. L00B

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN	DRWN
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PROJECT NAME:	DEEP RIVER UPGRADES CONTRACT 2006-352
CLIENT:	CITY OF DEEP RIVER
LOCATION:	DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION:	SCHEMATIC SYMBOLS & ACRONYMS
DATE:	04/19/2006
FILE NO.	35206-PLCS-L00B
SCALE:	NOT TO SCALE
DWG. NO.	L00B
REV. NO.	0

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PLC'S NETWORK

MAIN WATER PLANT

MCC3
ACTIVE FLOW

RACK-1
RACK-2
"XXXX"
JOHN MEUNIER
IP-192.168.123.13

IP-192.168.123.33
4 PORT SWITCH

HMI IN
DOOR
IP-192.168.123.22

PLC1 PANEL

RACK-1
RACK-2
"MAIN" PLC
IP-192.168.123.10

HMI IN
DOOR
IP-192.168.123.21

User Name: admin Password: maskcom
IP-192.168.123.31
16 PORT SWITCH

OPTIC FIBER
BOX

DSL MODEM
PHONE LINE

MCC1

RACK-1
"MCC1" PLC
IP-192.168.123.14

MCC2

RACK-1
"MCC2" PLC
IP-192.168.123.15

IP-192.168.123.20
SCADA Computer

CHEM PANEL

IP-192.168.123.32
4 PORT SWITCH
User Name: admin
Password: maskcom

RACK-1
RACK-2
"CHEM" PLC
IP-192.168.123.11

PUMPING STATION

MCC4

IP-192.168.123.34
4 PORT SWITCH

OPTIC
FIBER
BOX

RACK-1
IP-192.168.123.12
"LOWLIFT" PLC

OPTIC
LINK

ETHERNET
DEVICE NET
CONTROL NET

REV.	DESCRIPTION	DATE	BY	CHKD.	ENGR. APPR.
1	ADDED DSL MODEM	04/19/07	CL		

REF. DWG. NO.
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FILE NO. 35206-PLCS
DWG. NO. L00C

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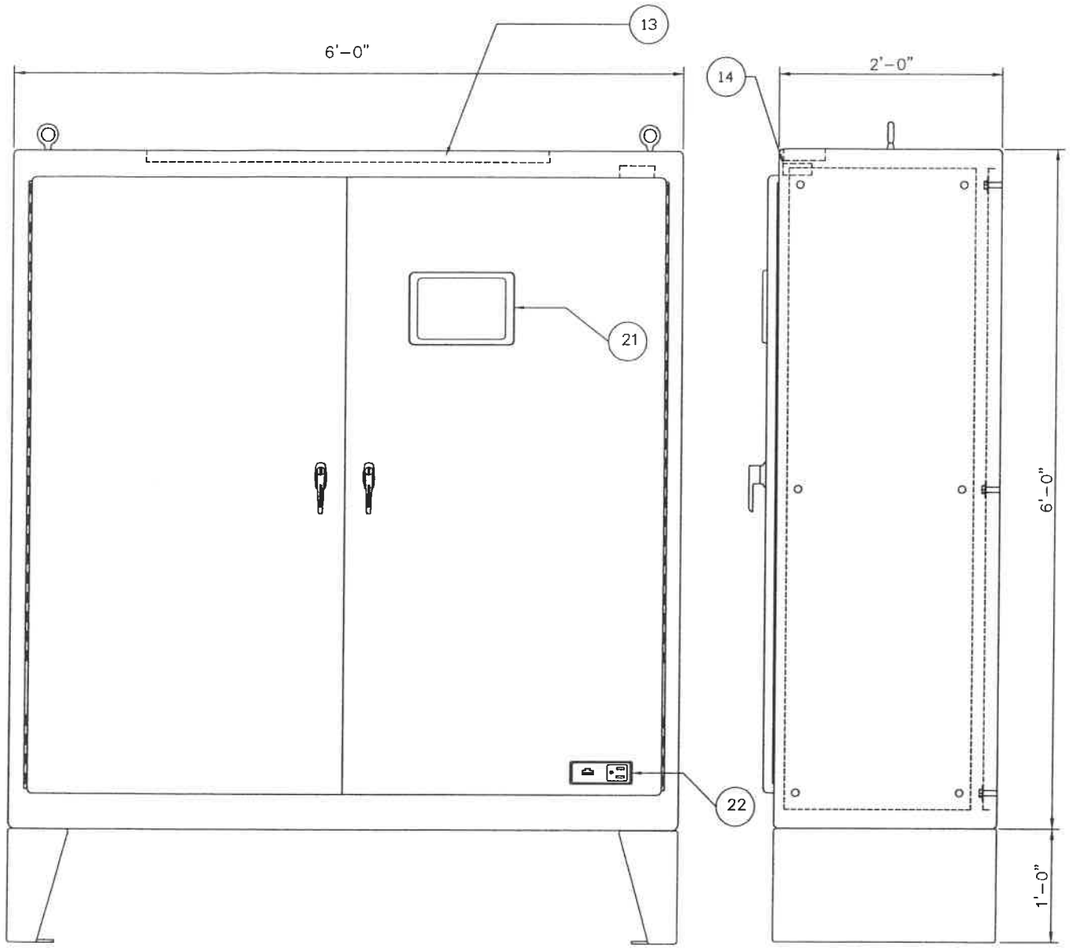
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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION: MAIN PLANT NETWORK LAYOUT
DATE: 04/19/2006
FILE NO. 35206-PLCS-L00C
SCALE: NOT TO SCALE
DWG. NO. L00C
REV. NO. 0

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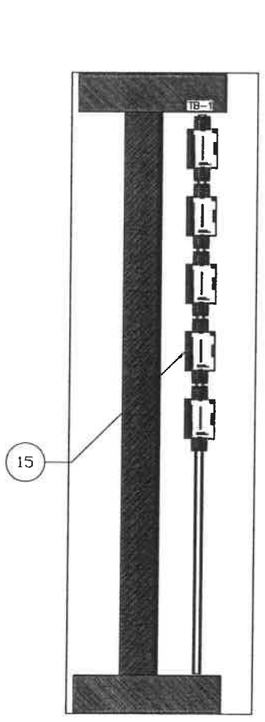
MAIN PLANT PLC – PANEL LAYOUT

PARTS LIST	
1	PROCESSOR & LOCAL MAIN RACK
2	REMOTE RACK #2
3	DIGITAL OUTPUT FIELD BLOCKS
4	DIGITAL OUTPUT INTERPOSING RELAYS
5	24 vdc POWER SUPPLY #1
6	FUSES FOR 24VDC
7	ANALOG OUTPUT SIGNAL ISOLATORS
8	ANALOG INPUT SIGNAL ISOLATORS
9	ANALOG FIELD INPUT TERMINAL BLOCKS WITH GND FOR SHIELD
10	ANALOG FIELD OUTPUT TERMINAL BLOCKS WITH GND FOR SHIELD
11	PANEL RECEPTICLES (ONE ON UPS)
12	WIRE TROUGH WAY (TYPICAL)
13	PANEL LIGHT
14	PANEL LIGHT SWITCH
15	DIGITAL INPUT FIELD BLOCKS
16	MAGNETIC CIRCUIT BREAKERS
17	120V TVSS
18	INTERLOCK RELAYS LR1 THROUGH LR3
19	INTERLOCK RELAYS FIELD TERMINAL BLOCKS
20	NETWORK SWITCH
21	HMI MOUNTED IN DOOR
22	PHOENIX CONTACT EXTERNAL NETWORK AND ELECTRICAL PLUG
23	
24	
25	
26	

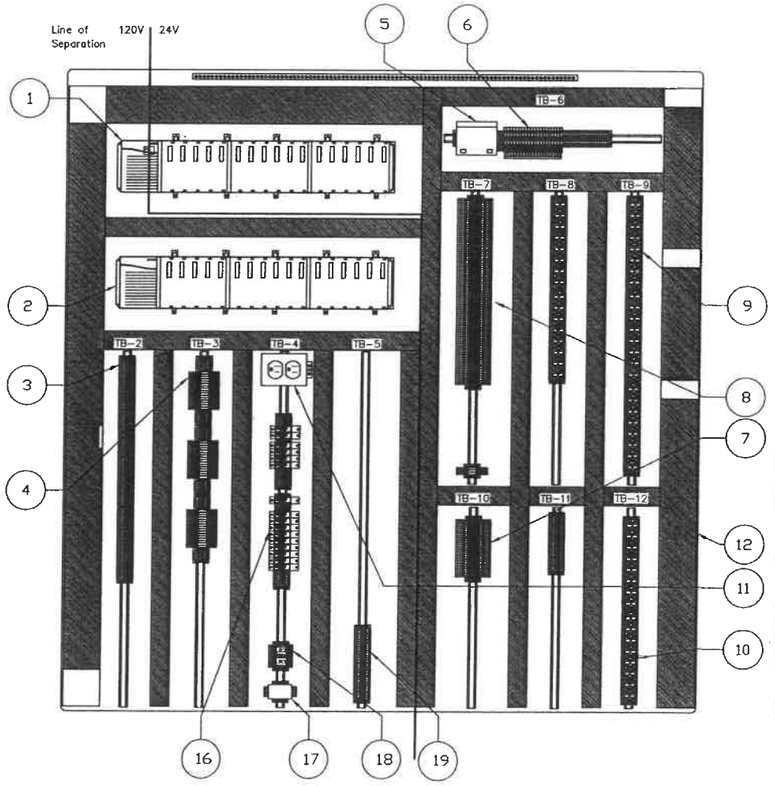


FRONT VIEW

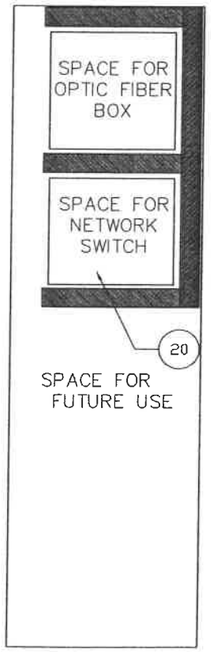
SIDE VIEW



LEFT PANEL



BACK PANEL



RIGHT PANEL

FILE NO. 35206-PLCS DWG. NO. L001A	REF. DWG. NO.	REV.	DESCRIPTION — THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DESN. MGR. CHECK	DRGR ENG. PRJMGR

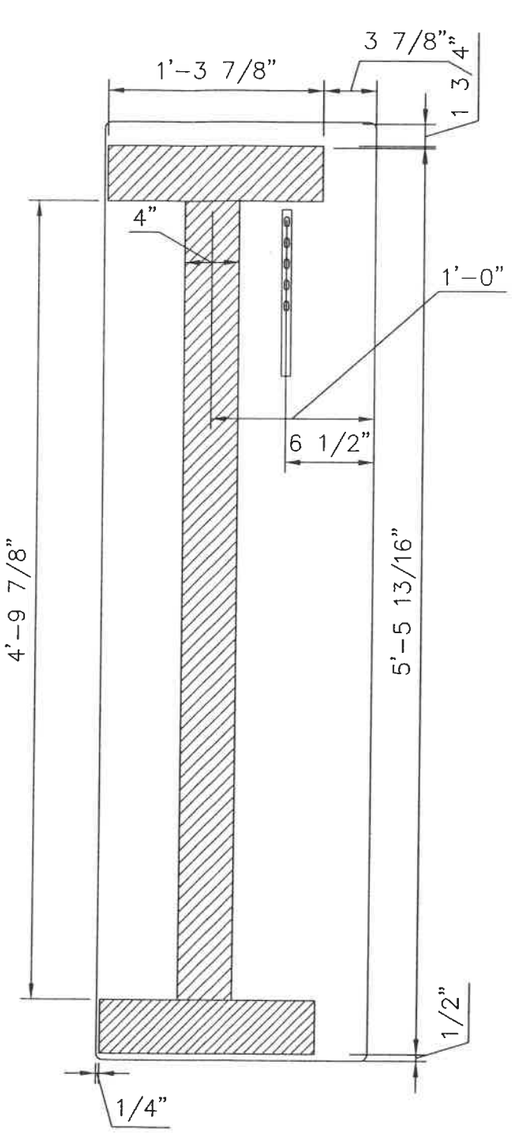
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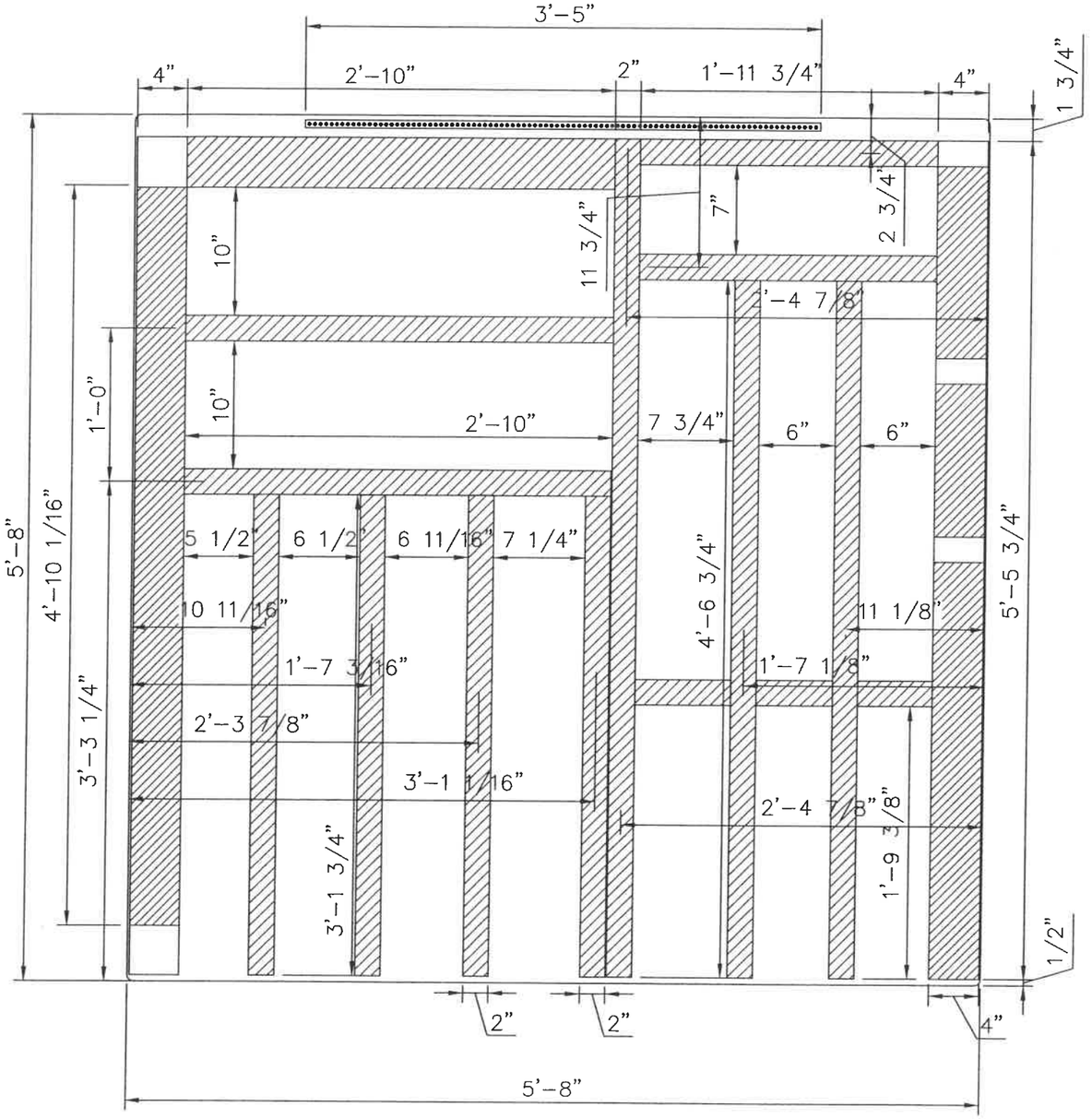
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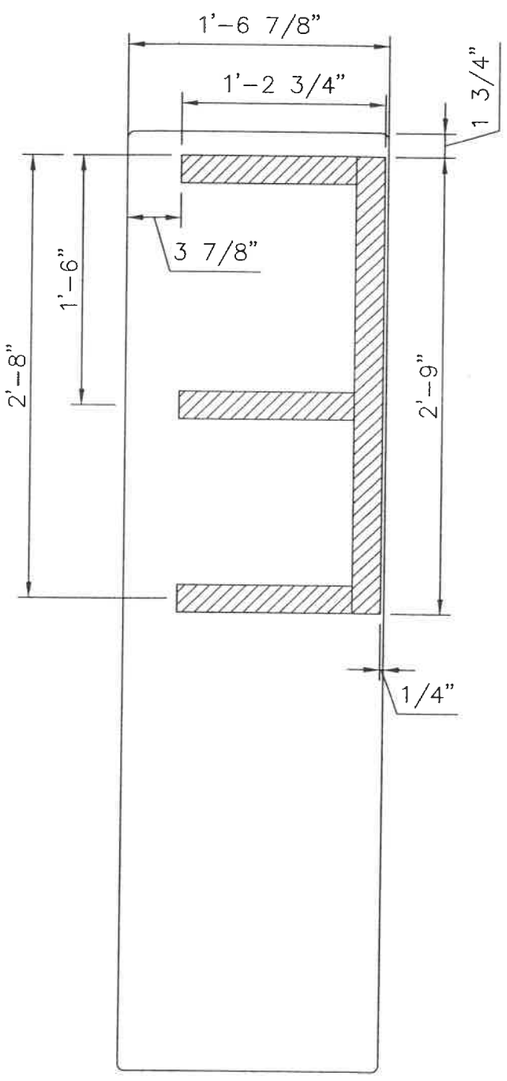
PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352	CLIENT: CITY OF DEEP RIVER
	LOCATION: DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION: MIAN PLANT PLC LAYOUT	DATE: 04/19/2006 — FILE NO. 35206-PLCS-L001A
	SCALE: NOT TO SCALE — DWG. NO. L001A — REV. NO. 0

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MAIN PLANT PLC – BACK PLANE DIMENSIONS







FILE NO. 35206–PLCS DWG. NO. L001B	REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DSGN BKR CHECK	DTGN DNG PRJMGR

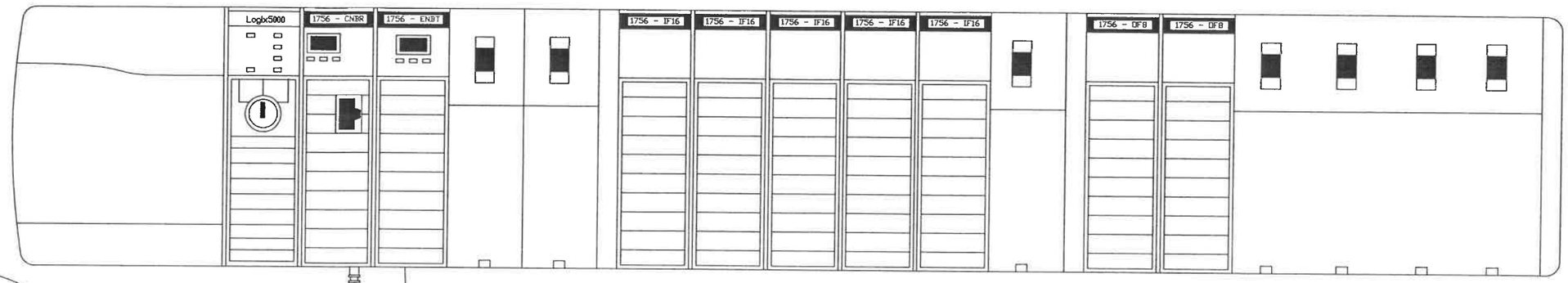
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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006–352	CLIENT: CITY OF DEEP RIVER
DESCRIPTION: MIAN PLANT BACK PLANE DEMENSIONS	LOCATION: DEEP RIVER WATER TREATMENT PLANT
	DATE: 04/19/2006
	FILE NO. 35206–PLCS–L001B
	SCALE: NOT TO SCALE
	DWG. NO. L001B
	REV. NO. 0

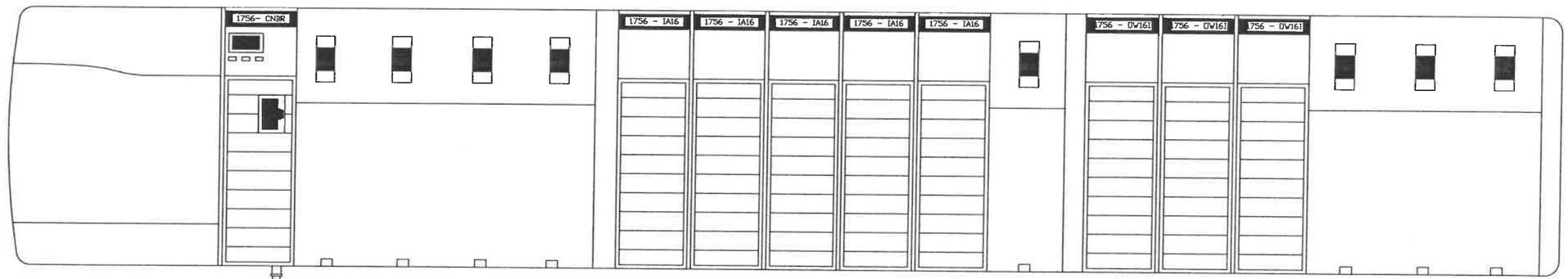
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MAIN RACK #1



TO
E-NET
SWITCH

MAIN RACK #2



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FILE NO. 35206-PLCS
DWG NO. L002

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: MAIN PLANT PLC LAYOUT

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO. 35206-PLCS-L002

SCALE: NOT TO SCALE

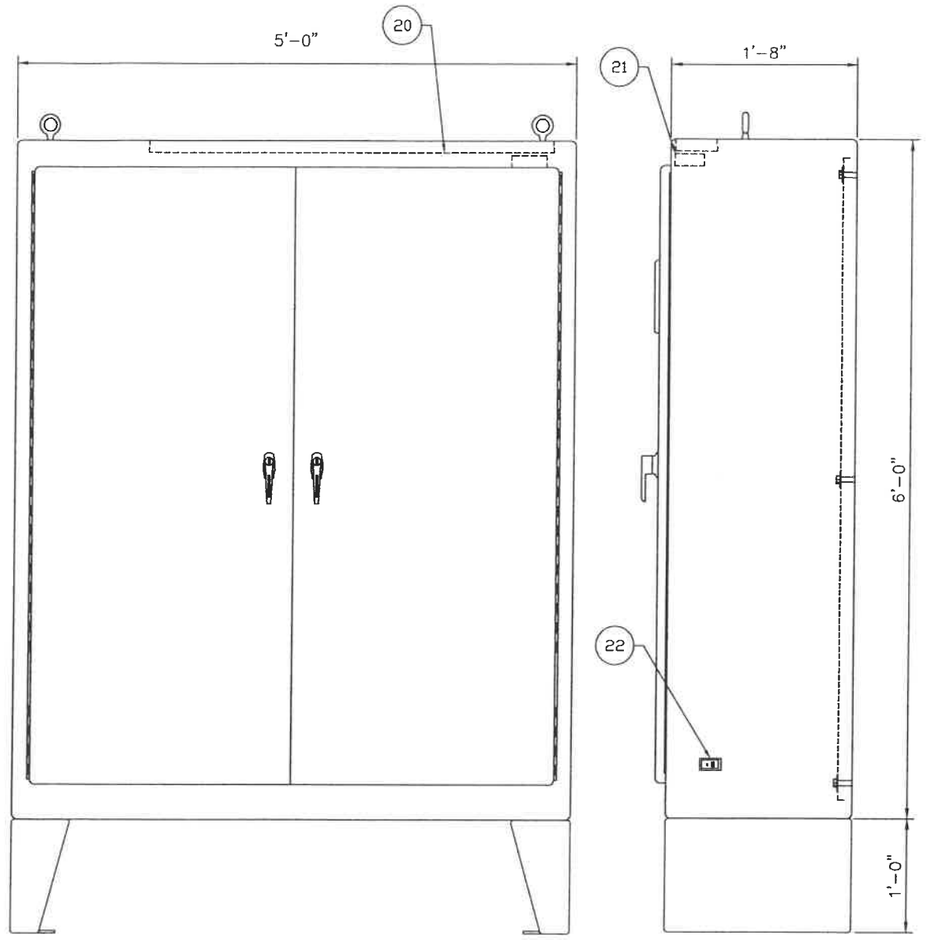
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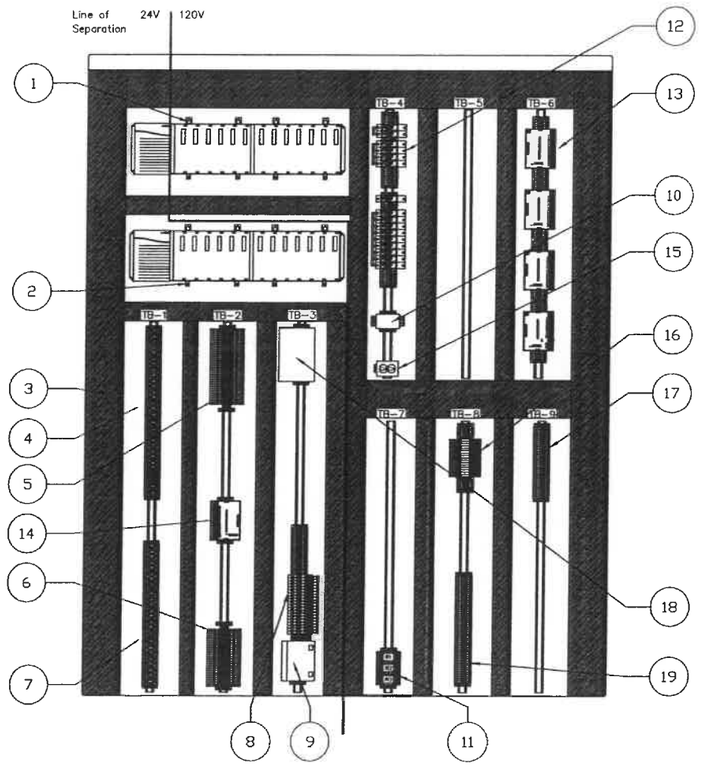
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CHEMICAL – PANEL LAYOUT

PARTS LIST	
1	PROCESSOR & LOCAL MAIN RACK
2	REMOTE RACK #2
3	WIRE THROUGH TYPICAL
4	FIELD ANALOG INPUT BLOCKS WITH GND FOR SHIELD
5	ANALOG INPUT ISOLATORS
6	ANALOG OUTPUT ISOLATORS
7	FIELD ANALOG OUTPUT BLOCKS WITH GND FOR SHIELD
8	24V FUSES
9	24V POWER SUPPLY
10	TRANSIENT VOLTAGE SURGE SUPPRESSOR
11	INTERLOCKING RELAYS
12	MAGNETIC CIRCUIT BREAKERS
13	DIGITAL INPUT BLOCKS
14	DIGITAL 24V DC INPUT MODULES
15	UPS POWERED 120V PLUG
16	INTERPOSING DIGITAL OUTPUT RELAYS
17	DIGITAL OUTPUT FIELD TERMINAL BLOCKS
18	4 PORT NETWORK SWITCH
19	INTERLOCKING RELAYS FIELD TERMINAL BLOCKS
20	PANEL LIGHT
21	PANEL LIGHT DOOR SWITCH
22	EXTERNAL NETWORK & UPS PLUG
23	
24	
25	
26	



FRONT VIEW SIDE VIEW



BACK PANEL

FILE NO. 35206-PLCS
DWG. NO. L101A

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN. MGR. CHECK	DSGN ENG. PLMGR
		THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED				

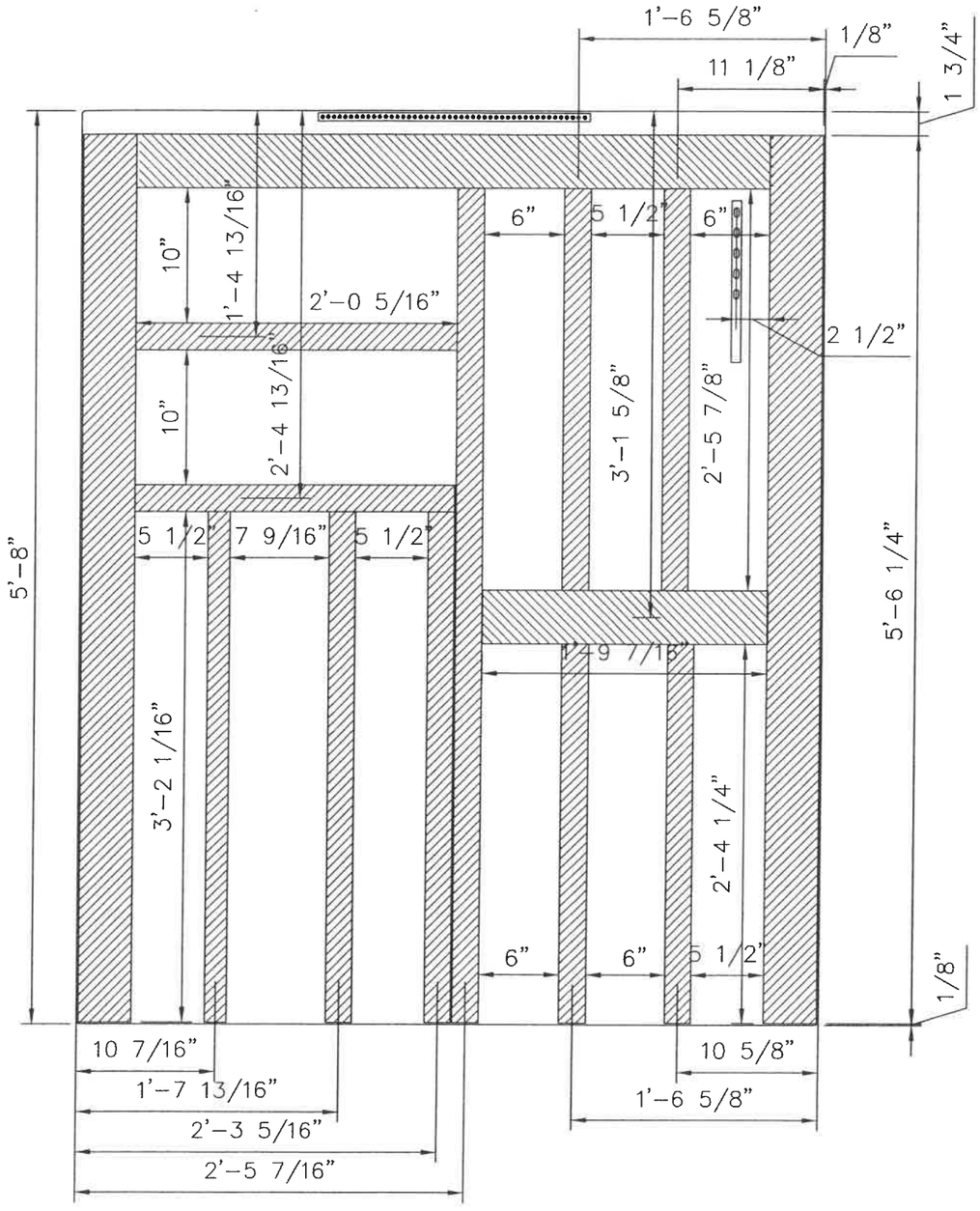
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Web Site/ www.stroma.ca

PROJECT NAME:	DEEP RIVER CONTRACT #35206
CLIENT:	TOWN OF DEEP RIVER
LOCATION:	WATER TREATMENT PLANT
DESCRIPTION:	CHEMICAL PANEL LAYOUT
DATE:	09/10/2006
FILE NO.	35206-PLCS-L101A
SCALE:	NOT TO SCALE
DWG. NO.	L101A
REV. NO.	0

04 20 2007 2:38:35 PM, claudel.leveille

CHEMICAL – PANEL DIMENSIONS



FILE NO. 35206–PLCS DWG. NO. L101B	REF. DWG. NO.	REV.	DESCRIPTION THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DSGN MGR. CHECK	DSGN ENG. PRIMARY

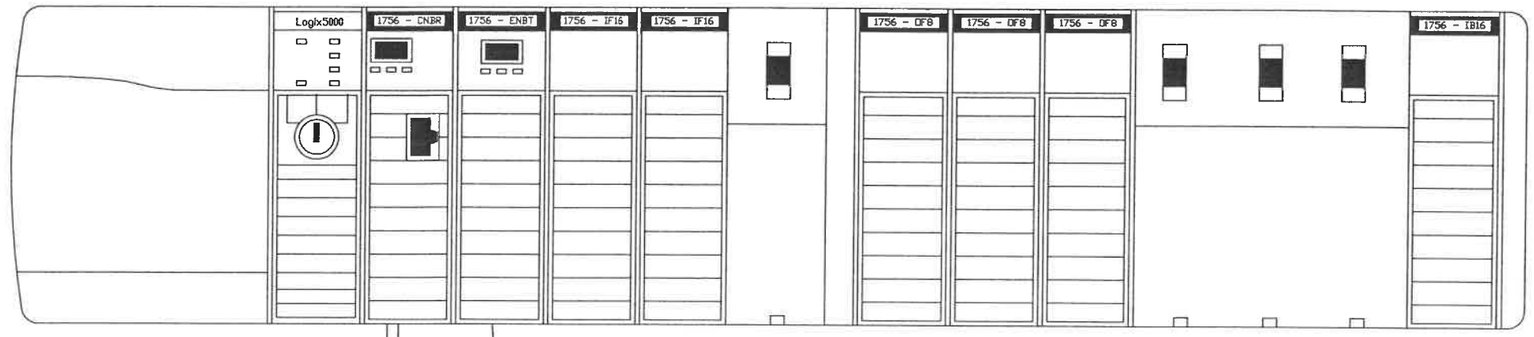
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PROJECT NAME: DEEP RIVER CONTRACT #35206	CLIENT: TOWN OF DEEP RIVER
	LOCATION: WATER TREATMENT PLANT
DESCRIPTION: CHEMICAL DIMENSIONNING	DATE: 09/10/2006
	FILE NO.: 35206–PLCS–L101B
	SCALE: NOT TO SCALE
	DWG. NO.: L101B
	REV. NO.: 0

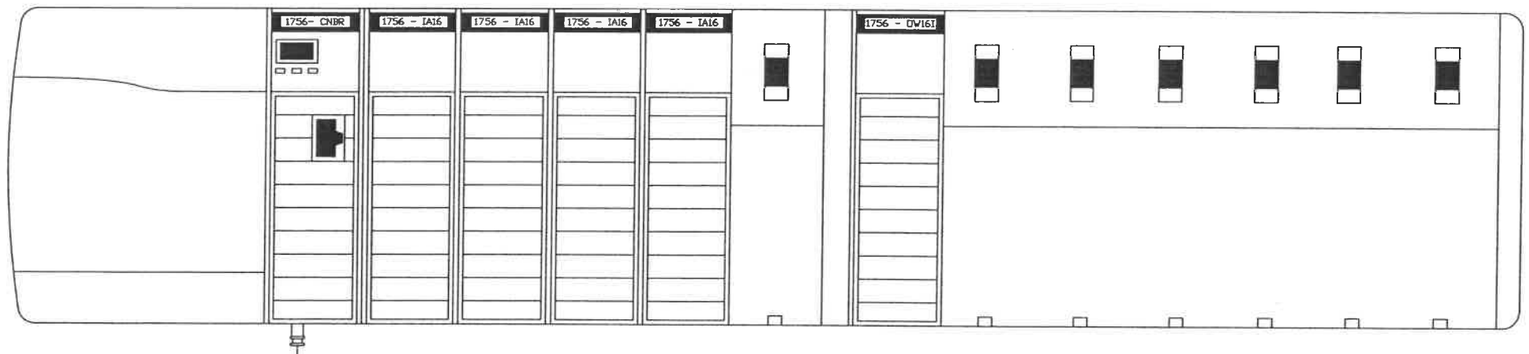
04 20 2007 2:38:31 PM, claudel.leveille

CHEM RACK #1



TO
E-NET
SWITCH

CHEM RACK #2



FILE NO. 35206-PLCS DWG. NO. L102	REF. DWG. NO.	REV.	DESCRIPTION — THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DRGN MGR. CHECK	DRGN DWG. PRUFER

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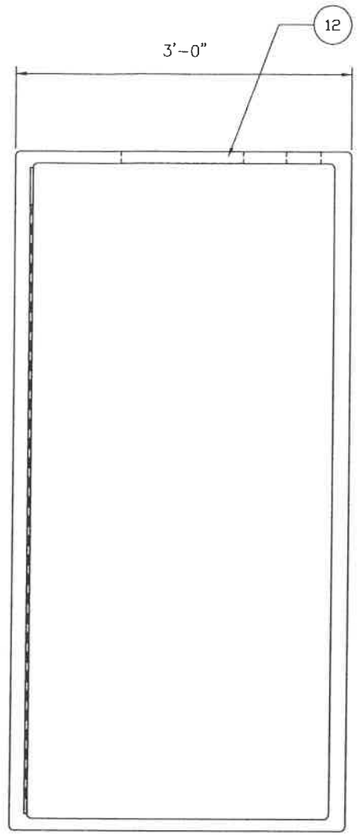
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F / 705-840-6001
Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352	CLIENT: CITY OF DEEP RIVER
	LOCATION: DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION: CHEMICAL PLC LAYOUT	DATE: 04/19/2006 — FILE NO.: 35206-PLCS-L102
	SCALE: NOT TO SCALE — DWG. NO.: L102 — REV. NO.: 0

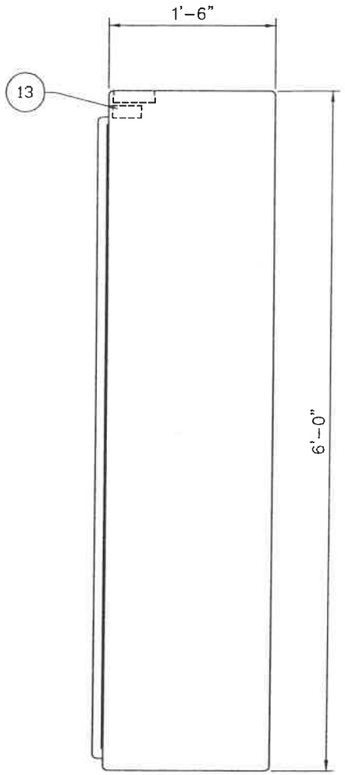
04 20 2007 2:38:41 PM, claudel.leveille

LOW LIFT – PANEL LAYOUT

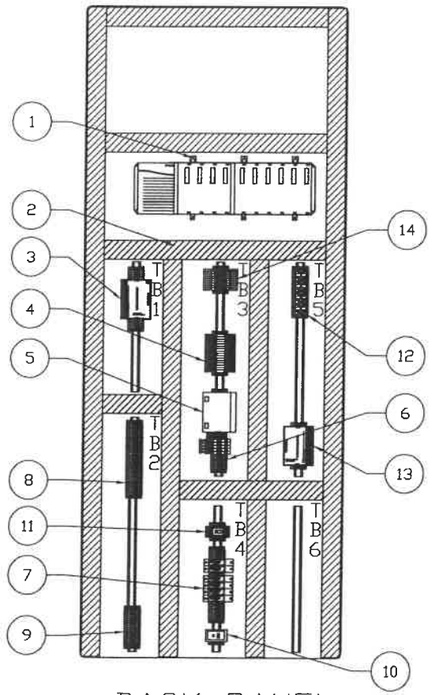
PARTS LIST	
1	PROCESSOR & LOCAL MAIN RACK
2	WIRE THROUGH TYPICAL
3	DIGITAL INPUT 120V MODULE
4	INTERPOSING RELAY
5	24V POWER SUPPLY
6	24V FUSES
7	120V MAGNETIC BREAKERS
8	DIGITAL OUTPUT
9	INTERLOCKING RELAY CONTACTS
10	TVSS
11	LOW LEVEL LOCKOUT RELAYS
12	FEILD TERMINALS FOR ANALOG INPUTS
13	DIGITAL INPUT 24VDC MODULE
14	ANALOG INPUT ISOLATORS
15	
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25	



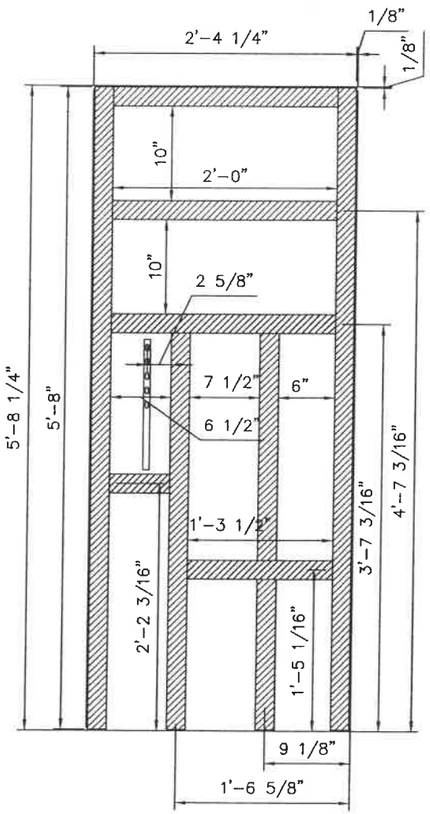
FRONT VIEW



SIDE VIEW



BACK PANEL



REV.	REF. DWG. NO.	DESCRIPTION	DATE	BY	CHECK	APPVD
		THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED				

FILE NO. 35206-PLCS
DWG. NO. L201

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: LOW LIFT PLC LAYOUT & DIMENSIONS

DATE: 04/19/2006

FILE NO. 35206-PLCS-L201

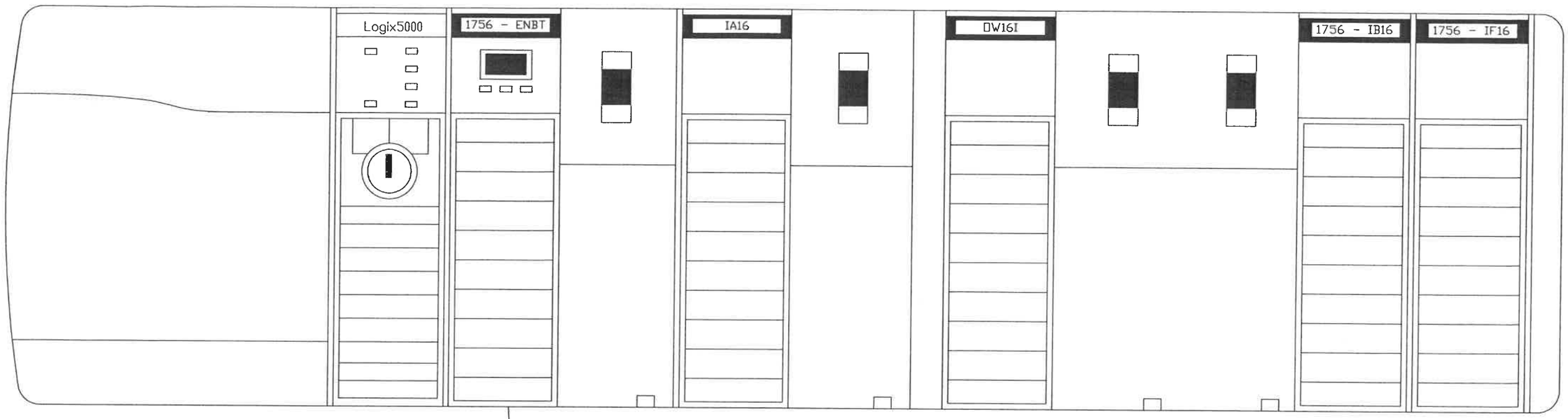
SCALE: NOT TO SCALE

DWG. NO. L201

REV. NO. 0

04 20 2007 2:38:46 PM, claudel.leveille

LOWLIFT RACK #1



TO
E-NET
SWITCH

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DRWN MOR. CHECK	DRWN ENG. APPROR
		THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED				

FILE NO. 35206-LOWLIFT
DWG. NO. L202

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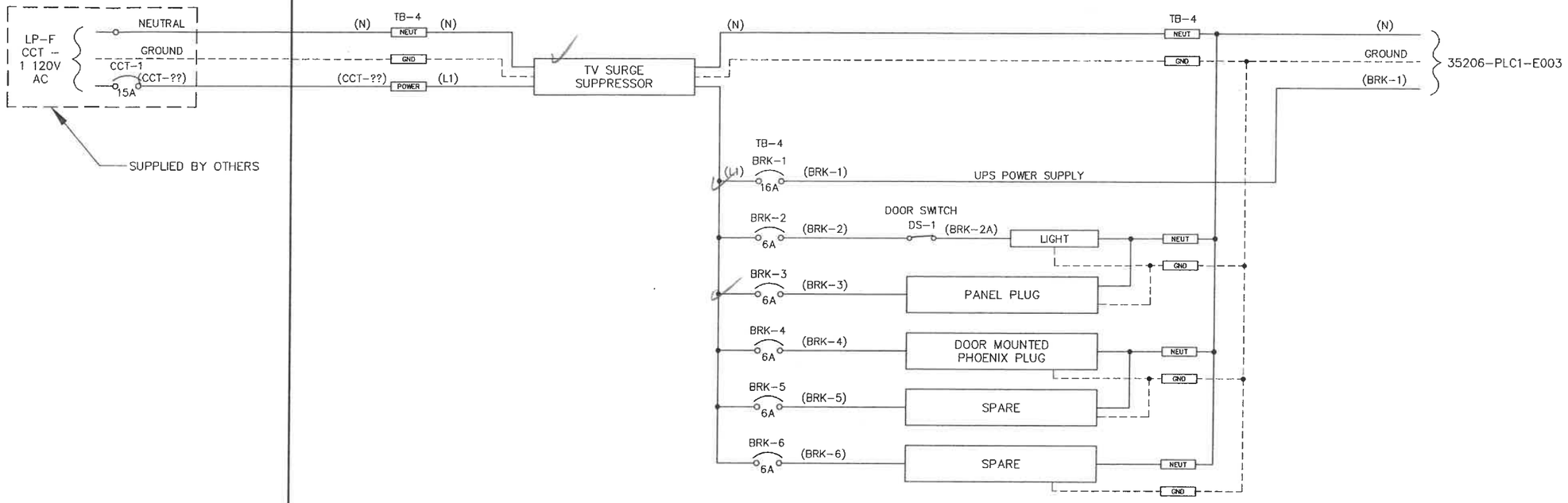
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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352	CLIENT: CITY OF DEEP RIVER
	LOCATION: DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION: LOWLIFT PLC LAYOUT	DATE: 04/19/2006
	FILE NO.: 35206-PLC1-L202
	SCALE: NOT TO SCALE
	DWG. NO.: L202
	REV. NO.: 0

04 20 2007 2:38:51 PM, claudel.leveille

FIELD

PLC1 110V POWER DISTRIBUTION



REF. DWG. NO.	REV.	DESCRIPTION (THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED)	DATE	BY	DESIGN MGR. CHECK	DRAWN ENG. APPROVE
	1	SEPERATION OF UPS POWER AND NORMAL POWER	06/26/06	CK	D. G.	D. G.

FILE NO. 35206-PLC1
DWG. NO. E002

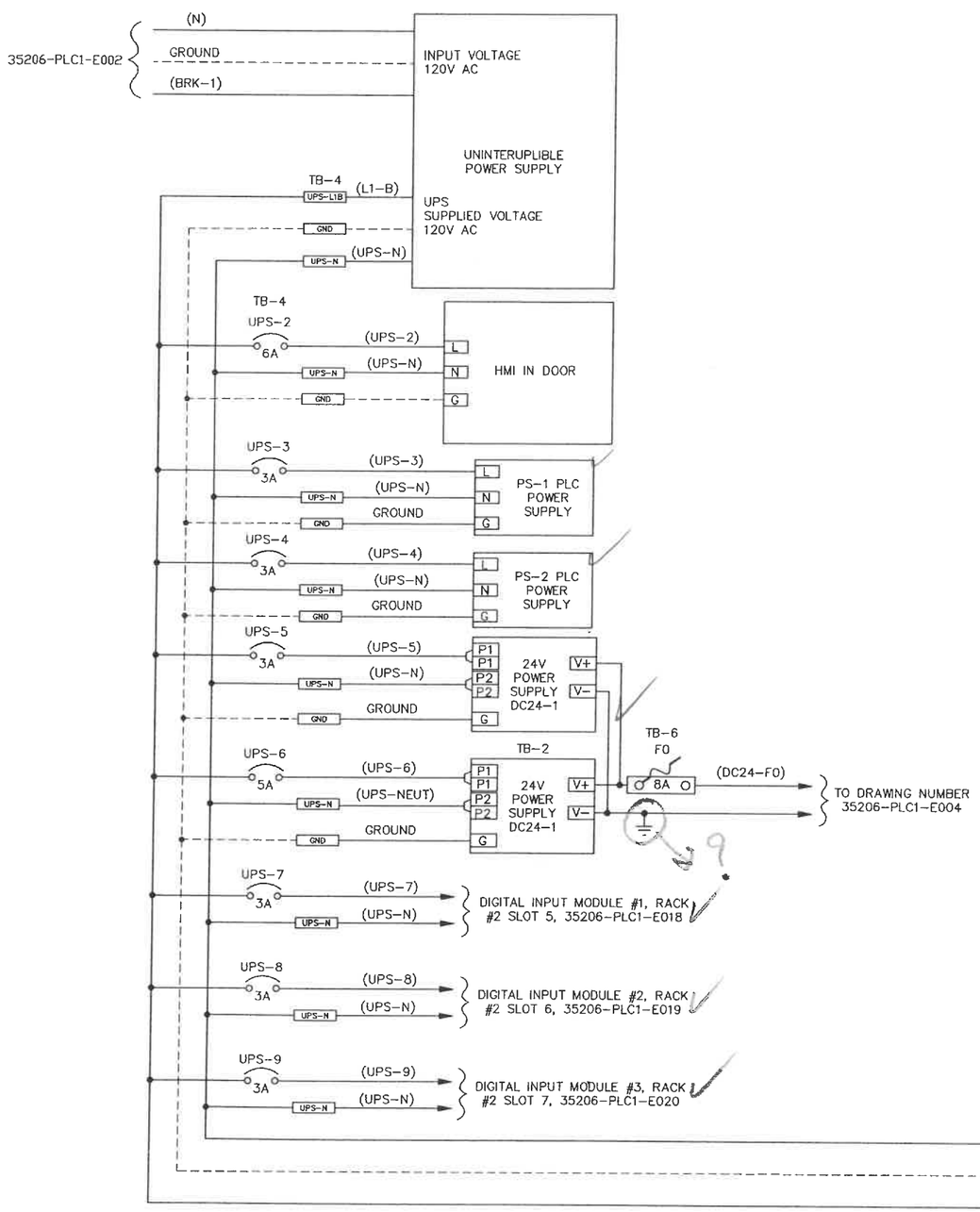
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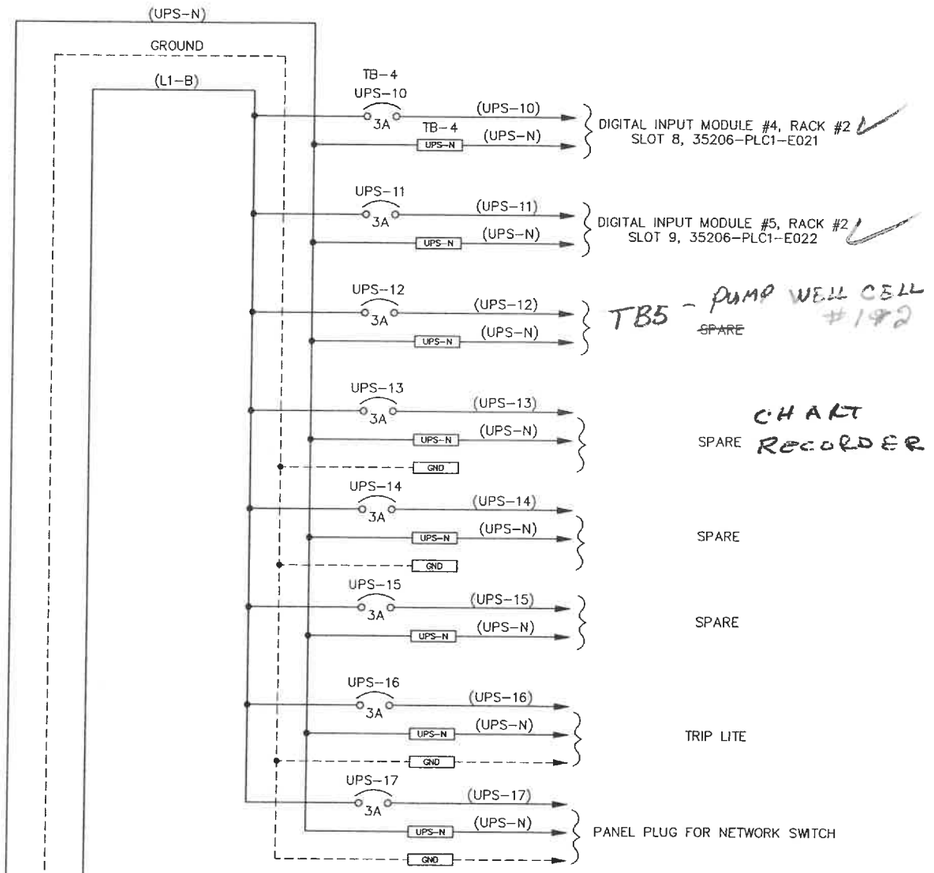
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PROJECT NAME: DEEP RIVER CONTRACT #35206	CLIENT: TOWN OF DEEP RIVER
	LOCATION: WATER TREATMENT PLANT
DESCRIPTION: MAIN PANEL 110V POWER SCHEMATIC	DATE: 09/10/2006
	FILE NO. 35206-PLC1-E002
	SCALE: NOT TO SCALE
	DWG. NO. E002
	REV. NO. 0

04 20 2007 2:35:38 PM, claudel.leveille

MAIN PLANT CONTROL PANELS UPS–110V POWER DISTRIBUTION





REV.	DESCRIPTION	DATE	BY
1	NEW PAGE, ADDITION OF INSTRUMENTS		

REF. DWG. NO.

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FILE NO. 35206-PLC1
DWG. NO. E003

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PROJECT NAME: DEEP RIVER WTP UPGRADES CONTRACT #35206

DESCRIPTION: MAIN PLANT UPS–110V POWER SCHEMATIC

CLIENT: TOWN OF DEEP RIVER

LOCATION: WATER TREATMENT PLANT

DATE: 09/10/2006

FILE NO.: 35206-PLC1-E003

SCALE: NOT TO SCALE

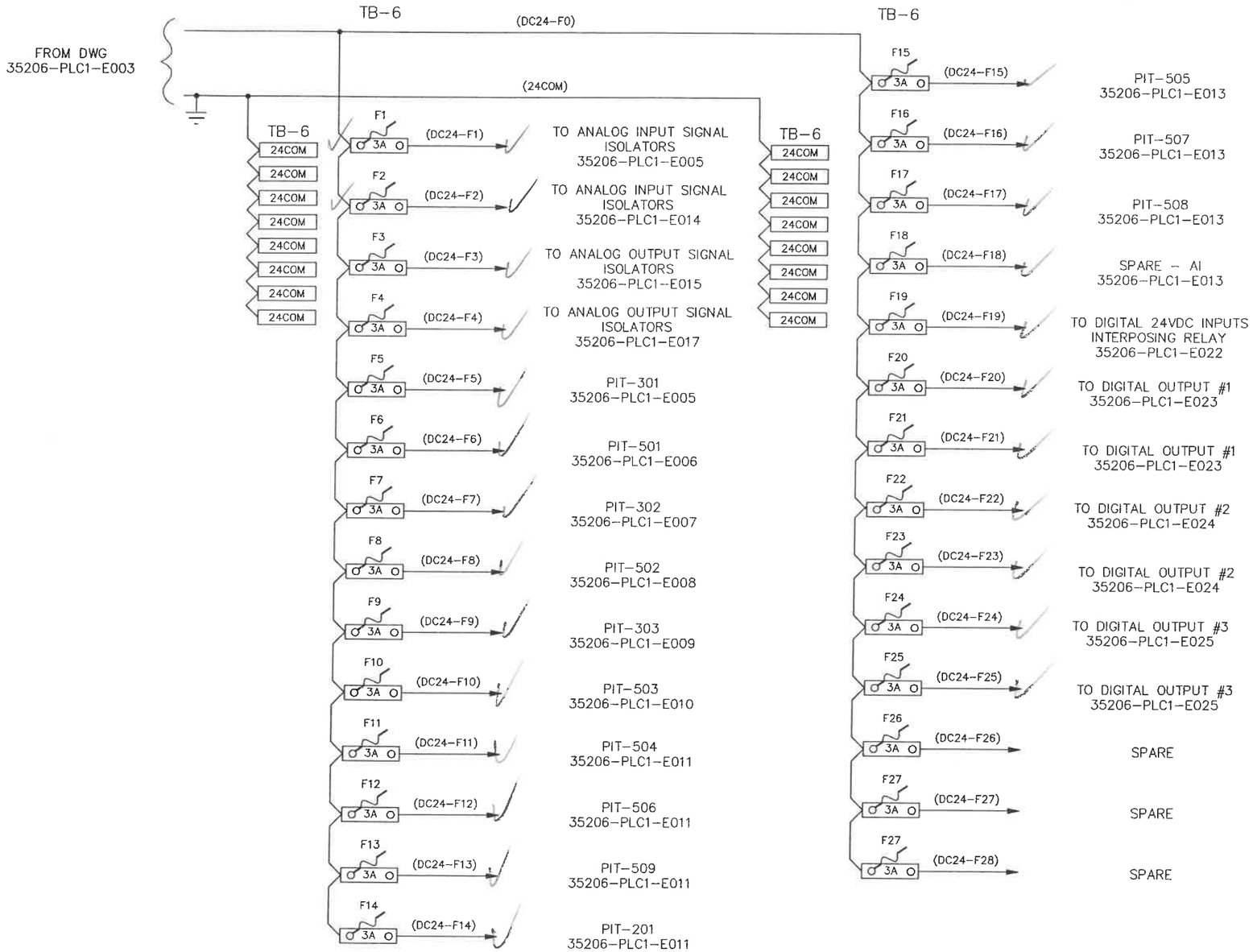
DWG. NO.: E003

REV. NO.: 0

04 20 2007 2:35:44 PM, claudel.leveille

MAIN PLANT PANELS 24VDC POWER SUPPLIES

DC24



REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN. MGR. CHECK	DSGN ENG. PT.MGR
	1	RENUMBERING OF ISOLATORS, ADDITIONAL SPARES FUSES	06/26/06	CL		

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FILE NO. 35206-PLC1
DWG. NO. E004

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PROJECT NAME: DEEP RIVER WTP UPGRADES CONTRACT #35206

CLIENT: TOWN OF DEEP RIVER

LOCATION: WATER TREATMENT PLANT

DESCRIPTION: MAIN PLANT PANEL 24V POWER SUPPLY SCHEMATIC

DATE: 09/10/2006

FILE NO. 35206-PLC1-E004

SCALE: NOT TO SCALE

DWG. NO. E004

REV. NO. 0

04 20 2007 2:35:49 PM, claudel.leveille

PLC1 ANALOG INPUT MODULE # 1-A

* (ALL ANALOG INPUTS) COME FROM FIELD
BELDEN CABLE W - #1, BK - #2

FIELD

PANEL TERMINALS

RACK 1 SLOT 5, 4-20mA ANALOG, 8 INPUT

TB-6 F1: 3A — DC24 — 24COM — (DC24-F1)

TB-7 PTB-1: PTB-1 PROVIDES POWER TO ANALOG INPUT SIGNAL ISOLATORS THROUGH THE BASE

DC24 — 35206-PLC1-E004 — 35206-PLC1-E006

TB-9

Filter #1 Valve Position Filtered Water to Reservoir	BFV-314	(BFV314-VPI)	(AI:1:05/00)	3-0	WHITE	WHITE	2
					BLACK	BLACK	1
Filter #1 Surge Tank Valve Position	BFV-316	(BFV316-VPI)	(AI:1:05/01)	3-1	GREEN	GREEN	4
					RED	RED	3
Filter #1 Valve Position Filtered Water to Waste	BFV-317	(BFV317-VPI)	(AI:1:05/02)	3-2	BLUE	BLUE	6
					ORANGE	ORANGE	5
Filter #1 Effluent Flow Rate	FIT-301	(FIT301-AIT)	(AI:1:05/03)	3-3	RED/BLACK	RED/BLACK	8
					WHITE/BLACK	WHITE/BLACK	7
Filter #1 Effluent Pressure	PIT-301	(PIT301-AIT)	(AI:1:05/04)	3-4	BLACK/WHITE	BLACK/WHITE	12
					BLUE/BLACK	BLUE/BLACK	11
Filter #1 Turbidity Level	TIA-301	(TIA301-AIT)	(AI:1:05/05)	3-5	GREEN/WHITE	GREEN/WHITE	14
					RED/WHITE	RED/WHITE	13
Filter #1 Water Level	LIT-301	(LIT301-AIT)	(AI:1:05/06)	3-6	BLACK/RED	BLACK/RED	16
					BLUE/WHITE	BLUE/WHITE	15
Finished Water Free Chlorine Residual (to Distribution)	CIA-502	(CIA502-AIT)	(AI:1:05/07)	3-7	ORANGE/RED	ORANGE/RED	18
					WHITE/RED	WHITE/RED	17
Chart Recorder Chlorine Residual Pen #1	CHART-RECORDER	(CIA502-AIT2)					

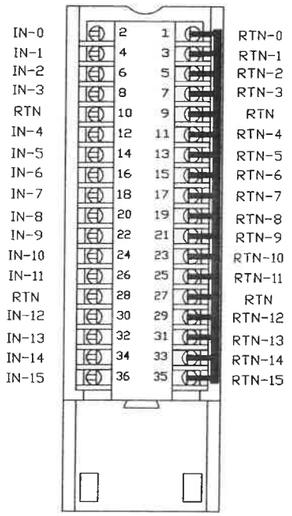
POWERED THROUGH BASE (DC24-F1)

NOT TERMINATED: GREEN/BLACK 9; ORANGE/BLACK 10

TB-6 F5

MODULE TERMINALS

ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-PLC1
DWG. NO. E005

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN. MGR. CHECK	DSGN. ENG. ENGR.
		THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED				

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION: ANALOG INPUT CARD #1 LOOP DRAWING
DATE: 04/19/2006
FILE NO.: 35206-PLC1-E005
SCALE: NOT TO SCALE
DWG NO.: E005
REV. NO.: 0

04 20 2007 2:35:54 PM, claudel.leveille

PLC1 ANALOG INPUT MODULE # 1-B

FIELD

PANEL TERMINALS

RACK 1 SLOT 5, 4-20mA ANALOG, 8 INPUT

35206-PLC1-E005 — DC24 — 24COM — 35206-PLC1-E007

TB-9 — TB-7

Finished Water Turbidity (to Distribution) — TIA-501 (+/-) — (TIA501-AIT) — W BLK BLK W — (AI:1:05/08) — 3-8 — BLK — S U,I OUT 6 GND — U,I 1 IN GND 2 — RED/GREEN — BLUE/RED — POWERED THROUGH BASE (DC24-F1) — 7+ 8- +3 -4 — MODULE TERMINALS: RED/GREEN 20, BLUE/RED 19

UV 303 Requested Lamp Power — UV-303 (+/-) — (UV303-LMP-RQU) — W BLK BLK W — (AI:1:05/09) — 3-9 — BLK — S U,I OUT 6 GND — U,I 1 IN GND 2 — BLACK/WHITE - RED — ORANGE/GREEN — POWERED THROUGH BASE (DC24-F1) — 7+ 8- +3 -4 — MODULE TERMINALS: BLACK/WHITE - RED 22, ORANGE/GREEN 21

UV 303 Actual Lamp Power — UV-303 (+/-) — (UV303-LMP-ACT) — W BLK BLK W — (AI:1:05/10) — 3-10 — BLK — S U,I OUT 6 GND — U,I 1 IN GND 2 — RED/BLACK - WHITE — WHITE/BLACK - RED — POWERED THROUGH BASE (DC24-F1) — 7+ 8- +3 -4 — MODULE TERMINALS: RED/BLACK - WHITE 24, WHITE/BLACK - RED 23

High Lift Pump #1 Pressure — PIT-501 (+/-/24) — (PIT501-AIT) — W BLK R BLK W — (AI:1:05/11) — 3-11 — BLK — S U,I OUT 6 GND — U,I 1 IN GND 2 — ORANGE/BLACK - WHITE — GREEN/BLACK - WHITE — POWERED THROUGH BASE (DC24-F1) — 7+ 8- +3 -4 — MODULE TERMINALS: ORANGE/BLACK - WHITE 26, GREEN/BLACK - WHITE 25

TB-6 F6

MODULE TERMINALS: NOT TERMINATED BLUE/BLACK - WHITE 27; NOT TERMINATED BLACK/RED - GREEN 28

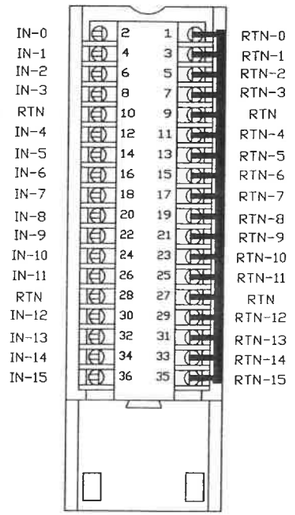
Generator Phase A CT — GENCT-A (+/-) — (GENCT-A) MORE INFO ON PAGE 35206-PLC1-E027 — W BLK BLK W — (AI:1:05/12) — 3-12 — BLK — S U,I OUT 6 GND — U,I 1 IN GND 2 — RED/BLACK - GREEN — WHITE/RED -GREEN — POWERED THROUGH BASE (DC24-F1) — 7+ 8- +3 -4 — MODULE TERMINALS: RED/BLACK - GREEN 30, WHITE/RED -GREEN 29

W BLK — (AI:1:05/13) — 3-13 — BLK — S U,I OUT 6 GND — U,I 1 IN GND 2 — ORANGE/BLACK - GREEN — GREEN/BLACK - ORANGE — POWERED THROUGH BASE (DC24-F1) — 7+ 8- +3 -4 — MODULE TERMINALS: ORANGE/BLACK - GREEN 32, GREEN/BLACK - ORANGE 31

W BLK — (AI:1:05/14) — 3-14 — BLK — S U,I OUT 6 GND — U,I 1 IN GND 2 — BLACK/WHITE - ORANGE — BLUE/WHITE - ORANGE — POWERED THROUGH BASE (DC24-F1) — 7+ 8- +3 -4 — MODULE TERMINALS: BLACK/WHITE - ORANGE 34, BLUE/WHITE - ORANGE 33

W BLK — (AI:1:05/15) — 3-15 — BLK — S U,I OUT 6 GND — U,I 1 IN GND 2 — ORANGE/WHITE - BLUE — WHITE/RED - ORANGE — POWERED THROUGH BASE (DC24-F1) — 7+ 8- +3 -4 — MODULE TERMINALS: ORANGE/WHITE - BLUE 36, WHITE/RED - ORANGE 35

ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-PLC1
DWG. NO. E006

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN. MGR. CHECK	DSGN ENG. ENGR
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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION: ANALOG INPUT CARD #1 LOOP DRAWING
DATE: 04/19/2006
FILE NO. 35206-PLC1-E006
SCALE: NOT TO SCALE
DWG. NO. E006
REV. NO. 0

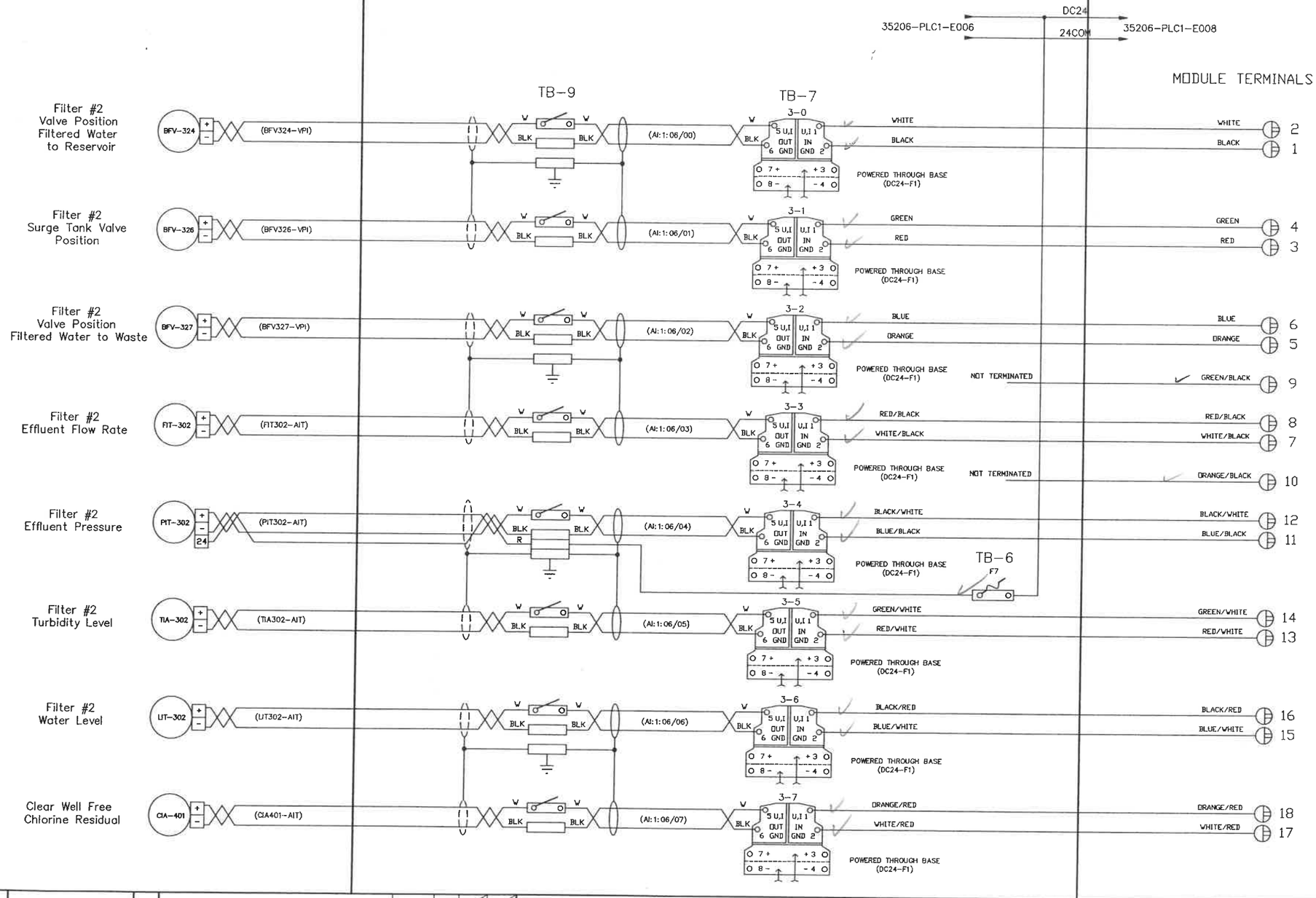
04 20 2007 2:35:59 PM, claudel.leveille

PLC1 ANALOG INPUT MODULE # 2-A

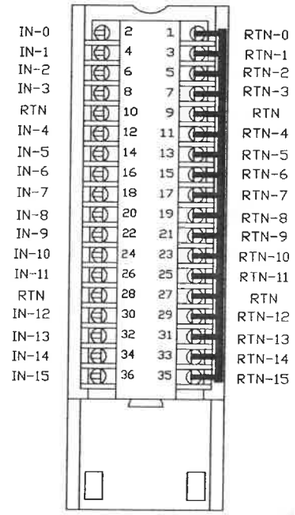
FIELD

PANEL TERMINALS

RACK 1 SLOT 6, 4-20mA ANALOG, 8 INPUT



ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS			
1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-PLC1
DWG. NO. E007

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN. WAR. CHECK	DSGN. ENG. APPROV.
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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: ANALOG INPUT CARD #2 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO.: 35206-PLC1-E007

SCALE: NOT TO SCALE

DWG. NO.: E007

REV. NO.: 0

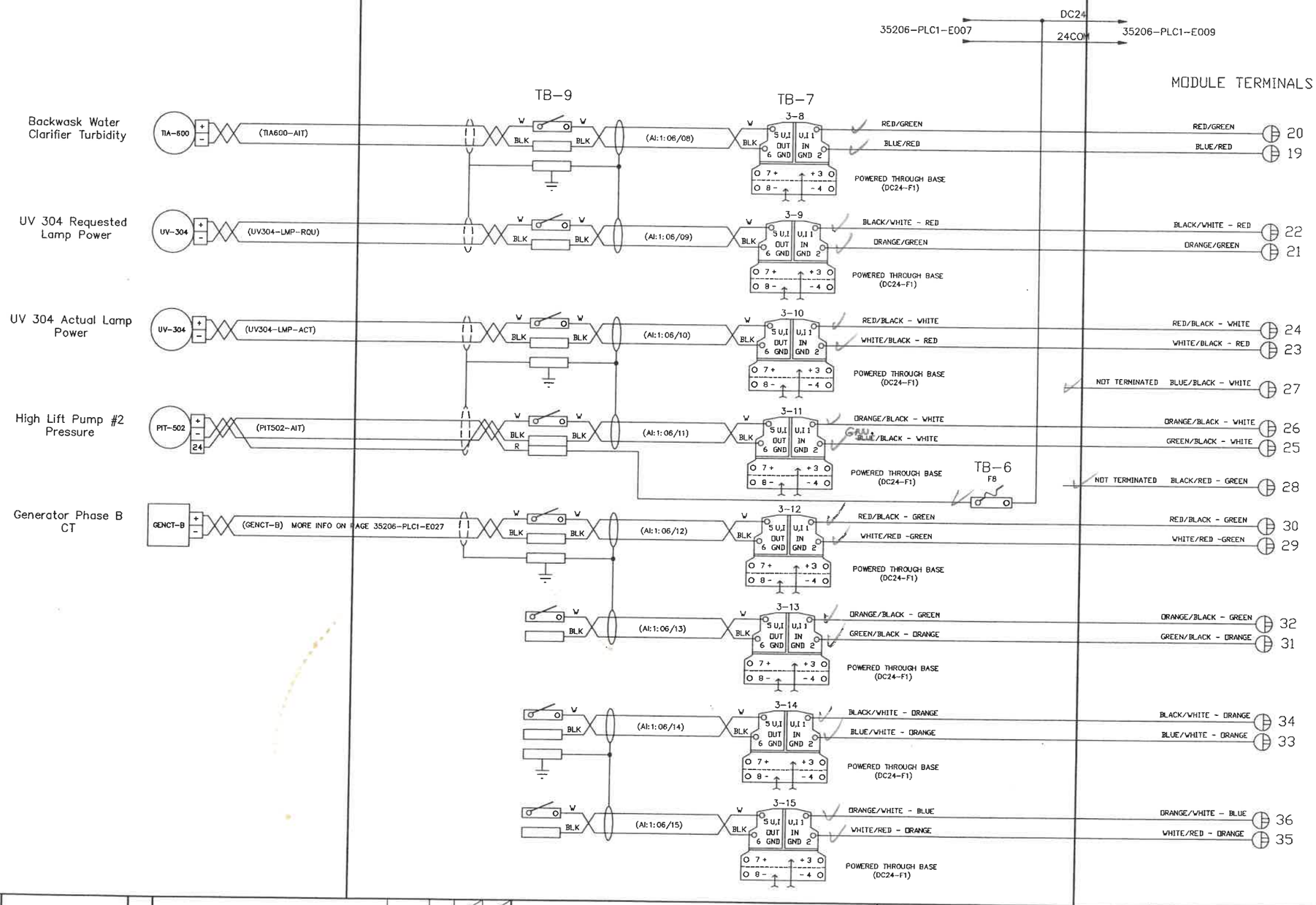
04 20 2007 2:36:04 PM, claudel.leveille

PLC1 ANALOG INPUT MODULE # 2-B

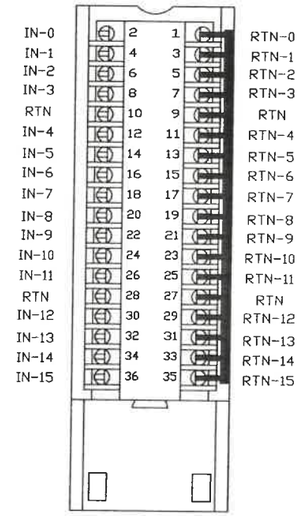
FIELD

PANEL TERMINALS

RACK 1 SLOT 6, 4-20mA ANALOG, 8 INPUT



ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-PLC1
DWG. NO. E008

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN.	DRCH.	CHECK	ENGR.
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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: ANALOG INPUT CARD #2 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO. 35206-PLC1-E008

SCALE: NOT TO SCALE

DWG. NO. E008

REV. NO. 0

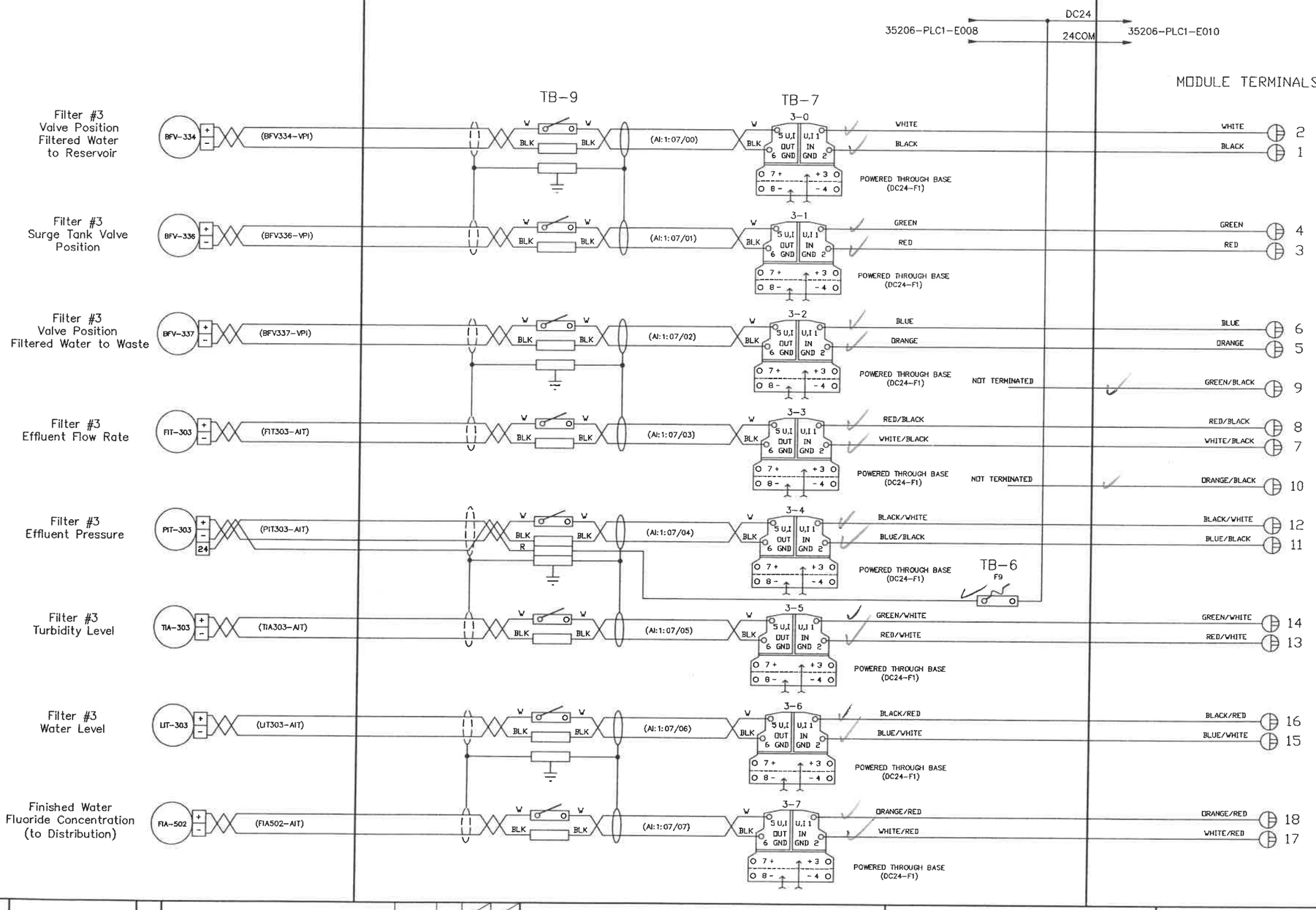
04 20 2007 2:36:10 PM, claudel.leveille

PLC1 ANALOG INPUT MODULE # 3-A

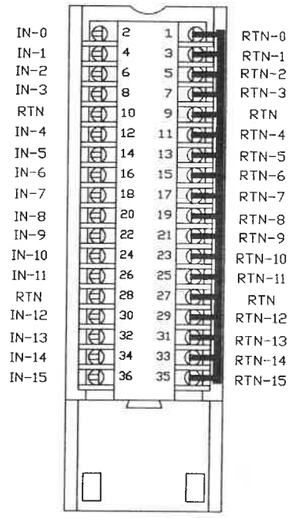
FIELD

PANEL TERMINALS

RACK 1 SLOT 7, 4-20mA ANALOG, 8 INPUT



ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS			
1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-PLC1
DWG. NO. E009

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN MGR. CHECK	DSGN ENG. PLANOR
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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: ANALOG INPUT CARD #3 LOOP DRAWING

DATE: 04/19/2006

FILE NO. 35206-PLC1-E009

SCALE: NOT TO SCALE

DWG. NO. E009

REV. NO. 0

04 20 2007 2:36:15 PM, claudel.leveille

PLC1 ANALOG INPUT MODULE # 3-B

FIELD

PANEL TERMINALS

RACK 1 SLOT 7, 4-20mA ANALOG, 8 INPUT

35206-PLC1-E009 — DC24 — 24COM — 35206-PLC1-E011

MODULE TERMINALS

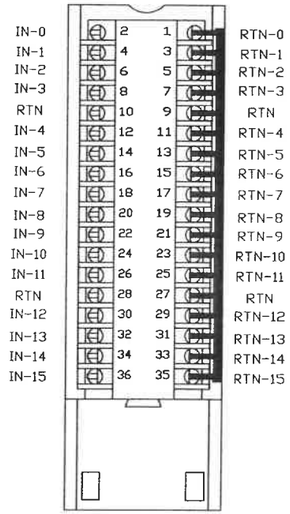
TB-9

TB-7

Finished Water pH (to Distrabution)	PIA-501	(PIA501-AIT)	BLK / BLK	(AI:1:07/08)	3-8	RED/GREEN	RED/GREEN	20	
						BLUE/RED	BLUE/RED	19	
						POWERED THROUGH BASE (DC24-F1)			
Dewatering Centrifuge Flow Meter	FIT-601	(FIT601-AIT)	BLK / BLK	(AI:1:07/09)	3-9	BLACK/WHITE - RED	BLACK/WHITE - RED	22	
						ORANGE/GREEN	ORANGE/GREEN	21	
						POWERED THROUGH BASE (DC24-F1)			
Surge Tank Flow Meter to Clarifier	FIT-602	(FIT602-AIT)	BLK / BLK	(AI:1:07/10)	3-10	RED/BLACK - WHITE	RED/BLACK - WHITE	24	
						WHITE/BLACK - RED	WHITE/BLACK - RED	23	
						POWERED THROUGH BASE (DC24-F1)			
							NOT TERMINATED BLUE/BLACK - WHITE	27	
High Lift Pump #3 Pressure	PIT-503 (24)	(PIT503-AIT)	BLK R / BLK	(AI:1:07/11)	3-11	ORANGE/BLACK - WHITE	ORANGE/BLACK - WHITE	26	
						~~BLUE~~/BLACK - WHITE	GREEN/BLACK - WHITE	25	
						POWERED THROUGH BASE (DC24-F1)			
							NOT TERMINATED BLACK/RED - GREEN	28	
Generator Phase C CT	GENCT-C	(GENCT-C) MORE INFO ON PAGE 35206-PLC1-E027	BLK / BLK	(AI:1:07/12)	3-12	RED/BLACK - GREEN	RED/BLACK - GREEN	30	
						WHITE/RED -GREEN	WHITE/RED -GREEN	29	
						POWERED THROUGH BASE (DC24-F1)			
			BLK / BLK	(AI:1:07/13)	3-13	ORANGE/BLACK - GREEN	ORANGE/BLACK - GREEN	32	
						GREEN/BLACK - ORANGE	GREEN/BLACK - ORANGE	31	
						POWERED THROUGH BASE (DC24-F1)			
			BLK / BLK	(AI:1:07/14)	3-14	BLACK/WHITE - ORANGE	BLACK/WHITE - ORANGE	34	
						BLUE/WHITE - ORANGE	BLUE/WHITE - ORANGE	33	
						POWERED THROUGH BASE (DC24-F1)			
			BLK / BLK	(AI:1:07/15)	3-15	ORANGE/WHITE - BLUE	ORANGE/WHITE - BLUE	36	
						WHITE/RED - ORANGE	WHITE/RED - ORANGE	35	
						POWERED THROUGH BASE (DC24-F1)			

TB-6 F10

ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-PLC1
DWG. NO. E010

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN CHK	DRWN CHK
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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: ANALOG INPUT CARD #3 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO.: 35206-PLC1-E010

SCALE: NOT TO SCALE

DWG. NO.: E010

REV. NO.: 0

04 20 2007 2:36:20 PM, claudel.leveille

PLC1 ANALOG INPUT MODULE # 4-A

FIELD

PANEL TERMINALS

RACK 1 SLOT 8, 4-20mA ANALOG, 8 INPUT

DC24 — 35206-PLC1-E010 — 24COM — 35206-PLC1-E012

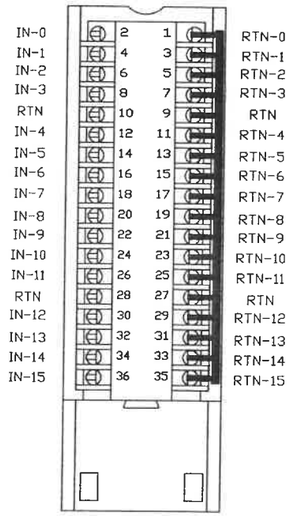
TB-8 TB-7 TB-6

High Lift Pump #4 Pressure	PIT-504	(PIT504-AIT)	BLK R BLK	(AI:1:08/00)	3-0	WHITE / BLACK	F11	WHITE 2 / BLACK 1
Backwash Pump #1 Pressure	PIT-506	(PIT506-AIT)	BLK R BLK	(AI:1:08/01)	3-1	GREEN / RED	F12	GREEN 4 / RED 3
High Lift Header Pressure	PIT-509	(PIT509-AIT)	BLK R BLK	(AI:1:08/02)	3-2	BLUE / ORANGE	F13	BLUE 6 / ORANGE 5
Backwash Flow Rate Meter	FIT-501	(FIT501-AIT)	BLK BLK	(AI:1:08/03)	3-3	RED/BLACK / WHITE/BLACK		NOT TERMINATED / GREEN/BLACK 9; RED/BLACK 8; WHITE/BLACK 7
Clear Well #1 Level	LIT-401	(LIT401-AIT)	BLK BLK	(AI:1:08/04)	3-4	BLACK/WHITE / BLUE/BLACK		NOT TERMINATED / ORANGE/BLACK 10; BLACK/WHITE 12; BLUE/BLACK 11
Pump Well Cell #1 Level	LIT-403	(LIT403-AIT)	BLK BLK	(AI:1:08/05)	3-5	GREEN/WHITE / RED/WHITE		GREEN/WHITE 14 / RED/WHITE 13
Settling Tank Effluent Channel Level	LIT-201	(LIT201-AIT)	BLK BLK	(AI:1:08/06)	3-6	BLACK/RED / BLUE/WHITE		BLACK/RED 16 / BLUE/WHITE 15
Raw Water Header Pressure	PIT-201	(PIT201-AIT)	BLK R BLK	(AI:1:08/07)	3-7	ORANGE/RED / WHITE/RED	F14	ORANGE/RED 18 / WHITE/RED 17

All modules: POWERED THROUGH BASE (DC24-F1)

MODULE TERMINALS

ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-PLC1
DWG. NO. E011

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN. MGR. CHECK	DSGN. ENGR. PR.MGR
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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: ANALOG INPUT CARD #4 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO. 35206-PLC1-E011

SCALE: NOT TO SCALE

DWG. NO. E011

REV. NO. 0

04 20 2007 2:36:25 PM, claudel.leveille

PLC1 ANALOG INPUT MODULE # 4-B

FIELD

PANEL TERMINALS

RACK 1 SLOT 8, 4-20mA ANALOG, 8 INPUT

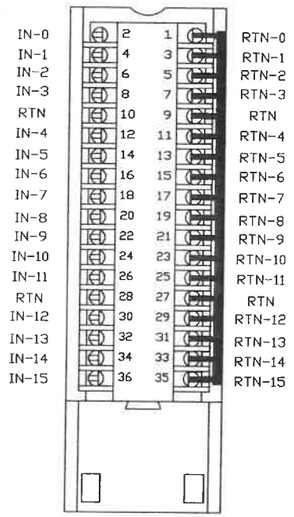
35206-PLC1-E011 — DC24 / 24COM → 35206-PLC1-E013

TB-8 / TB-7

FIELD		TB-8	TB-7	MODULE TERMINALS
Clarifier Settling Valve Tank A To Sludge Thickner	BFV-630 (BFV630-AIT)	(AI:1:08/08)	3-8	RED/GREEN → 20; BLUE/RED → 19
Sludge Thickner Level #1	LIT-601 (LIT601-AIT)	(AI:1:08/09)	3-9	BLACK/WHITE - RED → 22; ORANGE/GREEN → 21
Backwash Sludge Tank #1 Level	LIT-603 (LIT603-AIT)	(AI:1:08/10)	3-10	RED/BLACK - WHITE → 24; WHITE/BLACK - RED → 23; BLUE/BLACK - WHITE → 27 (NOT TERMINATED)
Sludge Blanket Level Monitor #1	SBL-600 (SBL600-AIT)	(AI:1:08/11)	3-11	ORANGE/BLACK - WHITE → 26; GREEN/BLACK - WHITE → 25; BLACK/RED - GREEN → 28 (NOT TERMINATED)
Clarifier Overflow Flow Meter	FIT-604 (FIT604-AIT)	(AI:1:08/12)	3-12	RED/BLACK - GREEN → 30; WHITE/RED -GREEN → 29
Clarifier Overflow Sulphide Analyzer	SIT-600 (SIT600-AIT)	(AI:1:08/13)	3-13	ORANGE/BLACK - GREEN → 32; GREEN/BLACK - ORANGE → 31
DISTRIBUTION P/T TIA 502		(AI:1:08/14)	3-14	BLACK/WHITE - ORANGE → 34; BLUE/WHITE - ORANGE → 33
		(AI:1:08/15)	3-15	ORANGE/WHITE - BLUE → 36; WHITE/RED - ORANGE → 35

All TB-8 wiring: W, BLK, BLK, W. All TB-7 wiring: W, BLK, S U,I OUT 6 GND, U,I I IN GND 2, O 7+ +3 O, O 8- -4 O. POWERED THROUGH BASE (DC24-F1)

ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-PLC1
DWG. NO. E012

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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: ANALOG INPUT CARD #4 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO. 35206-PLC1-E012

SCALE: NOT TO SCALE

DWG. NO. E012

REV. NO. 0

04 20 2007 2:36:30 PM, claudel.leveille

PLC1 ANALOG INPUT MODULE # 5-A

FIELD

PANEL TERMINALS

RACK 1 SLOT 9, 4-20mA ANALOG, 8 INPUT

35206-PLC1-E012 → DC24, 24COM → 35206-PLC1-E014

TB-8 / TB-7 / TB-6

High Lift Pump #5 Pressure	PIT-505	(PIT505-AIT)	(AI:1:09/00)	3-0	WHITE / BLACK	F15	WHITE / BLACK	2 / 1
Backwash Pump #2 Pressure	PIT-507	(PIT507-AIT)	(AI:1:09/01)	3-1	GREEN / RED	F16	GREEN / RED	4 / 3
Backwash Header Pressure	PIT-508	(PIT508-AIT)	(AI:1:09/02)	3-2	BLUE / ORANGE	F17	BLUE / ORANGE	6 / 5
High Lift Header Flow Meter	FIT-502	(fit-502-AIT)	(AI:1:09/03)	3-3	RED/BLACK / WHITE/BLACK		RED/BLACK / WHITE/BLACK	8 / 7
High Lift Header Flow Meter Pen #2	CHART-RECORDER	(FIT502-AIT2)					NOT TERMINATED / GREEN/BLACK	9
							NOT TERMINATED / ORANGE/BLACK	10
Clear Well #2 Level	LIT-402	(LIT402-AIT)	(AI:1:09/04)	3-4	BLACK/WHITE / BLUE/BLACK		BLACK/WHITE / BLUE/BLACK	12 / 11
Pump Well Cell #2 Level	LIT-404	(LIT404-AIT)	(AI:1:09/05)	3-5	GREEN/WHITE / RED/WHITE		GREEN/WHITE / RED/WHITE	14 / 13
Water Tower Level	LIT-WT01	(LITWT01-AIT)	(AI:1:09/06)	3-6	BLACK/RED / BLUE/WHITE		BLACK/RED / BLUE/WHITE	16 / 15
Water Tower Level Pen #3	CHART-RECORDER	(LITWT01-AIT2)						
			(AI:1:09/07)	3-7	ORANGE/RED / WHITE/RED	F18	ORANGE/RED / WHITE/RED	18 / 17

All modules powered through base (DC24-F1)

MODULE TERMINALS

ANALOG INPUT MODULE
AB # 1756-IF16

IN-0	2	1	RTN-0
IN-1	4	3	RTN-1
IN-2	6	5	RTN-2
IN-3	8	7	RTN-3
RTN	10	9	RTN
IN-4	12	11	RTN-4
IN-5	14	13	RTN-5
IN-6	16	15	RTN-6
IN-7	18	17	RTN-7
IN-8	20	19	RTN-8
IN-9	22	21	RTN-9
IN-10	24	23	RTN-10
IN-11	26	25	RTN-11
RTN	28	27	RTN
IN-12	30	29	RTN-12
IN-13	32	31	RTN-13
IN-14	34	33	RTN-14
IN-15	36	35	RTN-15

WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-PLC1
DWG. NO. E013

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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
DESCRIPTION: ANALOG INPUT CARD #5 LOOP DRAWING
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DATE: 04/19/2006
FILE NO. 35206-PLC1-E013
SCALE: NOT TO SCALE
DWG. NO. E013
REV. NO. 0

04 20 2007 2:36:36 PM, claudel.leveille

PLC1 ANALOG INPUT MODULE # 5-B

FIELD

PANEL TERMINALS

RACK 1 SLOT 9, 4-20mA ANALOG, 8 INPUT

DC24
35206-PLC1-E013
24COM

TB-9 / TB-7

Clarifier Settling Valve Tank B To Sludge Thickner	BFV-631	(BFV631-AIT)	(AI:1:09/08)	3-8	RED/GREEN BLUE/RED	RED/GREEN BLUE/RED	20 19
Sludge Thickner Level #2	LIT-602	(LIT602-AIT)	(AI:1:09/09)	3-9	BLACK/WHITE - RED ORANGE/GREEN POWERED THROUGH BASE (DC24-F1)	BLACK/WHITE - RED ORANGE/GREEN	22 21
Backwash Sludge Tank #2 Level	LIT-605	(LIT605-AIT)	(AI:1:09/10)	3-10	RED/WH-BK WHITE/BLACK - RED POWERED THROUGH BASE (DC24-F1)	WHITE/BLACK - RED	24 23
					NOT TERMINATED	BLUE/BLACK - WHITE	27
Sludge Blanket Level Monitor #2	SBL-601	(SBL601-AIT)	(AI:1:09/11)	3-11	~~RED/BLACK - WHITE~~ ORG-/BK-WH ~~BLUE~~/BLACK - WHITE GRN/BK-WH POWERED THROUGH BASE (DC24-F1)	~~RED/BLACK - WHITE~~ GREEN/BLACK - WHITE	26 25
					NOT TERMINATED	BLACK/RED - GREEN	28
Hydrocyclone Reject Flow Meter	FIT-603	(FIT603-AIT)	(AI:1:09/12)	3-12	~~ORANGE/BLACK - WHITE~~ RED/BLACK - GREEN WHITE/RED -GREEN POWERED THROUGH BASE (DC24-F1)	ORANGE/BLACK - WHITE RED/BLACK -GREEN WHITE/RED -GREEN	30 29
Backwash Sludge Influent Chamber Level	LIT-604	(LIT604-AIT)	(AI:1:09/13)	3-13	ORANGE/BLACK - GREEN GREEN/BLACK - ORANGE POWERED THROUGH BASE (DC24-F1)	ORANGE/BLACK - GREEN GREEN/BLACK - ORANGE	32 31
			(AI:1:09/14)	3-14	BLACK/WHITE - ORANGE BLUE/WHITE - ORANGE POWERED THROUGH BASE (DC24-F1)	BLACK/WHITE - ORANGE BLUE/WHITE - ORANGE	34 33
			(AI:1:09/15)	3-15	ORANGE/WHITE - BLUE WHITE/RED - ORANGE POWERED THROUGH BASE (DC24-F1)	ORANGE/WHITE - BLUE WHITE/RED - ORANGE	36 35

DC24 → F2 3A (DC24-F2) → PTB-2 1+, 5+
24COM → PTB-2 2-, 6-
PTB-2 3 NC, NC 7, 4 NC, NC 8
PTB-2 PROVIDES POWER TO ANALOG INPUT SIGNAL ISOLATORS THROUGH THE BASE (POWERED THROUGH BASE (DC24-F1))

MODULE TERMINALS

ANALOG INPUT MODULE
AB # 1756-IF16

IN-0	2	1	RTN-0
IN-1	4	3	RTN-1
IN-2	6	5	RTN-2
IN-3	8	7	RTN-3
RTN	10	9	RTN
IN-4	12	11	RTN-4
IN-5	14	13	RTN-5
IN-6	16	15	RTN-6
IN-7	18	17	RTN-7
IN-8	20	19	RTN-8
IN-9	22	21	RTN-9
IN-10	24	23	RTN-10
IN-11	26	25	RTN-11
RTN	28	27	RTN
IN-12	30	29	RTN-12
IN-13	32	31	RTN-13
IN-14	34	33	RTN-14
IN-15	36	35	RTN-15

WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE - RED
5	ORANGE	23	WHITE/BLACK - RED
6	BLUE	24	RED/BLACK - WHITE
7	WHITE/BLACK	25	GREEN/BLACK - WHITE
8	RED/BLACK	26	ORANGE/BLACK - WHITE
9	GREEN/BLACK	27	BLUE/BLACK - WHITE
10	ORANGE/BLACK	28	BLACK/RED - GREEN
11	BLUE/BLACK	29	WHITE/RED - GREEN
12	BLACK/WHITE	30	RED/BLACK - GREEN
13	RED/WHITE	31	GREEN/BLACK - ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK - GREEN
15	BLUE/WHITE	33	BLUE/WHITE - ORANGE
16	BLACK/RED	34	BLACK/WHITE - ORANGE
17	WHITE/RED	35	WHITE/RED - ORANGE
18	ORANGE/RED	36	ORANGE/WHITE - BLUE

FILE NO. 35206-PLC1
DWG. NO. E014

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	CHK'D	ENG'D
		THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED			ORIGINAL WORK	ORIGINAL ENG. PRIMARY

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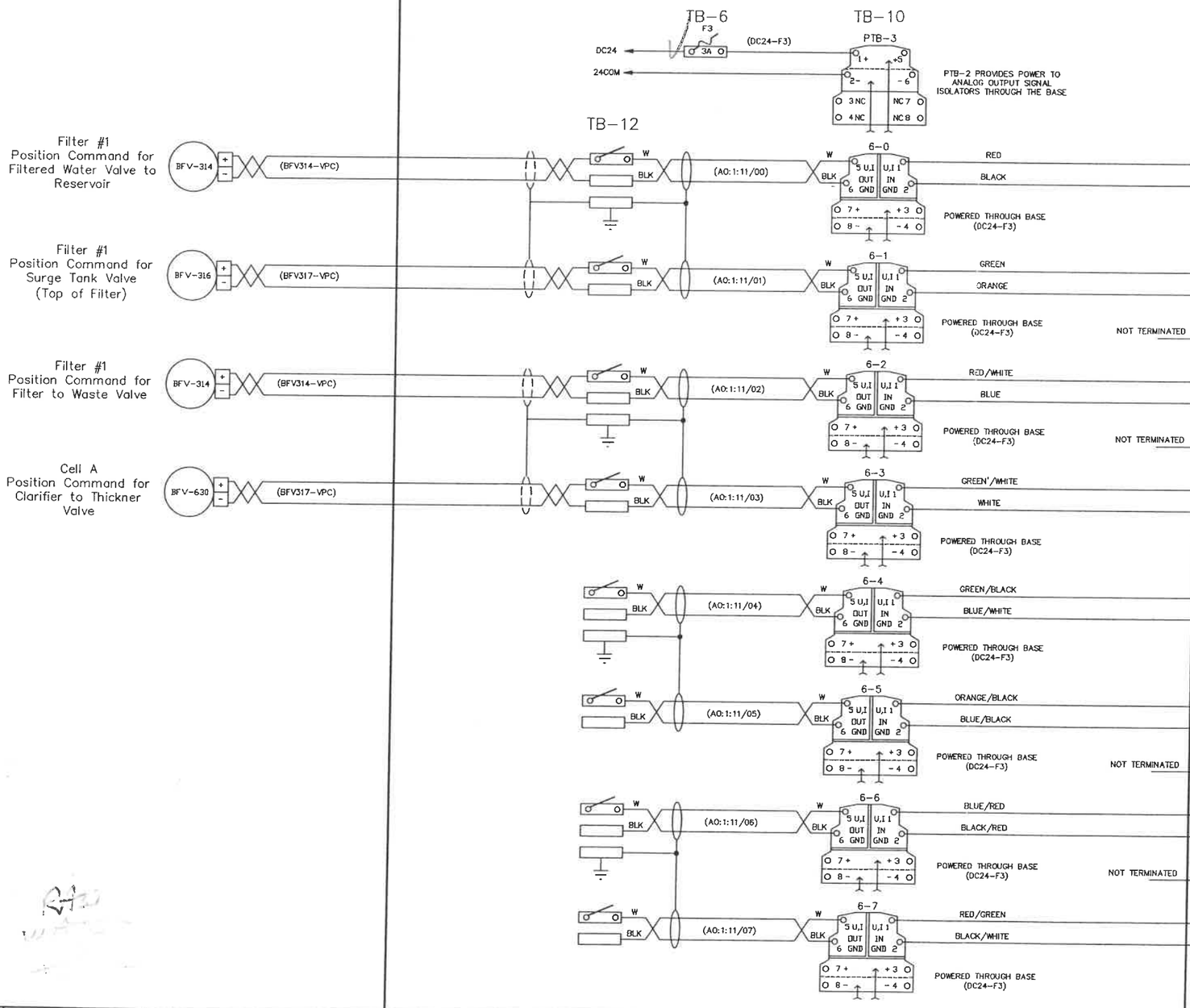
PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
DESCRIPTION: ANALOG INPUT CARD #5 LOOP DRAWING
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DATE: 04/19/2006
FILE NO. 35206-PLC1-E014
SCALE: NOT TO SCALE
DWG. NO. E014
REV. NO. 0

04 20 2007 2:36:41 PM, claudel.leveille

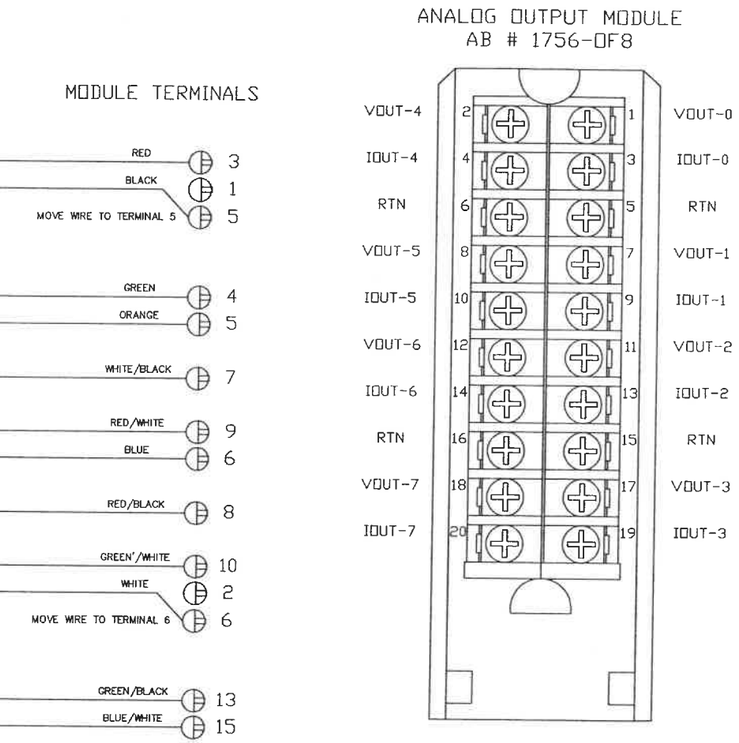
PLC1 ANALOG OUTPUT MODULE # 1

FIELD

PANEL TERMINALS



RACK 1 SLOT 11, 4-20mA ANALOG, 8 OUTPUTS



WIRE COLOR TABLE AND PINOUTS			
1	BLACK	11	BLUE/BLACK
2	WHITE	12	BLACK/WHITE
3	RED	13	RED/WHITE
4	GREEN	14	GREEN/WHITE
5	ORANGE	15	BLUE/WHITE
6	BLUE	16	BLACK/RED
7	WHITE/BLACK	17	WHITE/RED
8	RED/BLACK	18	ORANGE/RED
9	GREEN/BLACK	19	BLUE/RED
10	ORANGE/BLACK	20	RED/GREEN

FILE 35206-PLC1
DWG. NO. E015

REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DSGN. MGR. CHECK	DSGN ENG. PRIMER

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: ANALOG OUTPUT CARD #1 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO.: 35206-PLC1-E015

SCALE: NOT TO SCALE

DWG. NO.: E015

REV. NO.: 0

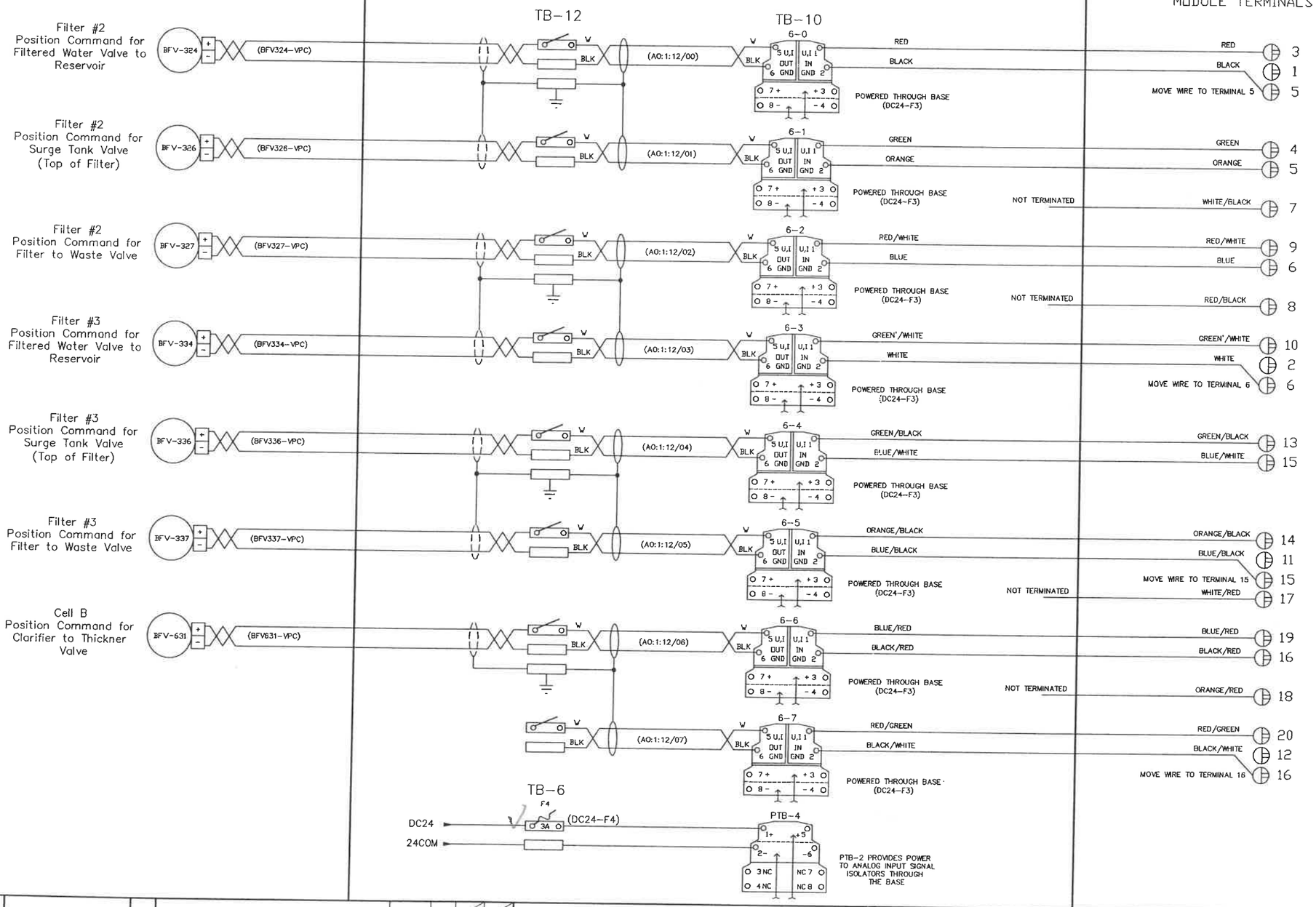
04 20 2007 2:36:46 PM, claudel.leveille

PLC1 ANALOG OUTPUT MODULE # 2

FIELD

PANEL TERMINALS

RACK 1 SLOT 12, 4-20mA ANALOG, 8 OUTPUTS



WIRE COLOR TABLE AND PINOUTS			
1	BLACK	11	BLUE/BLACK
2	WHITE	12	BLACK/WHITE
3	RED	13	RED/WHITE
4	GREEN	14	GREEN/WHITE
5	ORANGE	15	BLUE/WHITE
6	BLUE	16	BLACK/RED
7	WHITE/BLACK	17	WHITE/RED
8	RED/BLACK	18	ORANGE/RED
9	GREEN/BLACK	19	BLUE/RED
10	ORANGE/BLACK	20	RED/GREEN

FILE NO. 35206-PLC1
DWG. NO. E016

REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DSGN. ENG. CHECK	DSGN. ENG. APPROVE

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: ANALOG OUTPUT CARD #3 LOOP DRAWING

DATE: 04/19/2006

FILE NO. 35206-PLC1-E016

SCALE: NOT TO SCALE

DWG. NO. E016

REV. NO. 0

04 20 2007 2:36:51 PM, claudel.leveille

PLC1 DIGITAL INPUT MODULE # 1

FIELD

Filter #1 Influent Channel
- Valve is Open: BFV-310 (UPS-7) (BFV310-OP)
- Valve is Close: BFV-310 (UPS-7) (BFV310-CP)

Filter #1 Filtered Water Valve to Reservoir
- Valve is Open: BFV-314 (UPS-7) (BFV314-OP)
- Valve is Close: BFV-314 (UPS-7) (BFV314-CP)

Filter #1 Backwash Valve
- Valve is Open: BFV-315 (UPS-7) (BFV315-OP)
- Valve is Close: BFV-315 (UPS-7) (BFV315-CP)

Filter #1 Surge Tank Valve
- Valve is Open: BFV-316 (UPS-7) (BFV316-OP)
- Valve is Close: BFV-316 (UPS-7) (BFV316-CP)

Filter #1 Filter To Waste
- Valve is Open: BFV-317 (UPS-7) (BFV317-OP)
- Valve is Close: BFV-317 (UPS-7) (BFV317-CP)

Filter #1 Air Blower Valve
- Valve is Open: BFV-318 (UPS-7) (BFV318-OP)
- Valve is Close: BFV-318 (UPS-7) (BFV318-CP)

Cell A of Clarifier to Sludge Thickner Valve
- Valve is Open: BFV-630 (UPS-7) (BFV631-OP)
- Valve is Close: BFV-630 (UPS-7) (BFV631-CP)

Pump Well Cell #1 Level Switch in Alarm (Low Level Lockout) Refer to 35206-PLC1-E026: (UPS-7) LR1 6 5 (LS401-LA-I)

Spare: spare

PANEL TERMINALS

(UPS-7) UPS-7 3A → 35206-PLC1-E003

TB-1
16 PT. INTERFACE MODULE

(UPS-7) (UPS-7) (UPS-7) UPS-NEUT. L2 L2

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 L2 L2

ALLEN BRADLEY
PART #1492-IMF20D120

(UPS-7)

UPS-NEUT.

ALLEN BRADLEY
PART #1756-CABLE010A

RACK 2 SLOT 5, 110VAC 16 PT. INPUT

AB # 1756-IA16

IN-1 IN-0
IN-3 IN-2
IN-5 IN-4
IN-7 IN-6
L-2 L-2
IN-9 IN-8
IN-11 IN-10
IN-13 IN-12
IN-15 IN-14
L-2 L-2

FILE NO. 35206-PLC1
DWG. NO. E018

REV.	DESCRIPTION	DATE	BY	DSN. MOD. CHECK	DRDR ENG. APPROV.
REF. DWG. NO.	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED				

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION: DIGITAL INPUT CARD #1 LOOP DRAWING
DATE: 04/19/2006
FILE NO. 35206-PLC1-E018
SCALE: NOT TO SCALE
DWG. NO. E018
REV. NO. 0

04 20 2007 2:36:56 PM, claudel.leveille

PLC1 DIGITAL INPUT MODULE # 2

FIELD

PANEL TERMINALS

RACK 2 SLOT 6, 110VAC 16 PT. INPUT

Filter #2 Influent Channel
- Valve is Open: BFV-320 (UPS-8) (BFV320-OP)
- Valve is Close: BFV-320 (UPS-8) (BFV320-CP)

Filter #2 Filtered Water Valve to Reservoir
- Valve is Open: BFV-324 (UPS-8) (BFV324-OP)
- Valve is Close: BFV-324 (UPS-8) (BFV324-CP)

Filter #2 Backwash Valve
- Valve is Open: BFV-325 (UPS-8) (BFV325-OP)
- Valve is Close: BFV-325 (UPS-8) (BFV325-CP)

Filter #2 Surge Tank Valve
- Valve is Open: BFV-326 (UPS-8) (BFV326-OP)
- Valve is Close: BFV-326 (UPS-8) (BFV326-CP)

Filter #2 Filter To Waste
- Valve is Open: BFV-327 (UPS-8) (BFV327-OP)
- Valve is Close: BFV-327 (UPS-8) (BFV327-CP)

Filter #2 Air Blower Valve
- Valve is Open: BFV-328 (UPS-8) (BFV328-OP)
- Valve is Close: BFV-328 (UPS-8) (BFV328-CP)

Cell B of Clarifier to Sludge Thickner Valve
- Valve is Open: BFV-631 (UPS-8) (BFV631-OP)
- Valve is Close: BFV-631 (UPS-8) (BFV631-CP)

Pump Well Cell #2 Level Switch in Alarm (Low Level Lockout) Refer to 35206-PLC1-E026: (UPS-8) LR2 6 5 (LS402-LA-I)

Spare: spare

(UPS-8) UPS-8 3A → 35206-PLC1-E003

TB-1
16 PT. INTERFACE MODULE

(UPS-8) (UPS-8) (UPS-8) UPS-NEUT. L2 L2

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 L2 L2

ALLEN BRADLEY
PART #1492-INF20D120

(UPS-8)

UPS-NEUT.

ALLEN BRADLEY
PART #1756-CABLE010A

AB # 1756-IA16

IN-1	IN-0
IN-3	IN-2
IN-5	IN-4
IN-7	IN-6
L-2	L-2
IN-9	IN-8
IN-11	IN-10
IN-13	IN-12
IN-15	IN-14
L-2	L-2

FILE NO. 35206-PLC1
DWG. NO. E019

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DRGN. MGR. CHECK	DRGN ENG. PM/MGR
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CANADA, P1A 4K6
P / 705-840-6000
F / 705-840-6001
Web Site/ www.stroma.ca

PROJECT NAME:	DEEP RIVER UPGRADES CONTRACT 2006-352
DESCRIPTION:	DIGITAL INPUT CARD #2 LOOP DRAWING
CLIENT:	CITY OF DEEP RIVER
LOCATION:	DEEP RIVER WATER TREATMENT PLANT
DATE:	04/19/2006
FILE NO.	35206-PLC1-E019
SCALE:	NOT TO SCALE
DWG. NO.	E019
REV. NO.	0

04 20 2007 2:37:02 PM, claudel.leveille

PLC1 DIGITAL INPUT MODULE # 3

FIELD

PANEL TERMINALS

RACK 2 SLOT 7, 110VAC 16 PT. INPUT

Filter #3 Influent Channel	Valve is Open	BFV-330 (UPS-9)	(BFV330-OP)
	Valve is Close	BFV-330 (UPS-9)	(BFV330-CP)
Filter #3 Filtered Water Valve to Reservoir	Valve is Open	BFV-334 (UPS-9)	(BFV334-OP)
	Valve is Close	BFV-334 (UPS-9)	(BFV334-CP)
Filter #3 Backwash Valve	Valve is Open	BFV-335 (UPS-9)	(BFV335-OP)
	Valve is Close	BFV-335 (UPS-9)	(BFV335-CP)
Filter #3 Surge Tank Valve	Valve is Open	BFV-336 (UPS-9)	(BFV336-OP)
	Valve is Close	BFV-336 (UPS-9)	(BFV336-CP)
Filter #3 Filter To Waste	Valve is Open	BFV-337 (UPS-9)	(BFV337-OP)
	Valve is Close	BFV-337 (UPS-9)	(BFV337-CP)
Filter #3 Air Blower Valve	Valve is Open	BFV-338 (UPS-9)	(BFV338-OP)
	Valve is Close	BFV-338 (UPS-9)	(BFV338-CP)
Filter Room Low Temperature		TS-201 (UPS-9)	(TS201-LA)
~~Sludge Pump Room~~ Low Temperature		TS-601 (UPS-9)	(TS601-LA)
Backwash Surge Tank Influent High Level		LS-601 (UPS-9)	(LS601-HA)
Spare		spare (UPS-9)	

(UPS-9) → UPS-9 3A → 35206-PLC1-E003

TB-1
16 PT. INTERFACE MODULE

(UPS-9) (UPS-9) (UPS-9) UPS-NEUT.

L2 L2

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 L2 L2

ALLEN BRADLEY
PART #1492-IMF20D120

(UPS-9)

UPS-NEUT.

ALLEN BRADLEY
PART #1756-CABLE010A

AB # 1756-IA16

IN-1	IN-0
IN-3	IN-2
IN-5	IN-4
IN-7	IN-6
L-2	L-2
IN-9	IN-8
IN-11	IN-10
IN-13	IN-12
IN-15	IN-14
L-2	L-2

FILE NO. 35206-PLC1
DWG. NO. E020

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DRGN MGR. CHECK	DSGN ENG. APPROVE

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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: DIGITAL INPUT CARD #3 LOOP DRAWING

DATE: 04/19/2006

FILE NO.: 35206-PLC1-E020

SCALE: NOT TO SCALE

DWG. NO.: E020

REV. NO.: 0

04 20 2007 2:37:07 PM, claudel.leveille

PLC1 DIGITAL INPUT MODULE # 4

FIELD

Future UV System

- UV #1 Common Alarm — UV-303 (UPS-10) (UV303-XCA)
- UV #1 Major Alarm — UV-303 (UPS-10) (UV303-XMJ)
- UV #1 Minor Alarm — UV-303 (UPS-10) (UV303-XMN)
- UV #1 Lamp Status — UV-303 (UPS-10) (UV303-LMP-ST)
- UV #1 Ready Status — UV-303 (UPS-10) (UV303-ST)
- Finished Water pH Alarm (to Distribution) Alarm Contact — PIA-501 (UPS-10) (PIA501-XA)
- Finished Water Turbidity (to Distribution) Alarm Contact — TIA-501 (UPS-10) (TIA501-XA)
- Finished Water Free Chlorine (to Distribution) Alarm Contact — CIA-502 (UPS-10) (CIA502-XA)
- Finished Water Fluoride (to Distribution) Alarm Contact — FIA-503 (UPS-10) (FIA503-XA)
- Clearwell Cell #2 Free Chlorine Alarm Contact — CIA-401 (UPS-10) (CIA401-XA)
- Sludge Blanket Level Alarm Contact — SBL-600 (UPS-10) (SLB600-XA)
- Points #1 from Radio Water Tank Radio — ST-WT-01 (UPS-10) (STWT01-XA)
- Points #2 from Radio Water Tank Radio — ST-WT-02 (UPS-10) (STWT02-XA)
- Transmition Alarm from Water Tank Radio — TX-WT-01 (UPS-10) (TXWT01-XA)
- Spare — SPARE (UPS-10) (PIA502-XA)
- SPARE (UPS-10)

CLIENT PLC

DISTRIBUTION PIT ALARM CONTACT

PIA502-XA

AM & PM. LOW TEMP

PANEL TERMINALS

UPS-10 (UPS-10) 3A → 35206-PLC1-E003

TB-1
16 PT. INTERFACE MODULE

(UPS-10) (UPS-10) (UPS-10) UPS-NEUT.

L2 L2

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 L2 L2

ALLEN BRADLEY
PART #1492-IMF20D120

(UPS-10)

UPS-NEUT.

ALLEN BRADLEY
PART #1756-CABLE010A

RACK 2 SLOT 8, 110VAC 16 PT. INPUT

AB # 1756-IA16

IN-1	1	0	IN-0
IN-3	3	2	IN-2
IN-5	5	4	IN-4
IN-7	7	6	IN-6
L-2	9	8	L-2
IN-9	11	10	IN-8
IN-11	13	12	IN-10
IN-13	15	14	IN-12
IN-15	17	16	IN-14
L-2	19	18	L-2
	20		

FILE NO. 35206-PLC1
DWG NO. E021

REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	CHKD. WORK CHECK	CHKD. DWG. PRIMARY

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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: DIGITAL INPUT CARD #4 LOOP DRAWING

DATE: 04/19/2006

FILE NO.: 35206-PLC1-E021

SCALE: NOT TO SCALE

DWG. NO.: E021

REV. NO.: 0

04 20 2007 2:37:12 PM, claudel.leveille

PLC1 DIGITAL INPUT MODULE # 5

FIELD

Future UV System

- UV #2 Common Alarm — UV-304 UPS-11 (UV304-XCA)
- UV #2 Major Alarm — UV-304 UPS-11 (UV304-XMJ)
- UV #2 Minor Alarm — UV-304 UPS-11 (UV304-XMN)
- UV #2 Lamp Status — UV-304 UPS-11 (UV304-LMP-ST)
- UV #2 Ready Status — UV-304 UPS-11 (UV304-ST)
- Sludge Blanket Level Alarm Contact — SBL-601 UPS-11 (PIA501-XA)
- Shower #1 in Waste Area Alarm Contact — SA-600 UPS-11 (SA600-XA)
- Shower #2 in Waste Area Alarm Contact — SA-601 UPS-11 (SA601-XA)
- Shower #2 in Waste Area Alarm Contact — SA-602 UPS-11 (SA602-XA)
- Spare — SPARE
- Spare — SPARE
- Spare — SPARE
- Spare — SPARE
- Lower Gallery High Flood Alarm — LS-610 (DC24-~~F20~~) F-19 (LS610-HA)
- Filter Room Pipe Gallery High Flood Alarm — LS-301 (DC24-F20) ~ F19 (LS301-HA)
- Spare 24V DC Input — SPARE

PANEL TERMINALS

UPS-11 → 3A → 35206-PLC1-E003

TB-1
16 PT. INTERFACE MODULE

UPS-11, UPS-11, UPS-NEUT., UPS-11, L2, L2

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 L2 L2

ALLEN BRADLEY
PART #1492-IMF20D120

UPS-11

UPS-NEUT.

A2-COM → 24COM

TB-7

TB-11

(LS301-HA) 1 (R1-A2) R1-A1 + → A1 24V A2 R1 → 14 11 12 (DI:2:04/13)

(LS610-HA) 2 (R2-A2) R2-A1 + → A1 24V A2 R2 → 14 11 12 (DI:2:04/14)

3 (R3-A2) R3-A1 + → A1 24V A2 R3 → 14 11 12 (DI:2:04/15)

UPS-11

RACK 2 SLOT 9, 110VAC 16 PT. INPUT

AB # 1756-IA16

IN-1 IN-0
IN-3 IN-2
IN-5 IN-4
IN-7 IN-6
L-2 L-2
IN-9 IN-8
IN-11 IN-10
IN-13 IN-12
IN-15 IN-14
L-2 L-2

ALLEN BRADLEY
PART #1756-CABLE010A

TB-6
F19

TB-11
(DC24-F20) (DC24-F20) DC24-F19 DC24-F19 2A → 35206-PLC1-E004

REV.	DESCRIPTION	DATE	BY	DSGN. WDL CHECK	DRGN ENG. PALMER

REF. DWG. NO.

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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION: DIGITAL INPUT CARD #5 LOOP DRAWING
DATE: 04/19/2006
FILE NO. 35206-PLC1-E022
SCALE: NOT TO SCALE
DWG. NO. E022
REV. NO. 0

FILE NO. 35206-PLC1
DWG. NO. E022

04 20 2007 2:37:17 PM, claudel.leveille

PLC1 DIGITAL OUTPUT MODULE #2

FIELD

PANEL TERMINALS

RACK 2 SLOT 12, 10–265VAC 5–150VDC, 16 PT OUTPUT

INTERPOSING RELAY

24COM

F22 3A (DC24–F22) (DC24–F0)

F23 3A (DC24–F23) (DC24–F0)

35206–PLC1–E004

TB–2 / TB–3

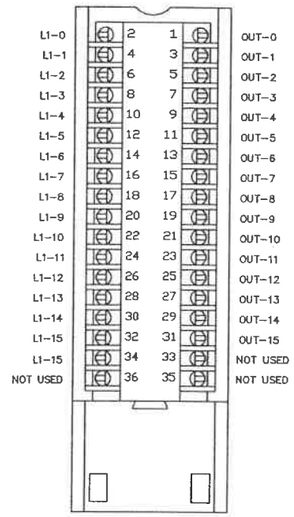
	Field	TB–2	TB–3	Rack 2 Slot 12
1	Filter #2 Command to Open Influent Channel Valve	(BFV320–OVC–A) / (BFV320–OVC–B)	1 / 2 (D02:12/00A) / (D02:12/00B)	BLACK / 24COM
2	Filter #2 Command to Close Influent Channel Valve	(BFV320–CVC–A) / (BFV320–CVC–B)	3 / 4 (D02:12/01A) / (D02:12/01B)	RED / 24COM
3	Filter #2 Command to Open Backwash Valve	(BFV325–OVC–A) / (BFV325–OVC–B)	5 / 6 (D02:12/02A) / (D02:12/02B)	ORANGE / 24COM
4	Filter #2 Command to Close Backwash Valve	(BFV325–CVC–A) / (BFV325–CVC–B)	7 / 8 (D02:12/03A) / (D02:12/03B)	WHITE/BLACK / 24COM
5	Filter #2 Command to Open Air Blower Valve	(BFV328–OVC–A) / (BFV328–OVC–B)	9 / 10 (D02:12/04A) / (D02:12/04B)	GREEN/BLACK / 24COM
6	Filter #2 Command to Close Air Blower Valve	(BFV328–CVC–A) / (BFV328–CVC–B)	11 / 12 (D02:12/05A) / (D02:12/05B)	BLUE/BLACK / 24COM
7			13 / 14 (D02:12/06A) / (D02:12/06B)	RED/WHITE / 24COM
8			15 / 16 (D02:12/07A) / (D02:12/07B)	BLUE/WHITE / 24COM
9			17 / 18 (D02:12/08A) / (D02:12/08B)	WHITE/RED / 24COM
10			19 / 20 (D02:12/09A) / (D02:12/09B)	BLUE/RED / 24COM
11			21 / 22 (D02:12/10A) / (D02:12/10B)	ORANGE/GREEN / 24COM
12			23 / 24 (D02:12/11A) / (D02:12/11B)	WHITE/BLACK – RED / 24COM
13			25 / 26 (D02:12/12A) / (D02:12/12B)	GREEN/BLACK – WHITE / 24COM
14			27 / 28 (D02:12/13A) / (D02:12/13B)	BLUE/BLACK – WHITE / 24COM
15			29 / 30 (D02:12/14A) / (D02:12/14B)	RED/BLACK – GREEN / 24COM
16			31 / 32 (D02:12/15A) / (D02:12/15B)	GREEN/BLACK – ORANGE / 24COM

5TH Auto Dialler

6TH Auto Dialler

Rack 2 Slot 12	
1	BLACK
2	WHITE
3	RED
4	GREEN
5	ORANGE
6	BLUE
7	WHITE/BLACK
8	RED/BLACK
9	GREEN/BLACK
10	ORANGE/BLACK
11	BLUE/BLACK
12	BLACK/WHITE
13	RED/WHITE
14	GREEN/WHITE
15	BLUE/WHITE
16	BLACK/RED
17	WHITE/RED
18	ORANGE/RED
19	BLUE/RED
20	RED/GREEN
21	ORANGE/GREEN
22	BLACK/WHITE – RED
23	WHITE/BLACK – RED
24	RED/BLACK – WHITE
25	GREEN/BLACK – WHITE
26	ORANGE/BLACK – WHITE
27	BLUE/BLACK – WHITE
28	BLACK/RED – GREEN
29	WHITE/RED – GREEN
30	RED/BLACK – GREEN
31	GREEN/BLACK – ORANGE
32	ORANGE/BLACK – GREEN

ANALOG INPUT MODULE
AB # 1756–IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206–PLC1
DWG. NO. E024

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	ORIGN. MAN. CHECK	ORIGN. DWG. CHK MGR
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P / 705–840–6000
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Web Site/ www.stroma.ca

PROJECT NAME:	DEEP RIVER UPGRADES CONTRACT 2006–352
CLIENT:	CITY OF DEEP RIVER
LOCATION:	DEEP RIVER WATER TREATMENT PLANT
DESCRIPTION:	DIGITAL OUTPUT CARD #2 LOOP DRAWING
DATE:	04/19/2006
FILE NO.	35206–PLC1–E024
SCALE:	NOT TO SCALE
DWG. NO.	E024
REV. NO.	0

04 20 2007 2:37:28 PM, claudel.leveille

PLC1 DIGITAL OUTPUT MODULE #3

FIELD

PANEL TERMINALS

RACK 2 SLOT 13, 10–265VAC 5–150VDC, 16 PT OUTPUT

INTERPOSING RELAY

		TB–2		TB–3		RACK 2 SLOT 13
Filter #3 Command to Open Influent Channel Valve	(BFV330–OVC–A)	1	(DO2:13/00A)	14	BLACK	1
	(BFV330–OVC–B)	2	(DO2:13/00B)	12	24COM	
Filter #3 Command to Close Influent Channel Valve	(BFV330–CVC–A)	3	(DO2:13/01A)	14	RED	3
	(BFV330–CVC–B)	4	(DO2:13/01B)	12	24COM	
Filter #3 Command to Open Backwash Valve	(BFV335–OVC–A)	5	(DO2:13/02A)	14	ORANGE	5
	(BFV335–OVC–B)	6	(DO2:13/02B)	12	24COM	
Filter #3 Command to Close Backwash Valve	(BFV355–CVC–A)	7	(DO2:13/03A)	14	WHITE/BLACK	7
	(BFV335–CVC–B)	8	(DO2:13/03B)	12	24COM	
Filter #3 Command to Open Air Blower Valve	(BFV338–OVC–A)	9	(DO2:13/04A)	14	GREEN/BLACK	9
	(BFV338–OVC–B)	10	(DO2:13/04B)	12	24COM	
Filter #3 Command to Close Air Blower Valve	(BFV338–CVC–A)	11	(DO2:13/05A)	14	BLUE/BLACK	11
	(BFV338–CVC–B)	12	(DO2:13/05B)	12	24COM	
Command to Open Backwash Water Clarifier Sulphite Isolating Solonoid Valve	(SV601–OVC–A)	13	(DO2:13/06A)	14	RED/WHITE	13
	(SV601–OVC–B)	14	(DO2:13/06B)	12	24COM	
		15	(DO2:13/07A)	14	BLUE/WHITE	15
		16	(DO2:13/07B)	12	24COM	
		17	(DO2:13/08A)	14	WHITE/RED	17
		18	(DO2:13/08B)	12	24COM	
		19	(DO2:13/09A)	14	BLUE/RED	19
		20	(DO2:13/09B)	12	24COM	
		21	(DO2:13/10A)	14	ORANGE/GREEN	21
		22	(DO2:13/10B)	12	24COM	
		23	(DO2:13/11A)	14	WHITE/BLACK – RED	23
		24	(DO2:13/11B)	12	24COM	
		25	(DO2:13/12A)	14	GREEN/BLACK – WHITE	25
		26	(DO2:13/12B)	12	24COM	
		27	(DO2:13/13A)	14	BLUE/BLACK – WHITE	27
		28	(DO2:13/13B)	12	24COM	
7th Auto Dialler		29	(DO2:13/14A)	14	RED/BLACK – GREEN	29
		30	(DO2:13/14B)	12	24COM	
8th Auto Dialler		31	(DO2:13/15A)	14	GREEN/BLACK – ORANGE	31
		32	(DO2:13/15B)	12	24COM	

24COM → (DC24–F24) → F24 3A → (DC24–F0)

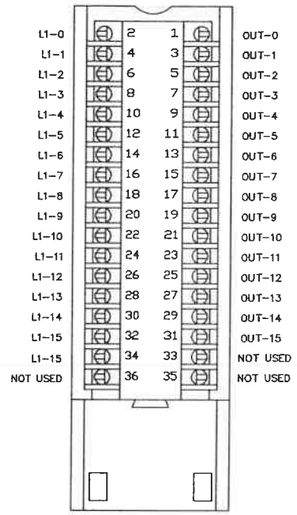
(DC24–F25) → F25 3A → (DC24–F0)

TB–3 D

35206–PLC1–E004

RACK 2 SLOT 13 pins 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32

ANALOG INPUT MODULE
AB # 1756–IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206–PLC1
DWG. NO. E025

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY
		THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED		

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F / 705–840–6001
Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006–352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: DIGITAL OUTPUT CARD #3 LOOP DRAWING

DATE: 04/19/2006

FILE NO. 35206–PLC1–E025

SCALE: NOT TO SCALE

DWG. NO. E025

REV. NO. 0

04 20 2007 2:37:33 PM, claudel.leveille

HIGH LIFT PUMP CUTOUT RELAYS

FIELD

PLC1 INTERNAL PANEL

PUMPS IN MCC

Pump Well Cell #1
Low Alarm
Lockout Level

LS-401 (UPS-12)
(LS401-LA)

TB-5 8

TB-4 UPS-7 (UPS-7) 3A UPS-L1B 35206-PLC1-E003 UPS-N TB-4 UPS-N

TB-5

(LR1-13) 13 LR1 14 (UPS-N)

3 2	(LR1-3)	1	(IT-P501-1)	(IT-P501-1) 1
	(LR1-2)	2	(IT-P501-2)	(IT-P501-2) 2 — HIGH LIFT PUMP P-501 INTERLOCK
6 5	(LR1-5)	3	(LS401-LA-I)	⊗ INPUT-15 ON PAGE 35206-PLC1-E018
9 8	(LR1-8)	4	(IT-P502-1)	(IT-P502-1) 1
	(LR1-9)	5	(IT-P502-2)	(IT-P502-2) 2 — HIGH LIFT PUMP P-502 INTERLOCK
12 11	(LR1-11)	6	(IT-P506-1)	(IT-P506-1) 1
	(LR1-12)	7	(IT-P506-2)	(IT-P506-2) 2 — BACKWASH PUMP P-506 INTERLOCK

UPS-12 (UPS-12) UPS-12 3A UPS-L1B 35206-PLC1-E003

Pump Well Cell #2
Low Alarm
Lockout Level

LS-402 (UPS-12)
(LS402-LA)

10

TB-4 UPS-8 (UPS-8) 3A UPS-L1B 35206-PLC1-E003 UPS-N TB-4 UPS-N

~~TB-5~~ ~~TB-11~~

(LR2-13) 13 LR2 14 (UPS-N)

3 2	(LR2-3)	11	(IT-P505-1)	(IT-P505-1) 1
	(LR2-2)	12	(IT-P505-2)	(IT-P505-2) 2 — HIGH LIFT PUMP P-505 INTERLOCK
6 5	(LR2-5)	13	(LS402-LA-I)	⊗ INPUT-15 ON PAGE 35206-PLC1-E019
9 8	(LR2-8)	14	(IT-P507-1)	(IT-P507-1) 1
	(LR2-9)	15	(IT-P507-2)	(IT-P507-2) 2 — BACKWASH PUMP P-507 INTERLOCK
12 11	(LR2-11)	16	(IT-P503-1)	(IT-P503-1) 1
	(LR2-12)	17	(IT-P503-2)	(IT-P503-2) 2 — HIGH LIFT PUMP P-503 INTERLOCK
17 16	~~(LR2-11)~~	18	(IT-P504-1)	(IT-P504-1) 1
	~~(LR2-12)~~	19	(IT-P504-2)	(IT-P504-2) 2 — HIGH LIFT PUMP P-504 INTERLOCK

FILE NO. 35206-PLC1
DWG. NO. E026

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY
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PROJECT NAME: DEEP RIVER WTP UPGRADES CONTRACT #35206
CLIENT: TOWN OF DEEP RIVER
LOCATION: WATER TREATMENT PLANT
DESCRIPTION: PUMP CUTOUT RELAYS
DATE: 09/10/2006
FILE NO.: 35206-PLC1-E026
SCALE: NOT TO SCALE
DWG. NO.: E026
REV. NO.: 0

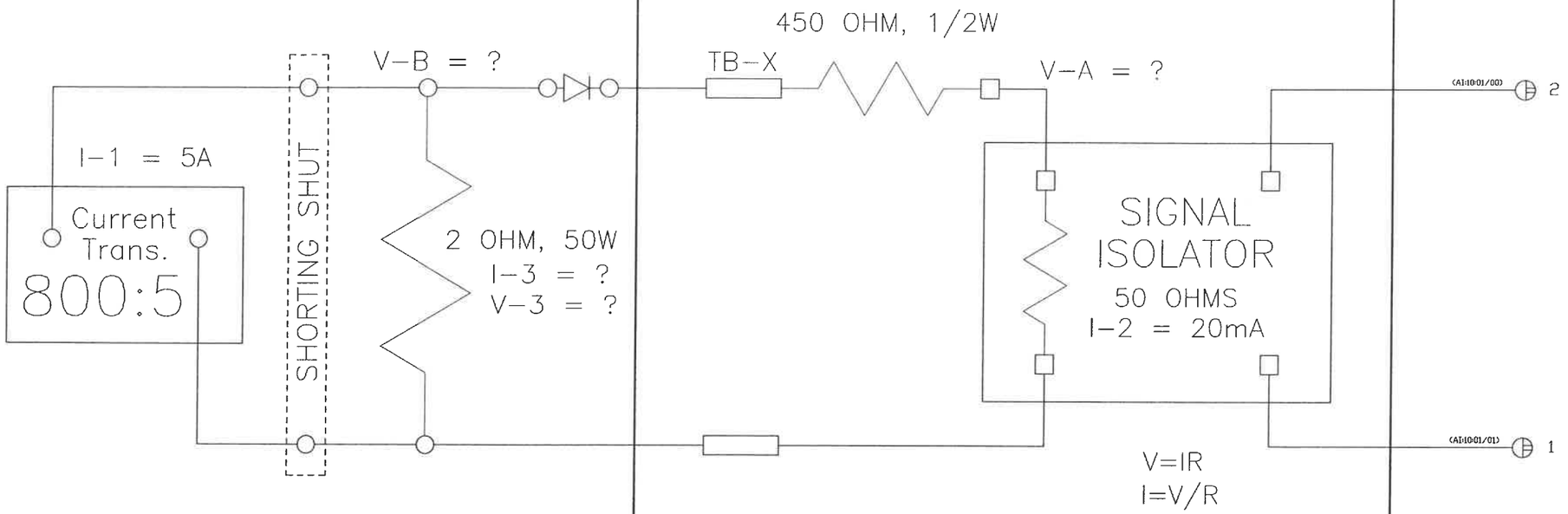
04 20 2007 2:37:38 PM, claudel.leveille

TYPICAL CURRENT SIGNAL TO MAIN PLANT PLC

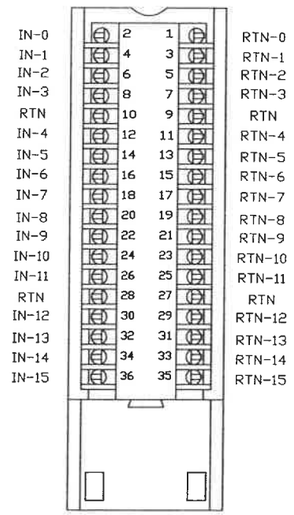
TRANSFER SWITCH	PANEL TERMINALS	RACK 1 SLOT 10, 4-20mA ANALOG, 8 INPUT

CURRENT TRANSFORMER AND SHORTING SHUT INSTALLED AND SUPPLIED BY OTHER

STROMA WILL SUPPLY RESISTERS



ANALOG INPUT MODULE
AB # 1756-IF16



V-A : .02 X 50 = 1V
V-B : 1V + (.020 X 450) = 10.0V
OR V-3 : 5 X 2 = 10V
I-3 : 10/2 = 5.0A
I-T : 5.0 + 0.02 = 5.02A

FILE NO. 35206-PLC1
DWG. NO. E027

REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DSGN MGR. CHECK	DRWN ENG. PRIMARY

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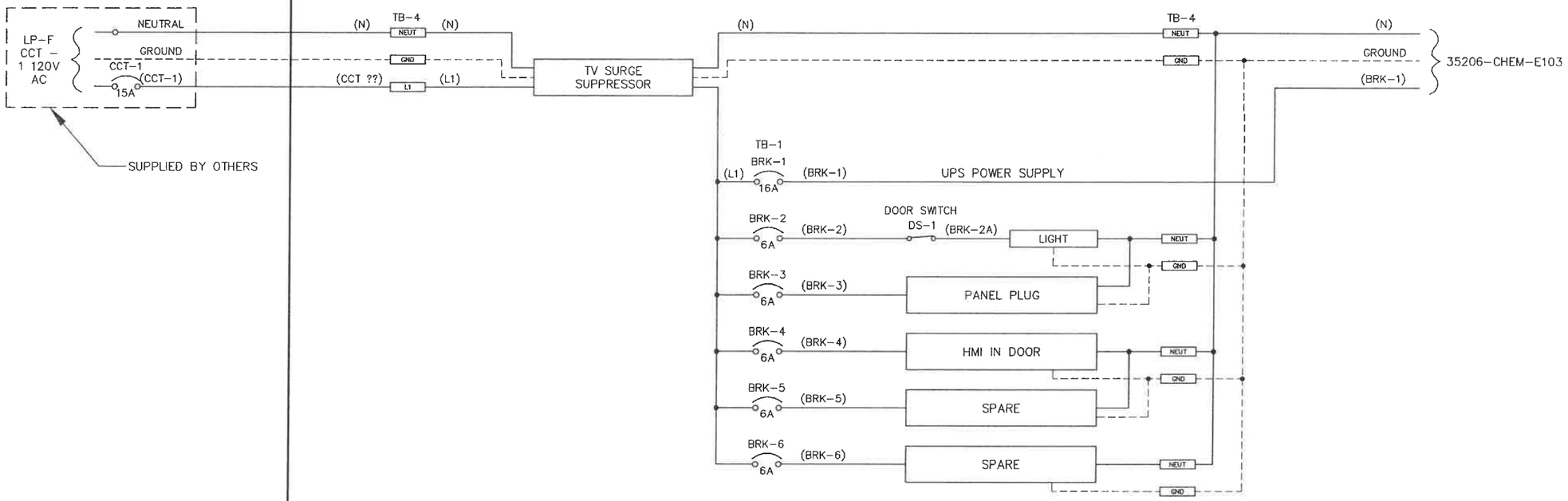
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CANADA, P1A 4K6
P / 705-840-6000
F / 705-840-6001
Web Site/ www.stroma.ca

PROJECT NAME:	CLIENT:	
DEEP RIVER CONTRACT #35206	TOWN OF DEEP RIVER	
	LOCATION: WATER TREATMENT PLANT	
DESCRIPTION: TYPICAL CT TO MAIN PLANT PLC	DATE: 09/10/2006	FILE NO. 35206-PLC1-E027
	SCALE: NOT TO SCALE	DWG. NO. E027 / REV. NO. 0

04 20 2007 2:37:43 PM, claudel.leveille

FIELD

CHEM PANEL 110V POWER DISTRIBUTION



FILE NO. 35206-CHEM DWG. NO. E102	REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DRAWN / CHECK	DESIGN / MGR.

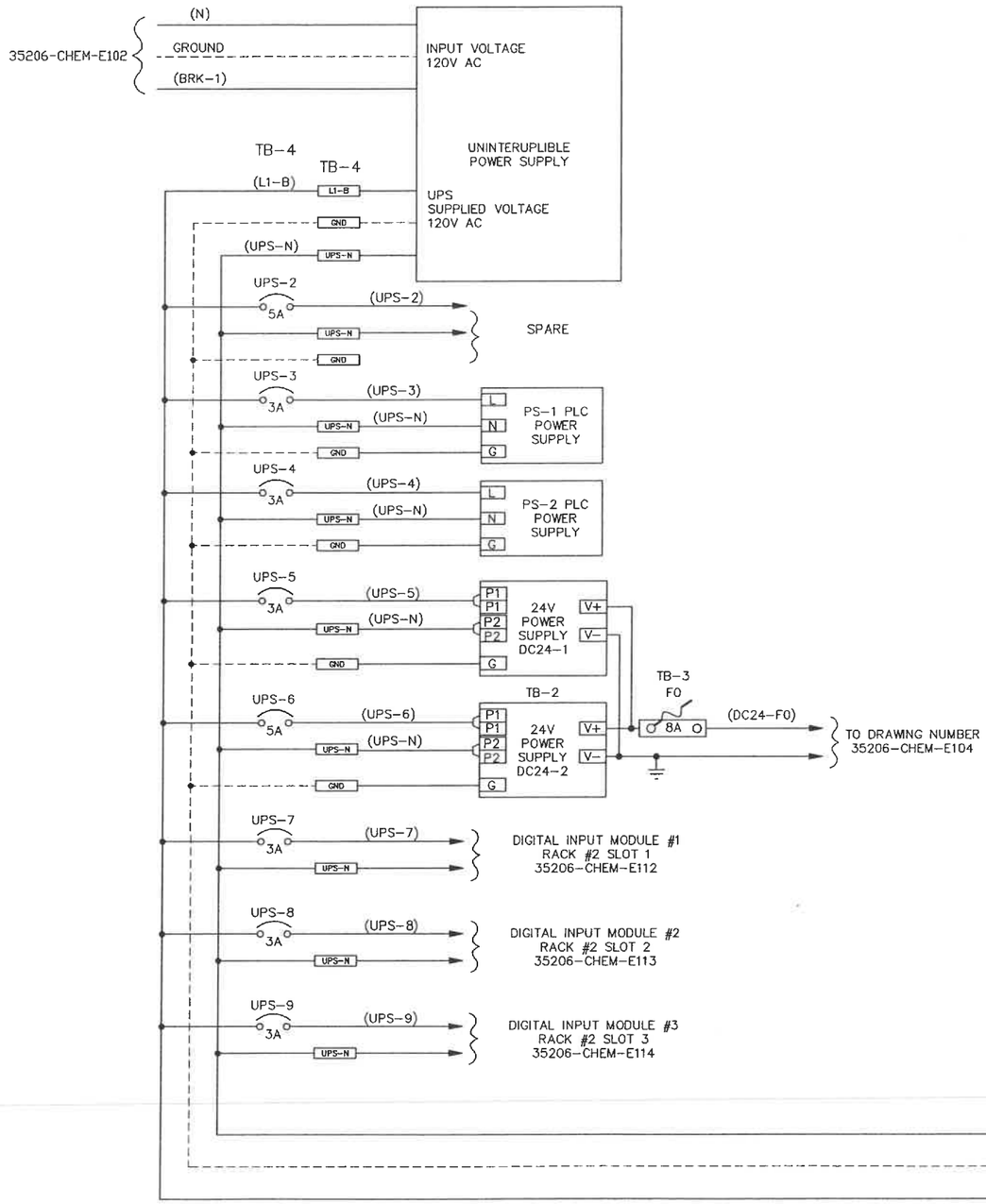
THIS DRAWING HAS BEEN PRODUCED ELECTRONICALLY AND IS ONLY VALID FOR CONSTRUCTION IF IT CONTAINS THE SEAL AND ORIGINAL SIGNATURE OF A PROFESSIONAL ENGINEER AUTHORIZED BY STROMA ENGINEERING. THIS DRAWING IS INTENDED FOR USE BY THE ORIGINAL CLIENT ON A SINGLE PROJECT AS NOTED BY THE DRAWING TITLE BLOCK. ANY OTHER USE, REVISION OR DISTRIBUTION OF THIS DRAWING OR ITS ASSOCIATED ELECTRONIC FILES REQUIRES THE EXPRESSED WRITTEN CONSENT OF STROMA ENGINEERING. STROMA ENGINEERING SHALL NOT BE LIABLE FOR ANY OTHER USE OR MISUSE OF THIS DRAWING AND ITS ASSOCIATED ELECTRONIC FILES.

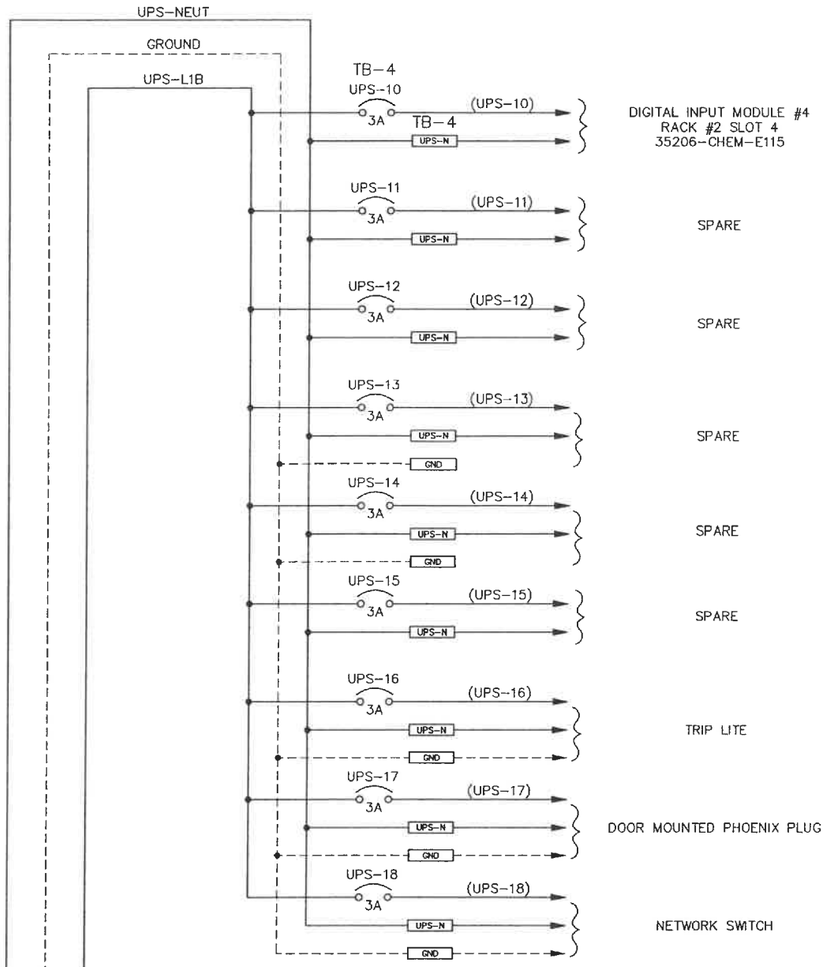
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CANADA, P1A 4K6
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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER CONTRACT #35206	CLIENT: TOWN OF DEEP RIVER		
	LOCATION: WATER TREATMENT PLANT		
DESCRIPTION: CHEMICAL PANEL 110V POWER SCHEMATIC	DATE: 09/10/2006	FILE NO. 35206-CHEM-E102	
	SCALE: NOT TO SCALE	DWG. NO. E102	REV. NO. 0

04 20 2007 2:33:33 PM, claudel.leveille

CHEM CONTROL PANELS UPS–110V POWER DISTRIBUTION





FILE NO. 35206-CHEM
DWG. NO. E103

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN. MGR. CHECK	DSGN. ENG. PLANR
		THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED				

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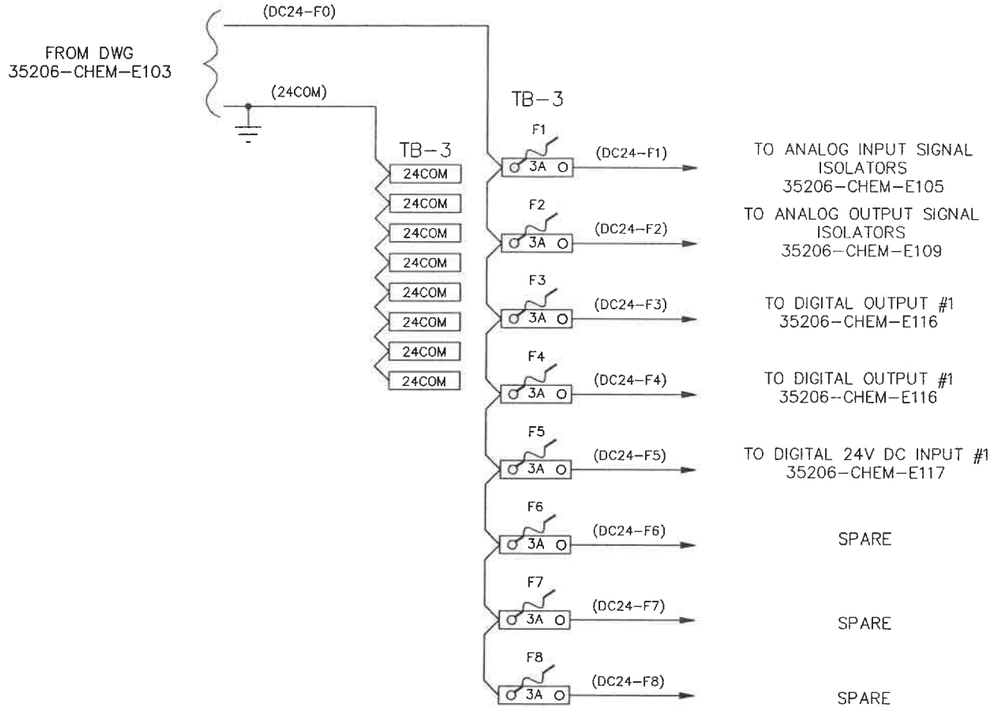
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F / 705-840-6001
Web Site/ www.stroma.ca

PROJECT NAME:	DEEP RIVER CONTRACT #35206
CLIENT:	TOWN OF DEEP RIVER
LOCATION:	WATER TREATMENT PLANT
DESCRIPTION:	CHEMICAL PANEL 110V POWER SCHEMATIC
DATE:	09/10/2006
FILE NO.	35206-CHEM-E103
SCALE:	NOT TO SCALE
DWG. NO.	E103
REV. NO.	0

04 20 2007 2:33:39 PM, claudel.leveille

CHEMICAL PANEL 24VDC POWER SUPPLIES

DC24



REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN. SUP. CHECK	DRWN DWG. PREP.
	1	RENUMBERING OF ISOLATORS, ADDITIONAL SPARES FUSES	06/26/06	CL		

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FILE NO. 35206-CHEM
DWG. NO. E104

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PROJECT NAME: DEEP RIVER WTP UPGRADES CONTRACT #35206

CLIENT: TOWN OF DEEP RIVER

LOCATION: WATER TREATMENT PLANT

DESCRIPTION: CHEMICAL PANEL 24V POWER SUPPLY SCHEMATIC

DATE: 09/10/2006

FILE NO. 35206-CHEM-E104

SCALE: NOT TO SCALE

DWG. NO. E104

REV. NO. 0

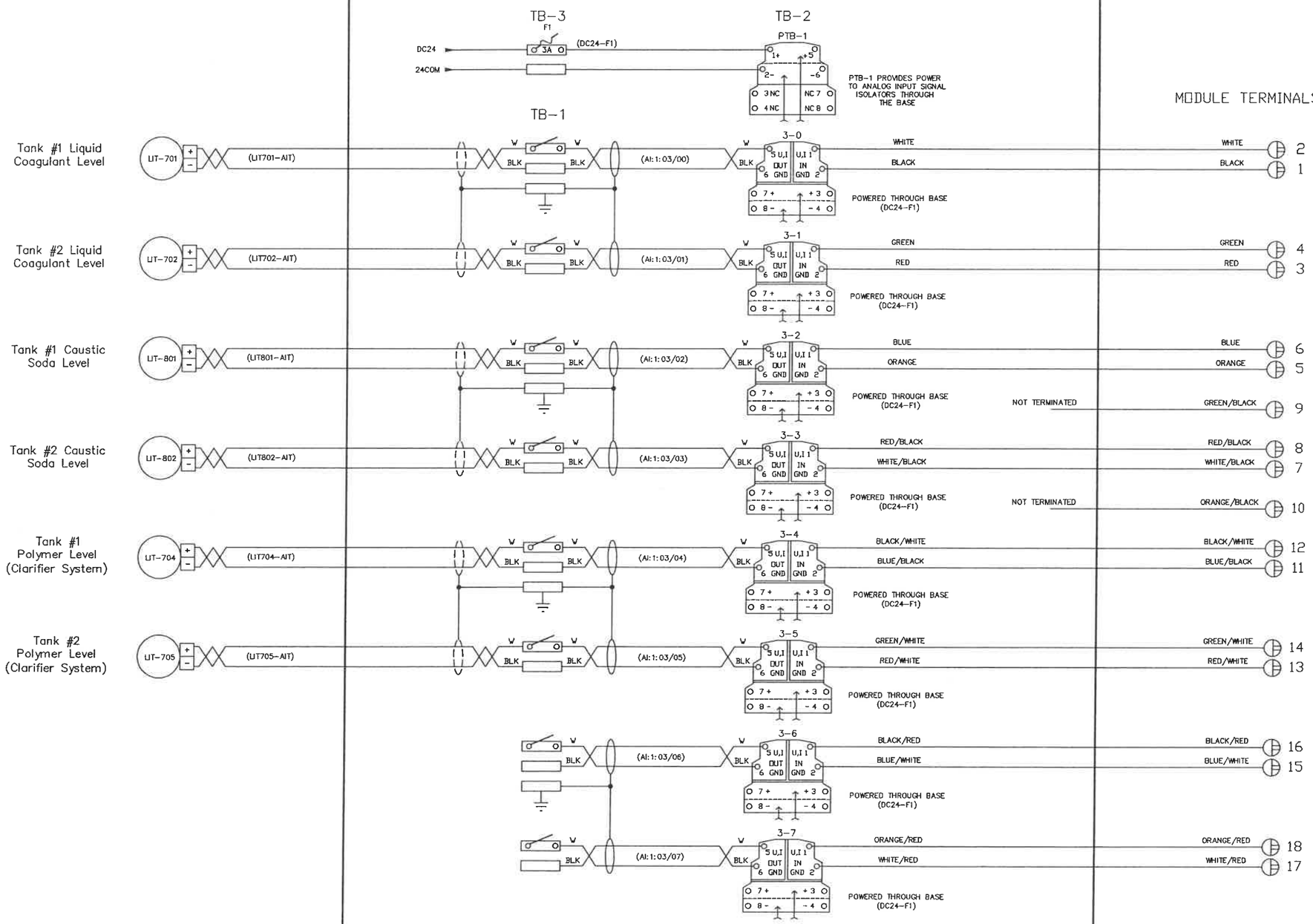
04 20 2007 2:33:44 PM, claudel.leveille

CHEM ANALOG INPUT MODULE # 1-A

FIELD

PANEL TERMINALS

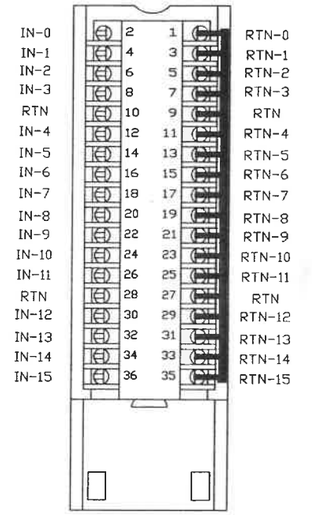
RACK 1 SLOT 3, 4-20mA ANALOG, 8 INPUT



MODULE TERMINALS

WHITE	2
BLACK	1
GREEN	4
RED	3
BLUE	6
ORANGE	5
GREEN/BLACK	9
RED/BLACK	8
WHITE/BLACK	7
ORANGE/BLACK	10
BLACK/WHITE	12
BLUE/BLACK	11
GREEN/WHITE	14
RED/WHITE	13
BLACK/RED	16
BLUE/WHITE	15
ORANGE/RED	18
WHITE/RED	17

ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-CHEM
DWG. NO. E105

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	ENGR. MGR. CHECK	DSGN ENG. ENGR.
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F / 705-840-6001
Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: ANALOG INPUT CARD #1-A LOOP DRAWING

DATE: 04/19/2006

FILE NO. 35206-CHEM-E105

SCALE: NOT TO SCALE

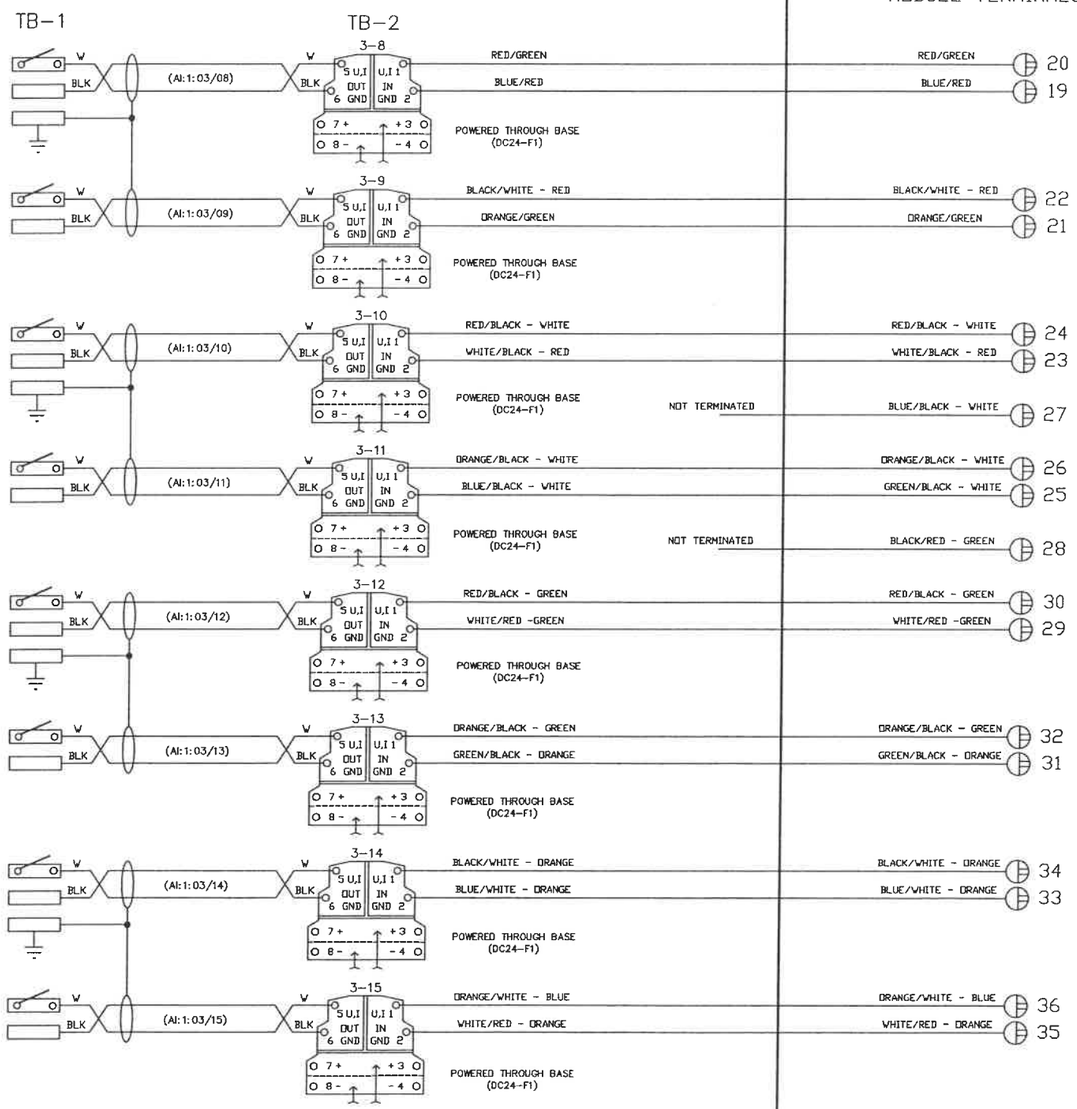
DWG. NO. E105

REV. NO. 0

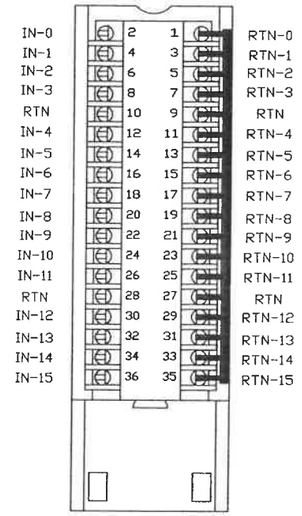
04 20 2007 2:33:49 PM, claudel.leveille

CHEM ANALOG INPUT MODULE # 1-B

FIELD	PANEL TERMINALS	RACK 1 SLOT 3, 4-20mA ANALOG, 8 INPUT



ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS			
1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-CHEM
DWG. NO. E106

REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	CHKD. ISSUE CHECK	CHKD. ENG. PRIMAR

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P / 705-840-6000
F / 705-840-6001
Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: ANALOG INPUT CARD #1 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO.: 35206-CHEM-E106

SCALE: NOT TO SCALE

DWG. NO.: E106

REV. NO.: 0

04 20 2007 2:33:54 PM, claudel.leveille

CHEM ANALOG INPUT MODULE # 2-A

FIELD

PANEL TERMINALS

TB-1 TB-2

FIELD	TB-1	TB-2	PANEL TERMINALS
Tank #3 Liaud Coagulant Level — LIT-703 (+/-)	(LIT703-AIT) — W, BLK, BLK, W	(AI:1:04/00)	3-0: BLK, S U,I OUT 6 GND, U,I I IN GND 2, 7 +, 8 -, +3, -4
Day Tank #3 Cautic Soda Level — LIT-803 (+/-)	(LIT803-AIT) — W, BLK, BLK, W	(AI:1:04/01)	3-1: BLK, S U,I OUT 6 GND, U,I I IN GND 2, 7 +, 8 -, +3, -4
Day Tank #4 Cautic Soda Level — LIT-804 (+/-)	(LIT804-AIT) — W, BLK, BLK, W	(AI:1:04/02)	3-2: BLK, S U,I OUT 6 GND, U,I I IN GND 2, 7 +, 8 -, +3, -4
Tank #3 Polymer Level (Centrifuge System) — LIT-706 (+/-)	(LIT706-AIT) — W, BLK, BLK, W	(AI:1:04/03)	3-3: BLK, S U,I OUT 6 GND, U,I I IN GND 2, 7 +, 8 -, +3, -4
Tank #4 Polymer Level (Centrifuge System) — LIT-707 (+/-)	(LIT707-AIT) — W, BLK, BLK, W	(AI:1:04/04)	3-4: BLK, S U,I OUT 6 GND, U,I I IN GND 2, 7 +, 8 -, +3, -4
SB (Sodium Bisuphide) Tank Level — LIT-805 (+/-)	(LIT805-AIT) — W, BLK, BLK, W	(AI:1:04/05)	3-5: BLK, S U,I OUT 6 GND, U,I I IN GND 2, 7 +, 8 -, +3, -4
HF (Fluoride) Day Tank Level — LIT-806 (+/-)	(LIT806-AIT) — W, BLK, BLK, W	(AI:1:04/06)	3-6: BLK, S U,I OUT 6 GND, U,I I IN GND 2, 7 +, 8 -, +3, -4
Deisel Fuel Tank Level — LIT-807 (+/-)	(LIT807-AIT) — W, BLK, BLK, W	(AI:1:04/07)	3-7: BLK, S U,I OUT 6 GND, U,I I IN GND 2, 7 +, 8 -, +3, -4

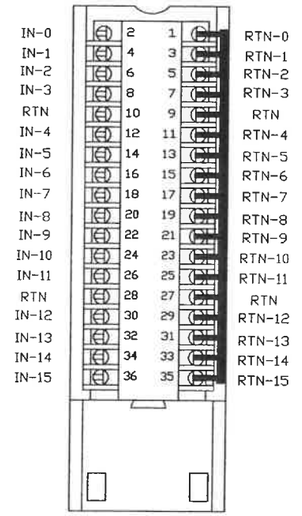
POWERED THROUGH BASE (DC24-F1)

RACK 1 SLOT 4, 4-20mA ANALOG, 8 INPUT

MODULE TERMINALS

3-0	WHITE	2
	BLACK	1
3-1	GREEN	4
	RED	3
3-2	BLUE	6
	ORANGE	5
	NOT TERMINATED	GREEN/BLACK 9
3-3	RED/BLACK	8
	WHITE/BLACK	7
	NOT TERMINATED	ORANGE/BLACK 10
3-4	BLACK/WHITE	12
	BLUE/BLACK	11
3-5	GREEN/WHITE	14
	RED/WHITE	13
3-6	BLACK/RED	16
	BLUE/WHITE	15
3-7	ORANGE/RED	18
	WHITE/RED	17

ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-CHEM
DWG. NO. E107

REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DRAW. DES.	CHECK	DRAW. ENG.	APPROVED

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
DESCRIPTION: ANALOG INPUT CARD #1-A LOOP DRAWING
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DATE: 04/19/2006
FILE NO. 35206-CHEM-E107
SCALE: NOT TO SCALE
DWG. NO. E107
REV. NO. 0

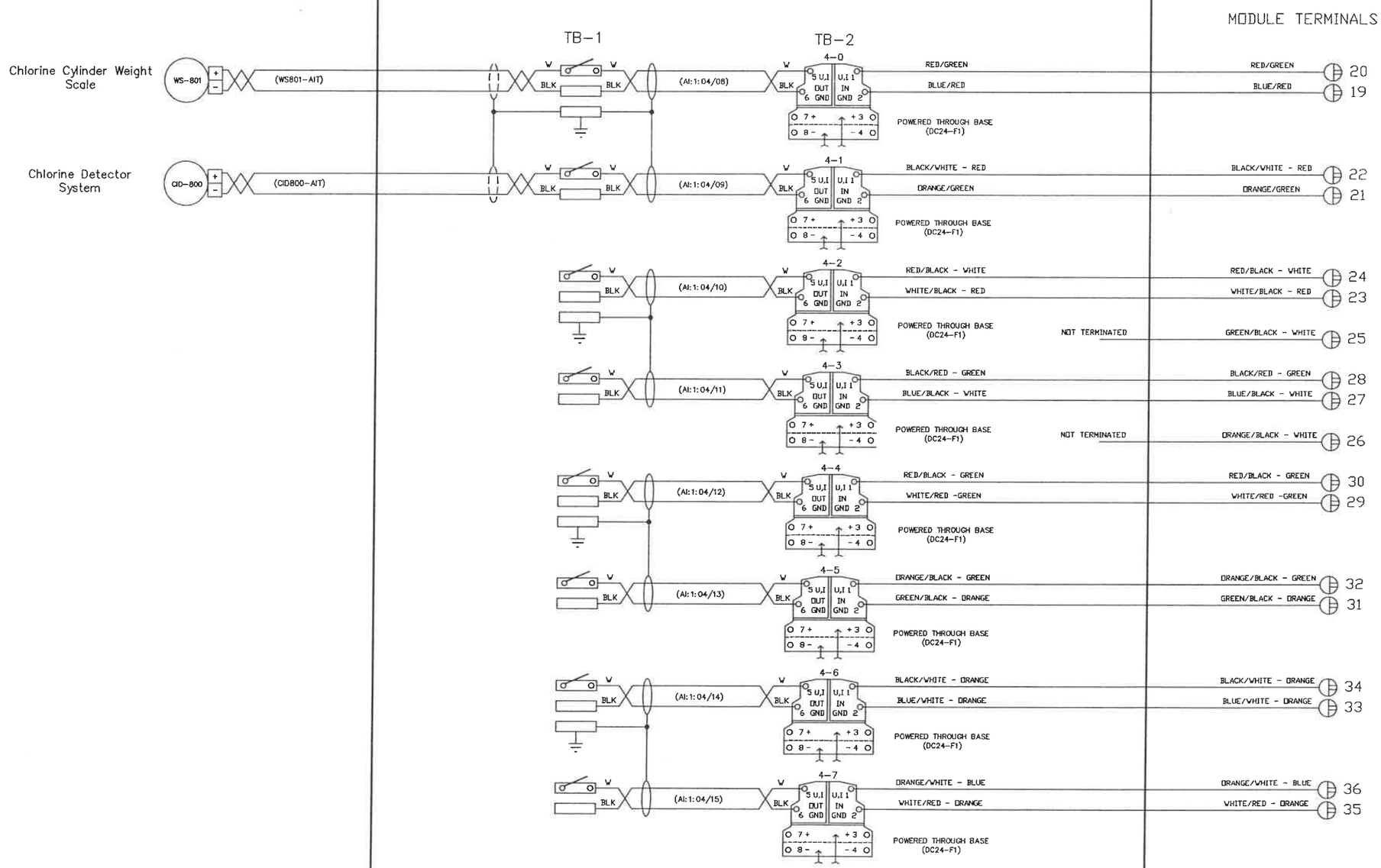
04 20 2007 2:33:59 PM, claudel.leveille

CHEM ANALOG INPUT MODULE # 2-B

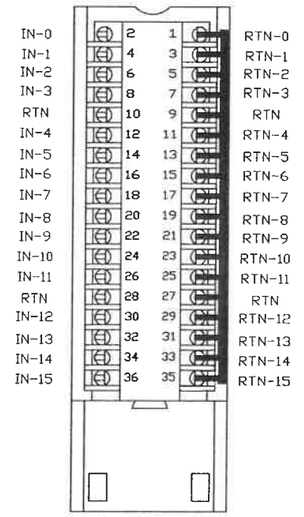
FIELD

PANEL TERMINALS

RACK 1 SLOT 4, 4-20mA ANALOG, 8 INPUT



ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE - RED
5	ORANGE	23	WHITE/BLACK - RED
6	BLUE	24	RED/BLACK - WHITE
7	WHITE/BLACK	25	GREEN/BLACK - WHITE
8	RED/BLACK	26	ORANGE/BLACK - WHITE
9	GREEN/BLACK	27	BLUE/BLACK - WHITE
10	ORANGE/BLACK	28	BLACK/RED - GREEN
11	BLUE/BLACK	29	WHITE/RED - GREEN
12	BLACK/WHITE	30	RED/BLACK - GREEN
13	RED/WHITE	31	GREEN/BLACK - ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK - GREEN
15	BLUE/WHITE	33	BLUE/WHITE - ORANGE
16	BLACK/RED	34	BLACK/WHITE - ORANGE
17	WHITE/RED	35	WHITE/RED - ORANGE
18	ORANGE/RED	36	ORANGE/WHITE - BLUE

FILE NO. 35206-CHEM
DWG NO. E108

REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DSGN MGR. CHECK	DSGN ENG. PRJMGR

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: ANALOG INPUT CARD #1 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO.: 35206-CHEM-E108

SCALE: NOT TO SCALE

DWG. NO.: E108

REV. NO.: 0

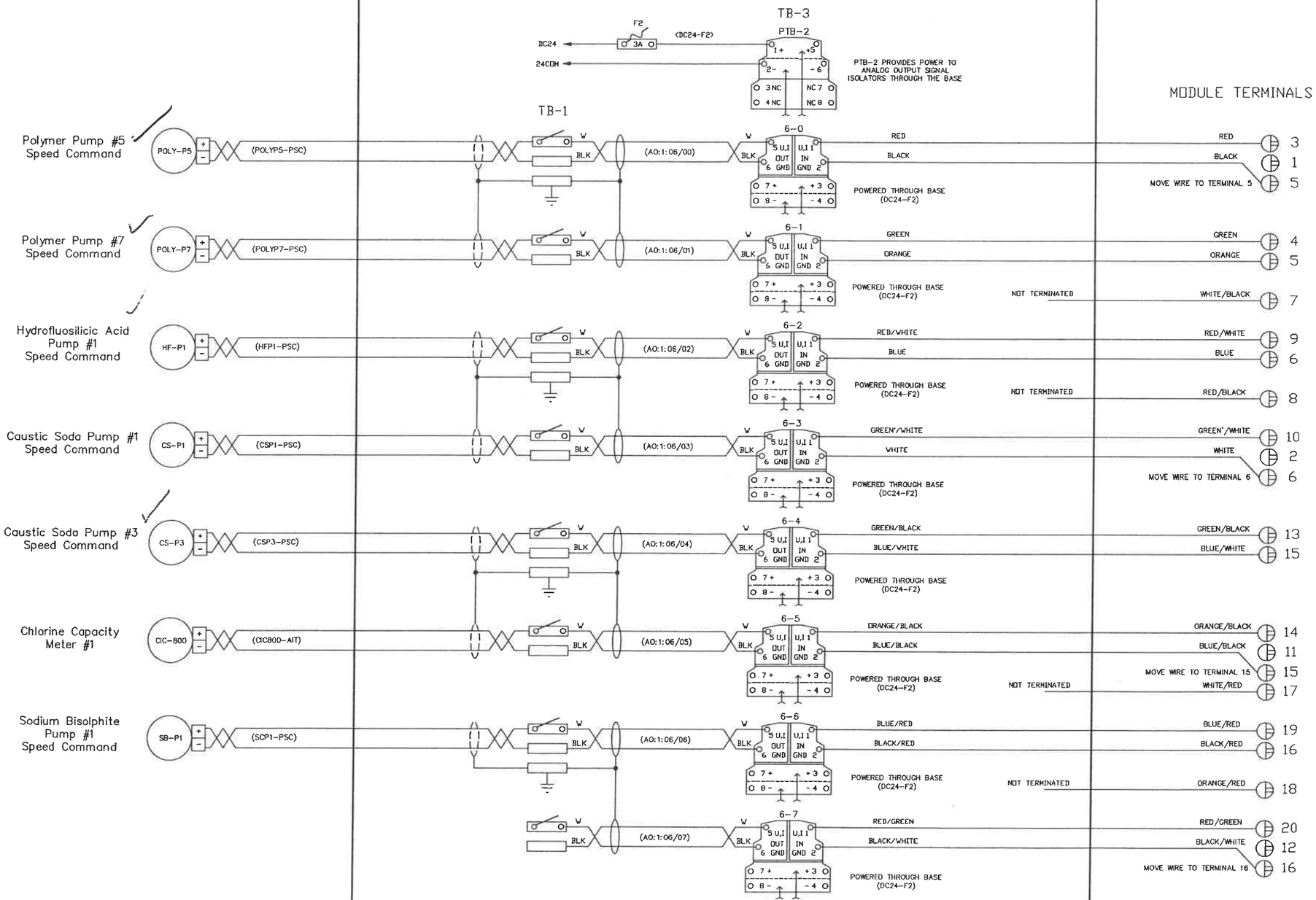
04 20 2007 2:34:04 PM, claudel.leveille

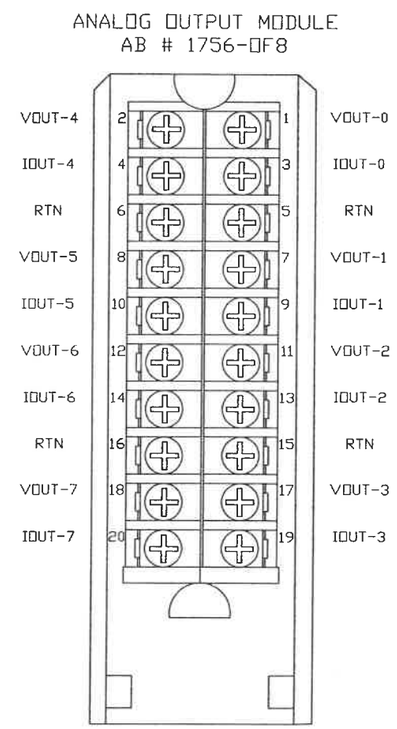
CHEM ANALOG OUTPUT MODULE # 1

FIELD

PANEL TERMINALS

RACK 1 SLOT 6, 4–20mA ANALOG, 8 OUTPUTS





WIRE COLOR TABLE AND PINOUTS			
1	BLACK	11	BLUE/BLACK
2	WHITE	12	BLACK/WHITE
3	RED	13	RED/WHITE
4	GREEN	14	GREEN/WHITE
5	ORANGE	15	BLUE/WHITE
6	BLUE	16	BLACK/RED
7	WHITE/BLACK	17	WHITE/RED
8	RED/BLACK	18	ORANGE/RED
9	GREEN/BLACK	19	BLUE/RED
10	ORANGE/BLACK	20	RED/GREEN

FILE NO. 35206-CHEM
DWG. NO. E109

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DRGN CHK	DRGN ENG. APPROVED
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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: ANALOG OUTPUT CARD #1 LOOP DRAWING

DATE: 04/19/2006

FILE NO. 35206-CHEM-E109

SCALE: NOT TO SCALE

DWG. NO. E109

REV. NO. 0

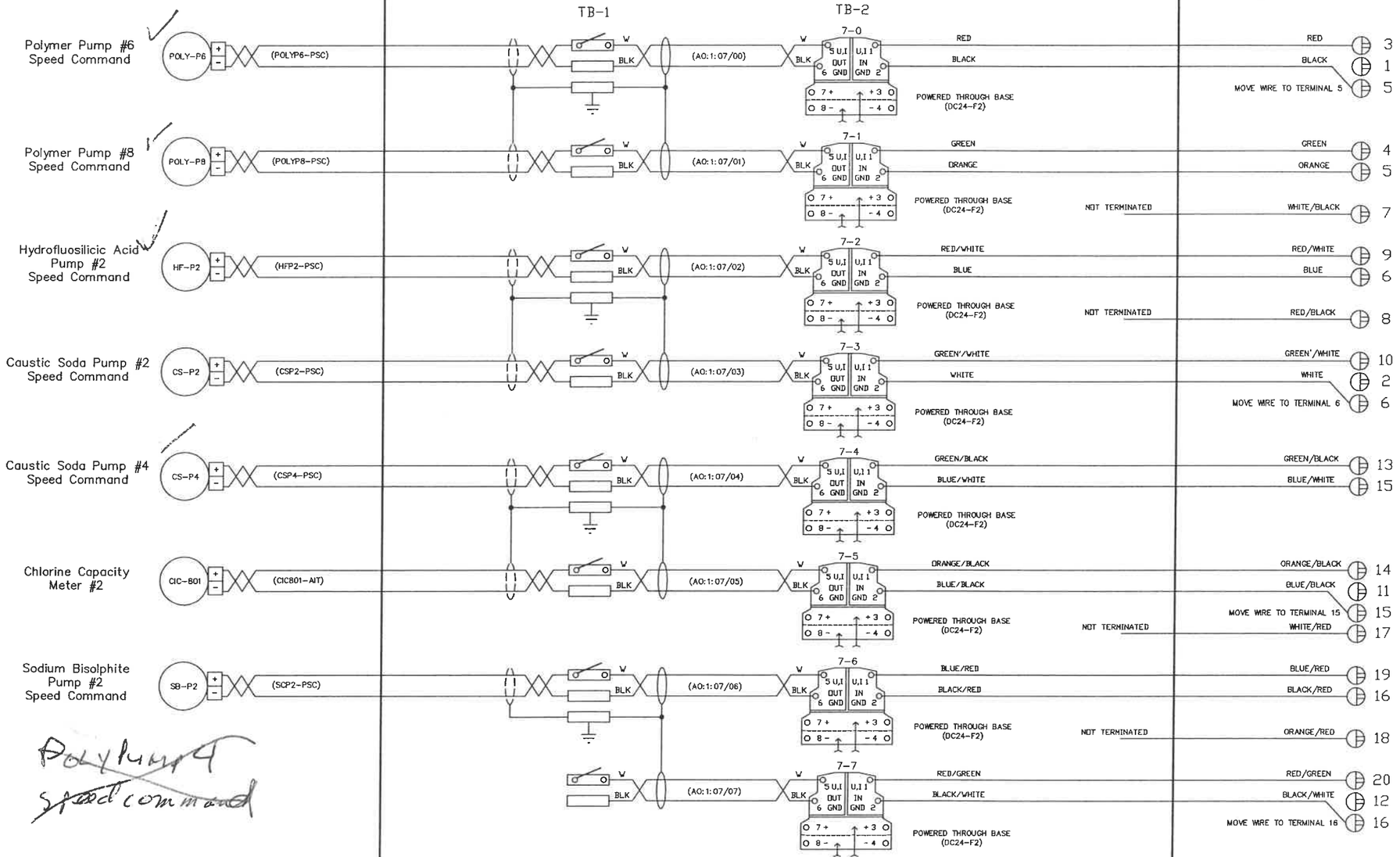
04 20 2007 2:34:10 PM, claudel.leveille

CHEM ANALOG OUTPUT MODULE # 2

FIELD

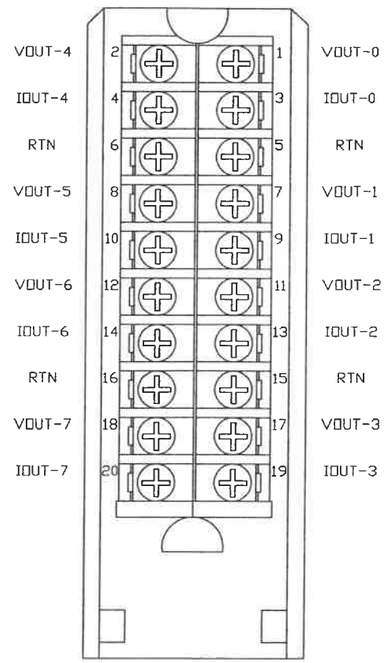
PANEL TERMINALS

RACK 1 SLOT 7, 4-20mA ANALOG, 8 OUTPUTS



Polypump 4
speed command

ANALOG OUTPUT MODULE
AB # 1756-OF8



WIRE COLOR TABLE AND PINOUTS			
1	BLACK	11	BLUE/BLACK
2	WHITE	12	BLACK/WHITE
3	RED	13	RED/WHITE
4	GREEN	14	GREEN/WHITE
5	ORANGE	15	BLUE/WHITE
6	BLUE	16	BLACK/RED
7	WHITE/BLACK	17	WHITE/RED
8	RED/BLACK	18	ORANGE/RED
9	GREEN/BLACK	19	BLUE/RED
10	ORANGE/BLACK	20	RED/GREEN

FILE NO. 35206-CHEM
DWG NO. E110

REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DESIGN VER. CHECK	ENGR DWG. APPROV

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: ANALOG OUTPUT CARD #2 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO. 35206-CHEM-E110

SCALE: NOT TO SCALE

DWG. NO. E110

REV. NO. 0

04 20 2007 2:34:15 PM, claudel.leveille

CHEM ANALOG OUTPUT MODULE # 3

FIELD

Polymer Pump #4
Speed Command

POLY-P9 (+ / −) (POLYP9-PSC)

Chlorine Capacity
Meter #3

CIC-802 (+ / −) (CIC802-AIT)

PANEL TERMINALS

TB-1 TB-2

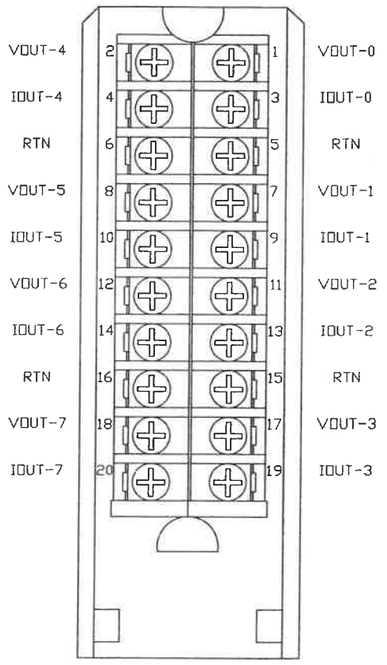
8-0	(AO:1:08/00)	BLK	RED	RED
			BLACK	BLACK
				MOVE WIRE TO TERMINAL 5
			POWERED THROUGH BASE (DC24-F2)	
8-1	(AO:1:08/01)	BLK	GREEN	GREEN
			ORANGE	ORANGE
			POWERED THROUGH BASE (DC24-F2)	NOT TERMINATED
8-2	(AO:1:08/02)	BLK	RED/WHITE	RED/WHITE
			BLUE	BLUE
			POWERED THROUGH BASE (DC24-F2)	NOT TERMINATED
8-3	(AO:1:08/03)	BLK	GREEN/WHITE	GREEN/WHITE
			WHITE	WHITE
			POWERED THROUGH BASE (DC24-F2)	MOVE WIRE TO TERMINAL 6
8-4	(AO:1:08/04)	BLK	GREEN/BLACK	GREEN/BLACK
			BLUE/WHITE	BLUE/WHITE
			POWERED THROUGH BASE (DC24-F2)	
8-5	(AO:1:08/05)	BLK	ORANGE/BLACK	ORANGE/BLACK
			BLUE/BLACK	BLUE/BLACK
			POWERED THROUGH BASE (DC24-F2)	MOVE WIRE TO TERMINAL 15
				NOT TERMINATED WHITE/RED
8-6	(AO:1:08/06)	BLK	BLUE/RED	BLUE/RED
			BLACK/RED	BLACK/RED
			POWERED THROUGH BASE (DC24-F2)	NOT TERMINATED ORANGE/RED
8-7	(AO:1:08/07)	BLK	RED/GREEN	RED/GREEN
			BLACK/WHITE	BLACK/WHITE
			POWERED THROUGH BASE (DC24-F2)	MOVE WIRE TO TERMINAL 16

RACK 1 SLOT 8, 4-20mA ANALOG, 8 OUTPUTS

MODULE TERMINALS

RED	3
BLACK	1
MOVE WIRE TO TERMINAL 5	5
GREEN	4
ORANGE	5
WHITE/BLACK	7
RED/WHITE	9
BLUE	6
RED/BLACK	8
GREEN/WHITE	10
WHITE	2
MOVE WIRE TO TERMINAL 6	6
GREEN/BLACK	13
BLUE/WHITE	15
ORANGE/BLACK	14
BLUE/BLACK	11
MOVE WIRE TO TERMINAL 15	15
WHITE/RED	17
BLUE/RED	19
BLACK/RED	16
ORANGE/RED	18
RED/GREEN	20
BLACK/WHITE	12
MOVE WIRE TO TERMINAL 16	16

ANALOG OUTPUT MODULE
AB # 1756-OF8



WIRE COLOR TABLE AND PINOUTS			
1	BLACK	11	BLUE/BLACK
2	WHITE	12	BLACK/WHITE
3	RED	13	RED/WHITE
4	GREEN	14	GREEN/WHITE
5	ORANGE	15	BLUE/WHITE
6	BLUE	16	BLACK/RED
7	WHITE/BLACK	17	WHITE/RED
8	RED/BLACK	18	ORANGE/RED
9	GREEN/BLACK	19	BLUE/RED
10	ORANGE/BLACK	20	RED/GREEN

FILE NO. 35206-CHEM
DWG. NO. E111

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DRGN MOD. CHKD	DRGN ENG. APVAL
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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352
DESCRIPTION: ANALOG OUTPUT CARD #3 LOOP DRAWING
CLIENT: CITY OF DEEP RIVER
LOCATION: DEEP RIVER WATER TREATMENT PLANT
DATE: 04/19/2006
FILE NO. 35206-CHEM--E111
SCALE: NOT TO SCALE
DWG. NO. E111
REV. NO. 0

04 20 2007 2:34:20 PM, claudel.leveille

CHEM DIGITAL INPUT MODULE # 1

FIELD

- Polymer Pump #5 — Status On/Off: POLY-P5 (5–8) (UPS-7) (POLYP5-ST)
- Polymer Pump #5 — Pump Alarm: POLY-P5 (UPS-7) (POLYP5-XA)
- Polymer Pump #7 — Status On/Off: POLY-P7 (UPS-7) (POLYP7-ST)
- Polymer Pump #7 — Pump Alarm: POLY-P7 (UPS-7) (POLYP7-XA)
- Hydroflurosilicic Acid Pump #1 — Status On/Off: HS-P1 (UPS-7) (HSP1-ST
- Hydroflurosilicic Acid Pump #1 — Pump Alarm: HS-P1 (UPS-7) HSP1-XA
- Csutic Soda Pump #1 — Status On/Off: CS-P1 (UPS-7) (SCP1-ST)
- Csutic Soda Pump #1 — Pump Alarm: CS-P1 (UPS-7) (SCP1-XA)
- Csutic Soda Pump #3 — Status On/Off: CS-P3 (UPS-7) (SCP3-ST)
- Csutic Soda Pump #3 — Pump Alarm: CS-P3 (UPS-7) (SCP3-XA)
- Sodium Bisulphite Pump #1 — Status On/Off: SB-P1 (UPS-7) (SBP1-ST
- Sodium Bisulphite Pump #1 — Pump Alarm: SB-P1 (UPS-7) (SBP1-XA
- Spare — Spare
- Spare — Spare
- Spare — Spare
- Spare — Spare

PANEL TERMINALS

TB-1
16 PT. INTERFACE MODULE

(UPS-7) → UPS-7 3A → 35206-PLC1-E103

(UPS-7) (UPS-7) (UPS-7) UPS-NEUT.

L2 L2

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 L2 L2

ALLEN BRADLEY
PART #1492-IMF20D120

(UPS-7)

UPS-NEUT.

ALLEN BRADLEY
PART #1756-CABLE010A

RACK 2 SLOT 1, 110VAC 16 PT. INPUT

AB # 1756-IA16

IN-1	IN-0
IN-3	IN-2
IN-5	IN-4
IN-7	IN-6
L-2	L-2
IN-9	IN-8
IN-11	IN-10
IN-13	IN-12
IN-15	IN-14
L-2	L-2

FILE NO. 35206-CHEM DWG. NO. E112	REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DRGN. MGR. CHECK	DSGN. ENG. PLANER

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Web Site/ www.stroma.ca

PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352	CLIENT: CITY OF DEEP RIVER
DESCRIPTION: DIGITAL INPUT CARD #1 LOOP DRAWING	LOCATION: DEEP RIVER WATER TREATMENT PLANT
	DATE: 04/19/2006 — FILE NO. 35206-CHEM-E112
	SCALE: NOT TO SCALE — DWG. NO. E112 — REV. NO. 0

04 20 2007 2:34:25 PM, claudel.leveille

CHEM DIGITAL INPUT MODULE # 3

FIELD

Polymer Pump #9

- Status On/Off — POLY--P9 (UPS-9) 5 8 (POLYP9-ST)
- Pump Alarm — POLY--P9 (UPS-9) (POLYP9-XA)
- Chemical Room #1 Temperature — TS-701 (UPS-9) (TS701-LA)
- Chemical Room #2 Temperature — TS--801 (UPS-9) (TS801-LA)
- Remote Vacuum Switchover Unit Valve Position — RVS-800 (UPS-9) (RVS800-ST)
- Spare
- Spare
- Spare
- Spare
- Spare
- Spare
- Spare
- Spare
- Spare
- Spare

PANEL TERMINALS

UPS-9 (UPS-9) 3A → 35206-PLC1-E003

TB-1
16 PT. INTERFACE MODULE

(UPS-9) (UPS-9) (UPS-9) UPS-NEUT.

L2 L2

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 L2 L2

ALLEN BRADLEY
PART #1492-INF20D120

(UPS-9)

UPS-NEUT.

ALLEN BRADLEY
PART #1756-CABLE010A

RACK 2 SLOT 3, 110VAC 16 PT. INPUT

AB # 1756-IA16

IN-1	2	3	IN-0
IN-3	4	5	IN-2
IN-5	6	7	IN-4
IN-7	8	9	IN-6
L-2	10	11	L-2
IN-9	12	13	IN-8
IN-11	14	15	IN-10
IN-13	16	17	IN-12
IN-15	18	19	IN-14
L-2	20	21	L-2

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY
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FILE NO. 35206-CHEM
DWG. NO. E114

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: DIGITAL INPUT CARD #3 LOOP DRAWING

DATE: 04/19/2006

FILE NO. 35206-CHEM-E114

SCALE: NOT TO SCALE

DWG. NO. E114

REV. NO. 0

04 20 2007 2:34:36 PM, claudel.leveille

CHEM DIGITAL INPUT MODULE # 4

FIELD

Push Button for Filling Coagulant Day Tank — (UPS-10) — (PB700-ST)

Push Button for Filling Caustic Soda Day Tank #3 — (UPS-10) — (PB800-ST)

Push Button for Filling Caustic Soda Day Tank #4 — (UPS-10) — (PB801-ST)

Chemical Shower #1 Tripped Alarm — SA-800 — (UPS-10) — (SA800-XA)

Chemical Shower #2 Tripped Alarm — SA-801 — (UPS-10) — (SA801-XA)

Chemical Shower #3 Tripped Alarm — SA-802 — (UPS-10) — (SA802-XA)

Chlorine Detedtion Unit

- Status On/Off — CID-800 — (UPS-10) — ~~(CIDB00-ST)~~ 16
- Alarm — CID-800 — ~~(UPS-10)~~ — ~~(CIDB00-XA)~~ 17

Spare

Spare

Spare

Spare

Spare

Spare

Spare

Spare

PANEL TERMINALS

(UPS-10) 4 → UPS-10 5 → 3A → 35206-PLC1-E003

TB-1
16 PT. INTERFACE MODULE

(UPS-10) → (UPS-10) 6 → (UPS-10) 9

UPS-NEUT.

L2
L2

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 L2 L2

ALLEN BRADLEY
PART #1492-INF20D120

9 (UPS-10)

UPS-NEUT.

ALLEN BRADLEY
PART #1756-CABLE010A

RACK 2 SLOT 4, 110VAC 16 PT. INPUT

AB # 1756-IA16

IN-1 IN-0
IN-3 IN-2
IN-5 IN-4
IN-7 IN-6
L-2 L-2
IN-9 IN-8
IN-11 IN-10
IN-13 IN-12
IN-15 IN-14
L-2 L-2

REV.	DESCRIPTION	DATE	BY	DSGN. MGR. CHECK	DRDN ENG. ENGR
	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED				

FILE NO. 35206-CHEM
DWG. NO. E115

REF. DWG. NO.

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: DIGITAL INPUT CARD #4 LOOP DRAWING

DATE: 04/19/2006

FILE NO.: 35206-CHEM-E115

SCALE: NOT TO SCALE

DWG. NO.: E115

REV. NO.: 0

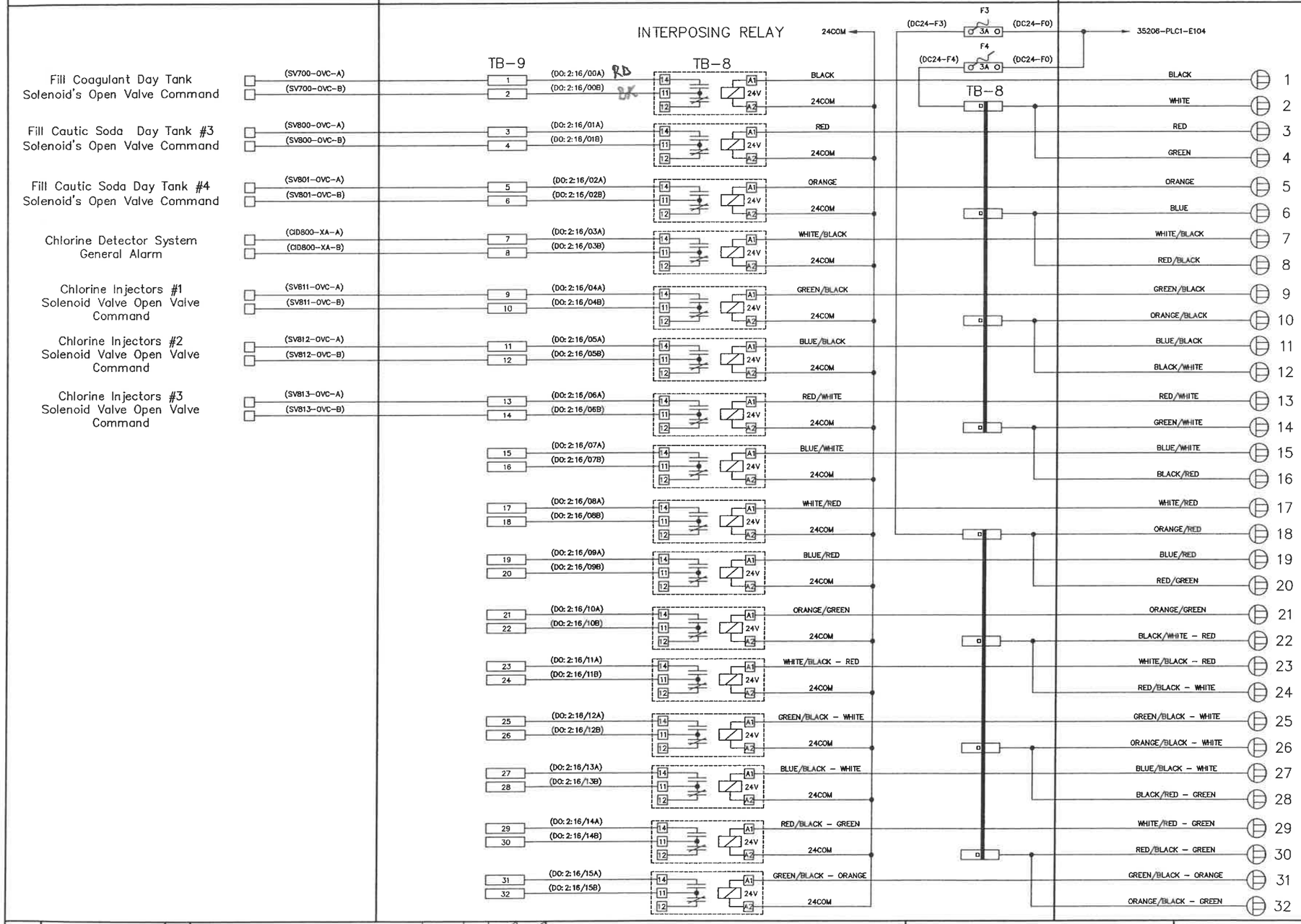
04 20 2007 2:34:41 PM, claudel.leveille

CHEM DIGITAL OUTPUT MODULE #1

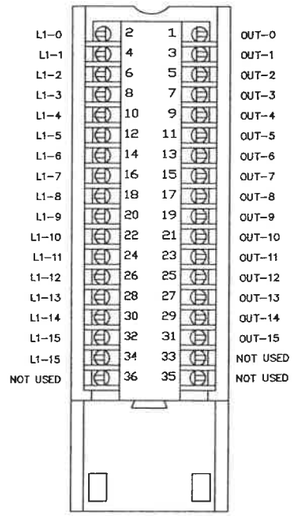
FIELD

PANEL TERMINALS

RACK 2 SLOT 6, 10-265VAC 5-150VDC, 16 PT OUTPUT



ANALOG INPUT MODULE
AB # 1756-IF16



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE - RED
5	ORANGE	23	WHITE/BLACK - RED
6	BLUE	24	RED/BLACK - WHITE
7	WHITE/BLACK	25	GREEN/BLACK - WHITE
8	RED/BLACK	26	ORANGE/BLACK - WHITE
9	GREEN/BLACK	27	BLUE/BLACK - WHITE
10	ORANGE/BLACK	28	BLACK/RED - GREEN
11	BLUE/BLACK	29	WHITE/RED - GREEN
12	BLACK/WHITE	30	RED/BLACK - GREEN
13	RED/WHITE	31	GREEN/BLACK - ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK - GREEN
15	BLUE/WHITE	33	BLUE/WHITE - ORANGE
16	BLACK/RED	34	BLACK/WHITE - ORANGE
17	WHITE/RED	35	WHITE/RED - ORANGE
18	ORANGE/RED	36	ORANGE/WHITE - BLUE

FILE NO. 35206-CHEM
DWG. NO. E116

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN MGR. CHECK	DSGN ENG. PRIMER
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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: DIGITAL OUTPUT CARD #1 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO. 35206-CHEM-E116

SCALE: NOT TO SCALE

DWG. NO. E116

REV. NO. 0

04 20 2007 2:34:46 PM, claudel.leveille

CHEM DIGITAL INPUT MODULE # 1

FIELD

PANEL TERMINALS

RACK 1 SLOT 12, 24VDC 16 PT. INPUT

Chemical Room #1 Spill Detection — LS-701 (DC24-F5) (PB700-ST)

Polymer Spill Detection — LS710-2 (LS-1) LS710-1 (DC24-F5) (PB800-ST)

Caustic Soda Spill Detection — LS-801 (DC24-F5) (PB801-ST)

Hydrofluorosilicic Acid Spill Detection — LS-802 (DC24-F5) (SA800-XA)

Sodium Spill Detection — LS-803 (DC24-F5) (SA801-XA)

Chlorine Room Scrubber Spill Detection — LS-804 (DC24-F5) (SA801-XA)

Old Pipe Galery Flood Alarm — LS-703 (DC24-F5) (CID800-ST)

Spare

Spare

Spare

Spare

Spare

Spare

Spare

Spare

(DC24-F5) TVSS (TVSS-ST)

Transient Voltage Surge Suppressure Monitoring

TS

TEMPERATURE PES

POWER FAILE RL

RADIO SIGNAL LOSS

F5

(DC24-F5) — 3A — 24V DC POWER SUPPLY

TB-1

16 PT. INTERFACE MODULE

(DC24-F5)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 24V COM 24V COM

ALLEN BRADLEY PART #1492-IMF241D24

24V COM

ALLEN BRADLEY PART #1756-CABLE010A

AB # 1756-IB16

(DI:12/01)	(DI:12/00)
(DI:12/03)	(DI:12/02)
(DI:12/05)	(DI:12/04)
(DI:12/07)	(DI:12/06)
24V DC	24V DC
(DI:12/09)	(DI:12/08)
(DI:12/11)	(DI:12/10)
(DI:12/13)	(DI:12/12)
(DI:12/15)	(DI:12/14)
24V DC	24V DC

FILE NO. 35206-CHEM
DWG. NO. E117

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	DSGN. WDL CHECK	DSGN ENG. PRJMGR
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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: DIGITAL 24V DC INPUT CARD #1 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO.: 35206-CHEM-E117

SCALE: NOT TO SCALE

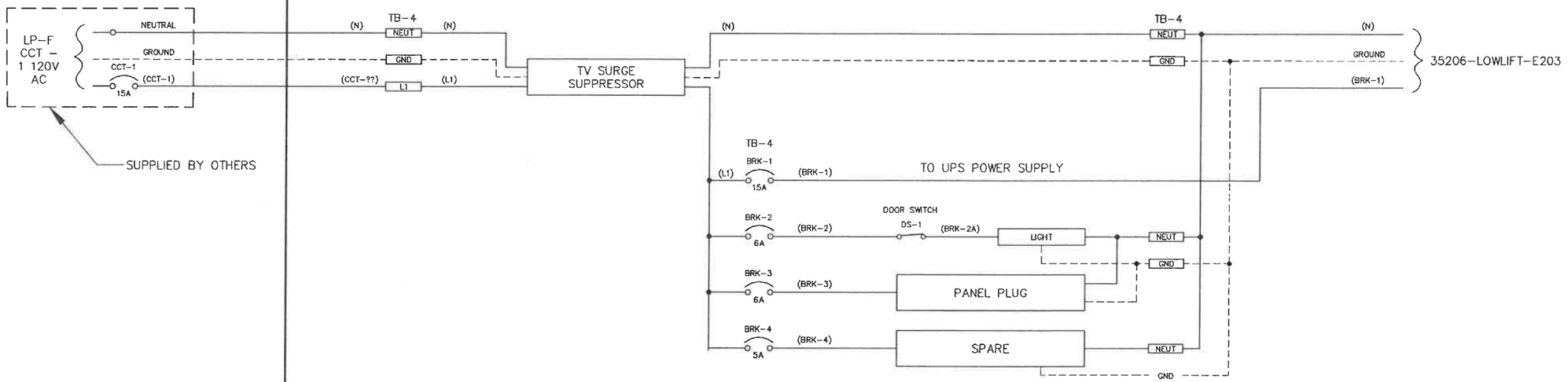
DWG. NO.: E117

REV. NO.: 0

04 20 2007 2:34:52 PM, claudel.leveille

FIELD

LOWLIFT PANEL – 110V POWER DISTRIBUTION



REV.	REF. DWG. NO.	DESCRIPTION (THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED)	DATE	BY	DESIGN WDS CHECK	DRAW EMC PRIMARY
1		SEPERATION OF UPS POWER AND NORMAL POWER	06/26/06	CK		

FILE NO. 35206-LOWLIFT
DWG. NO. E202

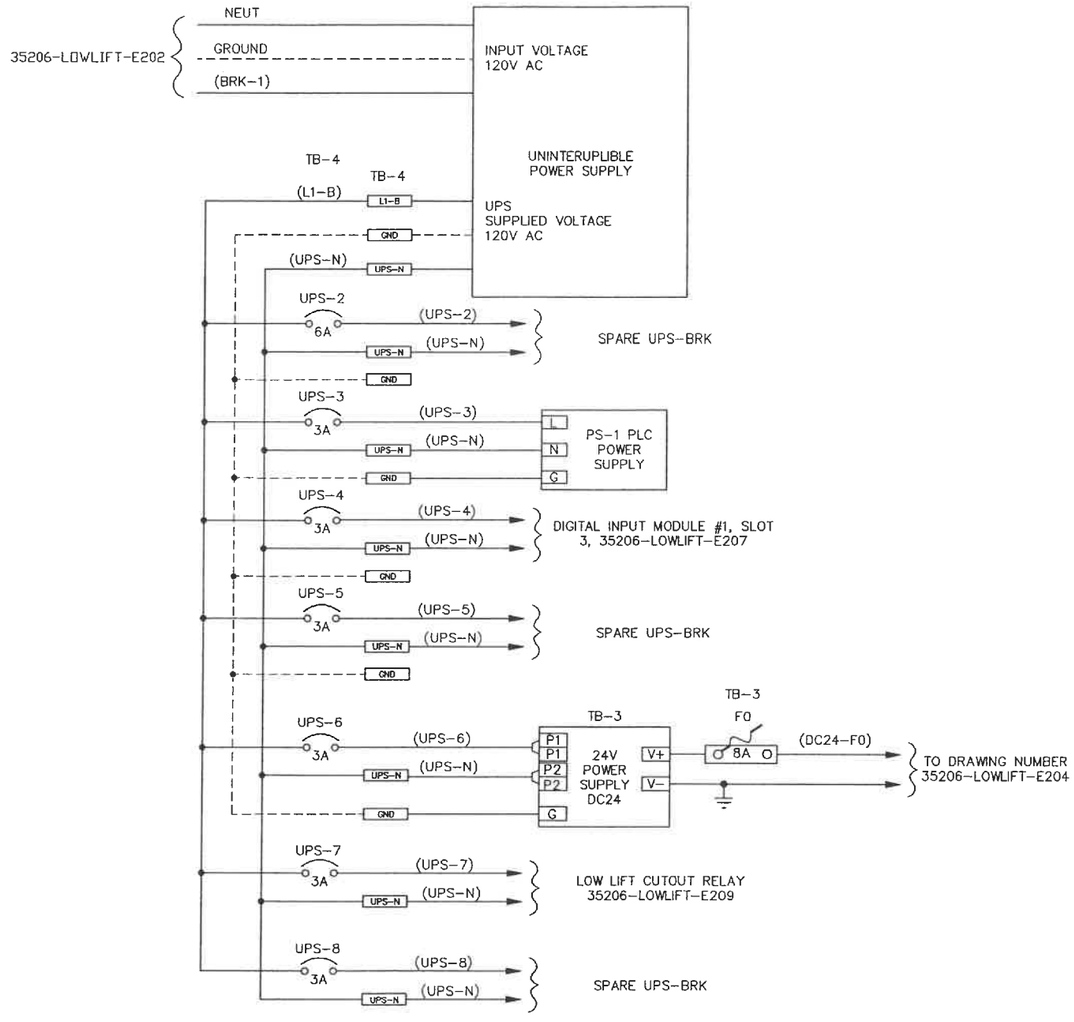
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PROJECT NAME: DEEP RIVER CONTRACT #35206	CLIENT: TOWN OF DEEP RIVER
	LOCATION: WATER TREATMENT PLANT
DESCRIPTION: MAIN PANEL 110V POWER SCHEMATIC	DATE: 09/10/2006
	FILE NO.: 35206-LOWLIFT--E202
SCALE: NOT TO SCALE	DWG. NO.: E202
	REV. NO.: 0

04 20 2007 2:34:57 PM, claudel.leveille

LOWLIFT CONTROL PANELS UPS-110V POWER DISTRIBUTION



REV.	DESCRIPTION	DATE	BY	DSGN. MGR. CHECK	DSGN. ENG. PRIMARY
1	NEW PAGE, ADDITION OF INSTRUMENTS				

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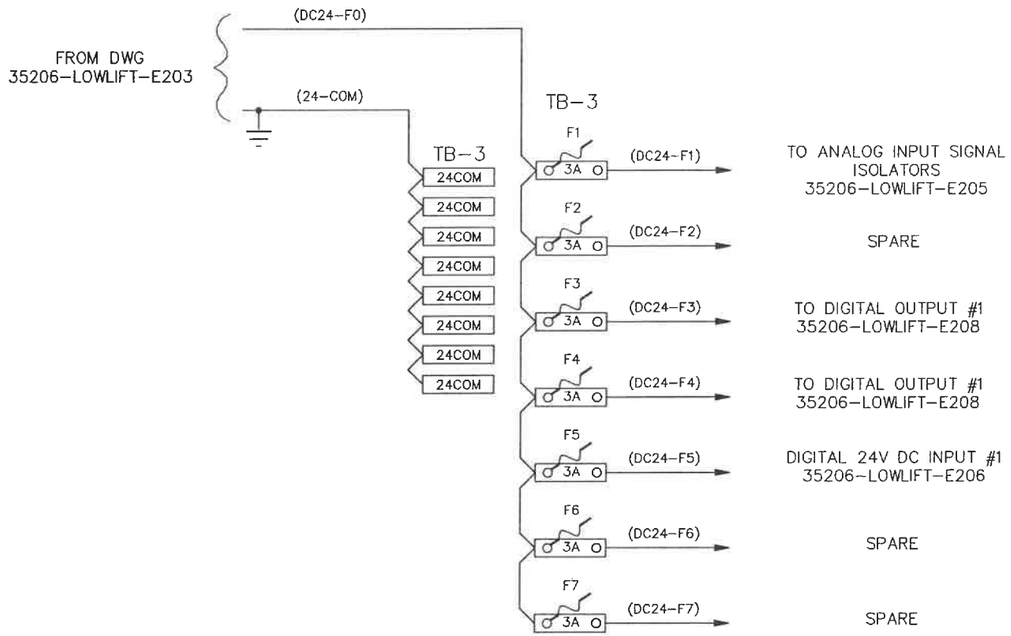
PROJECT NAME:	DEEP RIVER WTP UPGRADES CONTRACT #35206
CLIENT:	TOWN OF DEEP RIVER
LOCATION:	WATER TREATMENT PLANT
DESCRIPTION:	LOWLIFT PLANEL UPS-110V POWER SCHEMATIC
DATE:	09/10/2006
FILE NO.	35206-LOWLIFT-E203
SCALE:	NOT TO SCALE
DWG. NO.	E203
REV. NO.	0

FILE NO. 35206-LOWLIFT
DWG. NO. E203

04 20 2007 2:35:02 PM, claudel.leveille

LOWLIFT PANEL 24VDC POWER SUPPLIES

DC24



FILE NO. 35206-LOWLIFT
DWG NO. E204

REV.	DESCRIPTION	DATE	BY	DSGN MGR. CHECK	DSGN ENG. PR MGR
REF. DWG. NO.	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED				
1	RENUMBERING OF ISOLATORS, ADDITIONAL SPARES FUSES	06/26/06	CL		

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PROJECT NAME: DEEP RIVER WTP UPGRADES CONTRACT #35206

DESCRIPTION: LOWLIFT PANEL 24V POWER SUPPLY SCHEMATIC

CLIENT: TOWN OF DEEP RIVER

LOCATION: WATER TREATMENT PLANT

DATE: 09/10/2006

FILE NO.: 35206-LOWLIFT-E204

SCALE: NOT TO SCALE

DWG. NO.: E204

REV. NO.: 0

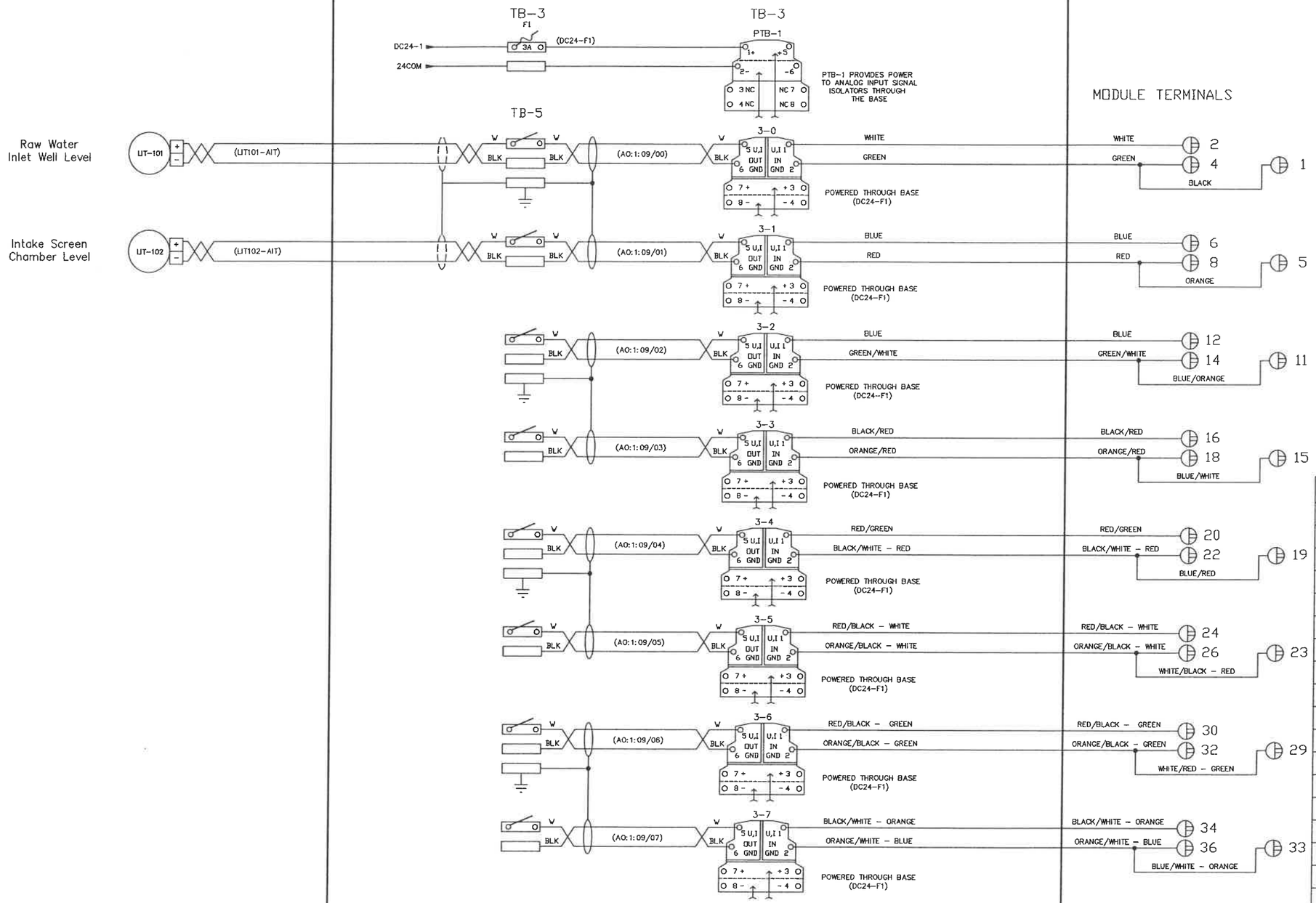
04 20 2007 2:35:07 PM, claudel.leveille

LOWLIFT ANALOG INPUT MODULE # 1

FIELD

PANEL TERMINALS

RACK 1 SLOT 9, 4–20mA ANALOG, 8 INPUT



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206-LOWLIFT
DWG. NO. E205

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	CHKD MAR. CHECK	CHKD ENG. PRIMAR
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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

DESCRIPTION: ANALOG INPUT CARD #1 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO. 35206-LOWLIFT-E205

SCALE: NOT TO SCALE

DWG. NO. E205

REV. NO. 0

04 20 2007 2:35:13 PM, claudel.leveille

LOWLIFT DIGITAL INPUT MODULE # 1

FIELD

Raw Pump #1 Pressure Switch High Alarm — PS-101 (DC24-F5) (PB700-ST)

Raw Pump #2 Pressure Switch High Alarm — PS-102 (DC24-F5) (PB800-ST)

Raw Pump #3 Pressure Switch High Alarm — PS-103 (DC24-F5) (PB801-ST)

Low Lift Pump House Flood Alarm — LS-102/1 (DC24-F5) (SA800-XA) 8001

Low Lift Pump House High level Flood Alarm — LS-102/2 (DC24-F5) (SA801-XA)

Spare

Spare

Transient Voltage Surge Suppressure Monitoring — (DC24-F5) TVSS (TVSS-ST)

Spare

Spare

Spare

Spare

Spare

Spare

Spare

Spare

PANEL TERMINALS

F5 3A — (DC24-F5) → 24V DC POWER SUPPLY

TB-5
16 PT. INTERFACE MODULE

(DC24-F5)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 24V COM 24V COM

ALLEN BRADLEY PART #1492-IMF24D24

24V COM

ALLEN BRADLEY PART #1756-CABLE010A

RACK 1 SLOT 8, 24VDC 16 PT. INPUT

AB # 1756-IB16

(DI:1:08/01)	2	1	(DI:1:08/00)
(DI:1:08/03)	4	3	(DI:1:08/02)
(DI:1:08/05)	6	5	(DI:1:08/04)
(DI:1:08/07)	8	7	(DI:1:08/06)
24V DC	10	9	24V DC
(DI:1:08/09)	12	11	(DI:1:08/08)
(DI:1:08/11)	14	13	(DI:1:08/10)
(DI:1:08/13)	16	15	(DI:1:08/12)
(DI:1:08/15)	18	17	(DI:1:08/14)
24V DC	20	19	24V DC

FILE NO. 35206-LOWLIFT
DWG. NO. E206

REF. DWG. NO.	REV.	DESCRIPTION	THIS DRAWING IS NOT VALID UNLESS THE LAST REVISION IS HAND SIGNED	DATE	BY	DRAWN WDL / CHECK	DRAWN ENG. / PM/QA

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: DIGITAL 24V DC INPUT CARD #1 LOOP DRAWING

DATE: 04/19/2006

FILE NO.: 35206-LOWLIFT-E206

SCALE: NOT TO SCALE

DWG. NO.: E206

REV. NO.: 0

04 20 2007 2:35:18 PM, claudel.leveille

LOWLIFT DIGITAL INPUT MODULE # 1

FIELD

Low Lift Pump #1
- Status On/Off: LLP-101 (UPS-4) / (LLP101-ST)
- Fault: LLP-101 (UPS-4) / (LLP101-XA)

Low Lift Pump #2
- Status On/Off: LLP-102 (UPS-4) / (LLP102-ST)
- Fault: LLP-102 (UPS-4) / (LLP102-XA)

Low Lift Pump #3
- Status On/Off: LLP-103 (UPS-4) / (LLP103-ST)
- Fault: LLP-103 (UPS-4) / (LLP103-XA)

TS100-LA
Low Lift Station
Low Temperature Alarm
- TS (UPS-4) / (BFV316-CP)

spare

spare

spare

spare

spare

spare

spare

spare

(UPS-4) LR3 6 5 (LS101-LA-1)

Raw Water Well #1
Lift Station
(Low Level Lockout)
Refer to 35206-PLC1-E209

PANEL TERMINALS

UPS-4
(UPS-4) 3A → 35206-PLC1-E203

TB-1
16 PT. INTERFACE MODULE

(UPS-4) (UPS-4) (UPS-4) L2 L2

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 L2 L2

ALLEN BRADLEY
PART #1492-IWF20D120

(UPS-4)

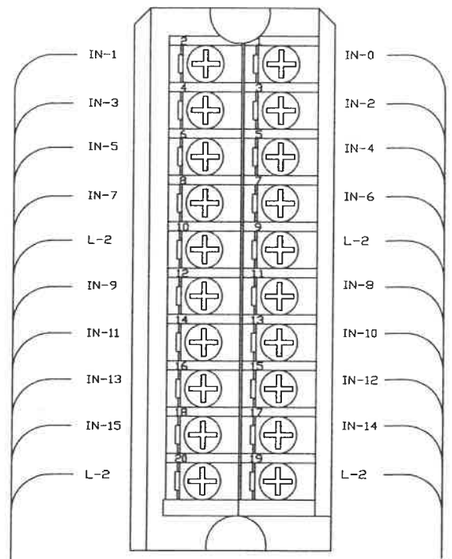
UPS-N

UPS-N

ALLEN BRADLEY
PART #1756-CABLE010A

RACK 1 SLOT 3, 110VAC 16 PT. INPUT

AB # 1756-IA16



REV.	DESCRIPTION	DATE	BY	DSGN SUP. / CHECK	DSGN ENG. / PROJ MGR
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DWG. NO. E207
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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006-352

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DESCRIPTION: DIGITAL INPUT CARD #1 LOOP DRAWING

DATE: 04/19/2006

FILE NO.: 35206-LOWLIFT-E207

SCALE: NOT TO SCALE

DWG. NO.: E207

REV. NO.: 0

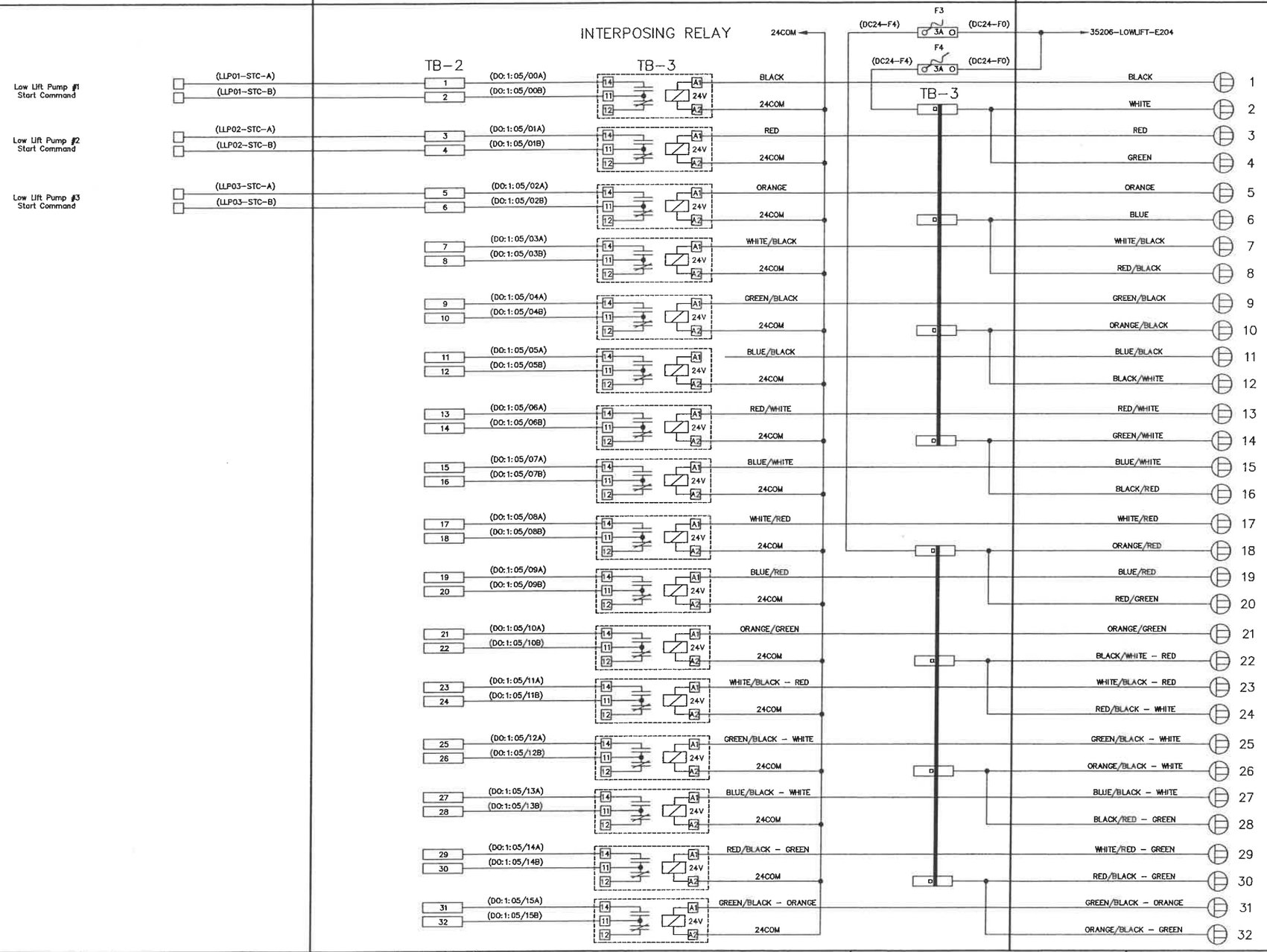
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PLC1 DIGITAL OUTPUT MODULE #1

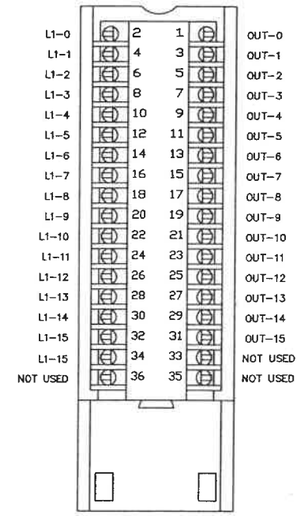
FIELD

PANEL TERMINALS

RACK 1 SLOT 5, 10–265VAC 5–150VDC, 16 PT OUTPUT



ANALOG INPUT MODULE
AB # 1756–OW16I



WIRE COLOR TABLE AND PINOUTS

1	BLACK	19	BLUE/RED
2	WHITE	20	RED/GREEN
3	RED	21	ORANGE/GREEN
4	GREEN	22	BLACK/WHITE – RED
5	ORANGE	23	WHITE/BLACK – RED
6	BLUE	24	RED/BLACK – WHITE
7	WHITE/BLACK	25	GREEN/BLACK – WHITE
8	RED/BLACK	26	ORANGE/BLACK – WHITE
9	GREEN/BLACK	27	BLUE/BLACK – WHITE
10	ORANGE/BLACK	28	BLACK/RED – GREEN
11	BLUE/BLACK	29	WHITE/RED – GREEN
12	BLACK/WHITE	30	RED/BLACK – GREEN
13	RED/WHITE	31	GREEN/BLACK – ORANGE
14	GREEN/WHITE	32	ORANGE/BLACK – GREEN
15	BLUE/WHITE	33	BLUE/WHITE – ORANGE
16	BLACK/RED	34	BLACK/WHITE – ORANGE
17	WHITE/RED	35	WHITE/RED – ORANGE
18	ORANGE/RED	36	ORANGE/WHITE – BLUE

FILE NO. 35206–LOWLIFT
DWG. NO. E208

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PROJECT NAME: DEEP RIVER UPGRADES CONTRACT 2006–352

DESCRIPTION: DIGITAL OUTPUT CARD #1 LOOP DRAWING

CLIENT: CITY OF DEEP RIVER

LOCATION: DEEP RIVER WATER TREATMENT PLANT

DATE: 04/19/2006

FILE NO. 35206–LOWLIFT–E208

SCALE: NOT TO SCALE

DWG. NO. E208

REV. NO. 0

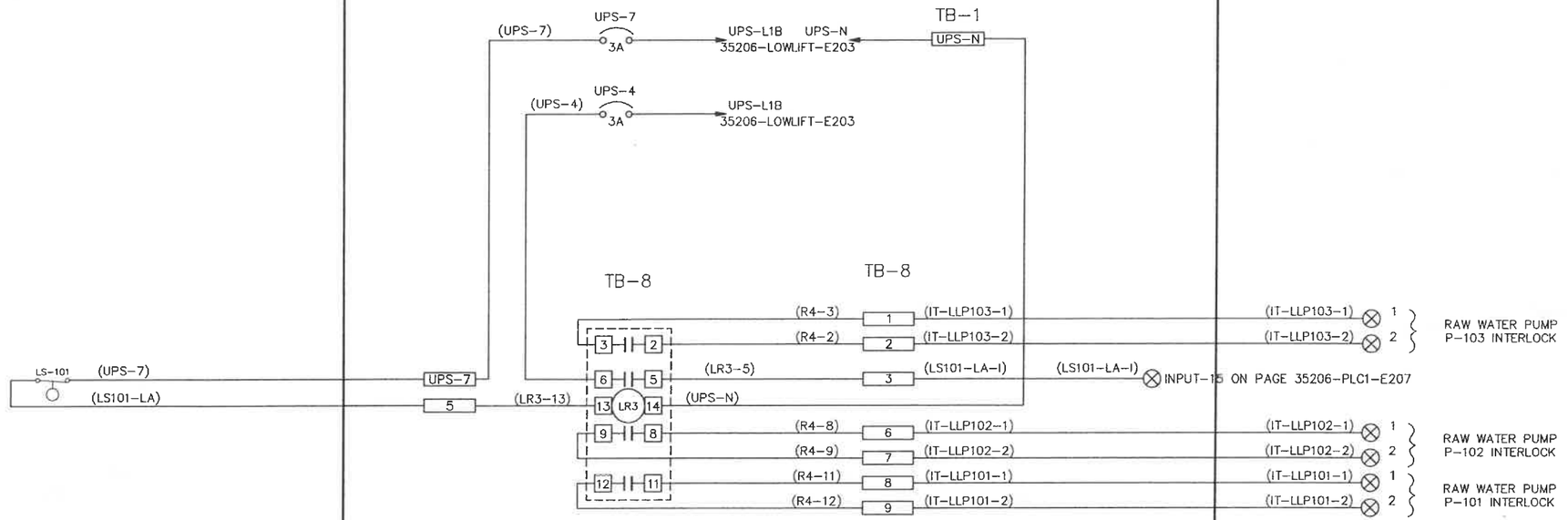
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LOW LIFT PUMP CUTOUT RELAYS

FIELD

Raw Water Well #1
Lift Station
(Low Level Lockout)
Refer to 35206-PLC1-E207

PLC1 INTERNAL PANEL



PUMPS

REF. DWG. NO.	REV.	DESCRIPTION	DATE	BY	CHKD	APPD
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PROJECT NAME: DEEP RIVER WTP UPGRADES CONTRACT #35206	CLIENT: TOWN OF DEEP RIVER
	LOCATION: WATER TREATMENT PLANT
DESCRIPTION: LOW LEVEL LOCKOUT RELAY	DATE: 09/10/2006
	FILE NO.: 35206-LOWLIFT-E209
	SCALE: NOT TO SCALE
	DWG. NO.: E209
	REV. NO.: 0

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Town of Deep River

Deep River Water Treatment Plant Trihalomethanes Reduction Upgrades

Chloramination Process Control Narrative

Wednesday, October 22, 2025

A001332

CIMA+

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Engineering for **people**

Chloramination Process Control Narrative

Deep River Water Treatment Plant

Trihalomethanes Reduction Upgrades

Project no. A001332 | File no. 370

Prepared by:

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1 Introduction

The Deep River Water Treatment Plant (WTP) is located at 177 River Rd., Deep River, County of Renfrew, Ontario. It is owned by the Corporation of the Town of Deep River (Town) and operated by the Ontario Clean Water Agency (OCWA). The Deep River WTP is operated with a rated capacity of 13,638 m^3/d under the Drinking Water Works Permit No. 189-201 and the Municipal Drinking Water License No. 189-101.

The WTP serves a population of approximately 4,109 people within the Town with a network of watermains and an elevated storage tank (water tower). In 2019, a booster pumping station and an approximately 9 km long watermain were constructed to connect the Deep River distribution system to the Canadian Nuclear Lab (CNL) facility, which contains an on-site reservoir.

The WTP contains a low lift pumping station building, which draws raw water from the Ottawa River and pumps it to the main treatment plant building. The water passes through three (3) parallel treatment trains, consisting of Actiflo® sand ballasted clarifier units and dual media filters. Three (3) Actiflo® units, with the addition of microsand, coagulant and polymer, provide coagulation, flocculation, and sedimentation. Water then flows to three (3) dual media (GAC and sand) filters before being disinfected in two (2) clearwells with chlorine gas (primary disinfection). Treated water is dosed with chlorine gas and ammonium sulphate for chloramination (secondary disinfection) before being pumped to the distribution system via high lift pumps. The pH of water may be adjusted before the Actiflo® process and as the treated water enters the distribution system.

1.1 Overview of Chloramination

Chloramination involves adding ammonia following chlorine addition for secondary disinfection, which forms a chloramine residual (principally monochloramine). Chloramines form low trihalomethanes (THMs) and haloacetic acids (HAAs), so their use as a secondary disinfectant in place of chlorine is an effective way to reduce disinfection by-products (DBPs). Chloramines are usually much more stable than free chlorine, so challenges related to maintaining a disinfectant residual at remote areas of the distribution system are often resolved.

1.2 Purpose

The purpose of this Process Control Narrative (PCN) is to describe the operation of the Ammonium Sulphate System, which is integral for chloramination for secondary

disinfection at the Deep River WTP, and provide a guide for the programing of the Ammonium Sulphate System.

2 Ammonium Sulphate System

2.1 System Description

The Ammonium Sulphate System includes:

- Two (2) diaphragm dosing pumps (one duty, one standby), each rated for 4.0 L/h,
- One (1) ammonium sulphate storage tank equipped with level sensor, piping, secondary containment, and appurtenances,
- One (1) dosing panel supplied as a package and complete with piping and appurtenances including pressure relief valve, pressure gauges, flow meter, and a calibration column, and
- One (1) static mixer with two (2) injection quills (one duty, one standby) on the treated water discharge header for ammonium sulphate dosing.

Ammonium sulphate, stored as liquid in a storage tank, is used for this chloramination (secondary disinfection). The system utilizes two diaphragm dosing pumps to deliver the liquid from the storage tank to the dosing point. The redundant pump configuration (one duty, one standby) ensures continuous operation during maintenance or in case of equipment failure. The system is controlled via the SCADA system, which monitors and adjusts the flow based on real-time demand to maintain the required dosing rate.

2.2 Control Modes

The control hierarchy to be implemented in the process area is based upon the following control modes: LOCAL, REMOTE-MANUAL, and REMOTE-AUTO. The hierarchy is further described in the following table.

Table 1: Control Modes

Level	Description
LOCAL	The selection of LOCAL or REMOTE mode of operation is typically made by an operator at the device, MCC, or area control panel by means of a selector switch. In LOCAL MANUAL mode the device can be controlled through the use of pushbuttons in the field. Switching from REMOTE to LOCAL will provide a bumpless transfer of device operation.
REMOTE-MANUAL	The selection between REMOTE-MAN and REMOTE-AUTO is based upon the last selection made at any of the workstations in the SCADA

Level	Description
	network or the local Operator Interface. Switching from REMOTE-AUTO to REMOTE-MANUAL will provide a bumpless transfer of the device operation. Switching from REMOTE-MANUAL to REMOTE-AUTO may cause the device to operate if the device is required to start/stop by the automatic device control logic. Under REMOTE-MANUAL mode of control, the starting and stopping of each device is through operator commands on the Human Machine Interface (HMI). Following a power failure, a device in REMOTE-MANUAL will require operator intervention for it to start again.
REMOTE-AUTO	Switching from LOCAL to REMOTE mode may cause the device to operate if the device is in REMOTE-AUTO and required to start/stop by the automatic device control logic. The selection between REMOTE-MANUAL and REMOTE-AUTO is based upon the last selection made at any of the workstations in the SCADA network or the local Operator Interface. Switching from REMOTE-AUTO to REMOTE-MANUAL will provide bumpless transfer of the device operation. Switching from REMOTE-MANUAL to REMOTE-AUTO may cause the device to operate if the device is required to start/stop by the Control Panel automatic device control logic.

2.3 I/O Points

The following sections detail the I/O associated with the equipment and instrumentation identified in this section of the narrative.

Table 2: Ammonium Sulphate System Operation – I/O Points

Device / Tag	Point	Type
Ammonium Sulphate Pump 1 (AMP01)	Start/Stop	DO
	Run Status	DI
	Control Mode	DI
	General Alarm	DI
	Temperature/Leakage Alarm	DI
	Speed Indication	AI
	Speed Control	AO
Ammonium Sulphate Pump 2	Start/Stop	DO

Device / Tag	Point	Type
(AMP02)	Run Status	DI
	Control Mode	DI
	General Alarm	DI
	Temperature/Leakage Alarm	DI
	Speed Indication	AI
	Speed Control	AO
Ammonium Sulphate Tank Level (AMT01_LI01)	Level Indication	AI
	General Alarm	DI
Ammonium Sulphate Flow Rate (AMP_FIT01)	Flow Indication	AI
	General Alarm	DI
Ammonium Sulphate Secondary Containment Spill Detection (AMT_LSH1)	Spill Detection	DI

2.4 Program Variables

The following points are identified as program variables, and as such are operator adjustable through the SCADA system.

Table 3: Ammonium Sulphate System – Program Variables

Description	Range
Duty Pump 1	AMP01 or AMP02
Duty Pump 2	AMP01 or AMP02
Pump 1 Minimum Speed	0-100% (0% speed set in drive)
Pump 1 Maximum Speed	0-100%
Pump 2 Minimum Speed	0-100% (0% speed set in drive)
Pump 2 Maximum Speed	0-100%
Automatic Duty Rotation Mode	Disabled/All Pumps Stopped/ Timed Interval
Timed Interval Setpoint	1-10 days
Ammonium Sulphate wt%	0 - 100 % (41% per product specification)

Description	Range
Specific Gravity (S.G.)	TBD (Typical S.G. of 41% ammonium sulphate solution is 1.23)
Target Chlorine to Ammonia Ratio	TBD (Currently 3.65)
Ammonia No Flow Alarm Setpoint	0 – 4.0 L/h

2.5 Virtual Points

The following points are identified as virtual points, and thus are calculated by the SCADA program. This listing does not include alarms that are determined within the SCADA program. Access to Runtime Resets is to be restricted to authorized personnel with appropriate log in rights.

Table 4: Ammonium Sulphate System – Virtual Points

Device / Tag	Description
Ammonium Sulphate Pump 1 (AMP01)	Run Time – Elapsed Time Meter (ETM)
Ammonium Sulphate Pump 2 (AMP02)	Run Time – Elapsed Time Meter (ETM)

2.6 Control Logic

The following section describes the control logic for the Ammonium Sulphate System. The equipment can be controlled in LOCAL, REMOTE-MANUAL and REMOTE-AUTO modes based on the operator selection as follows.

2.6.1 Normal Operation

All Ammonium Sulphate pumps can be operated locally or remotely. In remote manual mode, the Ammonium Sulphate Pumps operate based on manual run and manual speed set-points selected on screen.

In the REMOTE-MANUAL mode, the operator starts/stops the Ammonium Sulphate pumps through the SCADA system.

In the REMOTE-AUTO mode, the duty ammonium sulphate metering pump starts when FIT-502 Flow is greater than 0.2 L/s. Before the system can operate, the following conditions must be met:

- At least one ammonium sulphate metering pump is not in alarm
- The ammonium sulphate storage tank level is not low (greater than 0.1).
- Ammonium Sulphate Flow Transmitter AMP_FIT01 available and not in alarm
- WTP Treated Water Discharge Flow Transmitter FIT-502 Available
- CIA-502 Post Clearwell Free Chlorine Transmitter Available

The SCADA program automatically assigns ammonium sulphate pump duties based on ammonium sulphate pump availability and the selected duty rotation method. The duty rotation method is selectable from the SCADA HMI. The ammonia flow transmitter monitors the Ammonium Sulphate Feed Rate.

If an ammonium sulphate pump is running in REMOTE-AUTO mode and the observed ammonia flow fails to exceed the Ammonia No Flow Setpoint for a set time delay, the pump will stop and an Ammonia No Flow alarm will be annunciated on the HMI. This alarm will need to be acknowledged before the pump will be allowed to restart under SCADA-auto mode.

Note: An Ammonia No Flow alarm will not stop a pump while operating in SCADA-manual mode, but the Ammonia No Flow alarm will still be annunciated on the HMI.

The ammonia flow rate is calculated based on the level of free chlorine residual at the treated water discharge header (represented by CIA-502) and the flow (represented by FIT-502). The following calculation is used to establish the ammonia feed rate set-point.

$$Ammonium\ Sulphate\ Feed\ Rate\ \left(\frac{L}{h}\right) = \frac{Cl^2 free\ \left(\frac{mg}{L}\right) \times\ Flow\ \left(\frac{L}{s}\right) \times \frac{1\ g}{1000\ mg}\ x\ \frac{3600\ s}{h}}{Ammonium\ Sulphate\ wt\%\ \times S.G. \times 1000\ \left(\frac{g}{L}\right) \times Ratio\ \times 0.212}$$

Where,

- CL_2 free (mg/L) is read from free chlorine analyzer CIA-502 which continuously monitors free chlorine at the inlet to treated water discharge header.
- Flow (L/s) is the flow from the clear wells to the distribution system, measured by flow meter (FIT-502).

- Ammonium Sulphate wt% is 41% as per product specification.
- S.G. is the product specific gravity. A typical S.G. of 41% ammonium sulphate solution is 1.23 but should be based on specific ammonium sulphate solution technical data sheet provided by supplier.
- Ratio is the target chlorine to ammonia ratio in the water (adjusted manually if required by an operator). The value of the target ratio is currently 3.65.
- 0.212 is the proportion of nitrogen (N) present in ammonium sulphate ($(NH_4)_2SO_4$).

- For example:
    - If CL_2 free (mg/L) is 2.7 mg/L

    - Treated Water (FIT-502) Flow Value = as shown

$$Ammonium\ Sulphate\ Feed\ Rate\ (L/h) = \frac{2.7\ \left(\frac{mg}{L}\right) \times\ Flow\ \left(\frac{L}{s}\right) \times \frac{1\ g}{1000\ mg}\ x\ \frac{3600\ s}{h}}{\frac{41}{100} \times 1.23 \times 1000\ \left(\frac{g}{L}\right) \times 3.65\ \times 0.212}$$

Device / Tag	Flow 1	Flow 2	Flow 3	Flow 4
Treated Water Flow (FIT-502), L/s	10	30	90	158
Ammonium Sulphate Feed Rate (AMP_FIT01), L/h	0.25	0.75	2.25	3.95

The duty ammonium sulphate metering pump is controlled using PID feedback control loop to attempt to maintain the Ammonium Sulphate Feed Rate by modulating the pump speed when running. The Ammonium Sulphate Feed Rate is compared to the Ammonium Sulphate Flowmeter.

2.6.1.1 Pump Duty Selection and Rotation

Duty Selection: Through the SCADA system the operator can configure the pump duty table to use any of the available pumps as Duty or Standby. Operations may manually select the pump duties at any time by updating the contents of the duty table on SCADA. However, the SCADA program error checking logic will ensure that that only one pump is selected to each position. The duty pump selections will only be in affect when a pump is in REMOTE-AUTO mode.

Pump Duty Rotation: Five methods of pump duty rotation are available to the operator from the HMI. These are Duty Auto Rotation Mode, Timed Interval, Manual Mode, Auto by Pump runtime and, At Time by Pump Runtime, as described below:

- Duty Auto Rotation Mode: Duty is rotated at the moment when all pumps (Duty) are stopped. If the next duty pump is not available, the duty pump selection will not rotate.
- Timed Interval: Duty rotation will be based on a time interval setpoint that is entered from the HMI. The operator can select a time setpoint between 0-7 days. In this mode, when the interval time has elapsed, the pump selected to Standby will change to Duty and the Duty pump will change to Standby immediately. If a pump is running, all pumps will be off for less than a second during the changeover as one pump shuts down and the second starts up.
- Manual Mode: In this mode the pump duty does not automatically rotate. Operations can manually change the duty selection.
- Auto by Pump Runtime: Rotation occurs after Duty device has stopped the rotation is based on pump runtimes. The pump with the lower runtime will occupy the Duty position after the alternation.
- At Time by Pump Runtime: Rotation occurs at a specific time of day after the desired number of days has passed based on pump runtimes. The pump with the lower runtime will occupy the Duty position after the alternation.

2.6.2 Fault Response Operation

WTP Treated Water Discharge Flow Transmitter (FIT-502) Failure

- The operator will manually run the Ammonium Sulphate Pumps in LOCAL mode or REMOTE-MANUAL mode.
- If manual operation is not possible, full plant shutdown will be required.

Post Clearwell Free Chlorine Transmitter (CIA-502) Failure

- The operator will manually sample free chlorine in the laboratory to manually adjust the ammonium sulphate feed rate, with the equation shown in Section 2.6.1.
- If manual operation is not possible, full plant shutdown will be required.

Treated Water Total Chlorine Transmitter (CIA-501) Failure

- This is the regulatory transmitter, failure of CIA-501 will result in full plant shutdown.

Ammonium Sulphate Flow Transmitter (AMP_FIT01) Failure

- The operator will manually run the Ammonium Sulphate Pumps in LOCAL mode or REMOTE-MANUAL mode.

Ammonium Sulphate Spill Detected (AMT_LSH1)

- An alarm is issued if the ammonium sulphate flood switch is energized.

Pump Failure (AMP01 & AMP02)

- In the event of a pump failure an alarm is generated on the SCADA system. If the automatic duty rotation is not disabled, and Standby Pump is in REMOTE-AUTO mode and not in fault condition, then the duties will be rotated forcing Standby to Duty. This functionality is identical for all duty pump selections.

Power Failure

- In the event of a power failure all pumps will stop. An alarm will be generated on the plant SCADA system. All pump alarms and other failsafe alarms will be masked out based on the fact that there is a power failure.
- The WTP standby generator will run to resume WTP process operations.

Network Communication Failure

- In the event of Communication Failure between the Ammonium Sulphate Control Panel and plant SCADA system, the Control Panel will continue to run the Ammonium Sulphate System in automatic mode based on the last entered setpoints. A Communication Failure alarm will be generated through the SCADA system and local Autodialer at the process area.
- The Control Panel will continue to collect data locally when communication fails. The parameters stored, on 1 minute intervals, are as follows. The data can be extracted from the Control Panel either locally via the Ethernet port or over the WAN once communications is restored.
    - Ammonium Sulphate Storage Tank Level (per tank)
    - Ammonia Flow Rate
    - Ammonium Sulphate Pump Runtime (per pump)

2.7 Hardwired Interlocks

The hardwired interlocks in the Ammonium Sulphate System are intended to prevent damage to the equipment in the event of a failure. The following interlocks are hardwired in the pump control circuit.

- General Alarm
- Leak Detected

The General Alarm and Leak Detected interlocks immediately shut down the associated pump in all modes and generates an alarm on the SCADA system.

Failure of critical instrumentation for the secondary disinfection process (FIT-502, CIA-502, and CIA-501) shall shut down the operation of the active high lift pumps. Manual operation may be possible as discussed in Section 2.6.2.

2.8 Alarms

The following alarms are associated with the equipment, and are displayed on SCADA when the alarm occurs.

Table 5: Ammonium Sulphate System – Alarms

Device / Tag	Alarm	Range
Ammonium Sulphate Pump 1 (AMP01)	Failed to Start Uncommanded Start Failed to Stop Uncommanded Stop General Alarm Temperature/Leakage Alarm Speed Deviation Alarm	
Ammonium Sulphate Pump 2 (AMP02)	Failed to Start Uncommanded Start Failed to Stop Uncommanded Stop General Alarm Temperature/Leakage Alarm Speed Deviation Alarm	
Ammonium Sulphate Tank Level (AMT01_LI01)	HIHI HI LO LOLO Signal Error Alarm	TBD TBD TBD TBD

Device / Tag	Alarm	Range
	General Alarm	
Ammonium Sulphate System (AMP_00)	Shutdown Alarm	
Ammonium Sulphate Flow Meter (AMP_FIT01)	General Alarm	
Free Chlorine Analyzer (CIA-502)	General Alarm	
Total Chlorine Analyzer (CIA-501)	General Alarm	
Treated Water Discharge Header Flow Meter (FIT-502)	General Alarm	

All alarm conditions are monitored by the Control Panel and transmitted to the SCADA system via a SCADA communication link. All alarming is programmed and configured in the Control Panel including alarm, enabling, disabling and acknowledgement. These alarm conditions are transmitted to the SCADA system.

2.9 Monitoring

Ammonium Sulphate Flow Monitoring

The process will have a fixed flow meter (AMP_FIT01), which will have the following monitoring in SCADA:

Table 6: Ammonium Sulphate System – Monitoring Parameters

Device / Tag	Monitoring Parameter	Range
Ammonium Sulphate Flow Meter (AMP_FIT01)	Minimum Today	TBD L/h
	Minimum Yesterday	TBD L/h
	Total Today	TBD L/h
	Maximum Today	TBD L/h
	Maximum Yesterday	TBD L/h
	Total Yesterday	TBD L/h
	Total Last Month	TBD L/h
	Total This Month	TBD L/h


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