



CITY OF TIMMINS

REQUEST FOR TENDER

Contract No. 223027

<p>TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT</p>

**Closes: 2:00:00 pm, Timmins time
April 23rd, 2025**

***** ELECTRONIC PROPOSAL SUBMISSIONS ONLY *****



COMMUNICATIONS NOTICE

All questions related to this Request for Tenders (RFT) or for clarification on completing the Form of Tender shall be submitted through the Bidding System by clicking on the "Submit a Question" button for the specified Request for Tenders document.

The City reserves the right to extend the deadline for questions if required regarding this RFT.

Written answers or clarifications to issues of substance shall be shared with all Bidders and issued as part of the RFT in the form of an Addendum. **All Bidders are advised that any Addenda issued will only be posted on the following website:**

<https://timmins.bidsandtenders.ca/Module/Tenders/en>

It is the sole responsibility of each Bidder to check the website for any and all Addenda that have been issued for this Request for Tenders.

Should a bidder have any questions regarding this bid opportunity, please use the facilities provided within the Bids & Tenders suite on the "Vendor Questions" tab;

Inquiries outside of the provided facilities will not be answered and will be discarded

Only electronic bid submissions shall be accepted and received through the Bidding System by the closing date and time stated above.

There is no public opening for this Request for Tenders.



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PART 1 - INTRODUCTION

1.1. Scope of Work

The work generally involves installation of two high lift pumps and a backwash pumps at the Timmins Water Filtration Plant located at 110 Feldman Rd. Refer to Appendix 1A, 1B and 1C for attached drawings, specification and City of Timmins CCDC Supplementary Conditions and Division 1.

The contractor is also responsible for all applicable permits, forms and locates related to this work, and shall include any applicable fees to the lump sum price.

1.2. To Obtain Documents

A complete set of Request for Tender documents may be viewed for free on the City of Timmins' bid opportunities website <https://timmins.bidsandtenders.ca>.

PART 2 - INSTRUCTION TO BIDDERS

2.1. Closing Date and Time and Unofficial Results

ELECTRONIC TENDER SUBMISSIONS ONLY shall be received by the City's electronic tendering site, Bids & Tenders, no later than **2:00:00 pm local time on April 23rd, 2025** (the "Closing Date and Time"). The Closing Date and Time shall be determined by the bids&tenders web clock.

There is no public opening for this Request for Tender

2.2. Site Meeting

A **non-mandatory site visit** will be scheduled for **April 9th at 10:00 am**. Bidders are encouraged to attend. Participants are asked to meet at the main entrance.

A 3D scan of the project areas can be found at the link below:

<https://aec.cintoo.com/a69592557cfd0706a652>

Password (case sensitive): CIMAScanning12

Each Tenderer shall carefully examine the site and all services thereon which affect the proper execution of the work and obtain for himself a clear and comprehensive knowledge of the existing conditions.

Bidders are advised that any information received on site from independent site visits either by observation or by way of verbal communication is considered non-binding unless confirmed by way of written addenda.



**MAP LOCATION OF TIMMINS WFP
100 Feldman Rd.**

DISCLAIMER

The following URL address and map have been provided for illustration purposes only and every effort has been made to ensure accuracy. The City of Timmins cannot accept any responsibility for errors, omissions, or positional inaccuracy for this information.

<https://maps.app.goo.gl/tUnFvmteSGRo4sJv5>





2.3. Questions, Clarifications, and Addenda

All questions relating to this Request for Tenders, or any clarification with respect to this RFT document, must be made in writing no later than **4:00:00 PM on Monday, April 14th, 2025**.

- 1) The City reserves the right at any time prior to the award of the Contract,
 - i) to withdraw or cancel the Request for Tenders;
 - ii) to extend the time for the submission of Bids; or
 - iii) to modify the Request for Tenders,by the publication of an Addendum, which shall become part of the Request for Tenders, and the City shall not be liable for any expense, cost, loss or damage incurred or suffered by any Bidder (or any other person) as a result of its so doing.
- 2) Without limiting the City's right, subsection (1) may apply to situations where no Bid is compliant or an insufficient number of Bids have been received.
- 3) Any Addendum shall be posted on the following website and is sufficiently served upon any prospective Bidder if so posted at: **<https://timmins.bidsandtenders.ca>**
 - i) In addition to the above method of posting, the City may also notify prospective Bidders of any Addendum by any other method it deems appropriate, including email, telephone, fax, courier, hand-delivery or by personal delivery. The need for additional notification and the method(s) to be used shall be in the absolute discretion of the City and notification shall be to the co-ordinates provided by the bidder to the City at the time it obtained the Request for Tenders from the City.
 - ii) It is the sole responsibility of each Bidder to check the website and ensure that it has received any and all Addenda issued by the City. Bidders shall confirm in the Form of Tender that they have received, examined and provided for all Addenda issued under the Request for Tenders.
- 4) Where a Bidder submits their Bid prior to the Request for Tenders closing date and time and an Addendum has been issued by the City, the Bidding System automatically **WITHDRAWS** the Bidder's Bid submission and changes the Bid submission to an **INCOMPLETE STATUS (NOT accepted by the City)**. The withdrawn Bid can be viewed by the Bidder in the "**MY BIDS**" section of the Bidding System. The Bidder is solely responsible to:
 - i) Make any required adjustments to their Bid;
 - ii) Acknowledge all Addenda that have been issued for this Request for Tenders and;
 - iii) Ensure the re-submitted Proposal is **RECEIVED** by the Bidding System before the closing date and time stated in the Request for Tenders.
- 5) Bidders shall acknowledge receipt of any Addenda when submitting their Bid through the Bidding System. Bidders shall check a box for all Addenda and any applicable



attachments that has been issued before a Bidder can re-submit their Bid submission online.

- 6) All questions related to this Request for Tenders (RFT) or for clarification on completing the Form of Tender shall be submitted through the Bidding System by clicking on the "Submit a Question" button for the specified Request for Tenders document.
- 7) Any request directed to the City with respect to subsection (6) prior to the closing date of the Request for Tenders must allow sufficient time for a written response or clarification to be issued by the City prior to the closing date and time, should the City consider it necessary to issue such response or clarification.
- 8) A written response or clarification of substance shall be shared with each Bidder and issued in the form of an Addendum.
- 9) The City shall not be bound by any oral:
 - i) instruction;
 - ii) amendment or clarification of the Request for Tenders;
 - iii) information; or
 - iv) advice or suggestion,provided by any member of the City's staff or consultant to the City concerning the Request for Tenders or the manner in which the Work is to be carried out and the Bidder bears any and all risk in relying on such representation.

2.4. Project Schedule

- 1) The Contractor shall only work during favorable temperatures and weather conditions, including overnight curing as per the specifications of the product and type of work being performed.
- 2) The Contractor shall Commence work by Monday, June 9, 2025 and attain substantial completion of the work described in the Contract, barring delays as prescribed by the Conditions of the Contract by June 26, 2026.

2.5. Submittals and Deliverables

- 1) The Contract Administrator must receive and accept the following documents prior to Purchase Order being issued. All documents must refer to Project number and name. Documents shall include:
 - iv) Irrevocable Letter of Credit
 - v) Performance and Labour / Material Bonds
 - vi) Signed CCDC2-2020 Contract



- vii) Certificate of Insurance
 - viii) WSIB
 - ix) Contractor Orientation
- 2) The Contract Administrator must receive and accept all required submittals prior to commencement of work. All submittals must refer to Project number and name
Submittals shall include:
- i) Shop Drawings
 - ii) Building Permit
 - iii) ESA Permit
 - iv) Construction Schedule
 - v) Progress Draw Breakdown
 - vi) M.O.L Notice of Project
 - vii) Equipment List
 - viii) Contractors Health and Safety Procedure and Policy

2.6. Bidder's Responsibility

- 1) The Bidder shall be responsible for examining all drawings and details, also the Specifications and all other Contract Documents including all cost implications relating thereto in the Total Contract Price.
- 2) Unless otherwise stated in the Specifications, the Special Provisions or an Addendum, the Successful Bidder shall be required at its own cost to
 - i) apply for and obtain and pay for fees or charges for all Permits and licenses;
 - ii) pay inspection fees or charges for inspections other than those stipulated to be paid out of any inspection fee allowance provided for in the Contract Documents;
 - iii) pay all applicable taxes and all other charges other than Value Added Taxes or other applicable sales, imposed under the laws of Ontario and the laws of Canada applicable therein;
 - iv) provide such warranty and maintenance requirements as may be specified by the City, and in default of any such specification with respect to the Contract, a two years warranty and maintenance requirement;
 - v) provide all materials and services necessary to complete the Project so that it is finished, serviced and ready for use and operation.
- 3) Unless otherwise expressly agreed by the City in writing, where technical information or details form part of the Specifications, Tender Notice, or Special Provisions (including any quantity estimates, samples, or other documents of a similar kind or



nature as may be provided together with the Contract Documents or incorporated by reference therein),

- i) the City shall exercise reasonable care in the preparation of those estimates, but shall not be taken to warrant their accuracy and shall not be liable for any inaccuracy therein unless that inaccuracy is the result of the deliberate misrepresentation of the City or a member of its staff;
 - ii) estimates, reports, data, or details shall be deemed to have been provided only as a guide for potential Bidders;
 - iii) Bidders are required to examine carefully that information and the responsibility for verification of the information so provided shall rest with each Bidder.
- 4) Where the Project, Work or Supply is to be carried out on City occupied or owned property, Bidders shall be responsible for visiting the job site, and no allowance shall be made by the City for failure by the Bidder to examine carefully all conditions relating to the site or work.
- 5) Where clarification of any document, fact or opinion is required, it shall be obtained by the Bidder before submitting a Bid.
- 6) It shall be the Contractor's responsibility to co-ordinate, control and check work of its own forces and of all its subcontractors and to ascertain that all work is done in accordance with all Contract Documents, governing regulations and the general standards of good commercial practice and professionalism as understood in Ontario, assuring only first class workmanship, and using only proper materials and methods are suited to the function or performance intended.
- 7) The Successful Bidder shall be responsible for faithful and proper performance of all aspects of the Contract.
- 8) All persons submitting Bids and all their subcontractors, shall be held to have thoroughly examined all drawings, specifications and all other Contract Documents and to have visited and inspected the site on which the Project or Work is to be carried out, or the Supply is to be made, and to have thoroughly familiarized themselves with all pertinent conditions before delivery of their respective Bids, and no allowance shall be subsequently be given by the City for or by reason of any error or omission on the part of any Bidder or subcontractor with respect thereto. The City shall not be liable for any costs associated with any site inspection.
- 9) Without limiting the generality of any other provision of these Instructions, unless otherwise provided in the Specifications, or the Special Provisions, the Contractor shall be required to provide and pay for:
 - i) all material, labour and service costs, charges for use of tools and equipment whether owned or rented, and where any work is to be carried out or services are to be rendered on property owned or occupied by the City, all protective and safety provisions, site signs and site conveniences, together with all cranes, scaffolding and shoring, freight costs, and material-handling and storing, and all



services and incidentals whether shown or specified or required by good practice;

- ii) all bonds or other accepted forms of bid, performance, and labour and material payment security, insurance, permits and inspections; all applicable taxes, worker's compensation and all other applicable labour-compensation charges necessary to carry out the Project, make the Supply and complete all Work in accordance with the Contract Documents;
 - iii) all services and materials required to carry out the Project, do all of the Work and make the Supply, in accordance with all Contract Documents and all instructions given by the City thereunder, in accordance with governing regulations and codes and in compliance with good industrial and commercial practice for first class workmanship, which in all instances, unless otherwise stipulated, shall be deemed to require work that has a finished appearance, is ready for use or use and operation, and includes the installation of all linkages, interfaces, protocols, computer cards, computer memory, software, peripherals, housing, sheathing, insulation, and mechanical, electrical and other systems and connections required for proper functionality.
- 10) No subcontracting by the Successful Bidder shall relieve the Successful Bidder of any responsibility for the full performance of all obligations of the Successful Bidder under the Contract, but despite the approval of any subcontractor by the City, the Successful Bidder shall be fully responsible for every subcontractor's activities, works and acts and shall either, in person or through an accredited agent, receive all notices, communications, orders, instructions or legal services as if the Successful Bidder were performing the subcontracted portion of the Project, Work or Supply with its own resources.

2.7. Submission of Bid

- 1) Electronic Bid submissions only, shall be accepted and received by the Bidding System, on or before the closing date and time stated in this Request for Tenders.
- 2) Bids submitted by mail, in person, fax, e-mail, telex or other electronic means, other than through the Bidding System, shall not be accepted.
- 3) It is the exclusive responsibility of each Bidder to submit a complete Bid in accordance with these Instructions, the Form of Tender, the Tender Notice, the Specifications and the Special Provisions.
- 4) Bidders shall have a Bidding System vendor account and must be registered as a plan taker for this Request for Tenders. Only plan takers will have access to download this Request for Tenders document, receive Addendum email notifications, download Addendum and to submit their Bid electronically through the Bidding System.
- 5) If a Bidder has obtained the Request for Tenders document from a third party, the onus is on the Bidder to create a Bidding System vendor account and register as a plan taker for the bid opportunity.



- 6) It is the Bidder's responsibility to ensure that their Bid is received by the Bidding System on or before the closing date and time stated in the Request for Tenders document. The closing time shall be determined by the Bidding System web clock.
- 7) Bidders are advised that the timing of their Bid submission is based on when the Bid is RECEIVED by the Bidding System, not when a Bid is submitted by a Bidder, as Bid transmission can be delayed in an "internet traffic jam" due to file transfer size, transmission speed, etc.
- 8) Bidders shall allow sufficient time to upload their Bid submission, including any attachments. Late Bid submissions shall not be accepted by the Bidding System.
- 9) The Bidding System will send a confirmation email to the Bidder advising that their Bid was submitted successfully. If an email confirmation is not received, contact technical support at bids&tendersTM via email: support@bidsandtenders.ca or by telephone 1-800-594-4798.
- 10) All documents prepared and work carried out by a Bidder in preparing its Bid, and all oral presentations to the City in connection with a Bid, shall be without cost to the City, and neither the City's publication of a Request for Tenders nor the submission of a Bid shall be construed to oblige the City to award a Contract.

2.8. Alternate Bids and Optional Features Etc.

Alternate Bids and Optional Features are not permitted for this Request for Tenders.

- 1) Where optional features or other options are requested in the Tender Notice, Specifications, the Special Provisions or an Addendum, the availability and price of those features or other options shall be included in the appropriate place in the Form of Tender for each Bid to which they relate.

2.9. Request for Approved Equal or Alternate Product

- 1) The Total Contract Price shall be based on the materials, processes and products specified in the Contract Documents. Where two or more products are specified, the choice shall be that of the Contractor. Where the specifications include the words "or approved equal", equal product may be proposed by the Contractor up to 3 days prior to the end of the Questions Period for consideration by the Owner. Alternate product may also be proposed by the Contractor up to 3 days prior to the end of the Questions Period for consideration by the Owner.
- 2) The Owner will review the proposed alternate or equal product and will decide on their acceptability. The Contractor must provide sufficient information for the alternate or equal for the Owner to determine acceptability of such products.
 - iv) Information shall be sent via Bids & Tenders.



- v) Type of request (alternate or equal) shall be identified.
- 3) Provide comparison table of the requested product and the proposed alternative or equal product.
- 4) Should the proposed “approved equal” or alternates be accepted by the Owner, an addendum indicating this will be issued. If the Owner rejects some or all of the proposed alternates or equal product, the Contractor shall supply the materials, processes and products originally specified.
- 5) Unless alternatives and “approved equals” are submitted in this manner and subsequently accepted by Addendum, no deviation from the specified product will be accepted during Construction.

2.10. Additional Tender Documents

- 1) Tenderers must submit the following additional documents at the time of tender submission:
 - i) A written schedule of all contracts successfully completed by the Tenderer in the previous three years. Include the value of each Contract, the name of the owner, and the name and telephone number of the owner’s contact person who is willing and able to attest to the Tenderer’s capability to perform this Contract work.
 - ii) A list of all contracts presently undertaken, the value of each Contract, the scheduling of each Contract, and the name of the owner.
 - iii) The name, qualifications, and experience of the proposed Project Manager and Site Supervisor for this Contract work.
 - iv) A list of plant/equipment available for this Contract work, present location and whether “owned” or “rented”.
 - v) If Sub-Contractors are being retained for this Contract, the name, qualifications, and experience of the proposed Sub-Contractors shall be provided. The scope of work to be completed by the Sub-Contractor shall also be specified. The Tenderer shall make an entry against each possible sub-trade listed either by naming the proposed sub-contractor or by entering "by own forces", or by entering N/A for non-applicable, whichever applies. No blank spaces are to be left for the sub-trades listed below. Please include in this section the name of your retain Engineering company.
 - vi) A preliminary construction schedule showing milestone dates for construction activities.
 - vii) Provide cost breakdown of all sub-contractor work and own forces which will be the premise for payment.

2.11. Form of Tender



- 1) Every Bid shall be submitted on the City's prescribed Form of Tender in its entirety and shall,
- 2) include all material, services, appliances and labour, required to complete the work; and
- 3) be completed in English.
- 4) All blank spaces provided on the Form of Tender shall be filled in including alternate, separate, additional or Unit Prices and for the start and the total completion dates.

All words and phrases forming part of a Bid must be written out in full, and abbreviations must not be used. A Bidder who does not comply with this requirement shall bear the risk of any ambiguity.

2.12. Bid Security and Performance Bond

2.12.1. Bid Security

- 1) Each Bidder shall submit with its Bid a bid security in the form of a digital Bid Bond in an electronically verifiable and enforceable format naming The Corporation of the City of Timmins as obligee in the amount of **\$50,000.00** using the Bid Bond form CCDC220.
- 2) Bidders shall upload their Bid Bond to the Bidding System, in the bid submission file labelled "Bid Bond". All Instructions and details for assessing authentication shall be included with the digital bond uploaded in the Bidding System.
- 3) A bid security shall, include such terms, be in a form, be executed appropriately and be provided by an issuer authorized to do business in the Province of Ontario, satisfactory to the City in its reasonable discretion.
- 4) **The term of the Bid Security shall be for a minimum period of 90 days after the closing date set for the Tender. Any bid security submitted with less than the 90 day term shall be rejected.**
- 5) A Bid submitted without a required Bid Security shall be rejected.
- 6) Certified cheque, bank draft, money order or any other format other than a digital CCDC220 format Bid Bond is not acceptable and shall be rejected.
- 7) In the event of default or failure of the Successful Bidder to execute the Contract for Work as prescribed, or to deliver the performance and other security required under the Contract Documents, the City shall declare the bid security forfeited and the Bidder will be held responsible for any increased costs or damages incurred by the City.
- 8) Each Bidder that submits a Bid will be deemed to have acknowledged and agreed that the amount of the bid security required with respect to a Bid constitutes a genuine pre-



estimation on the part of the City of the damages that will be suffered by the City as a result of a failure or refusal on the part of the Bidder to provide such performance or other security as may be contemplated in the Contract Documents, or enter into a Contract for Work, as the case may be, but the amount payable under that bid security shall not prevent the City from recovering the excess of its provable damages over and above the amount of that bid security, whether by way of any legal proceeding or otherwise.

2.12.2. Performance Bond

If the Contractor is in default of the Contract, the Owner's Responsibilities and Rights, may at the Owner's discretion be exercised in accordance with the terms and conditions of the Performance Bond and the Labour and Material Bond, it being understood that the terms of such bonds shall in no event limit the Owner's recourse against the Contractor and/or the Surety for default under the Contract.

- 1) If contract value is **\$499,999.99 or less**, Tender shall be accompanied by an "Agreement to Provide Irrevocable Letter of Credit" in the amount of **10% of the Total Contract Value** in the form attached hereto as **Appendix 2**, from a financial institution acceptable to the Owner.

or,

- 2) If the contract value is **\$500,000.00 or greater**, Tender shall be accompanied by an "Agreement to Provide Irrevocable Letter of Credit" as stipulated above and "Agreement to Bond" in the form attached as **Appendix 3** from a person licensed under the Insurance Act to write surety and fidelity insurance.

2.12.2.1. Irrevocable Letter of Credit:

- 1) The "Irrevocable Letter of Credit" shall be in the form bound herein and the Performance Bond and the Labour and Material Bond contemplated by the Agreement to Bond shall be in the form prescribed under Construction Act, RSO 1990, c C30. The Irrevocable Letter of Credit, the Performance Bond and the Labour and Material Bond shall collectively constitute the Contract Performance Security which will be required to ensure the performance of the Contract, including, without limitation, the construction, alteration, repair and maintenance of all Work provided for by the Contract.
- 2) The Irrevocable Letter of Credit shall, upon achieving the Total Completion Date, be reduced to 2 ½% of the value of the Contract and shall then remain in full force and effect until the end of the Warranty Period or until such time as the Tenderer is released from the Warranty Period, whichever is longer.
- 3) Failure to submit the "Agreement to Provide Irrevocable Letter of Credit" as required may result in the Tender being disqualified. Failure to submit the "Agreement to Bond" will result in the automatic disqualification of the Tender.



- 4) The party to whom the Contract is awarded will be required to provide the fully executed Contract Performance Security within seven (7) calendar days of the date of notice of award to the successful Tenderer to the address given in the Tender.
- 5) The costs of providing the Contract Performance Security shall be deemed to be included in all of the items in the Form of Tender, and no separate payment shall be made for same.

2.12.2.2. Performance and Labour and Material Bonds:

Prior to execution of the Contract, the successful Tender shall deliver to the Owner the following surety bonds from a Surety Company in the prescribed form required by Regulation 303/18 of the *Construction Act*, R.S.O. 1990, c. C.30. The labour/material and performance Bonds shall include the duration of the warranty period and maintenance period hereunder. The Contract Price amount in relation to the Performance Bond and Labour and Material Bonds will be defined as followed; Contract Price less the amount of the Irrevocable Letter of Credit.

- 1) Form 31 Labour and Material Bond with a coverage limit of 50% of the Contract Price; and
- 2) Form 32 Performance Bond with a coverage limit of 50% of the Contract Price

Upon the breach by the successful Tenderer of any of the terms or conditions of the Contract, the Owner may, at any time, advance a claim against either or both surety bonds. The Tenderer acknowledges and agrees that any claim advanced by the Owner against the surety bonds will not in any way limit the Owner's ability to collect additional amounts owing from the successful Tenderer to the Owner.

- 1) A failure to provide any security shall:
 - i) constitute a breach of the requirements of the Tender; and
 - ii) entitle the City to claim under any bid security described in the Instructions to Bidders, section 2.11.1. Bid Security.

2.13. Review of Bids

- 1) At the close of the Tender, all apparently eligible Bids will be examined by a representative of the City's Purchasing Division to confirm that they are compliant and otherwise complete.
- 2) At its sole discretion, the City may clarify any aspect of any Bid received in respect of the Bid with any Bidder at any time, and may clarify any aspect of the price Bid by the Bidder, and
 - i) the purpose of such clarification may be,
 - ii) to enable the City to determine whether the Bid to which it relates complies with



the Tender;

- iii) to resolve any ambiguity in the language used, or any other vague or uncertain aspect of the Bid.
 - iv) no such clarification shall alter the Bid or constitute negotiation or re-negotiation of the price or any aspect thereof, or the nature or quality of the goods or services to be supplied or performed as set out in the Bid at the close of the Tender, and all correspondence with a Bidder for the purposes of such clarification shall be conducted through the Purchasing Division.
- 3) Without limiting subsection (2), the City's right to clarify shall include the right to request additional or missing information relating to the work that is to be done or the Goods or Services that are to be supplied or the manner in which the Project or Work is to be carried out.
 - 4) The right of clarification provided under this section is within the sole, complete and unfettered discretion of the City and is for its exclusive benefit, and may or may not be exercised by the City at any time and in respect to any or all Bids.
 - 5) The right to clarify shall **not** impose upon the City a requirement to clarify with the Bidder any part of a Bid, and where in the opinion of the Purchasing Manager the Bid is ambiguous, incomplete, deficient, or otherwise not acceptable in any aspect, and the City may reject a Bid either before or after seeking a clarification under this section.
 - 6) Neither the review of its submission with any Bidder, nor the seeking of clarification under this section, shall oblige the City to enter into a Contract with that Bidder, and shall not constitute an acceptance of that Bid or any other Bid.
 - 7) All clarifications under this section shall be in writing, in a form satisfactory for inclusion in the Contract and satisfactory to the City.
 - 8) Any Bidder may be required to meet with officials of the City within 30 days of being so requested to explain details of the submission, at a place in Timmins specified by the City, and transportation to and from the meeting for the Bidder's representatives, as well as the hourly or per diem costs of the meeting itself for any such representative, shall be at the expense of the Bidder.

2.14. Bids Open for Acceptance, Irrevocable, etc.

- 1) Bids shall not be opened until after the date and time specified for the closing of the Tender, and so far as practicable, all Bids shall be opened at one time.
- 2) Unless otherwise provided in the terms and conditions governing a specific Bid, a Bid shall be irrevocable (i.e. open for acceptance by the City of Timmins) for a period of **90 calendar days** following the closing date and time for the Tender.



- 3) The City shall notify the Successful Bidder as soon as practicable after the acceptance of its Bid and the Contract shall be deemed to arise upon the acceptance of the Bid of the Successful Bidder.
- 4) The price of all options and alternatives shall be separately stated from the Contract Price. Where options or alternatives are requested in the Contract Documents, the City shall not be obliged to purchase those options or alternatives when accepting a Bid, but may at its discretion elect to purchase all, some or none of the options or alternatives offered, but the Successful Bidder shall be obliged to adhere to the Contract Price quoted in its Bid.

2.15. Guidelines Regarding Bid Irregularities

As a guide to the Bidder, but without qualifying any rights and privileges reserved to the City, the Bidders Guidelines set out below is indicative of the manner in which discretion reserved by the City is to be exercised with respect to non-compliant Bids. However, the City shall not be liable to any Bidder or other person where it elects to exercise a discretion, reserved privilege or right in a manner different from that indicated below.

BIDDERS GUIDELINES		
IRREGULARITY		RESPONSE
1.	Qualified or conditional Bid (A Bid restricted by a statement added to the Form of Tender or a covering letter or alterations to the Form of Tender).	Automatic rejection unless the Request for Tenders specifically permit such qualification or condition.
2.	A Bid received in a format not specified in the Request for Tenders such as hardcopy submission, fax, email, etc.	Automatic rejection.
3.	A Bid received on documents other than those documents supplied by the Bidding System.	Automatic rejection.
4.	Bid Security: Amount of Bid security provided by Bidder is insufficient, does not name correct Municipality as obligee, or no Bid Security is provided or is not otherwise in compliance with the Request for Tenders requirements.	Automatic rejection.
5.	Execution of Bid bond: Corporate seal or electronic signature of Bidder, or both, are missing. Corporate seal or electronic signature of bonding company, or both, are missing.	Automatic rejection. Automatic rejection



BIDDERS GUIDELINES		
IRREGULARITY		RESPONSE
6.	Bid Security: Digital bid bond not provided or not an electronically verifiable and enforceable e-Bond.	Automatic rejection.
7.	Other irregularities.	An irregularity that goes beyond the scope of the Bidders Guidelines may be considered by the Purchasing Manager.

2.16. Reserved Privileges of the City

The City shall have the following reserved privileges, which may be exercised or waived in its absolute discretion:

- 1) The City may reject any Bid, the lowest Bid or all Bids, or may cancel the Tender and require the submission of new Bids;
- 2) In addition to considering Bid prices, when evaluating Bids and awarding the Contract, the City may exercise reasonable commercial judgment taking into account with respect to its decision:
 - i) the full cost implications to the City with respect to each Bid, including life-expectancy, the inclusion or exclusion of alternate or optional equipment or configurations and the price implications thereof, training or re-training costs, length and scope of warranty coverage, and long-term maintenance requirements;
 - ii) the need to achieve economies of scale in supply;
 - iii) the need to diversify sources of supply;
 - iv) compatibility with existing equipment, including battery systems and battery chargers, such compatibility to be determined by tests conducted either by the City or by an independent testing agency satisfactory to the City;
 - v) compatibility with existing computer software and hardware, and capability to generate reports suitable to the City's existing reporting requirements; such compatibility and capability to be determined by tests conducted either by the City or by an independent testing agency satisfactory to the City;
 - vi) any extraordinary or unjustified disparity between the lowest bid and the other bids received by the City;
 - vii) the amount offered by a Bidder for any scrap, rubble or other component of a building that is to be demolished, or land site that is to be cleared and dug, as part of the Project;
 - viii) decommission and demolition costs, the amount offered or obtainable for scrap, the costs of removing construction or other debris, and the ability to cannibalize



- existing infrastructure;
 - ix) the need to secure timely and reliable sources of supply;
 - x) the need to discontinue reliance on obsolete technology and methods;
 - xi) the need to provide state of the art service to the residents of the City, or to integrate any aspect of City operations with those of its neighbours;
 - xii) the need to avoid the use of unproven technology and methodologies;
 - xiii) the need to spread and minimize risk to the City;
 - xiv) the proximity of any service centre of a Bidder to the City;
 - xv) the benefit in employing suppliers who have a proven track record of successful delivery and good reputation within the business community for integrity and competence;
 - xvi) the prior record of the Bidder as a contractor to the City;
 - xvii) such other considerations as would influence the decision of a reasonable and prudent purchaser in the particular circumstances of the City at the time when the Contract is awarded.
- 3) In awarding the contract the City may take into account the adherence or non-adherence of a particular Bidder to the social, economic or labour relations policies of the City;
- 4) the City may reject a Bid submitted by a person which in the opinion of the City or its professional advisors, does not possess the experience, or financial, technical, personnel or other resources that may reasonably be expected to be necessary in order to carry out the obligations that the Bidder proposes to assume under the terms of its Bid;
- 5) the City may waive compliance with any minor requirement governing the submission of Bids, including (but not limited to) any requirement to:
- i) attend any meeting;
 - ii) inspect any site or thing;
 - iii) submit Bids in any particular form;
 - iv) state prices or any other aspect of a Tender in any particular manner;
- provided that in so doing the City shall not unfairly prejudice any other Bidder.
- 6) where in the view of the City, an insufficient number of Bids have been received in response to a Tender, the City may publish a further such request;
- 7) the City may accept any Bid conditionally;
- 8) where the lowest compliant Bid exceeds the budget approved by the City, or where during the course of the Tender it is determined by the City that it would not be



reasonable in the circumstances for the City to select its supplier solely by reference to price, the City reserves the right to identify a short list of one or more potential suppliers with whom it will seek to negotiate bilaterally a contract for the Project in question;

- 9) where the Contract is awarded to the lowest compliant Bidder, the City may negotiate amendments to the Contract or to the Work to be done or Services or materials to be supplied under the Contract;
- 10) the City may modify the terms and conditions of a Tender at any time prior to the closing date and time for the submission of a Bid, but despite any other provision of this Request for Tenders, where a Bid has been received prior to the time when such an modification is made, the City shall notify the Bidder concerned, and allow that Bidder a reasonable opportunity to submit a revised Bid.

2.17. Rejection of Bids by the City

- 1) At its discretion, the City may reject any Bid that does not,
 - i) comply with these Instructions; or
 - ii) contain in full all information required on the Form of Tender, these Instructions or any of the other Contract Documents provided by the City to the Bidder.
- 2) The City may reject any Bid submitted by a Bidder or cancel the Contract awarded to that Bidder without penalty, where any information provided by the Bidder in its Bid or as part of any pre-qualification procedure is determined to be false or otherwise misleading in any material respect.

2.18. Owner's Right to Approve or Reject Subcontractors

- 1) Where required in the Bidding System, the Bidder shall indicate the names and addresses of all nominated subcontractors that it proposes to use,
 - i) on the Project, Work or Supply or
 - ii) in connection with the provision of any supply of goods or an intended fixture.
- 2) The City reserves the right to reject any subcontractor so nominated.
- 3) No change shall be made to the list of nominated subcontractors after the closing of the Tender, without the prior written approval of the City's Contract Administrator (if there is one) or the Purchasing Manager in all other cases.

2.19. Withdrawal of Bids by Bidder

- 1) Bidders may withdraw their Bid prior to the closing date and time of the Request for Tenders.



- 2) Requests to withdraw Bids received by the Bidding System after the closing date and time of the Request for Tenders will be disregarded.
- 3) Bids withdrawn may be edited and re-submitted prior to the closing date and time of the Request for Tenders. Bidders are solely responsible to ensure:
 - i) Any required adjustments are made to their Bid;
 - ii) Acknowledge all Addenda that have been issued for this Request for Tender; and
 - iii) Ensure the re-submitted Bid is received by the Bidding System prior to the closing date and time of the Request for Tenders.

2.20. Disqualification of Tenderer's

A Tenderer may be excluded from eligibility to submit or a submitted Tender may be summarily rejected, where the Chief Administrative Officer, the Chief Procurement Officer and the applicable Executive Leadership Team Member agree, in consultation with the Owner Solicitor, in their absolute sole discretion that one of the following circumstances has occurred:

- 1) the Tenderer is or has been involved in Litigation with the Owner, its elected officials, officers or employees;
 - i) The City may reject a Bid submitted by a Litigant or a Person involved with a Litigant. A Person "involved" with a Litigant is a Person acting on behalf or in concert with a Litigant in the submission of the Bid; a Person in whom a Litigant holds a direct or indirect interest; a Person that has as a shareholder, director, officer, partner, employee or agent, a Litigant; and/or a Person that is a shareholder, director, officer, partner, employee or agent, of a Litigant.
 - ii) Before, and as a condition of accepting a Bid, the City may, but is not obligated to, require a Bidder or an officer of the Bidder to certify that such Bidder is not involved with a Litigant in any manner described in the section (definitions).
- 2) the Tenderer has failed to pay an amount owed to the Owner when due and owing;
- 3) there is documented evidence of poor performance and/or non-performance;
- 4) the Tenderer has withdrawn its Tender on a previous Tender Solicitation after Tenders have been opened by the Owner;
- 5) the Tenderer is in breach of the Purchasing By-law;
- 6) the Tenderer or its personnel have demonstrated abusive behaviour or threatening conduct towards Owners employees, their agents or representatives;
- 7) the Tenderer has been convicted of a criminal offence including but not limited to fraud or theft;



- 8) the Tenderer has been convicted of any quasi-criminal offence pursuant to applicable legislation or regulations including but not limited to the *Occupational Health and Safety Act*, as amended, where the circumstances of that conviction demonstrate a disregard on the part of the Tenderer for the health and safety of its workers, Owner Employees or the general public;
- 9) the Tenderer is bankrupt or insolvent;
- 10) the Tenderer has made a false declaration(s); or,
- 11) the Tenderer has committed professional misconduct or acts or omissions that adversely reflect on the commercial integrity of the Tenderer.

For the purposes of this Section 2.22, Tenderer shall be deemed to include any related entity and any partner, principal, director or officer of such Tenderer as well as any other legal entity with one or more of the same partner(s), principal(s), director(s) or officer(s).

2.21. Ability and Experience of Tenderer

- 1) It is not the intent of the Owner to accept a Tender and award a Contract to any Tenderer that does not furnish evidence, including but not limited to, information submitted in the Form of Tender, or as subsequently requested by the Owner, that indicates the Tenderer has the required ability and experience in this class of work, and that sufficient capital and plant is available to enable the Tenderer, in the Owner's opinion, to satisfactorily perform and complete the Work successfully, and to complete it in the time entered in the form of Tender.
- 2) In order to aid the Owner to consider the ability, experience and capacity of the Tenderer, the Owner may request, and the Tenderer shall furnish, within 48 hours after being requested to do so, additional information including but not necessarily limited to the following:
 - i) A tabulation of other work now under contract, giving the location, type, size, required date of completion and the percent of completion to date of each job.
 - ii) References, including contact information where recent projects of similar magnitude, complexity and class of work have been undertaken.
 - iii) Evidence that the Tenderer is licensed to do business in the Province of Ontario, in the case of a Corporation organized under the laws of any other Province or Country.
 - iv) Such additional information as will satisfy the Owner that the Tenderer is adequately prepared to fulfil the Contract.

2.22. Declaration of Bidders Compliance with City By-Laws

Should the Bidder's declaration in its Form of Tender that it is in compliance with all City of Timmins by-laws be untrue or incorrect, the City shall be entitled at its sole discretion to reject the Bidder's Bid.



2.23. Obligation of Suppliers to Deal in Good Faith and To Treat the City as its Most Favoured Customer

- 1) Each Bidder is required to deal with the City in utmost good faith both with respect to the submission of its Bid and with respect to the performance of any Contract awarded by the City upon the acceptance of that Bid.
- 2) Where through inadvertence, a contract is awarded to a Bidder who has made an unauthorized amendment to the City's Form of Tender, then within a reasonable time of the City discovering that unauthorized amendment, the City may:
 - i) cancel the Contract without compensation to the Bidder by giving written notice to that effect to the Bidder;
 - ii) recover from the Bidder any amount paid to the Bidder in excess of what would have been paid had that amendment not been made, and
 - iii) where in the reasonable opinion of the Purchasing Manager, the change was made by the Bidder as part of a deliberate attempt to deceive, ban the Bidder from competing for City contracts for a period of up to ten years.
- 3) Where in the reasonable opinion of the Purchasing Manager it is determined that,
 - i) on any one or more occasions a Bidder has,
 - a) unlawfully or to a grossly unreasonable degree intimidated, harassed, or otherwise interfered with an attempt by any other prospective supplier to bid for a City contract or to perform any Contract awarded by the City to that supplier;
 - b) assaulted or committed battery against any City employee (including any constable, officer or other employee of Timmins Police Services) in the performance of his or her duty;
 - c) deliberately retained a known over-payment, or has knowingly failed to notify the City of an over-payment or duplicate payment;
 - ii) a Bidder has employed in the performance of a contract with the City of Timmins or any local municipality which formed part of the Municipality of The City of Timmins, a systematic policy of,
 - a) over-billing;
 - b) charging for items not supplied;
 - c) charging for items of one grade, while supplying items of an inferior grade;
 - d) misrepresentation as to the quality or origin of Goods, their functionality or suitability for a purpose, or their performance characteristics; or
 - e) any other form of sharp practice,



the City may ban the Bidder, and any person with whom the Bidder is not at arm's length within the meaning of the *Income Tax Act* (Canada), from competing for City contracts for a period of up to ten years.

2.24. Award

The owner reserves the right in its sole discretion to award the Tender Solicitation in whole or in part. The award of this Tender Solicitation is conditional upon the allocation of sufficient funds by the Council for the City of Timmins.

Tender award is subject to receipt of Council Approval.

The lowest price Tender or any Tender shall not necessarily be accepted. While price and financial considerations constitute an element of the evaluation of Tenders, several other considerations are to be taken into account in evaluating the Tenders.

2.25. Prices

- 1) All Prices Bid, including any Unit Prices, must be in stated in Canadian funds.
- 2) There is no public opening for this Request for Tenders. All Bids shall be electronically opened and posted on the Bidding System, <https://timmins.bidsandtenders.ca/Module/Tenders/en> following the closing date and time of the Request for Tenders. The Bidder's name and the Total Contract Price shall be posted for each Bid received.
- 3) Following the electronic opening, the Bids shall be reviewed further to determine compliance with the Tender.
- 4) Total Contract Prices shall be evaluated on the basis of their respective net present value, provided that the City may make appropriate allowances for extended warranty coverage, lower maintenance cost, higher trade-in value, longer life expectancy and other factors relevant to determining the full life-time cost of the Bid. Preference may be given to a Bid that offsets cost with related savings, so as to provide for no or minimal net tax increases and maximum benefits to City. For the purposes of determining net present value, the discount rate and any escalation factor shall be uniformly applied to all Bids, but otherwise shall be in the discretion of the City.
- 5) Once the Contract has been awarded, only the Total Contract Price on which the award of the Contract is based will be disclosed. Official notification will only be given to the Successful Bidder; however, persons may obtain the Total Contract Prices for each submission received as well as the Contract award information from the following website: <https://timmins.bidsandtenders.ca/Module/Tenders/en>.

2.26. Schedule of Price



The Successful Bidder shall have no claim for any compensation against the City of Timmins if the Successful Bidder's actual quantities of services completed are above or below the estimated quantities provided in the Schedule of Prices.

2.27. Variation in Bid Prices

- 1) No variation in Bid Price(s) shall be permitted after the closing date and time for the Tender except,
 - i) where there is a variation due solely to an increase or decrease in the rate of applicable taxes beyond the control of the Bidder, occurring after the time and date of submission of its Bid, in which case the variation shall alter the price of the Bid only to the extent of the tax increase or decrease;
 - ii) where the City exercises its discretion to correct a patent computational or other mathematical error evident on the face of the Bid.
- 2) In the event that a tax increase or decrease occurs after the submission of its Bid, the Bidder must prove to the satisfaction of the City of Timmins that the Bidder will not benefit in any way by reason of the increase.
- 3) Where Bidders are instructed to price the Project on a unit or component basis, the City shall consider only the Unit Price per unit or component for the respective materials to be supplied or items of work or services to be performed, but the City may at its discretion correct obvious mathematical errors on the part of the Bidder in computing the:
 - i) total prices derived from estimated quantities and their related Unit Prices;
 - ii) the subtotals derived from the total prices;
 - iii) the Total Contract Price derived from the total prices and subtotals; and
 - iv) any combination of the foregoing.

2.28. Taxes

- 1) As various parts of a Project, Work or Supply may or may not be exempt from Federal or Provincial sales tax, Bidders are required to refer to the Special Provisions for details respecting payment exemptions, rebates and taxes.
- 2) All prices shall be quoted exclusive of Value Added Taxes and the City may adjust any price quoted contrary to this requirement; unless otherwise specified in the Form of Tender or any Special Provisions.
- 3) Bidders shall expressly disclose any other applicable sales, customs or excise tax or duty, including a levy or duty imposed as a Special Import Measure, and other taxes to which any Work or supply of Services or materials may be subject, other than Value Added Taxes.



2.29. Contract Agreement

Upon Award of the Tender and prior issuance of the Purchasing Order, contractor will have to sign a CCDC2 -2020 Contract as referred in Appendix 4, to formalize acceptance of the Contract.

2.30. Confidentiality

- 1) The City shall make every effort to safeguard the confidentiality of each Bid and material submitted in connection with a Bid.
- 2) City policy is to disclose only such information as is required by law. Please note that all submissions are subject to the provisions of the Municipal Freedom of Information and Protection of Privacy Act. Information regarding the application of this Act is available from the Access to Information and Privacy division of the City Clerk's office at City Hall.
- 3) In addition, certain contractual information must be disclosed to Council, and accordingly may become part of the public record.
- 4) Bidders may mark any part of their submission as confidential except the Total Contract Price and their name. A watermark or rubber stamp imprint is suitable for this purpose. The City will use its best efforts not to disclose any information so marked, but shall not be liable to a Bidder where information is disclosed by virtue of an order of the Privacy Commissioner or otherwise as required by law.

2.31. Conflict of Interest

- 1) No employee of the City shall personally sell goods or services to the City, nor have a direct or indirect interest in a company that sells goods or services to the City.
- 2) The City may reject any Bid submitted, or cancel any contract awarded, in contravention of subsection (1).
- 3) Each Bidder respectively shall be deemed to have warranted that it has not employed or retained any person, other than a bona fide employee, agent or broker working for the Bidder, to solicit or secure the proposed contract, and that it has not paid or agreed to pay any person, other than a bona fide employee, agent or broker working solely for the Bidder, any fee, commission, percentage, gift or other consideration contingent upon or resulting from the award of that proposed contract, or as an inducement to be awarded that contract. Without prejudice to any of its other rights, the City reserves the right to annul any contract or other arrangement entered into with a Bidder where there is a breach of this warranty.

2.32. Non-Merger



- 1) Except where otherwise expressly agreed, these Instructions shall not merge upon the execution of the Contract, but the provisions of the Instructions shall be deemed to remain in effect throughout that Contract.
- 2) These Instructions shall define and limit the scope of any contractual or other legal rights in favour of any Bidder or subcontractor flowing from the Request for Tenders or the submission or acceptance of any Bid.

2.33. Ownership of Documents, Use of Designs, etc.

- 1) All maps, drawings, plans, specifications, computer disks and documents,
 - i) provided by the City to a Bidder shall remain the property of the City and shall be returned by the Bidder upon demand by the City for their return, whether or not the Bidder submits a Bid; or
 - ii) prepared by the Bidder as part of its Bid or otherwise in connection with carrying out the Project or Works or making the Supply contemplated under the Contract shall be the property of the City and may be disposed of by the City as it considers fit.
- 2) Unless the City otherwise agrees in writing, where any plan, drawing or design is provided in connection with a Tender then,
 - i) the submission of a Bid by a Bidder shall be deemed to constitute a license by that Bidder to construct one sample model of the work or project contemplated based upon that plan, drawing or design, where such a sample is required in order to make an informed decision concerning the attractiveness, functionality or other merit of the plan, drawing or design in question; and
 - ii) upon the award of the Contract to the Successful Bidder, the Successful Bidder shall be deemed to have licensed the City to construct such number of examples of the work or project contemplated based upon that plan, drawing or design that are contemplated under the Contract Documents,

but the license conferred under clauses (a) and (b) shall not be deemed to constitute an assignment of any patent, copyright, trade mark or other intellectual property of the Bidder.

2.34. Samples and Demonstration

- 1) Samples are not required for this Request for Tenders.

2.35. Brand Names

- 1) Any reference to the trade name, brand name or catalogue number of a particular manufacturer shall be understood to have been made solely for the purpose of establishing and describing general performance and quality levels of the item to be supplied, unless specified otherwise.



- 2) No reference to the trade name, brand name or catalogue number of a particular manufacturer shall be construed to restrict Bidders to that manufacturer, but Bids shall be deemed to be invited for generic no-name equals and comparable equipment of any manufacturer.
- 3) Despite subsection 2), if an item other than the one specified is bid, it is the Bidder's responsibility to demonstrate that the product bid meets the specifications, and the Bidder shall submit brochures and samples upon request and provide full specifications in detail on the item(s) bid. The City shall be the sole judge (in its absolute discretion) as to whether an item bid meets its specifications.

2.36. Security Clearance

- 1) There are no security clearance requirements for this Request for Tenders.

2.37. Standard Warranty

Unless the Special Provisions otherwise provide, all construction work (including all Goods supplied and Services performed in relation thereto) shall be subject to a minimum two-year warranty from the date of the completion of the Project. Bidders are encouraged to offer longer term warranties, and an appropriate allowance may be made by the City in its evaluation of the Total Contract Prices of competing Bidders, based upon the length and scope of warranty offered by each respective Bidder.

2.38. Performance Review

- 1) At the conclusion of the Project, and during the course of carrying out the Project, where the Contract Administrator or Consultant so directs, the City and the Successful Bidder shall carry out a performance review in accordance with this section concerning the performance of work and the provision of services by the Successful Bidder.
- 2) Performance under the Contract shall be assessed by reference to the following criteria:
 - i) general responsiveness of the work relationship;
 - ii) conformity of the work done, materials supplied and provision of services with the Description of Project and Specifications;
 - iii) general dependability and quality of all work done and any Goods or Services supplied;
 - iv) timely performance;
 - v) general conformity with the reasonable expectations of the City under the terms of the Contract in their entirety;
 - vi) supervision of subcontractors and the maintenance of an orderly, neat and secure job site;



- vii) accuracy of carrying out instructions.
- 3) The respective representatives of the City and Successful Bidder shall meet at mutually agreeable times within ten Business Days of the final completion of the Contract or of the Contract Administrator or Consultant so directing.
- 4) Where a performance review is conducted under subsection (3), each of the agreed aspects of the Successful Bidder's performance shall be ranked by the City at one of the following standards:
 - i) Satisfactory (performance in accordance of general standard of City suppliers);
 - ii) Unacceptable (performance well below the general standard of City suppliers).
- 5) At any performance review under this section, the Successful Bidder shall be entitled to identify any aspect of the City's operations that is undermining the Successful Bidder's ability to deliver at least a satisfactory level of performance with respect to some criteria of assessment, and where the City concludes that this is in fact the case, the ranking given to the Successful Bidder with respect to that criteria of assessment will be adjusted accordingly.
- 6) Where at a performance review carried out prior to the completion of the Project, one or more criteria of assessment are ranked as unacceptable:
 - i) the parties shall agree at the time of the conduct of the review or within ten Business Days thereafter, on the measures to be taken by the Successful Bidder during the ensuing contract review period to improve its performance to at least a good standard;
 - ii) within ten Business Days of agreeing on those measures, the Successful Bidder shall confirm in writing that the measures in question have been implemented.
- 7) Where the Successful Bidder fails or refuses to implement measures as provided in subsection 6), it shall be deemed to be in default under the Contract, and the City may take such remedies as provided for in the Contract Documents or are otherwise available at law or in equity.
- 8) Where the unsatisfactory performance of the Successful Bidder is not corrected as required under this section, that performance may be taken into account by the City with respect to the award of any future contract to the Successful Bidder.

2.39. Permits, Licenses and Approvals

- 1) Unless otherwise expressly agreed by the City in writing, the Successful Bidder shall be responsible for obtaining and maintaining (at its own cost) all necessary permits, licenses and approvals relating to the Project, Work or Supply.
- 2) The Successful Bidder shall ensure that all persons supplying services or materials to the Project, Work or Supply hold all valid and current licenses required by law with respect to the services or materials to be supplied by them respectively.



2.40. MASH Agencies

By submitting a Bid in response to this Request for Tenders, the Successful Bidder agrees and acknowledges that other interested municipalities, municipal organizations, conservation authorities, hospitals, academic institutions, schools and health and social services organizations (MASH sector) may review this document.

They may deem it in their best interest to participate in the resulting Contract under the same terms and conditions, if mutually agreed upon between the interested MASH organization and the Successful Bidder.

Bidders are advised that the resulting volume quantities may be significantly higher than the estimated quantities in this Request for Tender since those reflect only City of Timmins usage. Bidders are requested to consider this information while preparing their Bids.

The City will issue its own Purchase Order or Contract for their respective Goods and/or Services to the Successful Bidder. Purchase Orders or Contracts will be issued independently by any participating MASH organization.

Bidders are advised that other MASH sector agencies may participate in the resulting Contract under the same terms and conditions. As a result, Bidders should consider while preparing their Bids that volume quantities may be significantly higher than the estimated quantities provided in this Request for Tenders.

2.41. Accommodations for Bidders with Disabilities

In accordance with the Ontario Human Rights Code, Ontarians with Disabilities Act, 2001 (ODA) and Accessibility for Ontarians with Disabilities Act, 2005 (AODA), the City of Timmins will accommodate for a disability, ensuring full and equitable participation throughout the bid process.

If a Bidder requires this Request for Tenders in a different format to accommodate a disability, the Bidder must contact the Purchasing Division at purchasing@timmins.ca as soon as possible and in any event prior to the closing date. The Request for Tenders in the different format will be issued only to the requesting Bidder and all Addenda will be issued in such different format only to the requesting Bidder.

PART 3 - DEFINITIONS AND INTERPRETATION

3.1. Definitions

- 1) In these Instructions to Proponents, Special Instructions, Proposal Submission Information and Form of Proposal, unless expressly provided otherwise, the following definitions shall apply:



Capitalized words and phrases used in this Request for Tenders, including all Appendices and Addenda, or as otherwise specified, the following definitions shall apply:

- i) "Addendum" means a written addendum issued under these Instructions;
- ii) "Bid" means a bid made by a Bidder in response to the Tender;
- iii) "Bid Price" means any Unit Price or other component of the Total Contract Price;
- iv) "Bidder" means any person submitting a Bid in response to a Tender Notice;
- v) "Bidding System" means the electronic system used by the City for the advertisement of public bid opportunities at the following website:
<https://timmins.bidsandtenders.ca/Module/Tenders/en> and which is required to be used for all dissemination of information by or on behalf of the City and submissions from Bidders for this Request for Tenders.
- vi) "Business Day" means any day other than a Saturday, Sunday, public holiday or other day on which banks in Ontario are authorized or required by law to be closed;
- vii) "City" means The Corporation of the City of Timmins, and where an authority or discretion is conferred upon the City under the Contract Documents, means the appropriate official of the City as designated or appointed under its governing by-laws, resolutions or policies from time to time;
- viii) "Contractor" means the person undertaking the execution of the Work under the term of the Contract, and pending execution of the Contract includes a Successful Bidder, within the meaning of the Instructions to Bidders;
- ix) "Contract Administrator" means the person designated by the City to manage the delivery or performance of the Project, Work or Supply to which the Tender relates, or the City's obligations under the Contract;
- x) "Contract Documents" means all of the following documents:
 - a) any Addendum,
 - b) any Special Provisions,
 - c) the General Conditions;
 - d) the Specifications, with any supplemental specifications taking priority over the standard specifications, if any;
 - e) any contract drawings,
 - f) these Instructions;



- g) the standard form text of the Form of Tender as prescribed by the City; provided by the City or any consultant to the City to the Successful Bidder, and also the Bid of the Successful Bidder to whom the contract is awarded, and any other document agreed by the parties to constitute one of the Contract Documents;
- xi) “Default” means any act or event of default as contemplated in the RFT documents; and without restricting or limiting the rights and privileges of the City to any broader interpretation, any default of or in respect of a term, covenant, warranty, condition or provision of the Contract, or a liability caused, by an officer, director, partner, employee, Sub-Contractor or agent (or an officer, director, partner or employee of a Sub-Contractor or agent) of the Successful Bidder shall constitute a default by the Successful Bidder;
- xii) “Electronic Bidding” means a method of issuing this Request for Tenders and/or receiving Bids where the process of using and/or receiving Bids by internet is considered appropriate, and in particular includes the Bidding System operated by bids&tendersTM system operated by eSolutions Group, 455 Philip Street, Waterloo, Ontario N2L 3X2
- xiii) “Form of Tender” means the tender form relating to the Project or Works, as the case may be, and for the sake of greater certainty includes the Tender Form, Form of Tender – Schedule of Quantities and Prices, and Schedule of Prices;
- xiv) “Goods” means any item of tangible personal property or computer software, and includes:
- a) deeds and instruments relating to or evidencing the title or right to such personal property, or a right to recover or receive such property;
 - b) tickets or like evidence of right to be in attendance at a particular place at a particular time or times or of a right to transportation; and
 - c) energy, however generated;
 - d) items of tangible personal property that are intended for installation as a fixture or otherwise for incorporation into land, a building or structure, or that are ornamental or industrial trees, grass sod, flowering plants, shrubs, soil, seed or fertilizer;
- xv) “Litigant” means a Person involved in litigation or potential litigation with the City, the City’s elected officials or employees. In this paragraph, the term “litigation” and “potential litigation” include, without limitation, matters before administrative or similar tribunals, or matters which, in the opinion of the City, have a reasonable prospect of being brought by the City or a Person with interests in the matter that are adverse to the City, before such an administrative or similar tribunal.
- xvi) “Lump Sum Price” means an all-inclusive one price that applies to a single item,



or specific Service as set out on the Form of Tender.

- xvii) "Person" means an individual, a partnership, a corporation, or a trust;
- xviii) "Purchasing Manager" means the City's Procurement Manager or the Director of Financial Services;
- xix) "Project" means the supply and delivery of Goods, the delivery and performance of any Services and the completion of the Work in whole or in part as contemplated in the Tender;
- xx) "Project Manager" means the person (if any) designated by the City to manage the delivery or performance of the Project, Work or Supply to which the Tender relates, or the City's obligations under the Contract;
- xxi) "Proper Invoice" is as defined in the Construction Act (Ontario) and will include the following:
 - a) a breakdown of the invoice amount by trade or division as required by the specifications,
 - b) an updated schedule in a form and level of detail acceptable to the Owner showing the percentage complete on each task,
 - c) Worker's Compensation Board clearances showing current coverage,
 - d) a Statutory Declaration in the form of CCDC 9A for every invoice after the first invoice,
 - e) the Owner's and Contractor's full legal names,
 - f) the Purchase Order number and Project number applicable to the Work,
 - g) the aggregate amount of holdbacks retained by the Owner under the Contract including the amount retained under the Proper Invoice and separately the amount of the holdbacks retained under and applicable to the Proper Invoice;
- xxii) "Services" means a service of any description required in order to complete the Project, whether commercial, industrial, trade, or otherwise, and includes all professional, technical and artistic services, and the transporting, acquiring, supplying, storing and otherwise dealing in Goods;
- xxiii) "Specifications" means all written or printed descriptions or instructions pertaining to the method and the manner of performing the Work, to the Scope of Work and to the quality of materials to be furnished under the Contract;
- xxiv) "Sub-Contractor or Sub-Trade" is a person or entity having a direct Contract with the Successful Bidder to perform a part or parts of the Services or to supply Goods and/or Services with respect to the Project, upon the prior approval of the City;



- xxv) "Successful Bidder" means the Bidder whose Bid is selected by the City for the award of the Contract in respect of a Project or Works;
- xxvi) "Supply" means the supply of a Good or Service, and
 - a) in relation to a Good, includes the sale, rental, lease or other disposition or provision of the Good or an interest therein or a right thereto, or an offer so to dispose of the Good or interest therein or a right thereto; and
 - b) in relation to a Service, includes the sale, rental or other disposition or provision of the Service or an offer so to provide a service;
- xxvii) "Tender" means the request for tenders to which these Instructions relates, and any renewal or substitute for that request for tender;
- xxviii) "Total Contract Price" means the fully inclusive, all-in total contract price, constituting the sum of all costs quoted by a Bidder in its Bid with respect to the Project, Work or Supply,
 - a) including the purchase price for all materials, labour costs, service costs, costs for temporary structures and facilities, utility costs, warranty costs, life cycle costs, operating and disposal costs; but
 - b) excluding any options or alternatives requested in the Tender Notice or other Contract Documents that the City elects not to purchase; and
 - c) excluding Value Added Taxes or other applicable sales or value added taxes, imposed under the Laws of Ontario and the Laws of Canada applicable therein;
- xxix) "Unit Price" means any Unit Price or other component of the Total Contract Price excluding the Value Added Taxes;
- xxx) "Value Added Taxes" means such sum as shall be levied upon the Total Contract Price by the Federal or Provincial or Territorial Government and is computed as a percentage of the Total Contract Price and includes the Goods and Services Tax, the Ontario Retail Sales Tax, the Quebec Sales Tax, the Harmonized Sales Tax, and any similar tax, the collection and payment of which have been imposed on the Bidder by the tax legislation;

3.2. Interpretation

In these Instructions and in all of the Contract Documents, unless the context otherwise necessitates,

- 1) a word importing the masculine, feminine or neuter gender only includes members of the other genders;



- 2) a word defined in or importing the singular number has the same meaning when used in the plural number, and vice versa;
- 3) a reference to any Act, bylaw, rule or regulation or to a provision thereof shall be deemed to include a reference to any Act, bylaw, rule or regulation or provision enacted in substitution therefor or amendment thereof;
- 4) the headings to each section are inserted for convenience of reference only and do not form part of the Contract;
- 5) all accounting terms have the meaning recognized by or ascribed to those terms by the Canadian Institute of Chartered Accountants;
- 6) all references to time shall be deemed to be references to current time in the City;
- 7) any reference to an officer of the City shall be construed to mean the person holding that office from time to time, and the designate or deputy of that person, and shall be deemed to include a reference to any person holding a successor office or the designate or deputy of that person;
- 8) words and abbreviations which have well-known professional, technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.

PART 4 - APPENDICES

APPENDIX 1A – SPECIFICATIONS

APPENDIX 1 B – DRAWINGS

APPENDIX 1 C – CITY OF TIMMINS CCDC SUPPLEMENTARY CONDITIONS

APPENDIX 2 – IRREVOCABLE LETTER OF CREDIT FORMS

APPENDIX 3 – AGREEMENT TO BOND

APPENDIX 4 – CCDC2-2020 CONTRACT



APPENDIX 1A - SPECIFICATIONS

Specifications	1
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DIVISION 1 – GENERAL REQUIREMENTS

DIVISION 1 – GENERAL REQUIREMENTS

Section No.	Title
01000	General Requirements
01025	Measurement and Payment
01110	Summary of Work
01120	Coordination and Sequence of Work
01140	Special Project Procedures
01200	Alternatives
01300	Administrative Requirements
01320	Construction Schedule
01330	Submittals
01330A	Submittals Template
01330B	Submittals Naming Convention
01351	Health and Safety
01355	Project Waste Management
01400	Environmental Protection
01410	Regulatory Requirements
01420	References
01450	Quality Control
01510	Temporary Facilities
01520	Construction Facilities
01610	Basic Product Requirements
01740	Cleaning
01750	Disinfection Water Infrastructure
01760	Warranty Work
01770	Closeout Procedures
01780	Closeout Submittals
01810	Testing and Commissioning
01820	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 Regional Municipality of Peel. Where specification sections designate "Owner's Operator" or "Operator", these designations shall be taken to mean the Ontario Clean Water Agency.
- 1.2.4 If there is a discrepancy between contract drawings, the most stringent drawing, clause, or note shall take precedent as per the Engineer's interpretation.
- 1.2.5 If there is a discrepancy between specification sections, the most stringent 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 "Timmins WFP City of Timmins".

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, 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.

1.5 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:

Contract or Project No.	Project Title	By	Date
	Town of Timmins Water Filtration Plant	J L Richards & Associates Ltd.	1976
83-7812	City of Timmins Water Treatment Plant Expansion Contract No. 3 and Contract No. 4	J L Richards & Associates Ltd.	1984
2003-W001	City of Timmins Water Filtration Plant Modifications to Lime System, Backwash System & Flow Meters	CH2MHILL	2003
W-2007-014	City of Timmins Water Filtration Plant Upgrades	GENIVAR	2007
2015-401	City of Timmins Water	WSP	2019

Contract or Project No.	Project Title	By	Date
	Filtration Plant Upgrades		

- .3 The workmanship and materials employed on the existing structures were of good quality and the building has not deteriorated significantly.
- .4 Bearing walls, structural steel and structural concrete is reasonably true and plumb.
- 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 on Contract Drawings.
- 1.5.4 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.
- 1.5.5 Survey Requirements by Contractor:
 - .1 Record locations, with horizontal and vertical data in Project Record Documents.
 - .2 Establish lines and levels, locate and lay out the works using appropriate instrumentation.
 - .3 Stake for grading, fill and topsoil placement and landscaping features.
 - .4 Stake slopes and berms.
 - .5 Establish pipe invert elevations.
 - .6 Stake batter boards for foundations.
 - .7 Establish foundation column locations and floor elevations.
 - .8 Establish lines and levels for mechanical and electrical work.

1.6 Subsurface Conditions

- 1.6.1 Promptly notify the Engineer in writing if subsurface conditions, or any reasonable assumption of probable conditions, differs materially from those indicated in the Contract Documents.

- 1.6.2 The Engineer or other agents of the Owner will promptly investigate the conditions and the Engineer will advise the Contractor in writing of any necessary changes to the Works.

1.7 Protection and Safety

- 1.7.1 The Contractor shall undertake the role of the "Constructor" as defined in the *Occupational Health and Safety Act*.
- 1.7.2 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.
- 1.7.3 Protect excavations, trenches and building from damage by rainwater, ground water, backing up of drains or sewers and other water, frost and other weather conditions. Provide sheeting, piling, shoring, pumps, equipment, temporary drainage, protective covering and enclosures. Provide necessary pumps including spare pump for keeping excavations free of water throughout construction period.
- 1.7.4 Protect active services. Cap inactive services and remove unwanted portions with approval of Engineer.
- 1.7.5 Protect finished work. Damaged work shall be restored or redone at the Contractor's expense at the discretion of the Engineer.
- 1.7.6 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.
- 1.7.7 Ensure that working conditions for the Owner are not adversely affected by work under this contract.

1.8 Manufacturer's Instructions

- 1.8.1 Install or erect products in accordance with manufacturer's direct written instructions.
- 1.8.2 Handle and store materials in accordance with manufacturers' and suppliers' recommendations and to prevent damage to materials during storage and handling.
- 1.8.3 Notify the Engineer in writing, of conflicts between the specification and manufacturer's instructions, so that the Engineer may establish the course of action.

1.9 Equipment Pricing by Manufacturers, Distributors or Dealers

- 1.9.1 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.

- 1.9.2 The Owner reserves the right to request that the Successful Bidder provide more detailed equipment price breakdowns than noted in Bids and Tenders for the establishment and recording of asset and depreciation values.

1.10 Progress Draw Cost Breakdowns

- 1.10.1 Use Table of Contents of the Specification as basis for identifying line items in the Detailed Contract Price Breakdown and any provisional items identified in Bids and Tenders.

1.11 Concealment of Services

- 1.11.1 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.
- 1.11.2 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.

1.12 Mobilization and Demobilization

- 1.12.1 The Contractor must provide for the mobilization/demobilization of the site in accordance with these contract documents.
- 1.12.2 Comply with the Engineer's and Owner's instructions in regard to the allocation of the mobilization areas of the site, construction fencing, temporary signage, field offices and storage areas, access and parking.
- 1.12.3 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.

1.12.4 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 damaged 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.

1.13 Damage to Existing Utilities and Structures

- 1.13.1 Obtain the necessary drawings and perform any necessary sub-surface investigations 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.
- 1.13.2 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.
- 1.13.3 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.
- 1.13.4 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.

1.14 Occupying the Site

- 1.14.1 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.
- 1.14.2 Areas shown as Contractor's Limits are areas to be used by the Contractor for construction, parking lot, storage and temporary facilities.
- 1.14.3 All inquiries and deliveries related to the Contractor's activities will be directed to the Contractor's site trailer.

- 1.14.4 Confine operations within areas designated for construction, storage and access as shown on the Contract Drawings and/or as directed by the Engineer.
- 1.14.5 Limit access to and from the site as instructed by the Engineer.
- 1.14.6 Maintain safe access to any existing facilities for the operations staff at all times.
- 1.14.7 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.
- 1.14.8 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.
- 1.14.9 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.

1.15 Contractor Use of Premises

- 1.15.1 Arrange with the Owner, Operator and Engineer for storage areas and access to the Works.
- 1.15.2 Make arrangements with property owners if additional areas are required. Obtain written agreements and submit copies to the Engineer.
- 1.15.3 Confine operations within working limits for construction, storage and access.
- 1.15.4 Install and maintain temporary chain link fencing along working and storage areas and access routes.
- 1.15.5 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.
- 1.15.6 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.
- 1.15.7 During construction of the facilities, liaise with the Engineer and plant operating staff to schedule work to minimize impacts on plant operations.

- 1.15.8 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.
- 1.15.9 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.

1.16 Owner Occupancy

- 1.16.1 The Owner and plant operating staff will occupy premises during entire construction period for execution of normal operations.
- 1.16.2 Cooperate with the Owner and operating staff in scheduling operations to minimize conflict and to facilitate usage by the Owner and plant operating staff.
- 1.16.3 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.
- 1.16.4 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 Related Sections

- 1.2.1 Section 01120 – Coordination and Sequence of Work
- 1.2.2 Section 01320 – Construction Schedule
- 1.2.3 Section 01770 - Close-out Procedures
- 1.2.4 Section 01780 – Closeout Submittals (Redline Drawings and O&M Manuals)
- 1.2.5 Section 01810 – Testing and Commissioning and Section 01820 – Demonstration and Training

1.3 Scope

- 1.3.1 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 Bids and Tenders shall be considered subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid.

1.4 Measurement for Payment

- 1.4.1 The Engineer will review the Contractor's application for payment based on the percentage of work completed for the billing period and prices entered in Bids and Tenders and related breakdown.
- 1.4.2 The Contractor's application will not be considered proper until all quantities and supporting documentation have been accepted by the Engineer.

1.5 Payment Requisitions

- 1.5.1 Contractor's Responsibilities:
 - .1 Submit for review a draft payment requisition breakdown (broken down by specification section) to the Engineer within three (3) weeks of the order to commence.
 - .2 Submit subsequent draft payment requisitions to Engineer on the date established at the Pre-Construction Meeting. The Engineer will review and

respond or make changes as required based on the progress of work completed for the billing period. Draft 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 Engineer in support of payment requisition.
- 1.5.2 The draft Detailed Contract Price Breakdown will be reviewed by the Engineer and Owner. The final version of this breakdown will form the basis of tracking payment requisitions throughout the duration of the Contract.
- 1.5.3 Engineer'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 Engineer'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.

1.6 Change Orders & Change Directives

- 1.6.1 Complete and promptly return all Request for Quotations (RFQs) issued by Engineer, quoting unit and/or lump sum prices as requested. Include appropriate supporting documentation to verify prices.
- 1.6.2 Do not proceed with work affected by RFQs until authorized to do so by Change Order, or authorization to proceed in writing by the Engineer.
- 1.6.3 A Change Order is only valid when signed by Engineer, Owner and Contractor.

- 1.6.4 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.
- 1.6.5 The "Contractor's cost" as provided in paragraph 6.3.6 of GC 6.3 – CHANGE DIRECTIVE shall only apply where the method of adjustment to be used is the Negotiated lump sum or Cost - Plus (Time and Materials) method.
- 1.6.6 The "Contractor's percentage fee" as provided in paragraph 6.3.6 of GC 6.3 – CHANGE DIRECTIVE shall be based on the following:
- .1 For work performed directly by the Contractor's forces: 15% for the first \$10,000 and 5% over and above \$10,000.
 - .2 For work performed by a Subcontractor: 15% for the first \$10,000 and 5% over and above \$10,000 for the Subcontractor, plus 5% for the Contractor, not compounded.
 - .3 No further mark-up shall be applied regardless of the extent to which the work is assigned or sublet to others. If work is assigned or sublet to an associate, as defined by the *Securities Act*, no Subcontractor mark-up whatsoever shall be applied.
 - .4 A reasonable rental to be agreed upon, if rental charge is not stipulated in the Contract, 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.
- 1.6.7 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.

- 1.6.8 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.

1.7 Submittals

- 1.7.1 The format and detail of the submitted payment details shall be provided in accordance with the Owner's requirements.
- 1.7.2 Submittals shall be made electronically in accordance with the requirements of Section 01330.
- 1.7.3 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 Bids and Tenders. Note that payment will only be processed for items approved for in writing by the Owner.
 - .3 New scope of work items as may arise over the course of the work, payable via the Owner's Contingency. Note that payment will only be processed for items approved for in writing by the Owner.

1.8 Schedule of Prices

- 1.8.1 Lump Sum Work:
- .1 Reflect the schedule of Sections and Prices and specified cash allowances in Bids and Tenders, as applicable.
 - .2 Break down by Divisions 1 through 16 including a breakdown by each Specification Section.
- 1.8.2 Any schedule which is deemed by the Engineer to be unbalanced or front-end loaded will not be acceptable. The Engineer reserves the right to modify any unbalanced payment breakdowns.
- 1.8.3 Summation of the complete Lump Sum Price Breakdown representing all of the Work shall equal the Contract Price.
- 1.8.4 Submit the Lump Sum Price Breakdown in a spreadsheet format compatible with the latest version of Microsoft Excel.
- 1.8.5 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 5% of the Lump Sum Total Price (not including HST). In the event the amount provided for this item exceeds 5% 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.

1.8.6 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 2.5% 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 2.5% 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.

1.8.7 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 site progress. The balance shall not be paid until Final “Redline Drawings” are submitted and accepted by the Engineer. Minimum \$ 10000 should be under this line item.
- .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 Engineer’s acceptance of the final submission. Minimum \$ 5000 should be under this line item.
- .3 Final 1% 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 Engineer.

1.9 Allowance and Contingency Items

- 1.9.1 Allowance and Contingency payments shall only be made with prior written authorization of the Owner.

- 1.9.2 Prior to authorization, the Contractor shall – in coordination with the Engineer 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.
- 1.9.3 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.

1.10 Estimated Quantities

- 1.10.1 All estimated quantities stipulated in Bids and Tenders 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.
- 1.10.2 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.
- 1.10.3 The Contractor shall track and submit verification on an ongoing basis to the Engineer. If the quantities are exceeded or over-estimated, the unit rate provided in Bids and Tenders 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.
- 1.10.4 No extra work shall take place without the Owner's approval in advance of the work being undertaken.

1.11 Measurement

- 1.11.1 Payment will be based on actual amount of work done and materials furnished on a monthly basis for payment requisition breakdown line items.
- 1.11.2 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 Specification Section line item upon submission and 2.5% of Specification Section 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 Specification Section line item. Except for section 11421 – Horizontal split-case pumps which is will not exceed 40 %.
- 1.11.3 Under all cases, no more than 90% of each Specification Section line item will be released until successful completion of equipment start-up, commissioning, and performance testing.
- 1.11.4 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.

1.12 Applications for Payment

- 1.12.1 The Contractor shall use a detailed Application for Payment form in a format acceptable to the Owner and Engineer.
- 1.12.2 Applications for payment shall be made on a monthly basis and shall include the following elements as a minimum:
 - .1 Signed and dated transmittal form/cover sheet
 - .2 Statutory declaration (form to be provided by the Owner)
 - .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 Engineer.
 - .5 Updated summary of the divisional price breakdown including all approved allowance and contingency items, holdback and taxes.
 - .6 Updated cash flow analysis.
- 1.12.3 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 Engineer. 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.
- 1.12.4 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 Engineer being satisfied that full mobilization has been carried out. If the Engineer is not so satisfied, the Engineer shall allow a payment amount which,

in the opinion of the Engineer, reflects the degree of mobilization effected to date.

- .2 The remaining 40% to be paid immediately prior to completion of the Work for Demobilization.
- .3 As referred to in subsection 1.8.5 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.

1.13 Payment

1.13.1 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.

1.13.2 Payment for all of the Work shown or specified in the Contract Documents is included in the Contract Price.

1.13.3 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 Bids and Tenders.

1.14 Nonpayment for Rejected or Unused Products

1.14.1 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 this project.
- 1.2.2 Work of this Contract comprises general construction associated with:
- .1 Mobilization and site preparation including contractor laydown area, etc.
 - .2 Demolition

- .1 Removal and disposal of existing stand-by Backwash Pump and motor located in Filter 1, 2, 3 Pipe Gallery and associated process, structural, electrical, and instrumentation and control components to the extent as shown on Contract Drawings.
- .2 Removal and disposal of existing High Lift Pump No. 6 and motor located in High Lift Pump Room 1 and associated process, structural, electrical, and instrumentation and control components to the extent as shown on Contract Drawings.
- .3 Removal and disposal of existing piping, appurtenances, structural, electrical, and instrumentation and control components related to High Lift Pump No. 7 to the extent as shown on Contract Drawings.
- .4 Salvage existing valves and other components as indicated on the drawings.
- .5 Removal of existing stairs located in High Lift Pump Room No. 2 as shown in Contract Drawings.
- .6 Removal and reinstatement of existing wooden enclosure located outside High Lift Pump Room No. 1.
- .3 New Backwash Pump Installation
 - .1 Construction of concrete base and installation of new backwash pump and motor.
 - .2 Supply and installation of new piping, fittings, valves, and pipe supports as per Contract Drawings and Specifications.
 - .3 Installation of electrical, instrumentation and control components as per Contract Drawings and Specifications.
- .4 New High Lift Pump No. 6 Installation
 - .1 Construction of concrete base and installation of new High Lift Pump No. 6 and motor provided by the City.
 - .2 Supply and installation of new piping, fittings, valves, and pipe supports as per Contract Drawings and Specifications.
 - .3 Installation of electrical, instrumentation and control components as per Contract Drawings and Specifications.
- .5 New High Lift Pump No. 7 Installation

- .1 Construct concrete base and installation of new High Lift Pump No. 7 and motor provided by the City.
 - .2 Supply and installation of new piping, fittings, valves, and pipe supports as per Contract Drawings and Specifications.
 - .3 Installation of electrical, instrumentation and control components as per Contract Drawings and Specifications.
 - .6 New High Lift Pump No. 8 Butterfly Valve Installation
 - .1 Installation of new butterfly valve on High Lift Pump No. 8 discharge pipe and associated fitting connection.
 - .7 Contractor to remove and re-install any stairs, handrails and doors as necessary to facilitate transportation of existing and new pumps in and out of the pump rooms.
 - .8 The existing monorails in Both High Lift Pump Rooms have limited capacity. The Contractor should consider using portable lifting tools and mechanism to bring the existing pumps and components out of the pump rooms and to bring the new pumps and components in the pump rooms. The cost of lifting equipment used by the Contractor is incidental to the Works and shall be included in the Contractor's bid price.
 - .9 Note that the High Lift Pump Room No. 2 has two skylights with approximately dimensions of 1000 mm x 1000 mm, while the High Lift Pump Room No. 1 does not have skylights.
 - .10 The Contractor shall retain Lakeside Process Controls as the system integrator/ system programmer. Contact: Manuprasad.pm@lakesidecontrols.com.
 - .11 Demobilization
- 1.2.3 The list above is not comprehensive and it is to be used only as a general guide to the extent of the work. The Contractor shall review all specifications and drawings to assess the full scope of work. This clause is not intended to fully define the scope of the contract.

1.3 Location of Work

- 1.3.1 Timmins Water Filtration Plant, 110 Feldman Rd, Timmins, P4N 7C2.

1.4 Contract Method

- 1.4.1 Construct the work under a single lump sum contract.

1.5 Hours of Work

- 1.5.1 Normal working hours shall be Monday to Friday between 7 am and 7 pm.
- 1.5.2 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.
- 1.5.3 The Contractor shall, as far as possible, refrain from work on days which are weekends or legal holidays for the Owner. If it is desired to work on any such weekend or holiday, the Contractor shall notify the Owner in writing at least four (4) days in advance of such weekend or holiday of their intention to work, stating the areas where the work will be conducted.
- 1.5.4 If the Contractor fails to give such notice in advance of any weekend or 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 weekend or holiday.

1.6 Work by Others

- 1.6.1 The contractor should coordinate with other contractors who are working at the Plant, along with Plant staff and as required.

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 to minimize impact on operations, subject to approval of the Engineer and the Owner.
- 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 so 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 shall be carried out in stages to accommodate the Owner's and the Owner's Operator 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 and 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 Timmins Water Filtration 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, gas and power supply and distribution system.
- 1.1.6 Prior to shutdown of any facilities the Contractor must request in writing 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 the work to suit plant operation at no additional cost to the Owner.

1.2 Related Sections

- 1.2.1 Section 01330 – Submittals
- 1.2.2 Section 01810 – Testing and Commissioning

1.3 Shutdown Coordination

- 1.3.1 A Request for Shutdown submittal shall be required for any of the following circumstances:

- .1 Operator assistance in isolating/operating existing valves and/or equipment.
 - .2 Construction activities outside of current work area or in common areas of plant (i.e., access roads and tunnels)
 - .3 Commencement of a new phase in a previously occupied area of plant
 - .4 Start-up and/or commissioning activities requiring Operator support
- 1.3.2 Coordinate all construction activities with the Owner and Operator through the Engineer and verify that these activities do not interfere with operations of the Facility. Obtain written permission from the Owner and Operator through the Engineer for each shutdown or temporary works at least twenty one (21) days in advance. The Request shall include 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 and Operator shall, at all times have unhindered access to all portions of the Facility that are in operation.
- 1.3.3 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.
- 1.3.4 Shutdown Coordination shall be as follows:
- .1 Contractor shall submit the Shutdown Notification form at least three (3) weeks prior to the actual shutdown or interference. Shutdown Notification form template will be provided, upon award.
 - .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 knows as Shutdown Date.
 - .4 Shutdown Notification forms that are submitted less than three (3) weeks ahead of the Shutdown Date will be rejected.
 - .5 The Contractor shall follow the above steps for each shutdown.
 - .6 The Contractor shall provide a Master Shutdown Calendar, which will have the scheduled shutdown date, affected services, processes, area, and duration of shutdown. The calendar will be given to the Owner and provide an overview of planned shutdowns to the Owner.

- 1.3.5 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.
- 1.3.6 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.
- 1.3.7 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.
- 1.3.8 Coordinate the requirements of this Section with all other Specification Sections in Division 1 General Requirements, and with all other applicable specification sections contained herein.

1.4 Submittals for Review

- 1.4.1 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 The Contractor shall be responsible for maintaining any equipment that is taken out of service as a result of construction activities.
- 3.1.6 Some shutdowns will have to take place outside normal working hours, i.e. night time and/or weekends in order to comply with shutdown limitations as described in this Section.
- 3.1.7 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.
- 3.1.8 Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service.
- 3.1.9 Coordinate space requirements and installation of process, 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, maintenance and repairs.

3.2 Monitoring & Emergency Response

- 3.2.1 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.
- 3.2.2 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 and the Owner's operator. The following table summarizes the maximum allowable shutdown duration for major equipment connections. Shutdowns are not limited to this table and will be limited to a maximum duration of 4 hours.

Process / System	Maximum Allowable Shutdown
Backwash Header at Filter 3 for Backwash Header Removal	Four (4) hours
Backwash Header at Filter 1	Four (4) hours
High Lift Pump Room No. 2 Suction Header for Backwash Pump Suction Pipe Connection	Four (4) hours

Process / System	Maximum Allowable Shutdown
Backwash Header at Filter 3 for Backwash Header Removal	Four (4) hours
High Lift Pump Room No. 1 Suction Header	Four (4) hours
High Lift Pump Room No. 1 Discharge Header	Four (4) hours
High Lift Pump Room No. 2 Suction Header	Four (4) hours
High Lift Pump Room No. 2 Discharge Header	Four (4) hours

3.3.2 The Contractor shall plan work to minimize the number and duration of shutdowns required.

3.4 Intermediate Contractual Milestones

3.4.1 Specific scope items are required to be successfully commissioned in stages.

3.4.2 These intermediate contractual milestones are summarized below.

Phase	Intermediate Contractual Milestone	Phase Completion Requirement
1	Demolition of existing standby Backwash Pump	
2	Demolition of existing High Lift Pump No. 7 piping, etc.	
3	Installation of new Backwash Pump	
4	Installation of new High Lift Pump No. 7	
5	Installation of existing High Lift Pump No. 8 butterfly valve	
6	Demolition of existing High Lift Pump No. 6	Successful commissioning of new High Lift Pump No. 7
7	Installation of new High Lift Pump No. 6	

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 proposed construction sequencing is as follows:

- .1 The intent is to complete the construction in High Lift Pump Room No. 2 first, followed by the construction in High Lift Pump Room No. 1.
- .2 Demolition of existing Backwash Pump and associated piping and appurtenances will require a short shutdown to disconnect the existing backwash pump discharge pipe from the existing header.
- .3 The existing stairs in High Lift Pump Room No. 2 will be modified to facilitate the installation of new Backwash Pump. Existing unit heaters, piping, and cable trays which interfere with the new Backwash Pump discharge pipe are to be relocated and reconnected.
- .4 Relocate ladders in overflow chamber, remove debris and existing piping at the bottom of overflow chamber.
- .5 Demolish existing High Lift Pump No. 7 and associated piping and appurtenances before installation of new pumps in High Lift Pump Room No. 2.
- .6 Isolate suction and discharge for High Lift Pump No. 7.
- .7 The new High Lift Pump No. 7 will be free issued by the Owner.
- .8 The construction of new High Lift Pump No. 7 and Backwash Pump bases and the installation of new pumps and associated piping and appurtenances will be conducted offline with minimum interruption to the plant operation.
- .9 Short shutdowns will be required when connecting the new pipes to the existing.
- .10 The existing gate valve on High Lift Pump No. 8 discharge pipe will be replaced with a butterfly valve complete with a dismantling joint. A short shutdown will be required for this installation.
- .11 Remove the existing wooden enclosure outside the High Lift Pump Room No. 1 and modify the stairs to facilitate pump lifting.
- .12 After commissioning new High Lift Pump No. 7 and Backwash Pump and bringing High Lift Pump Room No. 2 into operation, remove existing High Lift Pump No. 6.

- .13 The existing suction of High Lift Pump No. 6 will be capped with a blind flange complete with a flange support. The existing gate valve on pump discharge will be isolated with a blind flange complete with temporary valve support during construction.
- .14 Remove the existing High Lift Pump No. 6. pump base, existing valve and piping and associated appurtenances.
- .15 Install the new High Lift Pump No. 6. The new High Lift Pump No. 6 will be free issued by the Owner.
- .16 The construction of High Lift Pump No. 6 pump base and installation of pump along with associated piping and appurtenances shall be conducted offline with minimum impact to the plant operation.
- .17 Short shutdowns will be required for tie-ins of suction and discharge pipes after High Lift Pump No. 6 installed.

3.5.3 A tentative list of shutdowns is provided below:

Pipe Name	Shutdown Location and Approach
Existing backwash header	Close valve located between Filters 1, 2, 3 and Filters 4, 5, 6. on the backwash header
High Lift Pump Room No. 1 Suction Header	Close sluice gates in the reservoir and drain the pipe
High Lift Pump Room No. 1 Discharge Header	Close valves in valve chamber nearby
High Lift Pump Room No. 2 Suction Header	Close gate valves in suction trench
High Lift Pump Room No. 2 Discharge Header	Close valves in the valve chambers nearby and provide water shutdown notice to nearby residence

3.6 **Suggested Electrical Work Sequence**

- 3.6.1 Refer to Section 16020 – SEQUENCE OF ACTIVITIES for electrical power, control, communications and instrumentation system.

3.7 Contractor Use of Premises & Restricted Areas

- 3.7.1 The Contractor shall arrange with the Owner for easements for construction, storage and access to all of the Works within the Owner's property lines.
- 3.7.2 Confine operations within easements for construction, storage and access.
- 3.7.3 Install and maintain adequate security or construction fencing and gates around storage areas or the construction site and maintain during the construction period.
- 3.7.4 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.
- 3.7.5 Materials shall be stored separately on the Site at locations agreed
- 3.7.6 The Owner's Operating staff will operate any valve, switch, or other control on existing facilities.

3.8 Owner Occupancy

- 3.8.1 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 Contractors 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.
- 3.8.2 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.
- 3.8.3 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.

- 3.8.4 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.

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 and vaping are not permitted on site.

- 3.1.12 Comply with Chapter 321 of OSHA Regulations for Construction Projects.

3.2 Removal of Designated Substances

- 3.2.1 Refer to Division 2 for removal of designated substances requirements. Remove any designated substances and comply with the following:
- .1 Asbestos – Regulation 278/05
 - .2 Lead – Regulation 843/90
 - .3 Silica – Regulation 845/920
 - .4 Light ballasts in accordance with Ontario Regulation 347.
 - .5 Other designated substances identified in the survey reports. Refer to Designated Substances Survey Report included in the Specification Appendices.

3.3 Welding and Cutting

- 3.3.1 All welding and cutting within the existing works are to follow National Fire Protection Association (NFPA) Standard 51B “Fire Prevention During Welding, Cutting, and Other Hot Work”.
- 3.3.2 Prior to any hot work procedures, where all grinding, welding, cutting work to be done, must notify Operations (E-shift) through the completion of a Hot Work Permit, on a daily basis.

3.4 Work in Confined Spaces

- 3.4.1 Confined locations include manholes, underground chambers, tunnels, or other locations where the atmosphere may be contaminated by combustible gas or lack of oxygen.
- 3.4.2 Make all Contractor staff including subcontractors aware of confined spaces and the requirements for entering such spaces.
- 3.4.3 Where work is to be done in confined space conditions, follow the requirements listed in Paragraph 3.5, below.

3.5 Work Procedures for Confined Spaces

- 3.5.1 Hazardous Locations are to be classified and managed as Confined Spaces (as defined by O. Reg. 628/05, OSHA). All work and entry into the identified Confined Spaces is to be done in accordance with the Regulation (O. Reg. 628/05).
- 3.5.2 Where workers are required to enter a confined space, as defined by the OSHA, 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.
- 3.5.3 The Contractor is responsible for all confined space entry permitting, assessment, entry, control and rescue planning in accordance with the Regulation.
- 3.5.4 The Contractor shall maintain all appropriate documentation required under the Regulation and provide daily copies to the Engineer.
- 3.5.5 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 (see Section 1.3.5) and breathing apparatus/respiratory protection.
- 3.5.6 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.
- 3.5.7 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).

3.6 Assistance

- 3.6.1 Give reasonable help to the resident services staff in checking the setting out of the work. Arrange for ready access to work.

3.7 Holes in Existing Concrete

- 3.7.1 When it is required to make new holes in existing concrete for piping, conduit, cables, or equipment, using either method described below:
- .1 Chip with an electric hammer with chisel point. If any impediment is encountered, advise the Engineer before proceeding further. Adjust the location of holes as necessary to avoid electrical conduits. Cut reinforcing steel after permission is received.
 - .2 For any openings which are to be saw cut into an existing structure pre-drill the corners using a 100 mm dia. core drill do not over core corners.

.3 Core-drill holes after radiograph procedures are followed.

3.7.2 Radiograph the existing concrete for 3 diameters around the centreline of the proposed penetration. If no structural steel, piping or electrical conduits are found, core the hole. If structural steel, piping or electrical conduits are found, select an alternative location and radiograph it. If structural steel, piping or electrical conduits are found, do not core unless written permission from the Engineer is received.

3.7.3 Prior to commencing work, submit to the Engineer a photocopy of the license issued under the Atomic Energy Control Board Regulations for radiography. Perform work in accordance with current Atomic Energy Control Board Regulations for radiography. Be responsible for boundary controls and signs that protect the personnel and others from hazards in the radiograph work area. Inform the Engineer in writing for approval 2 weeks prior to commencing any radiography.

3.7.4 Radiograph shall be done after 4 p.m.

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 Control of Vibrations

- .1 The Contractor shall control vibration levels to prevent damage to concrete Work, existing structures, equipment, and utilities during construction.
- .2 The Contractor shall control the use of vibration producing construction techniques or equipment so that the ground adjacent to concrete has a resultant peak particle velocity (P.P.V.) not exceeding the following limits:

Age of Concrete (Hours)	Maximum Permissible Resultant P.P.V. (mm/s)
Less than 4	5
4 to 60	10
Over 60	50

- .3 The Contractor shall schedule and execute placing of concrete so that, for concrete 4 to 24 hours old, a minimum distance of 40 m between the source of vibration and the concrete is maintained.
 - .4 The Contractor shall retain the services of an independent inspection agency to monitor vibration effects.
 - .5 The Engineer reserves the right to require additional restrictive limits for vibration control if recommended by the inspection agency.
- 3.8.5 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.
 - 3.8.6 The Contractor shall sustain and support structures that are uncovered, weakened, endangered or threatened.
 - 3.8.7 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.
 - 3.8.8 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.
 - 3.8.9 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.

- 3.8.10 The Contractor shall comply with the requirements of Section 01400 – Environmental Protection.

3.9 Protection, Soundness, and Repair of New Construction

- 3.9.1 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.
- 3.9.2 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.

3.10 Storage and Protection of Materials and Equipment

- 3.10.1 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.
- 3.10.2 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.
- 3.10.3 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.
- 3.10.4 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.
- 3.10.5 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.

- 3.10.6 The Contractor shall maintain shafts and bearings in good condition by rotating them weekly.
- 3.10.7 The Contractor shall provide the manufacturer's written instructions for the storing of equipment during the construction period well in advance of equipment delivery.
- 3.10.8 The Contractor shall store specialty items to ensure protection from damage to materials or finish.
- 3.10.9 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.
- 3.10.10 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.

3.11 Protection Against Freezing

- 3.11.1 Furnish necessary equipment and fuel for heating buildings and structures during construction. Maintain a minimum temperature of 13°C in interior areas for mechanical, electrical, masonry, painting and other work susceptible to frost damage. The Contractor shall not rely on the Facility's existing heating system.
- 3.11.2 Drain pipelines in trenches which may be left exposed in winter. Drain pipelines below concrete slabs or in areas too large to heat practicably.
- 3.11.3 Refer to Divisions 3, 4, 9, 11, 15 and 16 as applicable for detailed cold-weather procedures for cast-in-place concrete, masonry, finishes, mechanical work and electrical work respectively.

3.12 Protection Against Flotation

- 3.12.1 The Contractor shall control groundwater levels to prevent damage to any pipe or structure due to water pressure during and after construction and until the Work is completed.

3.13 Protection Against Flooding

- 3.13.1 The existing Facility has below grade structures that are placed at risk of flooding if the existing below grade walls are breeched. Flooding of the below grade areas of the Facility will result in damage to the existing Facility, equipment and the operation of the existing Facility.
- 3.13.2 The Contractor shall be held fully responsible by the Owner for any damage to utilities, equipment, properties, buildings, homes or structures adjacent to, or in the general area of, the Work, through flooding resulting from any cause relating to the Work carried out under this Contract. The Contractor shall make good and repair such damage at their own expense.

3.14 Drainage

- 3.14.1 The Contractor shall keep all portions of their work properly and efficiently drained during construction and until completion, and they 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 their operations may cause to flow elsewhere.
- 3.14.2 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.
- 3.14.3 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.

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 shutdowns 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 if in-person meeting is required.

- 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 Building Permit
- .12 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 hardcopies for his use, as 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 part of 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. If agreed upon with the Engineer, progress meetings can be held virtually.
- 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 Shutdown Coordination Meetings

- 1.10.1 Shutdown coordination shall be per Section 01120.
- 1.10.2 The Contractor shall request a meeting for any shutdown that may impact the flow of water through the facility and/or has a duration of greater than six hours.
- 1.10.3 Require attendance of all parties directly affecting, or affected by, work of the specific equipment or facility that must be shutdown.
- 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 shutdown sequence and procedure
 - .3 Submit the proposed start date and time and duration of shutdown.
 - .4 Provide the isolation and assistance requirements needed by operating staff.
 - .5 Provide a contingency response approach in the event of problem or extended shutdown 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.
- 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.

- 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 bi-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]

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 Site Access
 - .5 Any initial Site Work as applicable
 - .6 Specified Work sequences, constraints, and Milestones, including Substantial and Total Performance of the Work date(s).
 - .7 Type of Work to be performed by the Subcontractor(s) involved.
 - .8 Major equipment design, fabrication, factory testing, and delivery dates.
 - .9 Delivery dates for Owner-furnished pre-purchased equipment, if applicable.
 - .10 Submittals such as shop drawings that are critical or near critical to schedule completion.

- .11 Major components of the Work and other relevant details, including at a minimum:
 - .1 Site Work
 - .2 Concrete Work
 - .3 Architectural Work
 - .4 Equipment Work
 - .5 Mechanical Work
 - .6 Electrical Work
 - .7 Leakage testing of pipes
 - .8 Shutdowns and Tie-ins
 - .1 Work by Owner
 - .2 Work by Contractor
 - .9 Instrumentation, SCADA design and control Work
 - .10 Any applicable interfaces with Owner pre-purchased equipment
 - .11 Other important Work for each major facility
 - .12 Equipment and system start-up, training, and test activities. Refer to Section 01810 Testing and Commissioning.
 - .13 Project close-out and cleanup
 - .14 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 Seasonal weather conditions have been considered and included in the planning and scheduling of the Work influenced by high and low ambient temperatures and/or precipitation.
- .5 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.
- .6 The Contractor has incorporated any other special conditions in planning the Work such as specified or required Work restriction periods, etc.
- .7 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 (20) 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.

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.

1.12 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.
- .3 The Contractor is to account for fifteen (15) days per calendar year of abnormally adverse weather in their base contract. Only abnormally adverse weather exceeding fifteen (15) days per calendar year will be evaluated for an extension to the contract completion time.

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 Comprehensive list of shop drawings and submittals and schedule for submission
 - .2 Proposed location and details of temporary buildings
 - .3 Shop drawings for permanent and temporary works
 - .4 Shutdown notifications
 - .5 Shutdown master-list
 - .6 Schedules and updates
 - .7 Samples
 - .8 Site progress reports
 - .9 Tests and reports
 - .10 Certificates and transcripts
 - .11 Maintenance data and operating instructions
 - .12 Interference drawings

- .13 Redline drawings
- .14 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 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 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.
- 1.2.17 Submit all equipment and instrument shop drawings in advance of the MCC and control panel shop drawings to allow coordination and any vendor specific power, I/O or control wiring requirements. Submission of shop drawings must follow this order for proper coordination of the Work. Furthermore, delay claims associated with long lead times for any equipment or MCC or any time being supplied for the Work will not be approved.
- 1.2.18 MCC and control panel shop drawings shall include schematic and wiring diagrams complete with:
 - .1 All internal control devices
 - .2 All external control devices
 - .3 Input and output contacts to PLC and/or HVAC Panel. Indicate drawing number for verification
 - .4 Reviewed or reviewed as noted shop drawings for equipment supplied under other sections i.e. Divisions 2, 11 to 15.
 - .5 Wires and terminal numbers

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

misc

ellaneous 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 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 conditions encountered during excavation
 - .3 The commencement and the completion dates of the work of each trade in each area of the Contract.
 - .4 The erection and removal dates of formwork in each area of the Contract
 - .5 The dates, the quantities, and the particulars of each concrete pour
 - .6 The dates, the quantities, and the particulars of roofing installation
 - .7 The dates on which major items are installed.
 - .8 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.
 - .9 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 and all surrounding existing sites within **20** m radius of the Facility.
- 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 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

☐

Tender
Purposes

☐

Your Comments

☐

Construction
Purposes

☐

As requested

☐

Other

Mode of Delivery:

☐

Postal Service

☐

For Pick-Up

☐

Courier Service

☐

FTP Site

☐

Hand Delivered

☐

Other

CONTRACTOR CERTIFICATION SHOP DRAWING STAMP



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] Contractor Reference #	[2] Revision No.	[3] Division	[3] Spec. Section – Clause(s) – [2 digit id#]	Manufacturer	[4] 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

1. GENERAL

1.1 Construction Safety Measures

- 1.1.1 Contractor shall submit a site-specific Health and Safety Plan within 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 Provide fire extinguishers, smoke and CO monitors for trailers.

1.3.3 Supply three additional hardhats and safety vests for visitors to site.

1.3.4 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.

- 1.3.5 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.
- 1.3.6 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 Refer to Designated Substances Survey Report in the Specification Appendices.

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 Prepare and implement a solid waste management and environmental protection plan for the Project.
 - .5 Submit monthly a summary of solid waste generated by construction operations.

- .6 Be responsible for final implementation of site recycling program by disposal of recyclable solid waste at appropriate recycling centres.
- .7 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 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 Trees

- 1.5.1 Protect all existing trees and shrubs from damage. Protect foliage, branches, trunks and roots from damage by equipment, men or

construction materials. Do not permit encroachment of machinery within the drip line in order to prevent damage to roots, trunk and foliage.

- 1.5.2 Remove trees and shrubs only as directed by the Engineer or specifically shown on the drawings.
- 1.5.3 Where damage does occur beyond recovery and cannot be replaced by similar plant material of the same type and size, pay penalties as established by the International Society of Arboriculture's booklet entitled 'A Guide to Professional Evaluation of Landscape Trees, Specimen Shrubs and Evergreens'.

1.6 Erosion and Sediment Control

- 1.6.1 Prior to the commencement of any work on this project which might cause erosion and/or sedimentation, the Contractor must receive approval from the Engineer for an erosion and sedimentation control program proposed by the Contractor. This program must be in accordance with Ontario Guidelines on Erosion and Sediment Control for Urban Construction Sites (latest revision).
- 1.6.2 Ensure adequate environmental protection and take precautions at times of inclement weather (i.e., ensure erosion and sedimentation control measures are functioning effectively and install additional measures as necessary).
- 1.6.3 All costs for developing and implementing an erosion and sediment control program shall be included in the price tendered.

1.7 Site Drainage and Unwatering Discharge

- 1.7.1 Unwatering is defined as the removal of standing water in an open excavation at less than 50,000 L/day.
- 1.7.2 Direct the discharge of unwatering operations from any site excavation to an adequate sediment basin by pumping unless approved otherwise by the Engineer. The discharge pipe shall be fitted with a "Wetland" filter bag for removal of silt. Filter bags shall be inspected periodically and replaced once full.
- 1.7.3 Prevent soil and debris carried by site drainage from entering existing sewers; swales or draining on to adjacent property in the vicinity. At areas where discharge of unwatering will, of necessity, flow onto adjacent private property make arrangements with the property owners concerned. Take adequate precautions to prevent damage to adjacent property. Avoid point discharge of unwatering which will cause erosion.
- 1.7.4 Direct all run-off and overland flow from the site working and stockpiling area to an adequate sediment basin prior to discharge to a water course. The sediment basin shall incorporate straw bales, filter berms, sand bags, etc. as required to eliminate silt or debris from entering any watercourse.

- 1.7.5 Install check dams and silt control fencing in locations as shown on the drawings and other locations, as directed by the Engineer.
- 1.7.6 The inspection, and cleaning as required, of siltation barriers shall be carried out weekly and after each rainfall. During prolonged rainfall, check daily. Clogged filter materials such as crushed stone or straw bales, etc., shall be replaced as required and as directed by the Engineer.
- 1.7.7 If the erosion and sediment control measures are damaged or fail the Contractor is responsible for rapid and effective response to such events to minimize the introduction of sediments to aquatic systems.

1.8 Noise Control

- 1.8.1 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.
- 1.8.2 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.

1.9 Dust Control

- 1.9.1 Prevent dust nuisance resulting from construction operations at all locations on site. Provide water for dust control as directed by the Engineer.
- 1.9.2 Use appropriate covers on trucks hauling fine or dusty material.
- 1.9.3 Use watertight vehicles to haul wet materials.
- 1.9.4 Employ only wet type equipment for saw cutting, or concrete grinding to control dust nuisance.
- 1.9.5 All trenches and areas disturbed by construction works that will produce dust shall be maintained dust free by an application of water.
- 1.9.6 Obtain Engineer's approval before chemicals are used for dust control. Under no circumstances is sodium chloride permitted for dust control.
- 1.9.7 Do not use calcium chloride on access roads.

1.10 Mud Control

- 1.10.1 Keep plant and public roadways clean and free from mud.
- 1.10.2 Provide mud mats and/or wash stations to prevent tracking of mud from any portion of the contract limits onto any paved roadway.

- 1.10.3 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 be 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.

1.11 Refuelling Areas

- 1.11.1 Carry out all refuelling, except the fuelling of backhoes and shovels at approved refuelling areas only.
- 1.11.2 Review in detail proposed route and sequencing of construction to plan access routes and fuelling areas. Establish suitable fuelling and maintenance areas and obtain approval from Engineer.
- 1.11.3 Do not refuel, clean or maintain equipment adjacent to or in any watercourses or drains leading to watercourses. Do not fuel equipment within 30 metres of any watercourse unless non-spill facilities are used. Emptying of fuel, lubricants, pesticides or construction materials into any watercourse is strictly forbidden.

1.12 Cleaning Equipment

- 1.12.1 Clean construction equipment prior to entering roadways. Do not clean equipment in locations where debris can gain access to sewers or watercourses.

1.13 Contingency and Emergency Response Plans

- 1.13.1 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.
- 1.13.2 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.

1.14 Spills

- 1.14.1 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.
- 1.14.2 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.
- 1.14.3 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.
- 1.14.4 Take immediate action using any available resources to contain and mitigate the effects on the environment from any accidental spill.

1.15 Removal and Disposal

- 1.15.1 Remove surplus materials and temporary facilities and controls from the Site.
- 1.15.2 Dispose of all non-contaminated waste materials, litter, debris and rubbish off-Site.
- 1.15.3 Do not burn or bury rubbish and waste materials on the Site.
- 1.15.4 Do not dispose of volatile or hazardous wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
- 1.15.5 Do not discharge wastes into streams or waterways.
- 1.15.6 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.

1.16 Environmental Awareness Training

- 1.16.1 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.

- 1.16.2 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 Building permit.
 - .4 Permits to Take Water.
 - .5 Ministry of Consumers and Commercial Relations.
 - .6 Ministry of Labour.
 - .7 Ministry of Environment
 - .8 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 arrange for and inform the Engineer of inspections required by building permits, ESA or any other Regulatory body requiring inspection.
- 1.4.5 The Contractor will arrange for and inform the Engineer of all other regular and final inspections required.
- 1.4.6 The Contractor will be responsible for all payments for the inspections as required for the permits.

1.5 Work in Vicinity of Overhead Power Lines

- 1.5.1 Contractor to confirm the setback requirements for operation near power lines with local utility.

- 1.5.2 Request Power Company to relocate, de-energize or guard any energized conductor where construction equipment may operate within 3 m of conductor.
- 1.5.3 Obtain Power Company approval prior to operating any equipment within 3 m of energized conductor.
- 1.5.4 Where practical, avoid storage of metallic pipe sections under high voltage overhead power lines.
- 1.5.5 If pipe sections must be stored under power lines, protect personnel from effects of induced currents by grounding pipe sections at two (2) locations with AWG #2 copper ground conductors and grounding rods.
- 1.5.6 Complete and submit applicable WSIB Forms prior to commencement of work.
- 1.5.7 Provide appropriate signs where required as per OSHA Section 44, 3(e)

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>

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- 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>

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- 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 Access to Work

- 1.4.1 Allow inspection/testing agencies access to the Works, off-site manufacturing and fabrication plants. Cooperate to provide reasonable facilities for such access.
- 1.4.2 Provide confined space access as required for inspection of the works.

1.5 Procedures

- 1.5.1 Notify appropriate agency and the Engineer in advance of requirement for tests, in order that attendance arrangements can be made.
- 1.5.2 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.
- 1.5.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.6 Rejected Work

- 1.6.1 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.
- 1.6.2 Make good other contractor's work damaged by such removals or replacements promptly.

- 1.6.3 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.

1.7 Tests and Mix Designs

- 1.7.1 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.

1.8 Layout of Work

- 1.8.1 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.
- 1.8.2 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.
- 1.8.3 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.
- 1.8.4 Run pipes, ducts, tubing and conduit plumb or level (except where specific slope is required for proper function) and parallel with building surfaces.
- 1.8.5 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.

1.9 Mill Tests

- 1.9.1 Submit mill test certificates as required of Specifications Sections or as requested by the Engineer.

1.10 Equipment and Systems

- 1.10.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

1.11 Minimum Standard

- 1.11.1 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.

1.12 Workmanship

- 1.12.1 The quality of the workmanship and finished product shall present a neat and attractive appearance when finished.
- 1.12.2 If ordered by the Engineer, the Contractor shall make enough openings in the Works and/or materials as are necessary to inspect the works.
- 1.12.3 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.
- 1.12.4 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 Localized Unwatering

- 1.3.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water. Unwatering pumps shall be electrical to keep the noise of running motors to a minimum.
- 1.3.2 Dispose of all groundwater and surface water runoff in a manner approved by the Engineer and Owner, as per Section 01400 –

Environmental Protection or Section 02140 – Dewatering as required by the Contract

1.4 Temporary Water Supply

- 1.4.1 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.
- 1.4.2 Enough water will be provided once only by the Owner for the purpose of leakage testing. Should the initial attempt not pass all testing requirements as stipulated by the Contract Documents and additional water for leakage testing purposes will be provided by the Owner at the Contractor's sole expense.

1.5 Temporary Heating and Ventilation

- 1.5.1 Any construction heaters used inside a building must be vented to the outside or be flameless type. Solid fuel salamanders are not permitted.
- 1.5.2 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.
- 1.5.3 Maintain inside temperatures above a minimum of 13°C in areas and adjacent to areas where construction is in progress or ongoing.
- 1.5.4 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.
- 1.5.5 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.
- 1.5.6 Substantial Performance will not be issued until the entire system is as near original condition as possible and is certified by the Engineer.
- 1.5.7 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.
- 1.5.8 Be responsible for damage to the Works due to failure in providing adequate heat and protection during construction.

1.6 Temporary Power

- 1.6.1 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.

- 1.6.2 The Contractor shall notify and make arrangements with the Utility Company for the supply of electric power for construction of the Works.
- 1.6.3 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.
- 1.6.4 The Contractor shall provide ground fault protection for all electrical equipment.
- 1.6.5 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.
- 1.6.6 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.

1.7 Temporary Lighting

- 1.7.1 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.
- 1.7.2 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.
- 1.7.3 The Contractor shall secure all temporary lighting and wiring from damage, falling or tripping hazards.

1.8 Temporary Communication Facilities

- 1.8.1 The Contractor will provide and pay for telephone hook up equipment necessary for the Contractor's own use.
- 1.8.2 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.

1.9 Temporary Pumping for Leaks

- 1.9.1 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/wastewater 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.

1.10 Sanitary Facilities

- 1.10.1 Provide sufficient sanitary facilities for all persons employed on the Contract subject to approval of type, size and location by the local health authorities and the Engineer.
- 1.10.2 Maintain facilities with all required toilet room supplies in a clean and sanitary condition and disinfect frequently.
- 1.10.3 Prohibit the committing of nuisance on the site and any employee found violating such a provision shall be promptly discharged.
- 1.10.4 Remove any contaminated soil and replace with fresh clean material. Leave site in a clean sanitary condition.

1.11 Fire Protection

- 1.11.1 Provide and maintain temporary fire protection equipment during performance of the Works required by governing codes, regulations and bylaws.
- 1.11.2 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.
 - .5 Plan for temporary drainage course detour and details.
 - .6 Tower crane location plans (if applicable)
- .4 Temporary Control Submittals:
 - .1 Noise control plan.
 - .2 Dewatering well locations.
 - .3 Plan for disposal of waste materials and intended haul routes.
 - .4 Plan for sediment control and storm water management.

- 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 shown on the Contract drawings and 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 washroom facilities.
- 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.

2.4 Project Sign

- 2.4.1 Provide and maintain at least three, 2400mm wide by 1200mm high signs constructed of 19 mm exterior high density overlaid plywood. Signs shall bear the name of the Contract, the Owner, the Contractor, and the Engineer. Paint shall be exterior-type enamel. Information to be included will be provided by the Engineer. Wording and colours on the sign shall be provided to the Contractor.
- 2.4.2 A suitable, stable framework to support each sign shall be provided and erected by the Contractor.
- 2.4.3 The Contractor shall erect project sign at locations acceptable to the Engineer as soon as the Work commences on Site and shall be maintained in position until Completion of the Work. The Contractor shall relocate the project signs when necessary or directed by the Engineer.
- 2.4.4 Upon completion of the Work, the Contractor is responsible for the removal of the signboards and the return of the signboards to the location of origin. No other signs or notices other than those required for the purposes of warning or indicating danger to the public in connection with their Work may be exhibited by the Contractor on the Site without the prior express approval of the Owner.

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 Electrical and Temporary Power

- 3.3.1 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 convey the power to the location where it is required.
- 3.3.2 Temporary power in the form of overhead lines or portable generators shall be provided by the Contractor at no additional cost to the Owner.
- 3.3.3 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.
- 3.3.4 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.
- 3.3.5 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.

3.4 Construction Parking

- 3.4.1 Access to the site for construction personnel is also used by other Contractors, consultants, the Engineer and the Owner.

- 3.4.2 Contractor's personnel are to park vehicles as directed by the Engineer and noted on the drawing. 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 roads or grass areas within the site.
- 3.4.3 Snow removal to be performed and paid for by the Contractor at no additional cost to the Contract. Included in the cost of snow removal is the off-site disposal of accumulated removed snow, at a time deemed necessary by the Engineer.
- 3.4.4 Groundskeeping to be performed and paid for by the Contractor at no additional cost to the Contract.
- 3.4.5 Provide and maintain adequate access to project site.
- 3.4.6 Build and maintain temporary roads where indicated or directed by the Engineer and provide snow removal during period of Work.
- 3.4.7 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.
- 3.4.8 When site space is not adequate, arrange for and/or maintain additional off-site parking at no extra cost to the Owner.

3.5 Hoisting

- 3.5.1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment.
- 3.5.2 All hoists and cranes shall be operated by qualified operators.

3.6 Temporary Barriers and Enclosures

- 3.6.1 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.
- 3.6.2 Where appropriate, equipment barriers with vehicular and pedestrian gates with locks.
- 3.6.3 Provide security and facilities to protect the Work and the Site from unauthorized entry, vandalism and theft.
- 3.6.4 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.

3.7 Removal of Temporary Facilities and Controls

- 3.7.1 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 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 sheet materials, lumber and drywall on flat, solid supports and keep clear of ground. Slope to shed moisture.
- 1.5.7 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.
- 1.5.8 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.

- 1.5.9 Remove and replace damaged products at own expense and to the satisfaction of the Engineer.
- 1.5.10 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.

1.7 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 cadmium plated bolts and nuts on stainless steel flanges; provide stainless steel washers under bolt head and nut; use cadmium plated steel bolts and nuts on black steel and cast flanges.
 - .1 Use 316 SS nuts, washers and bolts when used in a submersible application and high humidity condition

1.17 Equipment Anchorage

- 1.17.1 For all permanently or intermittently submerged services and for all exterior mounting locations, provide stainless steel anchor bolts conforming to ASTM A320.
- 1.17.2 For all other anchor bolts, provide cadmium plated or galvanized steel anchor conforming to ASTM A307, unless noted otherwise.
- 1.17.3 For rotating equipment over 35kW, provide anchor bolts with sleeves and washers to permit adjustment during installation of the equipment.
- 1.17.4 Do not use drilled expansion or adhesive anchors for anchor bolts unless submitted and reviewed by the Engineer.
- 1.17.5 Design anchor bolts for lateral forces for both pullout and shear in accordance with the requirements of Division 5.

- 1.17.6 Use 304 Stainless Steel as a minimum 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 Description

- 1.1.1 This section describes the cleaning requirements for existing facilities and the project site.

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 refers to the disinfection of all water retaining structures and piping (new and existing) where work is carried out under this contract.
- 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 potable water process piping and shall provide references of disinfection work completed for other water treatment plant projects in Ontario. Should the Contractor intend on completing the disinfection work with their own forces, they shall provide references of their experience to the Engineer for review and approval. The Engineer reserves the right to reject the Contractor's experience and the Contractor shall use a qualified specialist sub-contractors at no extra cost to the Owner.

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:

Reference No.	Standard Name
C651-14	AWWA Standard for Disinfecting Water Mains
C652-19	AWWA Standard for Disinfection of Water-Storage Facilities
C651-23	AWWA Standard for Disinfecting Watermains
C653-20	AWWA Standard for Disinfection of Water-Water Treatment Plants
N/A	MECP Watermain Disinfection Procedure 2020

- 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.

- .1 Samples can be taken by City Licensed Operators and will use the City's contracted Laboratory. The cost of disinfection sampling and testing shall be paid from an allowance in the Contract.

3.3 Discharge of Chlorinated Water

- 3.3.1 Safely dispose of all chlorinated water from draining operations or used for testing, flushing or disinfecting waterworks.
- 3.3.2 Do not discharge any chlorinated water into any storm sewer, watercourse or sanitary sewer. Note that most floor drains in the facility go to storm drains that are directly connected to the Mattagami river.
- 3.3.3 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.
- 3.3.4 Approved dechlorinating agents:
 - .1 Hydrogen Peroxide
 - .2 Sulphur Dioxide.
 - .3 Sodium Bisulphate.
 - .4 Sodium Metabisulphate.
- 3.3.5 In all cases, the wasted water must be neutralized to provide a total chlorine residual of less than **0.002 mg/L**. 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.
- 3.3.6 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.
- 1.5.2 Repair or make good settlements and defects on surfaces of backfilled trench or excavations.
- 1.5.3 Repair all damages to structures caused by settlement of ground adjacent to or over excavation.
- 1.5.4 Maintain all trees and shrubs either planted or relocated for the duration of the Warranty Period.

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 Scope

- 1.1.1 This Section outlines the procedures for the purpose of issuance of the Certificate of Substantial Performance, the Certificate of Completion, and the Final Certificate following the expiry of the Warranty Period for the Works.

1.2 Related Sections

- 1.2.1 Section 01740 – Cleaning
1.2.2 Section 01780 – Closeout Submittals
1.2.3 Section 01810 – Testing and Commissioning
1.2.4 Section 01820 – Demonstration and Training

1.3 References

- 1.3.1 Construction Act, R.S.O. 1990, Chapter C.30

2. PRODUCTS – NOT APPLICABLE

3. EXECUTION

3.1 Final Cleaning

- 3.1.1 Execute final cleaning per Section 01740 – Cleaning prior to Substantial Performance of the Work.

- 3.1.2 Clean debris from drainage systems or swales.
- 3.1.3 Clean the Site; sweep paved areas and rake clean landscaped surfaces.
- 3.1.4 Maintain cleaning until acceptance by the Owner.

3.2 Restoration

- 3.2.1 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.
- 3.2.2 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.
- 3.2.3 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.
- 3.2.4 Do not alter original conditions without prior written approval from the Engineer.
- 3.2.5 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.
- 3.2.6 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.
- 3.2.7 Ensure that quality, grades, elevations, and the extent of bedding, cover, and other backfill materials including subgrades, finish grades, and thickness of materials for roadways are properly documented during their removal to ensure reconstruction to at least their original and functional condition.
- 3.2.8 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.
- 3.2.9 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.

- 3.2.10 Remove from the Site clean material not approved for reuse.
- 3.2.11 Handle and store products and materials in a manner to prevent damage, adulteration, deterioration, and soiling and in accordance with manufacturers' instructions when applicable.
- 3.2.12 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.
- 3.2.13 Perform cutting, fitting, remedial, and coordination work to make the several parts of the Work fit together.
- 3.2.14 Except as specified otherwise, dismantle and salvage materials for reuse where practicable.
- 3.2.15 Exercise due care when removing material for salvage. Repair or replace materials damaged through improper handling or through loss after removal.
- 3.2.16 Store and protect removed material approved for reuse in approved locations. Beginning of restoration work means acceptance of existing conditions.
- 3.2.17 Repair pavement, roads, sod, and all other areas affected by construction operations and restore them to original condition or to minimum condition specified.

3.3 Substantial Performance

- 3.3.1 When the Contractor believes that they have achieved Substantial Performance of the Contract, the Contractor and all Subcontractors shall conduct an inspection of the Work, identify all deficiencies and defects, and effect repairs of all defects as required to verify conformance to the Contract requirements.
- 3.3.2 The Contractor shall apply, in writing to the Engineer, for Certification of Substantial Performance. The application shall include verification of satisfactory completion of the Contractor's Inspection and that corrections have been made. For greater clarity, the following Works **must** be completed prior to submitting the application for Certification of Substantial Performance:
 - .1 All equipment and systems have been tested and commissioned to the satisfaction of the Owner. All equipment start-up and commissioning reports shall be submitted to the Owner.
 - .2 All demonstration and training as required by Section 01820 shall be completed to the satisfaction of the Owner.
 - .3 The continuous Performance Run as outlined in Section 01810 shall be completed to the satisfaction of the Owner.

- .4 All red line As-Built mark-ups shall be submitted to the Engineer.
 - .5 All operations and maintenance data shall be compiled and submitted in a draft Operations and Maintenance Manual.
 - .6 All required Warranty Certificates shall be submitted in a form satisfactory to the Owner.
 - .7 All spare parts and a list of recommended spare parts shall be submitted to the Owner.
 - .8 A detailed schedule, acceptable to the Owner, for the correction of all deficiencies and for the completion of all uncompleted Works.
 - .9 3-2-1 calculation demonstrating substantial performance conditions have been met per the Construction Act.
- 3.3.3 The Engineer, the Owner, and the Contractor shall conduct a walk-through inspection of the Works within ten (10) working days of receipt of the Contractor's application to verify if the Works have been Substantially Performed. The Engineer, the Owner, and the Contractor shall develop a list of Deficiencies and Uncompleted Work.
- 3.3.4 When the Engineer is satisfied that the Contract has been Substantially Performed, the Engineer shall prepare a Certificate of Substantial Performance and a Substantial Performance Payment Certificate.
- 3.3.5 The Substantial Performance Certificate shall identify the date the Substantial Performance of the Contract was achieved which shall establish the commencement date for the Warranty Period. A copy of the certificate shall be provided to the Contractor and to the Owner.
- 3.3.6 The Contractor shall, within five (5) days of receipt of the Certificate, publish the Certificate in a Trade Newspaper, as required by the Construction Act. The Contractor shall provide proof of publication to the Engineer. Release of the Statutory Holdback may be made no earlier than sixty (60) days following publication of the Certificate of Substantial Performance.

3.4 Certificate of Completion

- 3.4.1 The Contractor shall complete all remaining outstanding work and correct all deficiencies within the timeframe as outlined in Contractor's proposed schedule.
- 3.4.2 When the Contractor believes that all uncompleted Work has been completed, and all deficiencies have been corrected, the contractor shall apply, in writing, to the Engineer for Certification of Completion of the Contract.

- 3.4.3 The Engineer, the Owner, and the Contractor shall conduct a walk-through inspection to verify that the Works have been Completed. The Engineer, the Owner, and the Contractor shall update the list of Deficiencies and Uncompleted Work to verify and document that the Works have been completed.
- 3.4.4 When the Engineer is satisfied that the Works are Complete, as defined under the Construction Act, the Engineer shall issue a Certificate of Completion and a Completion Payment Certificate.
- 3.4.5 Release of the Finishing Holdback may be made sixty (60) days following certification of Completion.

3.5 Final Certificate

- 3.5.1 Approximately one (1) month prior to the end of the Warranty Period, the Contractor shall request that a final inspection of the Works be undertaken. The Engineer, the Owner, and the Contractor shall conduct a final walk-through inspection to verify that any issues that have arisen during the Warranty Period have been adequately addressed by the Contractor and that there are no outstanding deficiencies or uncompleted Work.
- 3.5.2 Complete any outstanding work or deficiencies arising out of the final inspection that are deemed to affect Final Acceptance of the Work.
- 3.5.3 When the Engineer is satisfied that all warranty issues have been addressed, and that there are no outstanding deficiencies or uncompleted Work, the Engineer shall issue the Final Certificate and the Release of Maintenance Security Payment Certificate, if required.

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 draft Operations and Maintenance (O&M) Manuals and submit to the Engineer for review.
- 1.2.2 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.
- 1.2.3 Revise the content of documents as required prior to final submittal.

- 1.2.4 Ensure spare parts, maintenance materials and special tools provided are new, undamaged and not defective, and of the same quality and manufacture as products provided in the Works.
- 1.2.5 If requested, furnish evidence as to type, source and quality of products provided.
- 1.2.6 Defective products will be rejected, regardless of any previous inspections by the Engineer or other agents of the Owner. Defective products to be replaced at the Contractor's expense.

1.3 Operation and Maintenance Data

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.

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.
- .2 The manual content in Volume 1 will be prepared by the Engineer. Documentation for all other Volumes is the responsibility of the Contractor.

- .3 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:
 - Suggested check list sheets
 - List of points to be greased or oiled
 - Recommended type, grade and temperature range of lubricants
 - List of wear points to be inspected and/or adjusted regularly
 - 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-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 installed noting particularly any optional items and substitute items installed.
 - .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 For every new or retrofitted Motor Control Center, 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 The warranty will be a minimum of 1 year from the date of substantial performance of the contract, unless other sections require a longer warranty period.
- 1.11.6 Verify that documents are in proper form, contain full information, and are notarized.
- 1.11.7 Co-execute submittals when required.
- 1.11.8 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.
- 1.1.3 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 $\pm 2\%$ 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 $\pm 2\%$.
- 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 Sewer Lines by The Dye Dilution Method, Journal of the Water Pollution Control Federation, Vo. 55, Number 5, May 1983, pg. 531.
- .5 Flow Measurement in Open Channels and Closed Conduits, Vo. 1, US Dept. of Commerce, National Bureau of Standards, pg. 361
- .6 Techniques of Water Resources Investigation of the US Geological Survey, Chapter 16, Measurements of Discharge Using Tracers
- .7 Other standards as applicable
- .8 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 full 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 Pump Testing
 - .1 The Contractor with Supplier shall perform the pump testing.
 - .2 Comply with ANSI/HI 14.6-2016, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.
 - .3 Comply with ANSI/HI 11.6-2017, Rotodynamic Submersible Pumps: for Hydraulic Performance, Hydrostatic Pressure, Mechanical and Electrical Acceptance Tests
 - .4 Complete a factory hydrostatic pressure tests and submit the test reports.
 - .5 The standard tests shall be carried out on a combination of a pump and associated valves and fittings at the final site installation.
 - .6 For the mechanical test on the non-submersible pumps, the flow at the inlet and outlet of the whole combination shall comply with the following requirements:
 - .1 Testing operating conditions and procedure in accordance with ANSI/HI 14.6-2016.
 - .2 Dry-run test for 10 seconds
 - .3 Vibration at the pump bearing housing in two directions perpendicular to the shaft and in the axial direction.
 - .1 Vibration instruments can be either handheld or rigidly attached to the pump. For pumps with speeds above 600 rpm, the measurement

- instrumentation should be capable of measuring the RMS vibration velocity.
- .2 Refer to ANSI/HI 9.6.4 Rotodynamic Pumps for Vibration Measurements and Allowable Values for Vibration Test Requirements, including Instrumentation.
- .3 The planes of measurement shall be horizontal, perpendicular to the pump shaft (x), vertical (y) and at 90° to the above planes, parallel to the shaft for horizontal pumps and perpendicular for vertical pumps (z).
- .4 Temperature of both bearings or bearing housings.
 - .1 Temperature instruments can be any recognized temperature sensor, such as pyrometers, thermometers, thermo-couples, and the like.
 - .2 They should be capable of measuring the metal temperature on the outside of the housing of both bearings and may be handheld.
- .5 Leakage from mechanical seals, gaskets and bearing lubricant. Visual observation is sufficient for all leakage.
- .6 Oil temperature when oil sump is used.
- .7 Submit the test records or reports with the following data:
 - .1 The manufacturer's serial number, pump type and size
 - .2 Acceptance criteria
 - .3 Vibration levels with measurement locations
 - .4 Noise levels
 - .5 Bearing temperature
 - .6 Ambient temperature
 - .7 Leakage
 - .8 Free-running rotating parts
 - .9 Date of test

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 Refer to process equipment specifications to comply with the detailed performance test procedure.

3.5.2 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 in 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 of all protective devices.
 - .6 Cooperate with and permit system programmer to perform all necessary tests on control systems.
 - .7 Allow ten working days for control system commissioning.
 - .8 Arrange for and pay all costs for equipment manufacturer services as necessary to complete commissioning work.
 - .9 Arrange for all temporary diversions of flow and other utilities necessary to complete commissioning of individual systems.
 - .10 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 treated effluent water to the system 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 effect 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 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.
 - .2 Meet with the Engineer and the Owner to finalize the test plan for the performance and reliability run.
 - .3 Modify the test plan to suit prevailing operating conditions if necessary.
 - .4 Provide all instruments and test devices necessary to record operating parameters where they are not part of the works.
 - .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.

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

- 1.2.1 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.

1.3 Submittals and Schedule

- 1.3.1 Submit outline of all demonstration and training sessions 20 working days in advance of the planned start date.

- 1.3.2 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.
- 1.3.3 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.
- 1.3.4 Allow sufficient time in the construction schedule and test plan for completion of demonstration and training.
- 1.3.5 Coordinate attendance of demonstration and training specialists with availability of Owner and plant personnel.
- 1.3.6 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.
- 1.3.7 All training shall occur on site. Contractor to coordinate and pay for all cost associated with bringing qualified trainers to the site.
- 1.3.8 All training programs shall be completed prior to the start of commissioning.
- 1.3.9 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.
- 1.3.10 All training sessions will be conducted Monday to Friday between 8 a.m. to 3 p.m.

1.4 Pre-Conditions for Demonstrations and Training

- 1.4.1 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.
- 1.4.2 Training materials will be approved by the Engineer and available to trainees.
- 1.4.3 Final Operation and Maintenance Manual shall be complete.

1.5 Required Demonstration and Training Sessions

- 1.5.1 The Contractor shall retain the vendor of the free-issued pumps to perform training as prescribed in this Section.

- 1.5.2 Provide sufficient demonstration to cover start-up, operation, control, adjustment, calibration, trouble-shooting, servicing, maintenance and shut down of all components of the works.
- 1.5.3 Three (3) training sessions for Operation staff, scheduled at different times to accommodate for all work hours shifts, including night shifts.
- 1.5.4 One (1) training session for Maintenance staff, scheduled to accommodate for all work hours shifts.
- 1.5.5 Provide the following demonstration and training sessions as a minimum requirement:

Item No.	Session Title	Minimum Hrs Per Session
1	New Backwash Pump, related systems, Instrumentation and Control System	3
2	New High Lift Pump 7, related systems, Instrumentation and Control System	3
3	New High Lift Pump 6, related systems, Instrumentation and Control System	3
4	Flow meter	3

2. TRAINING SESSIONS

2.1.1 General:

- .1 Every equipment training session shall be recorded with a professional video camera. The Contractor shall provide high quality videos of each equipment training session to the Owner.
- .2 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

Timmins WTP High Lift and Backwash
Pump Replacement
City of Timmins

DIVISION 2
SITE WORKS

DIVISION 2 – SITE WORKS

DIVISION 2 – SITE WORKS

Section No.	Title
02050	Demolition
02922	Hydraulic Seeding

1. GENERAL

1.1 Scope

- 1.1.1 This specification covers the requirements for demolition, salvage, removal, and in-place abandonment, either completely or partially, of those materials and structures so designated on the drawings.
- 1.1.2 This Section also includes modifications of existing structures, piping, and equipment as indicated on the drawings.

1.2 Related Sections

- 1.2.1 DIV 1 – General Requirements
- 1.2.2 Section 01120 – Coordination and Sequence of Work
- 1.2.3 Section 01330 – Submittals
- 1.2.4 Section 01355 – Project Waste Management

1.3 Code and Regulatory Requirements

- 1.3.1 Obtain and pay for demolition permits. Give required notices.
- 1.3.2 Comply with applicable requirements of CSA S350-M1980 “Code of Practice for Safety in Demolition of Structures.”
- 1.3.3 Comply with applicable regulations of jurisdictional authorities governing waste management.

1.4 References

- 1.4.1 OHSA O.Reg. 213/91 – Occupational Health and Safety Act for Construction
- 1.4.2 OPSS 510 - Removal

1.5 Submittals

- 1.5.1 Complete submittals in accordance with Specification Section 01330.
- 1.5.2 Submit for approval drawings, diagrams or details showing sequence of disassembly work or supporting structures and underpinning. Drawings for structural elements shall bear seal and signature of professional engineer licensed to practice in Ontario.
- 1.5.3 Prepare and submit a waste reduction work plan. Describe management of demolition wastes. Identify materials which can be reused, recycled, and indicate method proposed for reducing, reusing recycling wastes.

1.6 Examination

- 1.6.1 Visit the site and the existing building to fully understand all existing conditions and extent of work required. No increase in cost or extension of performance time will be considered for failure to know conditions.
- 1.6.2 Take over buildings and structures to be demolished based on their condition at time of bid submission, except where indicated otherwise.

2. PRODUCTS

2.1 Not Used

3. EXECUTION

3.1 General Demolition Requirements

- 3.1.1 Coordinate the work with the Engineer, Operator, and the Owner to minimize disruptions to operations of the existing plant. Include the sequence of removals in the project schedule for review by the Engineer.
- 3.1.2 The removal drawings may not present all items to be demolished. The Contractor shall remove all items, components, system, cables, piping, supports and equipment within the contract limits shown on the contract drawings, except for those items specified remain. The general area in which the demolition work is to be performed shall be left clean and free of debris at the end of each shift; access routes must always be kept clear. If required, the general area shall be graded as required to provide a uniform appearance.

- 3.1.3 Schedule and organize all Demolition activities to ensure that the Security of the plant and plant operations are maintained continuously throughout the construction period.
- 3.1.4 Do not begin removals except in accordance with the approved sequence of construction and until approval has been given by the Engineer in writing.
- 3.1.5 At least three (3) weeks prior to commencing removal of any equipment, piping, or materials, the Contractor shall request that the Owner mark items to be salvaged. Except for items designated to be salvaged on the drawings or as indicated in the field, all removed equipment, piping, materials, fixtures, hardware, supports, etc., shall be disposed of by the Contractor.
- 3.1.6 Except for items designated to be salvaged, all removed equipment, piping, materials, fixtures, hardware, supports, etc., to be disposed of by the Contractor.
- 3.1.7 All equipment to be salvaged by the Contractor is to remain in good working order. Salvaged materials to be delivered and off loaded into storage anywhere within the plant boundaries.
- 3.1.8 All facilities in the work area which are not to be removed must remain in continuous use during the work, unless otherwise approved by the Owner or Owner's representative.
- 3.1.9 Demolition and salvage work shall create a minimum of interference with the Owner's operation and inconvenience to the Owner. Work shall be scheduled and coordinated to allow continuous, uninterrupted operation of the existing facility.
- 3.1.10 Coordinate work and disposal requirements in accordance with the Designated Substance Survey (DSS) and applicable regulations.
- 3.1.11 All backfilling required in the demolition area shall conform to the governing requirements of the Earthwork Section.
- 3.1.12 Demolish existing work as indicated on the drawings and as required to accommodate new work.
- 3.1.13 Demolish work in a safe and systematic manner, from top to bottom.
- 3.1.14 Do not throw or drop demolished materials from heights. Use chutes, conveyors or hoisting equipment to lower materials.
- 3.1.15 Demolish in a manner to minimize dust generation. Keep dusty materials wetted but prevent flooding or contaminated runoff.
- 3.1.16 Carefully remove and lower structural framing and other heavy and large objects as needed.
- 3.1.17 At all times leave work in safe condition, so that no part is in danger of uncontrolled toppling or falling.

3.1.18 Install temporary supports as required to prevent uncontrolled collapse of structures. Design of support to be completed by Professional Engineer licensed to practice in Ontario. Submit certified drawings for review.

3.1.19 Blasting will not be permitted.

3.2 Coordination

3.2.1 Coordinate all demolition and modification work with any new work to be performed to facilitate completion. Demolition work cannot start until approved by Engineer. Coordination is required with the Engineer and the Owner's operation staff.

3.2.2 Coordinate modification work and demolition to allow continuous, uninterrupted operation of the existing facility.

3.3 Protection

3.3.1 Prevent uncontrolled movement, any part of building being demolished; provide temporary shoring and bracing required.

3.3.2 Take steps to positively prevent uncontrolled falling of demolished materials.

3.3.3 Ensure that no part of existing structure is overloaded due to work carried out under this Section.

3.3.4 Prevent debris from blocking drainage systems.

3.3.5 Ensure the temporary guards, hoardings are provided during and upon completion of work in accordance with applicable safety regulations.

3.4 Preparation

3.4.1 Ensure that affected building areas are unoccupied and discontinued in use and that required screens, partitions, hoardings are in place prior to start of demolition work.

3.4.2 Verify that existing services in areas affected by demolition are disconnected, capped, or removed, prior to start of work. Perform scans as necessary to ensure any pipes, electrical or communication cables have been properly terminated prior to demolition.

3.4.3 Ensure that all process equipment within demolition areas, either to be removed or retained, is appropriately protected from damage, dust, or anything else which may cause damage during the demolition works.

3.4.4 Coordinate work and disposal requirements in accordance with the Designated Substance Survey (DSS) and applicable regulations.

3.5 Concrete Structures Demolition

- 3.5.1 Existing concrete structures, as noted, shall be removed to the limits indicated.
- 3.5.2 Existing concrete to be removed shall be cut into fragments and reduced in size as required to facilitate removal and disposal.
- 3.5.3 Disassembly, removal of all structural elements shall be carried out under the supervision of a professional structural engineer licensed to practice in Ontario hired by the Contractor.

3.6 Piping and Equipment Demolition

- 3.6.1 The City will drain and isolate the existing pipelines to be replaced.
- 3.6.2 The Contractor shall be responsible for the removal of process equipment, pumps and associated motors, piping, valves, and all other appurtenances associated with the item being removed as presented on the Contract Drawings.
- 3.6.3 Before piping removal, the Contractor shall completely drain the corresponding pipeline. The Contractor shall pay for all temporary pumps, piping and its operation required to drain the existing pipeline to be removed.
- 3.6.4 Existing air, cold/hot water and chemical piping including duct shall be cut, removed, abandoned, disconnected, and/or salvaged as indicated on the drawings or as required by the Owner.
- 3.6.5 Piping and equipment shall be disconnected, dismantled and removed as required and in such a manner as to minimize disturbance or damage to adjacent construction.
- 3.6.6 At any point or location where new work is to be connected or installed, the removal of existing work shall be done so as to facilitate the new installation work to the maximum possible extent.
- 3.6.7 All hazardous chemical waste shall be disposed of by a company who is licensed in Ontario and trained to handle and remove them. The hazardous chemical waste, pipe and valves shall be disposed of off-site with approval and permit.

3.7 Site Work Demolition

- 3.7.1 The demolition of existing drives, curbs, walks, dikes, and similar items shall be scheduled and performed so as to minimize inconvenience to the Owner.
- 3.7.2 The attention of the Contractor is called to the Summary of Work section pertaining to the construction sequence guidelines that are recommended to maintain plant operations.
- 3.7.3 The demolition of existing inground services including piping and chambers shall be coordinated so as to ensure the continual unhindered operation of the plant, allow for efficient changeovers

from existing to new inground services and to minimize inconvenience to the Region.

3.8 Repair of Existing Construction

- 3.8.1 Where structures to be demolished are connected to structures to remain, remove the existing construction in a careful manner so that adjacent construction, piping, or facilities to be left in place are not cracked or otherwise damaged.
- 3.8.2 The Contractor will be held responsible for any damage thereto because of their operations.
- 3.8.3 Use temporary supports designed by a Professional Engineer, where and as required for the support of existing facilities.
- 3.8.4 Holes and damage resulting from removal operations shall be filled, reconstructed, repaired, and finished to match and conform to adjacent surfaces and construction as determined by the Engineer.

3.9 Electrical Removal

- 3.9.1 The control stations, control panels, conduits, and other devices associated with the removed equipment may not be shown on the drawings.
- 3.9.2 Contractor to ensure that plant operation is not affected due to loss of power to any part of the wastewater treatment process.
- 3.9.3 The electrical sub-contractor shall be responsible for the following items:
 - .1 Provide temporary power supply to the existing facilities as presented in Section 01130 – Work Sequences and Tie-Ins.
 - .2 Disconnecting electrical power sources from all equipment and devices to be moved or removed.
 - .3 Removing electrical conductors from the conduits serving the equipment to be moved or removed.
 - .4 Removing local starters, control stations, control panels and other local control devices not an integral part of the associated equipment to be moved or removed.
 - .5 Disconnecting and removing abandoned motor control centres, and motor control line-ups.
 - .6 Removing exposed conduit connecting equipment and devices to be moved or removed and the power sources.
 - .7 Where abandoned conduit not indicated to be retained for future use enters a structural surface above the operating floor, it shall be undercut 25 mm with edges dovetailed and

the structure tightly and neatly repaired to resemble the remaining surface.

- .8 Where such a conduit enters a structural surface below the operating floor, it shall be cut flush with the floor or within 25 mm of other surfaces, and those in floors and walls filled with expanding grout to a depth of one diameter, but 50 mm minimum.
 - .9 On any equipment to be reapplied or abandoned in place, unused conduit openings shall be plugged and original identity nameplate shall be reversed or removed. Circuit lists and nameplates at sources of power shall be neatly corrected for changes in loads. Electrical items in motor control centres, control panels, panel boards, etc., separate from abandoned equipment shall be left as spares, unless indicated otherwise.
 - .10 Existing status and control panels shall be disconnected, removed, and returned to the Owner.
- 3.9.4 Remove abandoned power cable, electrical control panels, and power distribution equipment as required. Coordinate this work with the Owner and the Engineer.
 - 3.9.5 Abandoned conduits in good condition and at least as large as indicated for new circuits may be used as part of contract installation.
 - 3.9.6 Salvaged items to be reinstalled or delivered to the Owner's on-site storage shall be handled carefully.
 - 3.9.7 Removed electrical equipment shall first be offered to the Owner and if the Owner refuses right to Ownership, the equipment shall be disposed of off site by the Contractor.

3.10 Items to Be Salvaged by Contractor

- 3.10.1 Removal and salvage of any item of equipment or facility includes removal and salvage of all accessories, piping, wiring, supports, associated electrical starters and devices, base plates, and frames, and all other appurtenances, unless otherwise directed.
- 3.10.2 Existing materials and equipment removed, and not reused as a part of the work, shall become the Contractor's property, except for the items indicated by the Owner shall remain the Owner's property and shall be delivered to the Owner to a designated area by the Contractor in good condition.
- 3.10.3 Existing materials and equipment to be removed by the Contractor and reused as a part of the work shall remain the property of the Owner.
- 3.10.4 The Contractor shall carefully remove, in a manner to prevent damage, all materials and equipment specified herein or indicated to be salvaged and reused or to remain the property of the Owner.

- 3.10.5 The Contractor shall store and protect salvaged items specified or indicated to be reused in the work.
- 3.10.6 Any items damaged in removal, storage, or handling through carelessness or improper procedures shall be replaced by the Contractor in kind or with new items.
- 3.10.7 The Contractor may, at their option, furnish and install new items in lieu of those specified or indicated to be salvaged and reused, in which case such removed items will become the Contractor's property.
- 3.10.8 All other existing materials and equipment removed by the Contractor shall not be reused in the work, shall become the property of the Contractor, and shall be removed from the jobsite.

3.11 Instrumentation

- 3.11.1 Any mounting brackets, enclosures, stilling wells, piping, conduits, wiring, or holes that remain after removal of equipment and associated support hardware shall be removed or repaired in a manner acceptable to the Engineer.
- 3.11.2 Transmitters or switches containing mercury shall be removed and disposed of in an approved manner and by personnel knowledgeable about appropriate methods of handling mercury.

3.12 Concrete Modifications

- 3.12.1 Remove existing concrete where such removal is indicated on the drawings or directed by the Engineer.
- 3.12.2 Remove all dust, grease, curing compounds, impregnations, waxes, foreign particles, and disintegrated material.
- 3.12.3 If chipping is necessary, the edges shall be perpendicular to the surface or slightly undercut. Feather edges will not be permitted.
- 3.12.4 Remove all defective existing concrete down to sound concrete where indicated on the drawings or as directed by the Engineer.
- 3.12.5 Where existing concrete is to be removed, fill, repair, and finish the surfaces smooth and flush with adjacent undisturbed surfaces.
- 3.12.6 All exposed cut ends of reinforcement are to be drilled out to a depth of 40mm from concrete surface, and repaired with non shrink, non-metallic grout.
- 3.12.7 Unless otherwise indicated on the drawings or directed by the Engineer, clean and leave in place existing reinforcing exposed during concrete removal operations.
- 3.12.8 Where indicated on the drawings, extend existing reinforcing into the new construction by mechanical connection to the existing reinforcement. Mechanical connections shall be as specified on the drawings.

- 3.12.9 Any reinforcement bars the Engineer allows to be cut shall be cut off not less than 40 mm inside the finished and repaired surface. All anchor bolts, piping, and other hardware projecting from concrete surfaces after piping and equipment have been removed shall be cut 40mm inside the finished or repaired surface. Reinforcement bars and other steel construction to be removed may be flame-cut.
- 3.12.10 Remove concrete bases of existing equipment that have been relocated or removed, down to the reinforcing steel of the supporting slab. Initiate removal of curb base with a concrete saw, cutting around the perimeter, taking care not to chip or spall the surface of remaining structure. After existing materials have been removed, exposed reinforcing steel and structural slab shall be cleaned and filled with new concrete, finished to match the surrounding surface.
- 3.12.11 Where coring of concrete or masonry elements are necessary for installation of pipes or conduit;
- .1 Scan the floor or wall for electrical or process services prior to coring.
 - .2 Coring of holes shall be at 90 degrees to the concrete surface, and made so that the cored hole is neat and clean on both sides of the element.
 - .3 Core holes must be at minimum 3 hole diameters from any other opening.
 - .4 Core holes must be a minimum of 150mm from any concrete edge.
 - .5 Core holes should not be oversized.
 - .6 Core holes must not be made in any beams, columns or lintels without prior written approval of the engineer.
 - .7 Core holes must be sealed in accordance with the general mechanical and electrical specifications.
- 3.12.12 Concrete materials and placement shall be in accordance with the cast-in-place concrete section. Grouting shall be in accordance with the grouting section.
- 3.12.13 Provide dust control by water systems or vacuum system and tarping to limit any dust migration during any concrete demolition works.

3.13 Disposal and Clean-Up

- 3.13.1 With the exception of items designated for salvage or reuse, all materials, rubbish and debris resulting from demolition work shall become the Contractor's property and shall be removed from site and legally disposed of unless specifically indicated otherwise.

- 3.13.2 Do not allow demolished materials to accumulate on site. Promptly, as work progresses, remove and legally dispose of materials away from site.
- 3.13.3 Separate and salvage materials suitable for reuse and/or recycling from general waste stream or non-salvageable items. Transport and dispose of non-salvageable items to licensed disposal facility.
- 3.13.4 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.
- 3.13.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- 3.13.6 Collect, handle, store on-site and transport off-site, salvaged materials, salvaged for reuse and/or recycling in separate condition. Transport to authorized reuse/recycling location.
- 3.13.7 Burying, burning, selling waste materials on site is prohibited.
- 3.13.8 Disposal of liquid wastes into waterways, sewers is prohibited.
- 3.13.9 Clean-up work, storage and waste collection areas as work progresses.
- 3.13.10 Contractor shall be responsible for all cleaning of existing piping, equipment, and structures that is required to properly remove and dispose of items to be demolished.

3.14 Field Quality Control

- 3.14.1 Disassembly, removal of structural elements shall be carried out under the supervision of a professional engineer licensed to practice in Ontario.

END OF SECTION

1. GENERAL

1.1 Scope

- .1 This section covers hydraulic seeding requirements for works specified in the contract.

1.2 Related Sections

- .1 DIVISION 1 – GENERAL REQUIREMENTS.
- .2 Section 02911 – Topsoil and Finish Grading.

1.3 References

- .1 OPSS.MUNI 804 Seed and Cover
- .2 Canada Food Inspection Agency “Seeds Act”.
- .3 Canada “Fertilizers Act” and “Fertilizer Regulations”.

1.4 Measurement and Payment

- .1 This is a lump sum Contract and payment will be made for work completed during the payment period on a percentage basis of the sum entered in the breakdown of the lump sum price for 02922 – Hydraulic Seeding, as approved by the Engineer.

1.5 Submission Requirements

- .1 A legible, valid Certificate of Seed Analysis from a seed testing laboratory approved by the Canadian Food Inspection Agency for all single seed species and all seed mixtures to be used shall be provided to the Contract Administrator 24 hours prior to any seeding operations.
- .2 Submit in accordance with section 01330 – Submittals

1.6 Delivery, Storage, and Handling

- .1 Seed shall be delivered in original factory sealed container with the original legible label securely attached. Labelling shall be in accordance with the requirements of the Canada Seeds Act and Regulations. Each package shall be labelled to show:
 - .1 The name and address of the seed supplier.
 - .2 The name of the seed mix and the various individual seed species that comprise the seed mix, and the percentage by mass of each.
 - .3 The grade of the seed or seed mix.
 - .4 Percentage of pure seed.

- .5 Percentage germination.
- .6 The supplier's lot designation number corresponding to the Certificate of Seed Analysis.
- .7 Net mass in kilograms of the seed mix.

1.7 Warranty

- .1 Warranty all turf until completion of minimum 2 mowings. Turf areas shall be mowed when turf has reached a height of 100-125mm, and mowing height shall be 75-85mm.
- .2 Repair any deterioration, bare spots during warranty period. Contractor shall be responsible for all maintenance of turf areas during the warranty period, including watering and initial two mowings.
- .3 Replacement of turf damaged due to circumstances beyond the Contractor's control after completion shall not be an obligation under this warranty. The Contractor is responsible for watering during severe drought.
- .4 At the conclusion of the warranty period, the turf shall be predominantly green and succulent, showing evidence of rooting into the underlying soil. Turf areas shall not have greater than 3% scattered dead patches and these patches shall not exceed 0.15m² on an individual basis. Any turf area which fails to meet these requirements must be corrected by the Contractor to bring the turf within these criteria, including the warranty period for new, seed and cover.

1.8 Qualifications of The Contractor

- .1 Experienced, qualified personnel under the direction and supervision of a foreman with at least five years of horticultural and planting experience will carry out seeding and related work.
- .2 The work of this section will be carried out while the Contractor's foreman is on site and directly supervising the seeding operation.

1.9 Acceptance

- .1 Seeded areas will be accepted by the Engineer provided that:
 - .1 Plants are uniformly established. Seeded areas are free of rutted, eroded, bare or dead spots.
 - .2 Areas have been mowed at least twice.
 - .3 Areas have been fertilized.
 - .4 Areas are 98% free of weeds.

- .2 Areas seeded in fall will achieve final acceptance in the following spring, one month after start of growing season provided acceptance conditions are fulfilled.

1.10 Quality Assurance

- .1 All seeded areas shall be inspected by the Engineer using the Ministry of Transportation Ontario Seeding and Cover Quality Assurance Visual Inspection Field Guide to ensure compliance with the field guide at 30, 60, and 90-day periods following the seeding and cover operation.
- .2 At the 30-day inspection within the seeded area:
 - .1 The applied cover shall be visually intact and shall form a uniform, cohesive mat.
 - .2 Germination of the nurse crop shall be visually evident.
- .3 At the 60-day inspection within the seeded area:
 - .1 The nurse crop shall be visually evident at mature height in an evenly dispersed, uniform cover
 - .2 Germination of the specified permanent seed species shall be visually evident in an evenly dispersed uniform cover
 - .3 There shall not be any significant bare areas, both in terms of quantity and size.
 - .4 Non-seeded, non-specified vegetation shall not exceed 20% of the seeded earth area.
- .4 At the 90-day inspection within the seeded area:
 - .1 The permanent seed species shall be an average height of 50mm in a uniform 100% cover that is representative of the specified, permanent seed mix.
 - .2 There shall not be any bare areas, both in terms of quantity and size.
 - .3 Non-seeded, non -specified vegetation shall not exceed 20% of the seeded earth area.
- .5 Inspections shall not be made during the winter dormant period or when site conditions prohibit a visual field inspection. The timing intervals between inspections shall be suspended during the winter dormant period.
- .6 If the work does not meet the performance measures at inspection times, the Engineer shall notify the Contractor in writing of the deficiencies, and the Contractor shall re-apply the specified material in accordance with the specification within 14 days of receiving the notification. Engineer shall re-

inspect the seeded area 30 days after re-application of material. Inspections and re-application of material shall continue as required until the seeded areas have been accepted.

- .7 The work will only be accepted by the Engineer when the Work is properly established, and the turf is free of eroded, bare and dead spots and is 98% free of weeds. On completion and approval by the Owner and Engineer, all necessary instructions shall be provided for proper maintenance to ensure the continuing establishment and vigour of the turf.

2. PRODUCTS

2.1 Seed Mix

- 2.1.1 Seed mix shall be MTO Standing Roadside Mix. Canada #1 Lawn Grass Seed Mixture, containing the following seed mix %:
 - .1 50% Creeping Red Fescue (*Festuca rubra*)
 - .2 10% Kentucky Bluegrass (*Poa pratensis*)
 - .3 35% Perennial Ryegrass (*Lolium perenne*)
 - .4 5% White Clover (*Trifolium repens*)
- 2.1.2 Minimum seed germination shall be 70%, minimum seed purity 85%, maximum weed seed 0.5%.
- 2.1.3 The rate of seed application for Standard Roadside Mix seed is 1 kg/100 m² minimum.

2.2 Annual Nurse Crop Seed

- .1 Nurse crop seed shall be either Fall Rye Grain or Winter Wheat Grain, unless otherwise approved by the Contractor Administrator.

2.3 Fertilizer

- .1 Fertilizer shall be complete commercial fertilizer with minimum 50% of the elements derived from organic sources. Fertilizer shall comply with the provisions of the Canada Fertilizers Act and Regulations.
- .2 All fertilizers shall be granular, pelletized or pill form, and shall be dry and free flowing, unless otherwise specified, and shall be supplied in original factory sealed standard waterproof containers bearing the manufacture's original label indicating mass and analysis.
- .3 Store fertilizers in a weatherproof storage space and in such a manner that they will stay dry and their effectiveness will not be impaired.

- .4 The types, formulations, and rates of application for fertilizers shall be as recommended by the laboratory soil specialist, based on the analysis test results of the growing medium, and as approved by the consultant.

2.4 Mulch

- .1 Hydraulic mulch shall be capable of dispersing rapidly in water to form a homogeneous slurry and remain in such a state when agitated or mixed with other specified materials. When applied, hydraulic mulch shall be capable of forming a uniform, cohesive mat.
- .2 Hydraulic mulch shall not inhibit growth or germination of the seed mix.
- .3 Hydraulic mulch shall be dry, free of weeds and other foreign materials, and shall be supplied in factory sealed package bearing the manufacture's label indicating the product name and mass.

2.5 Water

- .1 Water shall be potable and free of impurities and chlorine that could inhibit germination and growth.
- .2 Water temperature shall not be more than 10°C below ambient air temperature.
- .3 The Contractor shall be responsible for obtaining water from its own sources. The Contractor will be responsible for obtaining any permits or certificates for water usage.
- .4 Water tanks used for the application of water will be clean and free of any contaminants that will be hazardous to the growth and development of plant material or to the general environment.

3. EXECUTION

3.1 Workmanship

- .1 Do not spray onto structures, signs, guiderails, fences, plant material, utilities and other than surfaces intended.
- .2 Clean up immediately, any material sprayed where not intended, to the satisfaction of the Engineer.
- .3 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
- .4 Protect seeded areas from trespass until plants are established.

3.2 Preparation

- .1 The Contractor shall ensure that topsoil placed has been fertilized and amended as recommended by the top soil testing agency, as covered under Section 02911 – Topsoil and Finish Grading.
- .2 The Contractor shall verify that all grades are correct prior to seeding.
- .3 The area to be seeded shall have a minimum of 50mm of loose topsoil. Surface must be free of deleterious material and free of lumps and hollows.

3.3 Fertilizing Program

- .1 Fertilize prior to fine grading as per result of topsoil fertility analysis.
- .2 Fertilize during establishment and warranty periods following a program satisfactory to the Engineer.

3.4 Hydraulic Seeder and Mulcher

- .1 The hydraulic seeder and mulcher shall be capable of mixing the materials into homogeneous slurry and maintaining the slurry in a homogeneous state until it is applied.
- .2 The discharge pumps and gun nozzles shall be capable of applying the materials uniformly over the specified area.
- .3 A hose extension for the hydraulic seeder and mulcher shall be on site and available for use for areas outside of the range of the gun nozzle.

3.5 Seeding

- .1 Seed shall be applied when winds are less than 10km/h using equipment suitable for area involved to the approval of the Engineer.
- .2 Seeding shall not be carried out during heavy rain or when field conditions are not conducive to seed germination such as frozen soil or soil covered with snow, ice, or standing water.
- .3 Quantities of material shall be measured by mass or mass-calibrated volume measurement to the satisfaction of the Engineer.
- .4 Seed, fertilizer and hydraulic mulch shall be thoroughly mixed in a water slurry and shall be distributed uniformly over the surface area using an approved hydraulic mulcher. The Contractor shall ensure that uniform dispersal is achieved and that the spray does not dislodge soil or cause erosion. Seeding shall overlap adjoining grass areas by 300mm.

- .5 Hydraulic mulch shall be applied at the rate of 2,000 kg of dry product per 10,000 m².

3.6 Clean Up

- .1 Should seed and cover materials be applied to the foliage of trees, shrubs, other susceptible plant material, water bodies, or any areas or objects not designated to be seeded, the Contractor shall immediately remove the seed and cover materials from the areas and wash the areas with clean water.

3.7 Protection and Maintenance

- .1 The Contractor shall protect and maintain the site and provide control erosion until final acceptance of the seed and cover. Maintenance includes but is not limited to weeding, fertilizing, cutting as required to maintain grass at a minimum height of 60mm, and watering. Contractor is responsible for supplying water to the site as required.
- .2 Soil shall be kept moist during the germination period and water shall be applied as required to sustain its prosperous growth and prevent deterioration. Water shall be applied to ensure moisture penetration of 75 to 100mm. watering shall be controlled to prevent washouts.
- .3 Water as per the following schedule for the first four (4) weeks after planting:
 - .1 Water every other day for the first week (min. 3 times). Water in morning only.
 - .2 Water once a week for the next 3 weeks.
 - .3 Should the following two (2) weeks be excessively hot and dry, water once a week as directed by the Engineer.
 - .4 Watering frequency may be increased or decreased as per climatic conditions, as consulted by the Engineer.
 - .5 Provide additional watering at no extra cost to ensure a complete seed take, 98% free of bare spots.
- .4 Grass shall be cut at least twice during the maintenance period. First cutting of grass shall occur when it reaches a height of 90-100mm, and it shall be cut to a height of 60-75mm. No more than 33% of overall grass height shall be removed at any one mowing.
- .5 Areas that fail to grow, are bare or thin, or which have been damaged by any means, shall be re-seeded.
- .6 Fertilizer shall be applied as deemed necessary and as approved by the Contract Administrator.

- .7 Maintain seeded areas free of weeds to the satisfaction of the Engineer.

3.8 Maintenance During Warranty Period

- .1 Perform the following operation from time of acceptance until the end of the warranty period:
 - .1 Repair and reseed dead or bare spots to satisfaction of the Engineer.
 - .2 Fertilize areas in accordance with the fertilizing program. Spread half of the required amount of fertilizer in one direction and the remainder at right angles and provide adequate water to the fertilized areas.
 - .3 Eliminate weeds by mechanical or chemical means to the satisfaction of the Engineer.

END OF SECTION

DIVISION 3 – CONCRETE

DIVISION 3 – CONCRETE

Section No.	Title
03100	Concrete Forms and Accessories
03200	Concrete Reinforcement
03300	Cast-in-Place Concrete
03905	Concrete Repairs

1. GENERAL

1.1 Scope of Work

- 1.1.1 Work supplied under this section includes the supply and installation of concrete formwork and falsework.

1.2 Related Sections

- 1.2.1 Section 03200 – Concrete Reinforcement
- 1.2.2 Section 03252 – Waterstops
- 1.2.3 Section 03300 – Cast-in-Place Concrete

1.3 Measurement and Payment

- 1.3.1 No measurement will be made under this section. Include costs in items of work for which concrete formwork and falsework is required.

1.4 References

- 1.4.1 Canadian Standards Association (CSA):
 - .1 CSA A23.1-19/A23.2-19 - Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete
 - .2 CSA O86-19 - Engineering Design in Wood
 - .3 CSA O121-17 - Douglas Fir Plywood
 - .4 CSA S269.1-16 (R2021)- Falsework and formwork
- 1.4.2 International Organization for Standardization
 - .1 ISO 16893 (2016) – Wood-Based Panels – Particleboard

1.5 Submittals

- 1.5.1 Make submittals in accordance with Section 01330 – Submittals.
- 1.5.2 Submit formwork and falsework drawings.
- 1.5.3 Submit both typical arrangements and specific configurations for each pour.
- 1.5.4 Show layout and dimensions of construction joints, drop beams, pipe encasements, and all other concrete edges in the structure.
- 1.5.5 Show materials and layout of panels for formwork.
- 1.5.6 Show extent and layout of reglets, etc.
- 1.5.7 Comply with CSA-S269.1 for falsework and formwork drawings.
- 1.5.8 Show design loads, maximum allowable rate of pouring and material specifications.
- 1.5.9 Contractor to retain a Professional Engineer licensed in the Province of Ontario to sign and seal all formwork and falsework design and provide inspection during construction.

2. PRODUCTS

2.1 Materials

- 2.1.1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121, CSA O86 and ISO 168693 Type P-HLB HMR.
- 2.1.2 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
 - .2 All water/wastewater retaining structures ties are to have interior tie members that are cast into the structure complete with water stops and cone ends.
 - .3 All below grade structures ties are to have interior tie members that are cast into the structure complete with water stops and cone ends.
- 2.1.3 Form panels:
 - .1 Plywood: high density overlay Douglas Fir to CSA O121 No.1 grade, square edge, 20mm thick.
- 2.1.4 Form release agent: non-toxic, biodegradable, low VOC.

- 2.1.5 Preformed joint filler: Ceramar flexible foam expansion joint filler by W.R. Meadows c/w joint cap.

3. EXECUTION

3.1 Fabrication and Erection

- 3.1.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- 3.1.2 Fabricate and erect formwork in accordance with CAN/CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations, and levels indicated within tolerances required by CAN/CSA A23.1/A23.2.
- 3.1.3 Align form joints and make watertight. Keep form joints to minimum.
- 3.1.4 Do not use form release agents on forms with CPF.
- 3.1.5 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners and joints, unless specified otherwise.
- 3.1.6 Form chases, slots, openings, drips, recesses, expansion, and control joints as indicated.
- 3.1.7 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- 3.1.8 Clean formwork in accordance with CAN/CSA A23.1/A23.2, before placing concrete.

3.2 Removal and Reshoring

- 3.2.1 Leave formwork in place for the following minimum periods of time after placing concrete.
- .1 Seven (7) days for walls and sides of beams.
 - .2 Seven (7) days for beam soffits, slabs, decks and other structural members
 - .3 Four (4) days for columns.
 - .4 Two (2) days for footings and abutment.
 - .5 Contractor Note: Concrete requires additional curing after form removal. The ambient environmental conditions may require additional curing at the discretion of the Engineer.
- 3.2.2 After removing formwork, provide shoring under beams and suspended slabs for a minimum of 21 days.

- 3.2.3 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required
- 3.2.4 Re-use formwork and falsework subject to requirements of CAN/CSA A23.1/A23.2.
- 3.2.5 All concrete surfaces, to be finished with a sack rubbed parge coat to the satisfaction of the Engineer. Refer to Section 03300 Cast in Place Concrete for concrete finish requirements.

END OF SECTION

1. GENERAL

1.1 Scope of Work

- 1.1.1 Work supplied under this section includes the supply and installation of concrete reinforcement.

1.2 Related Sections

- 1.2.1 Section 03100 – Concrete Forms and Accessories
1.2.2 Section 03300 – Cast-in-Place Concrete

1.3 Measurement and Payment

- 1.3.1 No measurement will be made under this section. Include costs in items of concrete work for which reinforcement is required.

1.4 References

- 1.4.1 Canadian Standards Association (CSA):
- .1 CSA A23.1-19/A23.2-19 - Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete
 - .2 CSA A23.3-19 - Design of Concrete Structures
 - .3 CAN/CSA G30.18-09 (R2019) - Carbon Steel Bars for Concrete Reinforcement
 - .4 CSA G40.20-13/G40.21-13 (R2018)- General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel

- .5 CSA W186-21 - Welding of Reinforcing Bars in Reinforced Concrete Construction
- 1.4.2 American Concrete Institute (ACI):
 - .1 ACI SP-66 (04) - ACI Detailing Manual-2004
- 1.4.3 Reinforcing Steel Institute of Canada (RSIC):
 - .1 RSIC Manual of Standard Practice 2018
- 1.4.4 American Society for Testing and Materials (ASTM):
 - .1 ASTM A1064/A1064M-15 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - .2 ASTM A276/A276M-16 - Standard Specification for Stainless Steel Bars and Shapes
 - .3 ASTM A955/A955M-20c - Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement
 - .4 ASTM A775/A775M-07b (2014) - Standard Specification for Epoxy-Coated Steel Reinforcing Bars

1.5 Submittals

- 1.5.1 Submit shop drawings in accordance with Section 01330 – Submittals.
- 1.5.2 Coordinate shop drawings with construction joint locations and pour schedules. Not all construction joints are shown on the drawings.
- 1.5.3 Indicate on shop drawings bar bending details, lists, quantities of reinforcement, sizes, spacing, locations of reinforcement and mechanical splices if approved by engineer, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacing and locations of chairs, spacers and hangers.
- 1.5.4 Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice – by Reinforcing Steel Institute of Canada.
- 1.5.5 Detail lap lengths and bar development lengths to CAN/CSA A23.3. Provide Type B tension lap splices, unless otherwise indicated.

2. PRODUCTS

2.1 Materials

- 2.1.1 Substitute different size bars only if permitted in writing by Engineer.
- 2.1.2 Reinforcing steel: billet steel, grade 400 MPa, deformed bars to CAN/CSA G30.18, unless indicated otherwise.
- 2.1.3 Chairs, bolsters, bar supports, spacers: continuous high chair type, Class C, D or E to CSA A23.1/A23.2.
- 2.1.4 Mechanical splices: subject to approval of Engineer.

2.2 Fabrication

- 2.2.1 Fabricate reinforcing steel in accordance with CAN/CSA A23.1, ACI SP-66 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada, unless indicated otherwise.
- 2.2.2 Obtain Engineer's approval for locations of reinforcement splices other than those shown on placing drawings.
- 2.2.3 Upon approval of Engineer, weld reinforcement in accordance with CSA W186.
- 2.2.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 Source Quality Control

- 2.3.1 Upon request, provide Engineer with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum four weeks prior to commencing reinforcing work.
- 2.3.2 Upon request, inform Engineer of proposed source of material to be supplied.

3. EXECUTION

3.1 Field Bending

- 3.1.1 Do not field bend or field weld reinforcement, except where authorized in writing by Engineer.
- 3.1.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- 3.1.3 Replace bars that develop cracks or splits.

3.2 Placing Reinforcement

- 3.2.1 Survey and place string lines for face of concrete prior to placement of reinforcement cage and dowels. Maintain string line for engineer's inspection of dowels.

- 3.2.2 Use sufficient chairs and other supports to prevent movement of reinforcement during concrete placement.
- 3.2.3 Use of hooks to lift reinforcement during a slab pour are not permitted, all reinforcement is to be tied into position prior to placement of concrete.
- 3.2.4 Displacement of slab reinforcement to use as positioning bars under a slab cage is not permitted, provide continuous chairs under slabs.
- 3.2.5 Use of spreader bars and chairs are required to maintain wall steel in the proper position, reduction of the clear space between inside and outside cage is to be avoided.
- 3.2.6 Place reinforcing steel as indicated on the structural drawings, on reviewed placing drawings and in accordance with CSA A23.1.
- 3.2.7 Prior to placing concrete, provide 72 hours' notice to Engineer and facilitate access for Engineer to review reinforcement placement. Make all necessary corrections before concrete is placed and allow re-inspection by Engineer, if requested.
- 3.2.8 Ensure cover to reinforcement is maintained during concrete pour.
- 3.2.9 Bend tie wire away from concrete surface. Ensure a cover for tie wires, form tie bolts etc. are same as the reinforcing bars. Do not let reinforcing tie wire touch formwork or be exposed in the finished concrete structure.

END OF SECTION

1. GENERAL

1.1 Scope of Work

- 1.1.1 Work supplied under this section includes the supply, testing and installation of cast-in-place concrete.

1.2 Related Sections

- 1.2.1 Section 03100 – Concrete Forms and Accessories
- 1.2.2 Section 03200 – Concrete Reinforcement
- 1.2.3 Section 03600 – Grout
- 1.2.4 Section 05500 – Metal Fabrications

1.3 References (Latest Edition at the Time of Tender)

- 1.3.1 Ontario Building Code (OBC) 2012
- 1.3.2 National Building Code of Canada (NBC) 2015
- 1.3.3 Canadian Standards Association (CSA):
 - .1 CSA A23.1-19/A23.2-19 – Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
 - .2 CSA A23.3-19 – Design of Concrete Structures
 - .3 CAN/CSA A3000-18 - Cementitious Materials Compendium

- 1.3.4 American Concrete Institute (ACI):
 - .1 ACI 350-06 - Code Requirements for Environmental Engineering Concrete Structures and Commentary
 - .2 ACI 350.1M - Metric Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures
 - .3 ACI 214R-11 - Guide to Evaluation of Strength Test Results of Concrete
 - .4 ACI 523.1R-06 – Guide for Cast-in-Place Low-Density Cellular Concrete
 - .5 ACI 237R-07 – Self Consolidating Concrete
- 1.3.5 Ontario Water Resources Act
- 1.3.6 American Society for Testing and Materials (ASTM):
 - .1 ASTM C260/C260M-10a – Specification for Air-Entraining Admixtures for Concrete
 - .2 ASTM C309-11 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - .3 ASTM C494/C494M-15 - Specification for Chemical Admixtures for Concrete
 - .4 ASTM C1017/C1017M-13e1 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete

1.4 Measurement and Payment

- 1.4.1 The total volume of the Cast-in-Place concrete will not be measured and the work will be paid for at the price included in the bid form for this section based on the percentage of the work completed.
- 1.4.2 Heating of water and aggregates and providing cold weather protection will not be measured but considered incidental to work.
- 1.4.3 Cooling of concrete and providing hot weather protection will not be measured but considered incidental to work.
- 1.4.4 Coordination with other trades for the supply of hardware, pipe sleeves, and other embedded materials including the related layout drawing and installation will not be measured but considered incidental to work.
- 1.4.5 Supply and installation of waterstops, construction joints, and expansion joints will not be measured but considered incidental to work.
- 1.4.6 Repair of any deficiencies in the concrete will not be measured but be considered incidental to work.

1.5 Quality Assurance

1.5.1 Performance of Concrete Mixes

- .1 Concrete will be tested as identified in the mix performance part of this specification which includes Section 1.6.2 "Prequalification Test Results", and Section 1.6.4 "Testing of Ready Mix Concrete".

1.6 Submittals

1.6.1 Certification of Materials and Concrete Producer

- .1 Submit to the Consulting Engineer for review of the following information:
 - .1 Statements identifying the sources and certifying:
 - .1 Cement types, sources, and conformance to CSA A23.1/A23.2 and CAN/CSA-A3000
 - .2 Aggregates comply with CSA A23.1/A23.2 and are from M.T.O. designated sources list; submit gradations
 - .3 Admixture product names and certification that they comply with CSA A23.1/A23.2 and ASTM C260, ASTM C494/C494M, or ASTM C1017/ C1017M. State type or class of admixture.
 - .4 Materials, plant, and equipment to be used in concrete work comply with the requirements of CSA A23.1/A23.2.
 - .2 Proposed mix designs including complete details of product additives and certification that all additives are compatible with all other additives.

1.6.2 Prequalification Test Results

- .1 Submit prequalification test results to the Engineer for each Ready Mix Concrete Mix proposed, showing adequate performance for:
 - .1 Compressive strength
 - .2 The standard deviation for the concrete compressive strength tests in conformance with ACI 214R.
 - .3 Air entrainment

1.6.3 Concrete Work Plan

- .1 Prior to the start of on-site concrete construction, prepare a concrete work plan in accordance with the requirements in section 3.2.1.4 and 3.2.2.2, including concrete mix production, concrete placing procedures and casting sequence, and curing procedures.

- .2 Submit the work plan to the Consulting Engineer for approval at least 10 days prior to the pre-construction concrete meeting as outlined in 3.2.1.

1.6.4 Testing of Ready Mix Concrete

- .1 Testing will be performed by an independent testing agency arranged by the Owner.
- .2 Testing of Ready Mix Concrete trucks on delivery will include:
 - .1 Slump
 - .2 Air content
 - .3 Wet density
 - .4 Concrete temperature
- .3 Samples will be cast for laboratory testing for:
 - .1 Compressive strength
- .4 Compressive strength cylinders: 7, 14, and 28 day compression samples (one set) will be taken and tested.
- .5 A set of Concrete cylinder samples shall be tested once per pour or once every 100 cu. m, whichever is more frequent.
- .6 Concrete slump, air and temperature shall be tested once per pour or once every 50 cu. m, whichever is more frequent.
- .7 Additional samples may be taken for other testing as determined by the Engineer.
- .8 Copies of all concrete testing carried out by the Engineer will be made available to the Contractor upon request.
- .9 The use of testing services does not relieve the Contractor of the responsibility to furnish materials and construction in compliance with the performance requirements of the contract documents.
- .10 The Contractor shall take samples and carry out testing as part of their quality control procedures to verify that the concrete satisfies the performance requirements set out in these specifications. Where possible, these tests shall be carried out on the same batches as tested by the independent testing agency.
- .11 Copies of the test results for all tests carried out by the Contractor must be made available to the Engineer for review and records.

2. PRODUCTS

2.1 Materials for Concrete Mixes

- 2.1.1 Use materials conforming to CSA A23.1/A23.2, and to the performance requirements which have been established in this section.
- 2.1.2 Cement
 - .1 Normal Portland Cement (Type GU) blended with cementitious slag. Use Portland cement and Slag cement conforming to CSA A3000 and comply to the following conditions and requirements:
 - .1 For structural and architectural concrete mixes, the supplier may incorporate cementitious slag into the proposed mix design as a replacement for up to 30 percent by mass of the quantity of Type GU Portland cement.
 - .2 For lean concrete, slag cannot be used to replace any of the Portland cement.
- 2.1.3 Water
 - .1 Use only potable water in all concrete mixes.
- 2.1.4 Additives
 - .1 Conform to CSA A23.1/A23.2 and ASTM C260, ASTM C494/C494M, or ASTM C1017/C1017M. State type or class of admixture.
 - .2 Use admixtures from one manufacturer and satisfy the intent and, where practical, the specific recommendations of that manufacturer.
 - .3 Ensure admixtures are compatible with each other and with any construction materials used that will be in contact with concrete. Ensure that the mix remains workable with the inclusion of such admixtures.
 - .4 Do not use calcium chloride nor admixtures containing chlorides.
 - .5 Shrinkage Reducing Admixture (not covered by CSA or ASTM standards).
 - .1 A shrinkage reducing admixture shall be used in all topping mixes and in elements with thickness of 125 mm or less.
 - .2 Acceptable products Masterlife SRA 035 by Master Builders added at a rate of 2.5 percent by weight of cementitious materials, or Eclipse by Grace Construction

Products added at a rate of 2 percent by weight of cementitious materials.

2.1.5 Aggregate

- .1 All mixes for concrete elements with thicknesses of 125 mm or less shall contain 14 mm aggregate.
- .2 Use 20 mm aggregate in the remainder of the mixes, unless approved or otherwise specified by the Engineer.

2.2 Concrete Mixes

- 2.2.1 Proportion in accordance with CSA A23.1/A23.2 - Table 5 Alternative Methods for Specifying Concrete.
- 2.2.2 Lightweight concrete mix shall be manufactured in accordance with ACI 523.1R.
- 2.2.3 Meet or exceed the requirements in the following tables:

Mix Number	1
Mix Description	Equipment Pads
Min. Specified Strength, 28 days	30 MPa
Max. Aggregate Size	14mm
SCM	-
Max. W/C Ratio	0.4
CSA Exposure Class	N
Plastic Air Range (%)	-
Additives	shrinkage reducing mixture

- 2.2.4 Final selection of slump for each mix is the responsibility of the contractor to suit specific site needs for workability and finishing.
- 2.2.5 Super plasticizer admixture to be added to the mix at the batching plant. Additional superplasticizer may be added on site to meet the workability requirements of the Contractor placing the concrete in accordance with the manufacturers published recommendations.
- 2.2.6 Utilize the same mix proportions throughout the project.
- 2.2.7 Where the performance of a mix deteriorates to values below the Contract requirements, cease supply of the mix. Re-evaluate the mix, propose revised proportions to meet the performance requirements for the mix, submit trial mix results, and after review, utilize the revised mix.

2.3 Concrete Repairs

- 2.3.1 Concrete spalls or honeycombing
 - .1 Polymer-modified, cementitious, trowel grade mortar:
 - .1 SikaTop 123 Plus
 - .2 Or approved equivalent
 - .2 Self-consolidating, cement-based concrete:
 - .1 Sikacrete-08 SCC
 - .2 Or approved equivalent
- 2.3.2 Resurfacing Mortar
 - .1 Sikagard 75 Epocem
 - .2 Or approved equivalent
- 2.3.3 . Anti-corrosion coating
 - .1 SikaTop Armatec110 EpoCem
 - .2 Or approved equivalent

2.4 Polyethylene Sheets

- 2.4.1 Curing Membrane – 6 mil polyethylene sheet
- 2.4.2 Curing Compounds - The curing compound, if permitted by the engineer, shall conform to the requirements of ASTM C309.

3. EXECUTION

3.1 Standard of Workmanship

- 3.1.1 Comply with CSA A23.1/A23.2.

3.2 Preparation

3.2.1 Pre-planning Requirements

- .1 Two weeks (14 calendar days) prior to placing of concrete, obtain Engineer's approval of the proposed method for the protection of the concrete during placing and curing
- .2 Submit the proposed sequence of casting for review by the Engineer including the location of the proposed construction joints.
- .3 Complete and submit the Concrete Pour Release Form prior to placing any concrete.
- .4 Provide three (3) working days' notice of the proposed time of commencing of concrete placement. The Contractor will be responsible for the Engineer's testing companies standby time costs in the event a concrete pour does not commence within 90 minutes of the proposed time indicated in the three (3) day notice.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Coordinate with the concrete supplier with respect to the workability requirements for the concrete. Do not add water to the concrete after the initial batching unless approved by the Engineer and the concrete supplier. If approval is granted, a record of the amount of water added must be kept and a copy submitted to the Engineer within three (3) days for their records.
- .7 Establish and maintain accurate records of poured concrete items to indicate date, location and size of pour, air temperature, concrete temperature, previously placed concrete temperature, batch ticket and test samples taken.
- .8 Do not place load upon new concrete until authorized by the Engineer.

3.3 Summer Concreting

- 3.3.1 Between June 1st and September 30th, except when the air temperature is below 3°C and winter concrete requirements dictate, the Contractor must prepare and submit their procedures for curing the concrete based on and to suit the ambient conditions anticipated during the curing period. Most cracking is a result of excessive water content in the concrete, rapid drying and thermal effects that including thermal shock during or shortly after the removal of the formwork, ambient conditions or shape considerations. The requirements are designed to minimize those effects and, thereby, to minimize the cracking of the concrete.

- 3.3.2 The maximum temperature of the concrete delivered to the site must be maintained at or below 26°C. This may require the addition of ice to the mix at the Ready Mix Concrete Plant. An amount of water, equivalent to the volume of the ice, must be removed from the mixing water.
- 3.3.3 For slabs: Slabs must be misted during the placing and finishing work. After the finishing has been completed, the slab must be flooded and be covered completely with tarpaulins for seven (7) days.. When temperatures are above 30°C the slab must be covered for a total of 14 days.
- 3.3.4 The surface of slabs, against which new concrete is to be placed, shall be cooled using intermittent wetting techniques and the temperature shall not be more than 5°C greater than the new concrete at the time of placing the new concrete.
- 3.3.5 The use of curing compounds is not to be considered normal practice and the use will be at the discretion of the Engineer. Curing compound shall be applied immediately after the removal of the forms for walls and similar structures. In addition, its use may be considered for slabs after the initial seven (7) day curing period has been completed.

3.4 Winter Concreting

- 3.4.1 Between October 1st and May 31st of the following year, and at any time when the air temperature is below 3°C, or when, in the opinion of the Engineer, there is a probability of its falling to that limit during the placing period, place concrete in accordance with the requirements of CSA A23.1/A23.2, "Cold Weather Requirements".
- 3.4.2 The temperature of the concrete, when deposited, shall not be less than 10°C and not more than 25°C. To accomplish this, the mixing water and, if necessary, the aggregates, shall be heated. Aggregates shall not be heated above 85°C.
- 3.4.3 The temperature difference between concrete being placed and the concrete against which it is placed is of primary importance during winter concreting. The temperature of the base concrete, measured 150 mm below the contact surface, must be within 5°C of the concrete being placed against it, but no lower than 5°C. Preheat the existing concrete as necessary to meet this requirement.
- 3.4.4 If uninsulated metal forms are to be used or if the temperature within the form falls below -5°C prior to placing the concrete, an insulated cover must be provided over the formwork and heat must be provided to raise the temperature to +5°C before pouring the concrete. All snow or ice must be removed from the form prior to placing the concrete. Insulated cover and heat must remain in place over the area for the cure period.

3.5 Vibrators

- 3.5.1 The use of mechanical vibrators is required for all structural concrete.
- 3.5.2 A sufficient number of vibrators shall be employed so complete compaction is ensured.
- 3.5.3 At least one (1) extra gasoline powered vibrator shall be on hand for emergency use.
- 3.5.4 Vibration shall not be continued to the extent that water forms on the surface.
- 3.5.5 Avoid any disturbance to concrete that has become too stiff to regain plasticity when vibrated.
- 3.5.6 Vibration shall not be applied directly to steel which extends into partially hardened concrete.

3.6 Construction

- 3.6.1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.
- 3.6.2 At construction joints, laitance must be mechanically removed from the face of concrete from previous castings before adjacent concrete is placed.
- 3.6.3 Sleeves and Inserts:
 - .1 No sleeves, ducts, pipes, or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by the Engineer.
 - .2 Where approved by the Engineer, set sleeves, ties, pipe hangers, and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 mm x 100 mm not indicated, must be approved by the Engineer.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from the Engineer before placing of concrete.
 - .4 Check locations and sizes of sleeves and openings shown on drawings.
 - .5 Sleeves and openings shall be placed at a minimum of three sleeve diameters centre to centre unless noted otherwise.
- 3.6.4 Anchor Bolts:
 - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

- .2 Protect anchor bolt holes from water accumulations, snow, and ice build-ups.
- .3 When using proprietary anchor systems set bolts and fill holes with epoxy grout, in accordance with the manufacturer's requirements. All proprietary anchors must be approved by the Engineer.
- .4 Locate anchor bolts used in connection with expansion shoes, rollers, and rockers with due regard to ambient temperature at time of erection.
- .5 Under special circumstances, with approval of the Engineer, grouted anchor bolts may be installed into preformed holes or holes drilled after concrete has set. Formed holes or sleeves to be minimum 100 mm diameter and be deformed.

3.6.5 Drainage Holes and Weep Holes:

- .1 Form weep holes and drainage holes in accordance with Section 03100 – Concrete Forms and Accessories. If wood forms are used, remove them after concrete has set.
- .2 Install weep hole tubes and drains as indicated.

3.6.6 Coordination:

- .1 Adjust the work to suit final shop drawings of the equipment being supplied. Verify all sizes with the trade supplying and installing the equipment. Obtain, utilize and submit data on relevant sizes to suit any change in equipment. Confirm the adjustments with the Engineer.

3.6.7 Grouting:

- .1 Grout under base plates and/or machinery using procedures in accordance with manufacturer's recommendations that result in 100 percent contact over grouted area. Install bleed holes in base plates to ensure full coverage of grout.

3.6.8 Curing Compounds:

- .1 The consultant may approve dependant on the location and situation, the use of curing compounds.

3.7 Finishes

3.7.1 Formed finishes specified herein shall be finished as defined by CSA A23.1/A23.2.

- .1 The surfaces exposed to view shall be given a "sack-rubbed finish".
- .2 All exposed and non-exposed corners shall be rubbed with a carborundum stone to remove any loose concrete and to create a smooth and rounded profile.

- .3 All exposed concrete and interior of tanks and channels shall have a smooth form finish as per 7.9.2.6.
 - .4 In type C-1, A-1 and A-2 type concrete all bugholes shall be filled.
- 3.7.2 Unformed surfaces shall be finished as defined by CSA A23.1/A23.2.
- .1 The floor surface of occupied spaces shall be “floated” and “trowelled” to create a Class A Floor finish as defined by Table 21 in CSA A23.1/A23.2.
 - .2 The floor surface of exterior or interior walkways and tankage or chambers, shall be “swirl trowelled” to create a non-slip surface.
 - .3 All tops of buried structures and foundations shall be finished by steel float to a sealed smooth surface.

3.8 Examination of Completed Structures

- 3.8.1 Undertake, with the Engineer, review of concrete surfaces for defects and finishes.
- 3.8.2 Undertake, with the Engineer, assessments and measurements of the concrete structures for cracking.
- 3.8.3 Provide a written summary of defects noted complete with a plan showing locations of each defect.
- 3.8.4 Submit a plan for repair of each defect in accordance with these specifications.

3.9 Patching or Repairs

- 3.9.1 No patching or repairing shall be carried out without the approval of the Engineer.
- 3.9.2 All preparation for repairs are to be reviewed by the engineer.
- 3.9.3 All patches, bug holes, and suspected honeycomb are to be reviewed by the engineer prior to patching.
- 3.9.4 Surface defects such as honeycombing, sand streaking, lift lines, variations in colour, soft areas, and large surface voids in the finished concrete shall be considered defective and shall be repaired by the contractor at no additional cost to the owner, regardless of structural or water retaining characteristics of the wall. Provide a methodology to repair all visible pour lines, for submission and approval by the Consultant.
- 3.9.5 All honeycombing shall be chipped out to sound concrete. The edge around the perimeter of the area shall be sawcut to a depth of 20 mm minimum to eliminate all “feathered” edges. All repairs of honeycomb shall be a proprietary repair material. If honeycombing

extends to the depth of the reinforcement, the chipping shall be continued to a depth of 1.4 times the diameter of the largest reinforcing bar and 40 mm minimum beyond the layer of reinforcement.

- 3.9.6 The patch shall be continuously covered with a 6 mil polyethylene sheet and heated to above 15°C for 14 days.
- 3.9.7 Chips and edge breaks in the concrete shall be repaired as noted above.

3.10 Site Tolerances

- 3.10.1 Concrete tolerance in accordance with CSA A23.1/A23.2.
- 3.10.2 The Contractor shall survey the site and shall provide a drawing layout of the concrete work to be included in the "as built" drawings.

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 03300 Cast-in-Place Concrete

1.3 Basis of Payment

1.3.1 Payment of this item shall be based on the lump sum price bid.

1.3.2 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.

1.4 Quality Assurance

- 1.4.1 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.

1.5 Submittals

- 1.5.1 Make all submittals in accordance with Section 01330.
- 1.5.2 Work plan: Prior to the start of work, submit the methods of preparation, repair, and curing and a list of repair locations.
- 1.5.3 Technical Data Sheet for each material applied.

1.6 Warranty

- 1.6.1 5 years leak free, combined manufacturers and contractor's warranty

2 PRODUCTS

2.1 Materials

- 2.1.1 Spall Repair
 - .1 Polymer-modified, cementitious, trowel grade mortar:
 - .1 SikaTop 122 Plus
 - .2 Or approved equivalent
 - .1 Self-consolidating, cement-based concrete:
 - .1 Sikacrete-08 SCC
 - .2 Or approved equivalent
- 1.1.2 Resurfacing Mortar
 - .2 Sikagard 75 Epocem
 - .3 Or approved equivalent
- 1.1.3 . 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 $\pm 3\text{mm}$ (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.

3.6 Post Application

- 3.6.1 Clean all tools and equipment after use with water.

END OF SECTION

DIVISION 5 – METALS

DIVISION 5 – METALS

Section No.	Title
05500	Metal Fabrications
05510	Metal Ladders
05550	Anchorage in Concrete and Masonry

1. GENERAL

1.1 Scope of Work

- 1.1.1 Design, supply and install the following items including bolts, nuts, washers, anchors, hardware,
 - .1 Guardrail complete with kick plates.
 - .2 All other miscellaneous metal items shown on the drawings.

1.2 Related Sections

- 1.2.1 Section 01330 - Submittals
- 1.2.2 Section 03300 - Cast-in-Place Concrete
- 1.2.3 Section 05510 - Metal Ladders
- 1.2.4 Section 09900 – Painting
- 1.2.5 Section 11190 – Pipe and Valve Supports

1.3 References

- 1.3.1 All products shall conform to the following standards and regulations:
- 1.3.2 ASTM International (ASTM).
 - .1 ASTM A53/A53-20 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - .2 ASTM A123/A123M-17 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - .3 ASTM A276/A276M-17 - Standard Specification for Stainless Steel Bars and Shapes
 - .4 ASTM A307-14e1 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 psi Tensile Strength
 - .5 ASTM A780/A780M-20 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 - .6 ASTM D1187/D1187M-20 - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
 - .7 ASTM D5360-15 – Standard Practice for Design and Construction of Bituminous Surface Treatment
 - .8 ASTM D6511/D6511M-18 - Standard Test Methods for Solvent Bearing Bituminous Compounds
 - .9 ASTM F1554-20 – Standard Specifications for Anchor Bolts

- .10 ASTM F3125-15 – Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 830 MPa and 1040 MPa Minimum Tensile Strength
- .11 ASTM F593-17 – Standard Specification for Stainless Steel bolts, Hex Cap Screws, and Studs.
- 1.3.3 Canadian Standards Association (CSA):
 - .1 CSA G40.20-13/G40.21-13 (R2018) - General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel
 - .2 CAN/CSA S16-19 - Design of Steel Structures
 - .3 CAN/CSA S157-17/S157.1-17 - Strength Design in Aluminum / Commentary on CSA S157-05, Strength Design in Aluminum
 - .4 CSA W47.2-11 (R2020) – Certification of Companies for Fusion Welding of Aluminum
 - .5 CSA W48-18 - Filler Metals and Allied Materials for Metal-Arc Welding
 - .6 CSA W59.2-M1991 (R2018) - Welded Aluminum Construction
 - .7 CSA W59-18 - Welded Steel Construction (Metal-Arc Welding)
- 1.3.4 American Welding Society (AWS)
 - .1 AWS D1.6/D1.6M-17 – Structural Welding Code – Stainless Steel
- 1.3.5 The National Association of Architectural Metal Manufacturers (NAAMM):
 - .1 NAAMM-AMP 521-01(R2012) – Pipe Railing System Manual (Fourth Edition)

1.4 Shop Drawings

- 1.4.1 Submit shop drawings in accordance with Section 01330 – Submittals.
- 1.4.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.
- 1.4.3 Design loads and general arrangement shall be clearly identified on the shop drawings.
- 1.4.4 In preparing shop drawings, the fabricator shall verify that all component parts and assembly of each item will support the

superimposed loads without deflection detrimental to function, appearance or safety.

- 1.4.5 Provide signed and sealed shop drawings certified by a Professional Engineer licensed in the Province of Ontario.
- 1.4.6 Upon request, submit design calculations signed and sealed by a Professional Engineer licensed in the Province of Ontario.

1.5 Protection

- 1.5.1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
- 1.5.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.
- 1.5.3 Prevent metals from collecting standing water and protect from staining.

2. PRODUCTS

2.1 Materials

- 2.1.1 Structural steel columns and beams: to CSA G40.20/G40.21, Grade 350W.
- 2.1.2 Steel angles, channels and plates: to CSA G40.20/G40.21, Grade 300W.
- 2.1.3 Hollow Structural Sections (HSS): conform to CAN/CSA G40.21, Grade 350W, Class H.
- 2.1.4 Welding materials:
 - .1 to CSA W59 for Steel.
 - .2 to CSA W59.2 for Aluminum.
 - .3 to AWS D1.6 for Stainless Steel
- 2.1.5 Welding electrodes: to CSA W48 Series.
- 1.1.1 Anchor Rods: to ASTM F1554.
- 2.1.6 High Strength Bolts and Nuts: to ASTM F3125
- 2.1.7 Aluminum shall conform to the following alloy designations of the Aluminum Association:
 - .1 Extruded Shapes – Structural: 6061-T6.
 - .2 Smooth Plates: 5083-H34.
 - .3 Rivets and Bolts: 6061-T6.
 - .4 Checkered or Tread Plate: 6061-T6.

- 2.1.8 Stainless steel shapes: to ASTM A276, Type 316L
- 2.1.9 Stainless steel plate: Type 316L
- 2.1.10 Stainless steel bolts and nuts: to ASTM F593, Type 316L
- 2.1.11 Grout: non-shrink, non-metallic, flowable, 24h, 15 MPa at 24 hours, pull-out strength 7.9 MPa.

2.2 Fabrication

- 2.2.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- 2.2.2 Use self-tapping shake-proof screws on items requiring assembly by screws or as indicated.
- 2.2.3 Where possible, fit and shop assemble work, ready for erection.
- 2.2.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 Finishes

- 2.3.1 Bituminous Paint: quick-drying asphalt utility enamel.
- 2.3.2 Aluminium to be anodized.

2.4 Isolation Coating

- 2.4.1 Isolate aluminum from following components, by means of bituminous paint:
 - .1 Dissimilar metals except stainless steel, zinc or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.5 Guardrail

- 2.5.1 Materials and sizes as indicated on drawings.
- 2.5.2 All transitions to be welded and smooth.
- 2.5.3 Gaps in guards around equipment, or between individual guard pieces, to be no more than 200mm.
- 2.5.4 Guardrail to be designed in accordance with OBC requirements, and to be engineered and stamped by vendor.

2.6 Safety Gate

- 2.6.1 Gates in guardrail are to be of the same material as the guardrail.
- 2.6.2 Gates to be complete with a lockable latch, and to swing shut automatically.

- 2.6.3 Gate to be installed as to close in the direction of the hazard.
- 2.6.4 Clapper plate to be of the same material as the gate and be installed on the gate as per vendor design.
- 2.6.5 Spring-loaded hinge mechanism to be corrosion resistant material, all other hardware to be of stainless-steel Type 316.
- 2.6.6 Gates to be designed for guard loading as per OBC, and to be engineered and stamped by vendor.
- 2.6.7 Gate top rail to match the top rail elevation of adjacent guardrails.
- 2.6.8 Gate to be coated in safety yellow at the manufacturer's plant.

2.7 Pipe Supports

- 2.7.1 Supply pipe supports as described in section 11190 Pipe Supports.
- 2.7.2 All pipe supports shall be Type 304L stainless steel

2.8 Miscellaneous Items

- 2.8.1 Review all drawings and include all other metal fabrication not included in the above noted list.

3. EXECUTION

3.1 Erection

- 3.1.1 Do welding work in accordance with CSA W59, unless specified otherwise.
- 3.1.2 Erect metal work square, plumb, straight and true, accurately fitted with tight joints and intersections.
- 3.1.3 Provide suitable means of anchorage acceptable to engineer such as dowels, anchor clips, bar anchors, expansion bolts and shields, chemically anchored bolts and toggles.
- 3.1.4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- 3.1.5 Provide components for building by other sections in accordance with shop drawings and schedule.
- 3.1.6 Make field connections with bolts to CAN/CSA S16 or weld.
- 3.1.7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

END OF SECTION

1. GENERAL

1.1 Scope of Work

- 1.1.1 Design, fabricate and install metal ladder assemblies in accordance with the requirements set forth in this section.

1.2 Related Sections

- 1.2.1 Section 01330 – Submittals
- 1.2.2 Section 03300 – Cast-in-Place Concrete
- 1.2.3 Section 05500 – Metal Fabrications
- 1.2.4 Section 09900 - Painting

1.3 Reference Standards

- 1.3.1 American Society for Testing and Materials (ASTM):
 - .1 ASTM A123/A123M-17 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - .2 ASTM A276/A276M-17 - Standard Specification for Stainless Steel Bars and Shapes
 - .3 ASTM A307-14e1 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 psi Tensile Strength
 - .4 ASTM A53/A53M-20 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - .5 ASTM F1554-20 - Standard Specifications for Anchor Bolts
 - .6 ASTM F3125-15 – Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 830 MPa and 1040 MPa Minimum Tensile Strength
- 1.3.2 The National Association of Architectural Metal Manufacturers (NAAMM):
 - .1 NAAMM AMP 510-92 - Metal Stair Manual (Fifth Edition)
- 1.3.3 American National Standards Institute (ANSI):
 - .1 ANSI/NAAMM AMP 521-01 (R2012) – Pipe Railing Systems Manual (Fourth Edition)
 - .2 ANSI/NAAMM MBG 531-17 - Metal Bar Grating Manual
- 1.3.4 Canadian Standards Association (CSA):
 - .1 CSA G40.20-13/G40.21-13 (R2018)- General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel
 - .2 CSA S16-19 - Design of Steel Structures

- .3 CAN/CSA S157-17/S157.1-17 - Strength Design in Aluminum / Commentary on CSA S157-05, Strength Design in Aluminum
- .4 CSA W59-18 - Welded Steel Construction (Metal-Arc Welding)
- .5 CSA W59.2-M1991 (R2018) - Welded Aluminum Construction

1.3.5 Ontario Building Code (OBC) 2020

1.4 Quality Assurance

1.4.1 In addition to the requirements of 01450 – Quality Control, the following measures are required:

1.4.2 Fabricator Qualifications

- .1 Work of this section shall be carried out by a fabricator specialized in the type of work specified herein.
- .2 Fabricator must have been producing stair systems for at least ten (10) years.

1.5 Submittals

1.5.1 Complete submittals in accordance with Specification Section 01330.

1.5.2 Shop Drawings

- .1 Submit engineered and certified shop drawings in accordance with Section 01330 – Submittals.
- .2 Indicate construction details, sizes of aluminum and/or steel sections and thickness of aluminum and/or steel sheets.
- .3 Show all field connections.
- .4 Indicate all required field measurements.
- .5 Indicate all design loadings.
- .6 Provide shop drawings certified by a Professional engineer licensed in the Province of Ontario.

1.5.3 Delivery Storage and Handling

- .1 Refer to Specification Section 01610 - Basic Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.

.4 Storage On Site

- .1 Store material in a location and in a manner to avoid damage. Stacking shall be done in a way, which will prevent bending and damage to factory finishes.
- .2 Store aluminum, steel and stainless steel components and materials in clean, dry location, away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that will permit circulation of air inside the covering.
- .3 Keep handling on-site to a minimum. Exercise particular care to avoid damage to finishes of materials.
- .4 Replace defective or damaged materials with new.

2. PRODUCTS

2.1 Design Requirements

- 2.1.1 Detail and design ladders and anchorage in accordance with Ontario Building Code MMAH Supplementary Standard SB-8 requirements.
- .1 Factor of safety for designing components with fall arrest systems – 10:1
 - .2 Factor of safety for designing components for normal use – 4:1
 - .3 For ladders with extension handles, a concentrated lateral load of 0.9 kN shall be considered acting on top of each extension handle.

2.2 Materials

- 2.2.1 Steel sections: to CSA G40.21, Grade 350W.
- 2.2.2 HSS Steel: to CSA G40.21, Grade 350W, Class C.
- 2.2.3 Welding materials: to CSA W59.
- 2.2.4 Anchor Rods: to ASTM F1554.
- 2.2.5 High Strength Bolts and Nuts: to ASTM F3125
- 2.2.6 Aluminum shall conform to the following allowable designations of the Aluminum Association:

Extruded Shapes – Structural	6061-T6
Smooth Plates	5083-H34
Rivets and Bolts	6061-T6

- 2.2.7 All stainless steel to ASTM A276, Type 316.

2.3 Fabrication

- 2.3.1 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.
- 2.3.2 Accurately form connections with exposed faces flush, mitres and joints tight. Make risers of equal height.
- 2.3.3 Grind or file exposed welds and steel sections smooth.
- 2.3.4 Shop to fabricate stairs in sections as large and complete as practicable.

2.4 Ladders

- 2.4.1 Galvanized steel ladders and related hardware as shown on the drawings.

2.5 Finishes

- 2.5.1 Aluminum shall be clear anodized.
- 2.5.2 Galvanizing: hot-dipped galvanizing with zinc coating 610 g/m2 to ASTM A123M.
- 2.5.3 Zinc primer: zinc rich, ready mix primer as per section 9900 – Paint.

2.6 Shop Painting

- 2.6.1 Clean surfaces in accordance with Steel Structures Painting Council SSPC-SP2.
- 2.6.2 Apply two (2) coats of primer of different colours to parts inaccessible after final assembly.
- 2.6.3 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale and grease. Do not paint when temperature is below 7°C.
- 2.6.4 Do not paint surfaces to be field welded.

3. EXECUTION

3.1 Installation of Ladders

- 3.1.1 Prior to installation, field check and verify structural framing, ensure enclosures, weld plates, blocking, size and location of pockets are as called for on drawings.
- 3.1.2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.

- 3.1.3 Do welding work in accordance with CSA W59, unless specified otherwise.
- 3.1.4 Touch-up shop primer to bolts, welds and burned or scratched surfaces at completion of erection.

END OF SECTION

1. GENERAL

1.1 Scope of Work

- 1.1.1 This section covers the procurement and installation of anchors in concrete and masonry, including cast-in-place anchor bolts, adhesive anchors, expansion anchors and epoxy grouted anchor bolts and reinforcing steel.

1.2 Related Specification Sections

- 1.2.1 Comply with requirements of Division 1.

1.3 Code and Regulatory Requirements

- 1.3.1 Canadian Standards Association (CSA):
 - .1 CAN/CSA-G30.18-09 (2019) - Carbon Steel Bars for Concrete Reinforcement
- 1.3.2 American Society for Testing and Materials (ASTM):
 - .1 ASTM A307-14e1 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 psi Tensile Strength
 - .2 ASTM F593-17 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
 - .3 ASTM F594-09 (2020) - Standard Specification for Stainless Steel Nuts

- .4 ASTM A153/A153M-16a - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- .5 ASTM A385/A385M-20 - Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
- 1.3.3 American National Standards Institute (ANSI):
 - .1 ANSI/ASME B18.22M-1981 (R2010) - Metric Plain Washers
- 1.3.4 American Concrete Institute (ACI):
 - .1 ACI 355.2-19 – Qualifications of Post-installed Mechanical Anchors in Concrete
 - .2 ACI 355.4-19 - Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary
- 1.3.5 ICC Evaluation Services (ICC-ES):
 - .1 ICC-ES AC193 – Mechanical Anchors in Concrete Elements
 - .2 ICC-ES AC308 – Post-Installed Adhesive Anchors in Concrete elements.
 - .3 ICC-ES ACC446 – Headed Cast-in Specialty Inserts in Concrete

1.4 Quality Assurance

- 1.4.1 Implement a system of quality control to ensure that the minimum standards specified herein are attained.
- 1.4.2 All post-installed anchors in concrete shall have current published ICC-ES Evaluation Report indicating the anchor is approved for installation in cracked concrete and shall have seismic qualification to meet the project requirements.
- 1.4.3 Special inspection, where required by code, shall be in accordance with a current published ICC-ES Evaluation Reports.
- 1.4.4 Where material or equipment must be supported from the structure, the installer of that material or equipment support shall be responsible for supplying the anchors and meeting the requirements of this specification unless specifically noted otherwise on the Drawings.
- 1.4.5 All post-installed anchors shall be installed by an installer trained for that specific product by a manufacturer's field representative. All training must be conducted on the jobsite prior to the installation of any products.
- 1.4.6 All adhesive anchor installations in the horizontal to vertically overhead orientation shall be conducted by a certified Adhesive Anchor Installer(AAI) as certified by ACI-CRSI Adhesive Anchor Installer Certification program or approved equivalent.

1.5 Submittals

- 1.5.1 Submit in accordance with Section 01330 – Submittal.
- 1.5.2 Letters of certification indicating the manufacturer and types of adhesive anchors, expansion anchors and epoxy grouts to be supplied.
- 1.5.3 A current ICC-ES Evaluation Service Report shall be submitted for all anchors that will be considered for use on this project.
- 1.5.4 Product Data: Manufacturer's data sheets on each product to be used.
- 1.5.5 Manufacturer's Published Installation Instructions (MPII)
- 1.5.6 Installation Training Records:
 - .1 Provide a list of names of all installers who are trained by the Manufacturer's Field Representative on this jobsite prior to installation of products. Record must include the installer name, date of training, products included in the training and trainer name and contact information
 - .2 Provide a copy of the current ACI-CRSI "Adhesive Anchor Installer" certification cards for all installers who will be installing adhesive anchors in the horizontal to vertically overhead orientation.

1.6 Delivery, Storage and Handling

- 1.6.1 Materials shall be handled, transported and delivered in a manner that will prevent damage or corrosion. Damaged materials shall be promptly replaced.
- 1.6.2 Keep anchors, rod materials, nuts and washers in original manufacturer's packaging with label intact until needed for use.
- 1.6.3 Keep anchors free of dirt and debris.
- 1.6.4 Protect anchors from corrosion and deterioration.
- 1.6.5 Store all anchoring products in strict accordance with manufacturer's recommendations. For adhesive anchors, consider temperature, exposure to sunlight, and shelf life.

2. PRODUCTS

2.1 General

- 2.1.1 Unless otherwise specified or indicated on the drawings, all anchor bolts shall be cast-in-place anchor bolts with forged heads or embedded nuts and washers. Unless otherwise indicated, bolts in concrete shall have a diameter of at least 20 mm and bolts in grouted masonry shall have a diameter of at least 13 mm.

- 2.1.2 Adhesive anchors and expansion anchors may be used instead of cast-in-place anchors where with the specific acceptance by the Engineer. Only acceptable systems listed in 2.2.1.5 shall be used, unless approved by the Engineer.
- 2.1.3 Cast-in-place Anchor Bolts: Unless otherwise indicated on the drawings, anchor bolts used in the following locations and applications shall be of the indicated materials.
 - .1 Submerged locations: Stainless steel
 - .2 Locations subject to splashing: Stainless steel
 - .3 Buried locations: Stainless steel
 - .4 Anchorage of structural steel columns: Galvanized steel
 - .5 Other exterior locations: Galvanized steel
 - .6 Other interior locations: Carbon steel
- 2.1.4 Threaded Rod with adhesive and Expansion Anchors: Unless otherwise indicated on the drawings, threaded rods and expansion anchors used in the following locations and applications shall be of the indicated materials.
 - .1 Submerged locations: Stainless steel, no mechanical anchors permitted
 - .2 Locations subject to splashing: Stainless steel, no mechanical anchors permitted
 - .3 Buried locations: Stainless steel
 - .4 Anchorage of structural steel columns: Stainless steel, no mechanical anchors permitted.
 - .5 Other exterior locations: Stainless steel, no mechanical anchors permitted
 - .6 Other interior locations: Carbon steel

2.2 Materials

- 2.2.1 Materials shall be as indicated below:
 - .1 Expansion Anchors: Hilti "Kwik-Bolt"; Red Head "Trubolt Wedge Anchor"; Dewalt "Power-Stud Anchor".
 - .2 Reinforcing Bars: CAN/CSA G30.18 grade 400.
 - .3 Anchor Bolts and Nuts:
 - .1 Carbon Steel: ASTM A307 or grade 300 rod, with compatible nuts.

- .2 Stainless Steel: Bolts, ASTM F593, Alloy Group 2 (316 SS); nuts, ASTM F594, Alloy Group 2.
- .3 Galvanized Steel: Carbon steel bolts and nuts; hot-dipped galvanized, ASTM A153/A153M and ASTM A385/A385M.
- .4 Flat Washers: ANSI/ASME B18.22M; of same material as anchor bolts and nuts.
- .4 Threaded Rod Anchors and Nuts:
 - .1 Carbon Steel: Grade 300W rod, with compatible nuts.
 - .2 Stainless Steel: Rods, ASTM F593, Alloy Group 2 (316 SS); nuts, ASTM F594, Alloy Group 2.
 - .3 Galvanized Steel: Carbon steel rods and nuts; hot-dipped galvanized, ASTM A153/A153M and ASTM A385/A385M.
- .5 Adhesive Anchors for Concrete and Grout Filled Masonry:
 - .1 Threaded Rods and Nuts: As specified for Threaded Rod Anchors and Nuts and as recommended by the adhesive manufacturer.
 - .2 Adhesive: Hilti "HIT HY 200 v3", "HIT-ICE", "HIT RE500", Dewalt "AC200+".
- .6 Epoxy Grout for Reinforcing Bars, Threaded Rod Anchors and Anchor Bolts:
 - .1 Adhesive for Floors and Horizontal Surfaces: Sika "Sikadur 35, Hi-Mod LV"; BASF "MasterEmaco ADH 326"; Sika "Sikadur 32 Hi-Mod", Hilti "HIT RE-500 v3", Dewalt "Pure220+".
 - .2 Adhesive for Vertical Surfaces and Overhead Applications: Sika "Sikadur 31 Hi-Mod Gel".
 - .3 Aggregate: As recommended by the epoxy grout manufacturer.
 - .4 Water: Clean and free from deleterious substances.
- .7 Adhesive Anchors for Hollow Masonry System:
 - .1 Threaded Rod Anchors and Nuts: As specified for Threaded Rod Anchors and Nuts and as recommended by the adhesive manufacturer.
 - .2 Adhesive: Hilti "HIT HY 270" System; Redhead "Epcon Ceramic 6" System.
 - .3 Screen Tubes: As recommended by the manufacturer.

2.3 Anchors

- 2.3.1 Cast-in-Place Anchor Bolts shall be provided with:
- .1 Sufficient threads to permit a nut to be installed on the concrete side of the concrete form or the supporting template.
 - .2 Two (2) nuts, a jam nut and a washer shall be furnished for cast-in-place anchor bolts indicated on the drawings to have locknuts;
 - .3 Two (2) nuts and a washer shall be furnished for cast-in-place anchor bolts without locknuts.
- 2.3.2 Adhesive Threaded Anchors and Expansion Anchors shall be provided with:
- .1 Threaded rod anchors in adhesive anchor systems shall be free of coatings that would weaken the bond with the adhesive.
 - .2 Unless otherwise required, single nut and washer shall be furnished for threaded rod anchors, adhesive anchors and expansion anchors.
 - .3 Adhesive anchors in hollow masonry shall utilize screen tubes as recommended by the manufacturer.

3. EXECUTION

3.1 General

- 3.1.1 Identify location of embedded items such as reinforcing steel, stressing tendons, conduit, heating tubes, etc. prior to drilling holes by scanning. Coordinate with respective trades if any apparent conflict exists. Exercise care in coring and drilling to avoid damaging any existing embedded items. If embedded items are encountered, stop drilling and contact Engineer immediately for direction. Any offsets or relocations of anchors must be approved by Engineer.
- 3.1.2 Drill holes of proper diameter and depth in accordance with manufacturer's published design information for that specific anchor. Use only equipment approved by anchor manufacturer. All holes shall be perpendicular to the concrete surface unless shown otherwise on structural plans and/or details.
- 3.1.3 Do not drill holes until base material has achieved full design strength.
- 3.1.4 Installation of all post-installed anchor products shall be conducted in strict accordance with the Manufacturer's Published Installation Instructions (MPII). Use hammer drills for adhesive anchors (unless noted otherwise).

- 3.1.5 Anti-seize thread lubricant shall be liberally applied to projecting, threaded portions of stainless steel anchors immediately before final installation and tightening of the nuts.
- 3.1.6 Anchors shall be located at least 100 mm away from conduits, sleeves and drains bodies at their largest point measured on top of the slab above the anchor, and the like, embedded in the concrete.
- 3.1.7 Anchors shall be installed in drilled holes with a minimum depth and diameter specified by the manufacturer unless noted otherwise.
- 3.1.8 Anchors shall be assumed, for determining required anchor size, to be installed in an unreinforced concrete mass.
- 3.1.9 Clean out holes, properly prepare substrate, and install anchors in accordance with manufacturer's instructions and current ICC-ES ESR. Proper tools must be on job site.
- 3.1.10 If, when drilling the holes for the anchors, reinforcement is encountered and the hole must be shifted to clear the reinforcement, the abandoned hole shall be patched with non-shrink grout of similar properties as the base concrete.

3.2 Cast-In-Place Anchors and Anchor Bolts

- 3.2.1 Cast-in-place anchor bolts shall be delivered in time to permit setting before the structural concrete is placed.
- 3.2.2 Cast-in-place anchors and anchor bolts shall be carefully positioned with templates and secured in the forms prior to placing concrete. Contractor shall verify that anchorage devices are positioned in accordance with the design drawings and with applicable equipment submittal drawings. Anchors and bolts shall be positioned sufficiently in advance of the concrete placement so that an on-site representative of Engineer or Owner will have sufficient time to inspect the bolts prior to placing concrete. If special inspection of the anchor bolts is required by the local building code, anchorage shall be placed in sufficient time and with sufficient notification so that such inspection can take place without delaying progress of the work.
- 3.2.3 Threads, bolts and nuts spattered with concrete during placement shall be cleaned prior to final installation of the bolts and nuts.

3.3 Adhesive Anchors

- 3.3.1 Epoxy grout components shall be packaged separately at the factory and shall be mixed immediately before use. Proportioning and mixing of the components shall be done in accordance with the manufacturer's recommendations.
- 3.3.2 Preparation: Where indicated on the drawings, anchor bolts, threaded rod anchors and reinforcing bars shall be epoxy grouted

in holes drilled into hardened concrete. Diameters of holes shall be as follows:

Item	Diameter of Hole
Reinforcing Bars and Threaded Rod Anchors	3 mm larger than the outside diameter of the bar or the rod
Headed Anchor Bolts	Bolt diameter plus 50 mm and sufficient to clear the bolt head.

- 3.3.3 The embedment depth for epoxy grouted anchor bolts, threaded rod anchors and reinforcing bars shall be at least 15 bolt, rod or bar diameters, unless otherwise indicated on the drawings.
- 3.3.4 Holes shall be prepared for grouting as recommended by the epoxy grout manufacturer.
- 3.3.5 Installation: Anchor bolts, threaded rod anchors and reinforcing bars shall be clean, dry and free of grease and other foreign matter when installed. The bolts, rods and bars shall be set and positioned and the epoxy grout shall be placed and finished in accordance with the recommendations of the grout manufacturer. Care shall be taken to ensure that all spaces and cavities are filled with epoxy grout, without voids.

3.4 Expansion Anchors

- 3.4.1 Expansion anchors shall be installed in accordance with the drawings, but in no case shall the depth of the hole be less than six (6) bolt diameters. The minimum distance between the centre of any expansion anchor and an edge or exterior corner of concrete shall be at least six (6) times the diameter of the bolt. Unless otherwise indicated on the drawings, the minimum distance between the centres of expansion anchors shall be at least 12 times the diameter of the bolt.

3.5 Site Acceptance Testing

- 3.5.1 Bring to the attention of the Consultant any defects in the work or departures from the contract documents that may occur during construction. The Consultant will decide upon corrective action and give his recommendations in writing.
- 3.5.2 The Consultant's general review during construction and inspection and testing by independent inspection and testing agencies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.
- 3.5.3 Prior to commencing significant segments of the work, give the Consultant and independent inspection and testing agencies appropriate notification, so as to afford them reasonable

opportunity to review the work. Failure to meet this requirement may be cause for the Consultant to classify the work as defective.

3.5.4 Appointment of Independent Inspection and Testing Companies:

- .1 The Owner will appoint the independent inspection and testing companies to make inspections or perform tests as the Consultant directs. The independent inspection and testing companies shall be responsible only to the Consultant and shall make only such inspections or tests as the Consultant may direct.
- .2 When defects are revealed, the Owner may request, at the Contractor's expense, additional inspection or testing to ascertain the full extent of the defect.

3.5.5 Tests on Installed Anchors/rebar:

- .1 Anchors/rebar: The independent inspection and testing company may test up to 10 percent of some of the installed anchors/rebar to the manufacturer's specified working load. Should defective anchors/rebar or under-capacity installations be found a higher percentage will be tested at the Contractor's expense.

3.6 Defective Materials and Work

- 3.6.1 Where evidence exists that defective work has occurred or that work has been carried out incorporating defective materials, the Consultant may have tests, inspections or surveys performed, analytical calculations of structural strength made and the like in order to help determine whether the work must be repaired or replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Consultant's opinion, the work may be acceptable.
- 3.6.2 Materials or work which fails to meet specified requirements may be rejected by the Consultant whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION

DIVISION 9 – FINISHES

DIVISION 9 – FINISHES

Section No.	Title
09900	Paint

2. GENERAL

2.1 Intent

- 2.1.1 This section describes the materials and procedures for painting and coatings.

2.2 Scope of Work

- 2.2.1 Work under this section includes providing paint or coatings but not limited to:

- .1 Surface preparation of substrate
- .2 Provision of materials, labour, and equipment required to complete painting or coatings works
- .3 Waste management and disposal of materials

2.3 References

- 2.3.1 The Master Painters Institute (MPI):
 - .1 MPI Architectural Painting Specification Manual 2005
 - .2 MPI Approved Products List, 2012
- 2.3.2 American Society for Testing and Materials (ASTM):
 - .1 ASTM D3960-05 (201) - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
 - .2 ASTM D523-14 (2018) - Standard Test Method for Specular Gloss
- 2.3.3 Underwriters Laboratories of Canada (ULC):
 - .1 UL 2760 - Surface Coatings: Recycled Water-borne
 - .2 UL 2768 - Standard for Sustainability for Architectural Surface Coatings
- 2.3.4 Environmental Protection Agency (EPA):
 - .1 EPA SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods
- 2.3.5 Society of Protective Coatings
 - .1 SSPC-SP 1 - Solvent Cleaning
 - .2 SSPC-SP 2 - Hand Tool Cleaning
 - .3 SSPC-SP 3 - Power Tool Cleaning
 - .4 SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning
 - .5 SSPC-SP 7/NACE No. 4 - Brush-off Blast Cleaning
- 2.3.6 National Fire Code of Canada 2015

2.4 Submittals

- 2.4.1 Make submittals in accordance with Section 01330 – Submittal Procedures.
- 2.4.2 All paint systems to be submitted at same time for coordination and colour selection.

- 2.4.3 Provide on cover letter, listing all submitted products with MPI products numbers and categorized by MPI formula systems as outlined in this specification.
- 2.4.4 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.
- 2.4.5 Product Data:
 - .1 Subcontractor to receive well written confirmation of specific surface preparation procedures and primers used for fabricated steel items from fabricator/supplier to ensure appropriate and manufacturer compatible finish coat materials prior to commencement of painting.
 - .2 Subcontractor to receive written Product Data regarding chemical composition of coatings or treatments applied by others (pressure preservatives, admixtures and sealers, etc.) and their paintability.
 - .3 Submit Product Data for concrete and concrete block primers.
- 2.4.6 Surface Preparation
 - .1 Submit manufacturer's representative's written approval of surface preparation methods and any specific recommendations for alternative methods.
- 2.4.7 Closeout Submittals
 - .1 Submit three (3) copies of list of materials used, together with MSDS for each Product for incorporation into the Operations and Maintenance Manuals. Include maintenance information such as cleaning and full pigment information for future touch up.
- 2.4.8 Extra Materials
 - .1 Submit one (1) unopened four-litre can of each type and colour of finish coating. Identify colour and paint type in

relation to established colour schedule and finish formula. Deliver to Engineer and store where directed.

2.5 Quality Assurance

- 2.5.1 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.
- 2.5.2 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.
- 2.5.3 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.
- 2.5.4 Retain the bat or lot number for each product.
- 2.5.5 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.
 - .2 Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

2.6 Delivery, Storage and Handling

- 2.6.1 Deliver and store materials in original containers, sealed, with labels intact.
- 2.6.2 Indicate on containers or wrappings:
 - .1 Manufacturer's name and address.
 - .2 Type of paint.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- 2.6.3 Remove damaged, opened and rejected materials from site.
- 2.6.4 Provide and maintain dry, temperature controlled, secure storage. Store materials and supplies away from heat generating devices.

- 2.6.5 Store materials and equipment in a well-ventilated area with temperature range to meet the manufacturer's specifications.
- 2.6.6 Provide minimum one (1) 9 kg dry chemical fire extinguisher adjacent to storage area.
- 2.6.7 Remove only in quantities required for same day use.
- 2.6.8 Fire Safety Requirements:
 - .1 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .2 Handle, store, use and dispose of flammable combustible materials in accordance with the National Fire Code of Canada.

2.7 Environmental Requirements

- 2.7.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials.
- 2.7.2 Ventilation:
 - .1 Contractor to provide continuous ventilation during and after application of paint. Run ventilation system 24 hours per day during installation and for seven (7) days after completion of application of paint.
- 2.7.3 Substrate and ambient temperature must be within limits prescribed by manufacturer to approval of Engineer.
- 2.7.4 Maintain minimum substrate and ambient air temperature of 10°C. Maximum relative humidity 85 percent. Maintain supplemental heating until paint has cured sufficiently. Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.
- 2.7.5 Apply paint finish only in areas where dust is no longer being generated by related construction operations, such that airborne particles will not affect the quality of the finished surface.
- 2.7.6 Apply paint only when surface to be painted is dry, properly cured and adequately prepared.

2.8 Warranty

- 2.8.1 Warrant work of this Section for a period of 2 years 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.

3. PRODUCTS

3.1 Materials

- 3.1.1 Paint materials for each coating formula to be products of a single manufacturer.
- 3.1.2 Regulatory Requirements:
 - .1 Conform to latest edition of Industrial Health and Safety Regulations issued by applicable authorities having jurisdiction in regard to site safe.
 - .2 Comply with more stringent of applicable laws, bylaws, codes, fire regulations, health and safety regulations of authorities having jurisdiction or requirements. Ensure standards used for work of this Section are considered a minimum.
 - .3 Where required, ensure paints and coatings meet flame spread and smoke developed ratings designated by local code requirements and/or authorities having jurisdiction.
 - .4 Conform to requirements of local authorities having jurisdiction in regard to storage mixing application and disposal of paint and related waste materials.
- 3.1.3 Low odour products: whenever possible, select products exhibiting low odour characteristics. If two (2) products are otherwise equivalent, select the product with the lowest odour.
- 3.1.4 Water based paints and coatings must maintain a minimum surface and ambient air temperature of between 18°C and 32°C during application and drying of paint and maintain until building occupancy occurs.
- 3.1.5 Solvent based paints and contains must maintain a minimum interior surface and ambient air temperature of between 7°C and 35°C during application and drying of paint and maintain until building occupancy occurs.
- 3.1.6 Where required, use only materials having minimum MPI "Environmental Friendly" E3 rating based on VIC (10 CFR 59)
- 3.1.7 Where indoor air quality (odour) is an issue, use only MPI listed materials having a minimum E3 rating.
- 3.1.8 Water-borne surface coatings must:

- .1 Meet or exceed all applicable governmental and/or industrial safety and performance standards.
 - .2 Manufactured and transported in such a manner that all steps of the process, including the disposal of waste products arising therefrom, will meet the requirements of all applicable governmental acts, bylaws and regulations including, for facilities located in Canada, the Fisheries Act and the Canadian Environmental Protection Act (CEPA).
- 3.1.9 Water-borne surface coatings must not be formulated or manufactured with: aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- 3.1.10 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61°C or greater.
- 3.1.11 Water-borne surface coatings and recycled water-borne surface coatings must contain information describing proper disposal methods within their packaging.
- 3.1.12 Recycled water-borne surface coatings must not contain:
- .1 Lead in excess of 600.0 ppm weight/weight total solids.
 - .2 Mercury in excess of 50.0 ppm weight/weight total product.
 - .3 Cadmium in excess of 1.0 ppm weight/weight total product.
 - .4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
 - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.
- 3.1.13 Substitution Limitations:
- .1 Comparable Products from other manufacturer not listed herein will be accepted provided they meet requirements of MPI Approved paints and this Specification after full review by the Engineer.

3.2 Colours

- 3.2.1 Contractor to provide colour sample matching existing, surrounding paint colour.
- 3.2.2 Engineer will provide colour schedule based upon the submitted colour sample.
- 3.2.3 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

- 3.2.4 Perform all colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials allowed only with Engineer's written permission.
- 3.2.5 Second coat in a three-coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

3.3 Interior Paint Finishes / Coatings

- 3.3.2 Vertical / Ceiling Concrete Surfaces:
 - .1 INT 3.1E Latex MPI Gloss Level 3 – Egg Shell finish – premium grade; by the following manufacturers
 - .1 Benjamin Moore
 - .2 PPG Architectural
 - .3 Sherwin-Williams
- 3.3.3 Concrete Masonry Units (CMU's):
 - .1 INT 4.2F Epoxy tile-like finish (for dry environments) over latex block filler – premium grade; by the following manufacturers:
 - .1 Cloverdale Paint
 - .2 PPG Architectural
 - .3 Sherwin-Williams

4. EXECUTION

4.1 General

- 4.1.1 Perform all painting operations in accordance with MPI Architectural Painting Specification Manual, except where specified otherwise.
- 4.1.2 Apply all paint materials in accordance with paint manufacturer's written application instructions.
- 4.1.3 Commencement of work does not imply acceptance of surfaces except as qualified herein. Surfaces such as concrete, masonry, structural steel and miscellaneous metal, wood, gypsum board and plaster, is not responsibility of this Subcontractor. Commencement of work implies acceptance of previously completed work.

4.2 Preparation

- 4.2.1 Provide scaffolding, staging, platforms and ladders, as required for execution of work. Erect scaffolding to avoid interference with work of other trades. Comply with the Occupational Health and Safety Act.
- 4.2.2 Remove electrical cover plates, light fixtures, surface hardware on doors, door stops, bath accessories and all other surface mounted fittings and fastenings prior to undertaking any painting operations. Store for re-installation after painting is completed.
- 4.2.3 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- 4.2.4 Prohibit traffic, where possible, from areas where painting is being carried out and until paint is cured.
- 4.2.5 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Engineer.

4.3 Protection

- 4.3.1 Protect existing building surfaces not to be painted from paint splatters, markings and other damage. If damaged, clean and restore such surfaces as directed by Engineer.
- 4.3.2 Cover or mask floors, windows and other ornamental hardware adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.
- 4.3.3 Protect items that are permanently attached such as Fire Labels on doors and frames.
- 4.3.4 Protect factory-finished products and equipment.

4.4 Existing Conditions

- 4.4.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Engineer all damage, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- 4.4.2 Investigate moisture content of surface to be painted, and report findings to Engineer. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- 4.4.3 If substrate is steel, do not apply coatings over or when surface temperature is within 3°C of the dew point.
- 4.4.4 If the substrate is wood, do not stain or paint if moisture reading is higher than 15%. Inspect work to assure surfaces are smooth, free from machine marks and nail heads have been countersunk.
- 4.4.5 If substrate is new plaster or masonry, allow to cure for 30 to 90 days. Ensure moisture content is between 12% to 14% and test for alkalinity and neutralize (pH 6.5 – 7.5) before proceeding with priming.
- 4.4.6 If substrate is gypsum board, inspect to ensure joints are completely filled and sanded smooth. Inspect surfaces for “nail popping”, screw heads not recessed and taped, breaks in surface or other imperfections.
- 4.4.7 Where Room Finish Schedule indicates existing and/or new wall finishes to be painted, existing surfaces such as existing door and frames, mechanical supply and return air grilles (walls and ceilings), access doors and electrical panels which have been previously painted to be painted for a complete finish room. If Room Finish Schedule indicates “-“ it denotes entire room need not be painted, paint only patched areas.

4.5 Cleaning

- 4.5.1 Clean all surfaces to be painted as follows.
 - .1 Remove all dust, dirt and other surface debris by vacuuming and wiping with dry, clean cloths.
 - .2 Wash surfaces with solution of T.S.P. bleach and clean, warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 To prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

- .6 Use trigger-operated spray nozzles for water hoses.
- .7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean-up water-based paints.
- 4.5.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint or pre-treatment as soon as possible after cleaning and before deterioration occurs.
- 4.5.3 Sand existing surfaces with intact, smooth, high gloss coatings to provide adequate adhesion for new finishes.

4.6 Surface Preparation

- 4.6.1 Prepare substrate in accordance with the MPI Architectural Painting Specification Manual
- 4.6.2 Remove doors before painting to paint bottom and top edges and re-hang once dry. Do not paint stainless steel or bronze door butts. Paint or finish top and bottom edges of doors. Touch-up or refinish tops and edges after fitting.
- 4.6.3 Previously Finished Surfaces:
 - .1 Clean existing interior surfaces to be repainted or varnished to provide bond. Remove rust, scale, oil, grease, mildew, chemicals and other foreign matter. Remove loose paint and fill flush with suitable patching material. Clean off bubbled, cracked, peeling or otherwise defective paint by stripping with suitable environmental strippers or by burning. Do not burn off paints suspected of having lead content. Treat residue from stripping as Hazardous Waste. Flatten gloss paint and varnish with sandpaper and wipe off dust. If previous coatings have failed so as to affect proper performance or appearance of coatings to be applied, remove previous coatings completely and prepare substrates properly and refinish as specified for new work. Leave entire surface suitable to receive designated finishes and in accordance with manufacturer's instructions.

4.7 Application

- 4.7.1 Method of application to be as approved by Engineer. Apply paint by brush, roller, air sprayer or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- 4.7.2 Safety Precautions:
 - .1 When handling solvent coating materials, wear approved vapour/particulate respirator as protection from vapours. Dust respirators do not provide protection from vapours.

4.7.3 Brush application:

- .1 Work paint into cracks, crevices and corners. Paint surfaces not accessible to brushes by spray, daubers or sheepskins.
- .2 Brush out runs and sags.
- .3 Remove runs, sags and brush marks from finished work and repaint.

4.7.4 Spray application:

- .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied and equipped with suitable pressure regulators and gauges.
- .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
- .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
- .4 Brush out immediately all runs and sags.
- .5 Use brushes to work paint into cracks, crevices and places that are not adequately painted by spray.

4.7.5 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Engineer.

4.7.6 Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

4.7.7 Allow surfaces to dry and properly cure, after cleaning and between subsequent coats, for minimum time period, as recommended by manufacturer.

4.7.8 Sand and dust between each coat to remove visible defects.

4.7.9 Finish tops of cupboards, cabinets and projecting ledges, both above and below sight lines as specified for surrounding surfaces.

4.7.10 Finish inside of cupboards and cabinets as specified for outside surfaces.

4.7.11 Finish closets and alcoves as specified for adjoining rooms.

4.7.12 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

4.7.13 Finish behind wall-mounted items.

4.7.14 Finish listed surfaces indicated on the Room Finish Schedule and/or noted on Drawings and as specified. Refer to Room Finish

Schedule for type, location and extent of finishes required and include touch-ups and field painting necessary to complete work shown, scheduled or specified.

- 4.7.15 Finishes and number of coats specified in Room Finish Schedule are intended as minimum requirements guide only. Refer to manufacturer's recommendations for exact instructions for thickness of coating to obtain optimal coverage and appearance.
- 4.7.16 Do not paint baked paint surface, chrome plated, stainless steel, aluminum or other surfaces finished with final finish in factory. Finish paint primed surfaces.
- 4.7.17 Apply additional paint coats, beyond number of coats specified for any surface, to completely cover and hide substrate and to produce a solid, uniform appearance.
- 4.7.18 Apply primer coat soon after surface preparation is completed to prevent contamination of substrate
- 4.7.19 Provide paint coating thicknesses indicated, measured as minimum DFT.

4.8 Field Quality Control

- 4.8.1 Field inspection of painting operations to be carried out by independent inspection firm as designated by Engineer.
- 4.8.2 As work progresses and upon completion of work, submit written reports and manufacturers' confirmation that materials and application methods conform to manufacturers' requirements.
- 4.8.3 Advise Engineer when each applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- 4.8.4 Cooperate with inspection firm and provide access to all areas of the work.
- 4.8.5 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 Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas and foreign materials in paint coatings.

- .2 Evidence of poor coverage at rivet 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.)

4.9 Restoration

- 4.9.1 Clean and re-install all hardware items that were removed before undertaking painting operations.
- 4.9.2 Remove protective coverings and warning signs as soon as practical after operations cease.
- 4.9.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and splatter immediately as operations progress, using compatible solvent.
- 4.9.4 Protect freshly completed surfaces from paint droppings and dust to approval of Engineer. Avoid scuffing newly applied paint.
- 4.9.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Engineer.

4.10 Waste Management

- 4.10.1 Disposal of paint waste:
- 4.10.2 Be responsible for removal and disposal of material and waste generated.
- 4.10.3 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are hazardous Products and are subject to regulations for disposal. Obtain information on these controls from applicable authorities having jurisdiction.
- 4.10.4 Separate and recycle waste materials. Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility. Treat materials that cannot be reused as hazardous waste and dispose of in an appropriate manner.
- 4.10.5 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- 4.10.6 To reduce amount of contaminants entering waterways, sanitary/storm drain systems or into ground adhere to the following procedures:

- .1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case clean equipment using free draining water.
- .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
- .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
- .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
- .5 Dry empty paint cans prior to disposal or recycling (where available).
- .6 Close and seal tightly partly used cans of materials including sealants and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
- .7 Set aside and protect surplus and uncontaminated finish materials not required by Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.
- .8 Cleaning
- .9 Clean all surfaces to be painted as follows.
- .10 Remove all dust, dirt and other surface debris by vacuuming and wiping with dry, clean cloths.
- .11 Wash surfaces with solution of T.S.P. bleach and clean, warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
- .12 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
- .13 Allow surfaces to drain completely and allow to dry thoroughly.
- .14 To prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
- .15 Use trigger-operated spray nozzles for water hoses.
- .16 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean-up water based paints.
- .17 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint or pre-treatment as

soon as possible after cleaning and before deterioration occurs.

- .18 Sand existing surfaces with intact, smooth, high gloss coatings to provide adequate adhesion for new finishes.

END OF SECTION

Timmins WTP High Lift and Backwash
Pump Replacement
City of Timmins

DIVISION 11
EQUIPMENT

DIVISION 11 – EQUIPMENT

DIVISION 11 – EQUIPMENT

Section No.	Title
11010	Equipment General Requirements
11090	Identification and Labelling
11101	Piping, Valves, and Fittings
11170	Pipeline Pressure and Leakage Testing
11180	Pipe Welding
11190	Pipe and Valve Supports
11290	Valve Electrical Actuators
11423	Double Suction Horizontal Split Case Pumps
11720	Installation of Pre-purchased Equipment

1. GENERAL

1.1 Description

- 1.1.1 The work of this section covers the general clauses for the supply and installation of all process equipment and other works as specified herein and/or indicated on the Drawings.
- 1.1.2 Provide all labour and materials, obtain all necessary permits and pay all fees as may be required.

1.2 Related Sections

- 1.2.1 Division 1 – General Requirements
- 1.2.2 Division 2 – Site Works
- 1.2.3 Division 3 – Concrete
- 1.2.4 Division 5 – Metals
- 1.2.5 Division 9 – Finishes
- 1.2.6 All Sections in Division 11
- 1.2.7 Division 13 – Instrumentation, Control & SCADA
- 1.2.8 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 between sections, 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 Contractor. Technical specifications under which the equipment will be purchased are available.
- 1.4.4 Any existing equipment which is removed shall be handled as specified and indicated on the contract drawings.
- 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 Contractor shall repair the existing concrete wall, roof or floor when the existing piping or valve is replaced with the new one or abandoned. Submit the shop drawings for the Engineer's review and approval if there is no detail drawing.
- 1.4.9 All equipment and instruments to be installed within classified areas shall be explosion proof.
- 1.4.10 Other than stainless steel, all other metal surfaces shall be protected by an approved, corrosion resistant coating.
 - .1 All other metal surfaces shall be protected by an approved, corrosion resistant coating.
 - .2 In accordance with Section 09900.
 - .3 Acceptable coatings:
 - .1 SSPC-SP6 commercial sandblast (except motor), a prime coat of Tnemec 431 epoxy and a finish coat of Tnemec 431 epoxy.
 - .2 Fusion bonded epoxy (AWWA C-213).
 - .3 Coating thickness: total finish of 30 MDFT minimum.
 - .4 Submit the alternative coating for the Engineer's review.
- 1.4.11 Flange connections shall be provided for different pipe materials.
- 1.4.12 The Contractor shall be responsible for providing the same flange type to connect the instrument and pipe flanges. If the number of holes on the flanges is different as per different code requirements, provide the same number of holes or change flange type as per the Engineer's review. No extra cost to the Owner shall be permitted to change the flange type.
- 1.4.13 Where any buried piping is extended from inside building to outside, double dresser couplings shall be installed on the line as per the contract detailed drawings. The coupling material shall be the same as pipeline.
- 1.4.14 Comply with the City of Timmins Design Standards if there is any conflict between the standards and technical specifications.
- 1.4.15 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.
- 1.4.16 Unless the pipe elevation or location is changed more than 0.2 m due to any interferences, no extra cost to the Owner shall be permitted.

- 1.4.17 The Contractor shall review the required equipment pad heights and provide them shown on the process drawings. Typical height may be 150 mm only on a detail.
- 1.4.18 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 of all related specification sections. Use equipment specifications together with all sitework, concrete, building, 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 Refer to 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 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 three (3) 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 (2) 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.
- 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.
- 1.9.7 Where pipes pass through existing concrete core drill concrete as described under specification Section – 02050 Demolition and Section 01140 – Special Project Procedures.

1.10 Flushing Connections

- 1.10.1 In accordance with Contract Drawing Details.
- 1.10.2 Unless otherwise present on the Contract Drawings, provide 50mm diameter flushing connections with SS ball valve, threaded brass nipple, male NPT adapter, and dust cap with 300mm long brass chain. Provide 50mm bronze quick couplers, OPW Kamlok or equal.

1.11 Valve End Joints

- 1.11.1 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/ class 150 / class 250 flanges with bolt holes straddling the vertical

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 PAINTING

- 1.13.1 In accordance with Section 09900 – Paint.

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 01780 – Closeout Submittals.

1.17 As-Built Information

- 1.17.1 Submit as-built information as per Section 01780 – Closeout 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

2.1 Not Used.

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 Design 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 Design equipment 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 plant operating conditions.

- 3.5.7 Design the general mechanical and electrical equipment and particularly gearings, contacts and other wearing parts to satisfy the need for long periods of operation without frequent maintenance or attention.
- 3.5.8 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 or copper tubing extensions where required. Secure the nipples and tubing to the equipment at appropriate locations.
- 3.5.11 Design equipment installed outdoors for service under climatic conditions typical for the area. Give particular attention to winter operating conditions.

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, and exceeding the capacity of existing monorail, 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 Vibration

- 3.10.1 All system vibration testing in accordance with Section 01810 – Testing and Commissioning.

3.11 Anchor Bolts

- 3.11.1 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 pumps by means of bolts with sleeves cast into the concrete to a minimum depth of 150 mm or specified by the pump manufacturers. 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.

3.12 Field Welding and Fabrication

- 3.12.1 Ascertain details of field welding and fabrication to be carried out for the erection and installation of the various items of equipment.
- 3.12.2 Fabricate the equipment in accordance with CSA Standard S16, Steel Structures for buildings and the manufacturer's instructions.
- 3.12.3 Have the welding shielded, conforming to CSA Standard W59.0, General Specifications.

3.13 Equipment Guards

- 3.13.1 Provide removable protective guards for all open rotating equipment including pulleys, belts, drives, shafts and couplings, etc.
- 3.13.2 Ascertain the extent of the work for the installation and/or the supply etc., of equipment guards by direct contact with the equipment suppliers.

3.14 Protection of Equipment

- 3.14.1 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.

3.15 Testing and Commissioning

- 3.15.1 Unless otherwise specified, provide commissioning and startup in accordance with Section 01810 - Testing and Commissioning.
- 3.15.2 Unless otherwise specified, furnish a certificate of final inspection and approvals from the electrical inspection authority to the Engineer.

3.16 Training

- 3.16.1 Unless otherwise specified, provide Demonstration and Training in accordance with Section 01820 – Demonstration and Training.

END OF SECTION

1. GENERAL

1.1 Scope

- 1.1.1 The scope of this section covers all equipment supplied under this Division.

1.2 Intent of Section

- 1.2.1 The intent of this section is to describe the requirements for the labelling and identification of equipment, piping, valving, and associated processes.

1.3 General

- 1.3.1 Identification to be in the English language.
- 1.3.2 For all equipment supplied under this Division provide lamicoid identification labels.
- 1.3.3 Labels shall be installed after all painting has been completed and shall be secured with self-tapping screws or adhesive.
- 1.3.4 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, attached the nameplate in an approved location on the equipment support or frame.
- 1.3.5 Identify all equipment with the corresponding remote controls and sensors.

- 1.3.6 Reference tag numbers as shown on drawings on all equipment.
- 1.3.7 Wording on nameplates and piping to be approved by Engineer prior to manufacture.

1.4 Reference Standards

- 1.4.1 All labelling colours shall be in accordance with the Recommended Standards for Waterworks – 2003, Guidelines for the Design Guidelines for Drinking Water Systems - 2008, MOECC, CSA and C.G.S.B. Standards.
- 1.4.2 Perform identification work in accordance with CGSB 24-GP-3A-67 and NFPA 20 except where specified otherwise.
- 1.4.3 Provide ULC and CSA registration plates, as required by respective agency.

1.5 Related Sections

- 1.5.1 DIVISION 1 – GENERAL REQUIREMENTS.
- 1.5.2 DIVISION 3 – CONCRETE.
- 1.5.3 DIVISION 5 – METALS.
- 1.5.4 DIVISION 9 – FINISHES.
- 1.5.5 DIVISION 11 – EQUIPMENT.
- 1.5.6 DIVISION 16 – ELECTRICAL.

1.6 Measurement and Payment

- 1.6.1 The Lump Sum in the Bid Form for “Identification and Labeling of Equipment, Piping and Valves” shall include all the provisions in this section.

1.7 Samples

- 1.7.1 Submit Samples in accordance with Section - 01330 - Submittal Procedures.
- 1.7.2 Submit samples and lists for all labels and tags for proposed wording for approval before engraving.

2. PRODUCTS

2.1 Manufacturer's Nameplates

- 2.1.1 Provide metal nameplate on each piece of equipment, mechanically fastened complete with raised or recessed letters.
- 2.1.2 Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors, pump capacity and date of manufacture.

2.2 System Nameplates

2.2.1 Colour:

- .1 Hazardous: red letters, white background
- .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

2.2.2 Sizes:

- .1 Lamicoid 3 mm thick plastic engraving sheet, black face, white core, self-adhesive or white anodized aluminium, matte finish, square corners, letters accurately aligned, and machine engraved into core unless specified otherwise, or otherwise required by applicable codes.
- .2 Conform to the following table:

Size No.	Dimensions (mm x mm)	No. of Lines	Letter Height (mm)
1	10x50	1	3
2	13x75	1	5
3	13x75	2	3
4	20x100	1	8
5	20x200	1	8
6	20x100	2	5
7	25x125	1	12
8	25x125	2	8
9	35x200	1	20

- .3 Use average of 25 letters/numbers (maximum).
- .4 Use Size No. 6 for terminal cabinets and control panels.
- .5 Use Size No. 9 for equipment in mechanical rooms.

2.3 Motor Nameplate

2.3.1 All motors to be supplied with corrosion-resistant metal name plates giving the following information:

- .1 Supply voltage (V), Full load current (A), Phase, Frequency (Hz), Power (kW), Service Factor, Rotations Per Minute/Rated Speed (RPM), Insulation class, Bearing numbers, Model number, and Serial number

2.4 Piping

2.4.1 Identification:

- .1 To CGSB 24-GP-3a-67 unless specified elsewhere.

- .2 Identify medium by lettered legend, classification by primary and secondary colours, and direction of flow by arrows.

2.4.2 Sizes:

- .1 Refer to TWFP Valve Schedule Pipe Labels for colours and sizing
- .2 Provide flow direction arrows with labelling identifying liquid/gas conveyed. Use double headed arrows where flow is reversible.
- .3 Legend: block capitals to following table:

Outside Diameter of Pipe or Insulation (mm)	Size of Letters (mm)
30	13
50 - 100	19
150	32
> 150	50

- .4 Primary Colours
 - .1 At valves and fittings: 500 mm long.
 - .2 Elsewhere: 1000 mm long.
- .5 Secondary colour bands (including recirculation route): 50 mm wide, 75 mm in from one end of primary colour band).
- .6 Arrows:
 - .1 Outside diameter of pipe/insulation 75 mm high and greater: 150 mm long x 50 mm high.
 - .2 Outside diameter of pipe/insulation less than 75 mm: 100 mm long x 50 mm high.
 - .3 Use double headed arrows where flow is reversible.

2.4.3 Material:

- .1 Paint to CGSB 1-GP-60M
- .2 Legend markers, arrows colour bands: plastic coated cloth material with protective overcoating and waterproof contact adhesive undercoating, suitable for 100 per cent RH and continuous operating temperature of 75°C and intermittent temperature of 100°C. Apply to prepared surfaces. Wrap tape around pipe or pipe covering with ends overlapping one pipe diameter.
- .3 Waterproof and heat resistant plastic marker tags for pipes and tubing 20mm nominal and smaller.

- .4 Acceptable material: W.H. Brady Inc., Seton Name Plate Corp.,

2.5 Controls and Identification

- 2.5.1 Identify all systems, equipment, components, controls, and sensors.
- 2.5.2 Inscription to identify function and Tag Number.

3. EXECUTION

3.1 Manufacturer's Nameplates

- 3.1.1 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

3.2 System Nameplates

- 3.2.1 Locations:
 - .1 In conspicuous location to facilitate easy reading from operating floor and to properly identify equipment and/or system.
 - .2 Provide stand-offs for nameplates on hot surfaces and insulated surfaces.

3.3 Piping

- 3.3.1 Locations of piping identification:
 - .1 On long straight runs in open areas of equipment rooms clearly visible from any one viewpoint in operating areas or walking isles maximum distance between labels is 5m.
 - .2 Adjacent to all changes in direction.
 - .3 On both sides of visual obstruction or where run is difficult to follow.
 - .4 Both sides where piping passes through walls, partitions, and floors.
 - .5 Label to be easily and accurately readable from usual operating areas and all readily accessible points.
 - .6 Plane of label to be approximately at right angles to most convenient line of sight with consideration of operating positions, lighting conditions, reduced visibility of colour of label caused by dust and dirt and risk of physical damage.

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 structures., used to convey potable water.
- 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, 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 AWWA C504, Rubber Seated Butterfly Valves.
- 1.2.12 AWWA C512, Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service

- 1.2.13 AWWA C542, Electric Motor Actuators for Valves and Slide Gates.
- 1.2.14 AWWA C550, Protective Epoxy Interior Coatings for Valves and Hydrants
- 1.2.15 AWWA C606, Grooved and Shouldered Joints
- 1.2.16 ASTM A774/A774M, As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures
- 1.2.17 ASTM A778, Welded, Unannealed Austenitic Stainless Steel Tubular Products
- 1.2.18 ASTM B88, Seamless Copper Water Tube

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 20°C maximum/1°C minimum water temperature
 - .3 95% maximum relative humidity (non-condensing)
 - .4 7.5 - 9 water pH
 - .5 elevation ± 272.00 meters above sea level
 - .6 Water will contain nominal chlorine residual at 1 to 2 mg/L.
 - .7 Disinfection of piping and valves prior start-up in this project 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 Engineer 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 Manufacturer'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.
- 2.1.5 All the NSF 61 certified drinking water piping, spools, fittings and components shall be fabricated by a shop that complies with NSF/ANSI 61.
- 2.1.6 Pressure testing of stainless steel piping systems for general water service at ambient temperatures shall follow, as a guide, AWWA C600.
- 2.1.7 All fittings located on High Lift Pump discharge piping shall be rated 150 psi. Where Sch 10S does not provide MAWP 150 psi such as tees and laterals, use bigger wall thickness or provide reinforce pad. Submit with shop drawing for review design stress calculations sealed by Professional Engineer licensed in Ontario.

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 1034 kPa (150 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 shall be Type 316L stainless steel ASTM A778 / A774, Schedule 10S, to be pickled and passivated as per ASTM A380.
- 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 1034 kPa at 100°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 - slip-on, RF, 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 EPDM, full faced or RF, ANSI B16.21.
- 2.3.5 Where flanges are to be attached to short and long radius (any angle), elbows, increasers, and reducers (except of bell type), straight butt-weld extension piece of minimum length 120 mm shall be added unless indicated otherwise on the Drawings.
- 2.3.6 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.
- 2.3.7 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.
- 2.3.8 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.
- 2.3.9 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.
- 2.3.10 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.
- 2.3.11 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.
- 2.3.12 Victaulic Style couplings shall be provided as shown in Contract Drawings.

- 2.3.13 Stainless steel bolts and nuts shall be used for flange connection between dissimilar material pipes.
- 2.3.14 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 316L stainless steel AWWA C228 stainless steel per ASTM F593 / F594, dimensions to ASME B18.2.

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.

2.7 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 Gaskets

- 2.8.1 Certified NSF / ANSI 61-G & 372 NSF-61 EPDM rubber for potable water systems. For flat faced flanges, use full-face gaskets. For raised-face flanges, use ring type gaskets.
- 2.8.2 Use gasket materials for flanged connections suitable for the temperature, pressure, and corrosiveness of the fluid conveyed in the pipeline.
- 2.8.3 Unless otherwise specified, minimum Gasket Material Thickness for full face gaskets:
 - .1 Greater than 75 mm pipe diameter, 3.2 mm thick.

2.9 Piping Schedule

- 2.9.1 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.
- 2.9.2 Process piping schedule is provided in the following table:

Service	Flange Rating	Pipe Material	Operating Pressure (kPa)	Max Working Temp (°C)	Test Pressure (kPa)	Duration (hr)
High Lift Pump 6 Suction and Discharge	ANSI 250	316L SS Sch 10S	885	40	1350	4

Service	Flange Rating	Pipe Material	Operating Pressure (kPa)	Max Working Temp (°C)	Test Pressure (kPa)	Duration (hr)
High Lift Pump 7 Suction and Discharge	ANSI 250	316L SS Sch 10S	885	40	1350	4
Backwash Pump Suction and Discharge	ANSI 150	316L SS Sch 10S	200	40	1035	4

2.10 Valves

2.10.1 Major process valve schedule is provided in the following table. A complete list of valve schedule is attached to this section.

Service	Valve Type	Size (mm)	Valve Rating	Valve Flange Rating	Actuator Type
High Lift Pump 6 Suction	Butterfly Valve	300	Class 250B	Class 250	HW
High Lift Pump 6 Discharge	Tilted Check Valve	300	ANSI Class 250	ANSI Class 250	n/a
High Lift Pump 7 Suction	Butterfly Valve	450	Class 250B	Class 250	HW
High Lift Pump 7 Discharge	Tilted Check Valve	400	ANSI Class 250	ANSI Class 250	n/a
High Lift Pump 7 Discharge	Butterfly Valve	400	Class 250B	Class 250	HW
High Lift Pump 8 Discharge	Butterfly Valve	400	Class 250B	Class 250	HW
Backwash Pump Suction	Butterfly Valve	450	Class 150B	Class 150	HW

Service	Valve Type	Size (mm)	Valve Rating	Valve Flange Rating	Actuator Type
Backwash Pump Discharge	Butterfly Valve	400	Class 150B	Class 150	SE
Backwash Pump Discharge	Butterfly Valve	400	Class 150B	Class 150	SE
Backwash Pump Discharge	Swing Check Valve	400	Class 150B	Class 150	n/a

Note: HW – Hand Wheel Actuator, SE – Standard Electrical Actuator

- 2.10.2 All potable water valves to be ANSI/NSF61 and NSF 372 approved and labelled.
- 2.10.3 All lubricants, epoxies, grease, etc. to conform to ANSI/NSF61.
- 2.10.4 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.
- 2.10.5 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.
- 2.10.6 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.
- 2.10.7 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.
- 2.10.8 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.
- 2.10.9 Acceptable Coating Material: Carboline 891, or as approved.
 - .1 Coating Application: 2 coats, 6 mils minimum dry film thickness per coat to manufacturer's instructions.
 - .1 Mark valves with size, pressure rating and manufacturer on a corrosion resistant nameplate mounted on the body.
 - .2 Equip valves with a disc position indicator and a direction of flow indicator.
 - .3 Provide tee wrench of steel pipe and tubing with socket for 50 mm square operating nut.
 - .4 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 Valve Operators

2.11.1 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

2.11.2 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.

2.11.3 Electrical Actuators:

- .1 Refer to Section 11290 - Valve Electrical Actuator.

2.12 Butterfly Valves

- 2.12.1 Supply and install all butterfly valves as shown on the drawings and/or as specified herein.
- 2.12.2 Butterfly valves shall meet or exceed the latest revision of ANSI/AWWA Standard C504 and shall meet or exceed the requirements of this specification. Valves shall have a working pressure of 150 psi (1034 kPa) and 250 psi (1720 kPa). Valves shall meet NSF/ANSI 61/372.
- 2.12.3 Valve bodies shall be of ductile iron per ASTM A536 (65-45-12). Flanged end valves shall be of the short body design with Class 150 or 250 flanged ends faced and drilled per ASME B16.1 standard for cast iron flanges. Mechanical Joint end valves shall meet the requirements of ANSI/AWWA C111/ANSI 21.11.
- 2.12.4 Discs shall be offset to provide an uninterrupted 360 degree seating edge and shall be ductile iron per ASTM A536 (65-45-12) or 316 stainless steel ASTM A743. The disc seating edge shall be solid 316 stainless steel. Sprayed mating seating surfaces are not acceptable. The disc shall be securely attached to the valve shaft utilizing a field removable/replaceable 17-4 PH stainless steel torque screw on sizes 3-12" (80-300mm) or a tangential pin locked in place with a set screw on sizes 14-20" (350-500mm).
- 2.12.5 Valve shafts shall be of ASTM A564 Type 630, 17-4 PH stainless steel. Valve shaft seals shall be self-compensating V-type packing with a minimum of four sealing rings. One- piece molded shaft seals and o-ring shaft seals are not acceptable.
- 2.12.6 Seat shall be of Acrylonitrile-Butadiene (NBR) for water, or as required for other services, and shall be molded in and vulcanized to the valve body. The seat shall contain an integral shaft seal protecting the valve bearings and packing from any line debris. Seats vulcanized to cartridge inserts in the valve body and seats on the disc are not acceptable.
- 2.12.7 Valve shaft bearings shall be non-metallic and shall be permanently lubricated.
- 2.12.8 Coatings - unless otherwise specified by customer, exterior and interior metallic surfaces of each valve shall be painted per the latest revision of ANSI/AWWA C504. The interior of the body shall have a full rubber lining vulcanized to the valve body. Rubber lining on the flange face and boot style seats is not acceptable.
- 2.12.9 Actuators shall be sized to customer specified operating conditions. If actual operating conditions are not provided within customer specification, per ANSI/AWWA C504, the valve actuator shall be sized to operate the valve at the rated working conditions of the valve. Each valve and valve actuator shall be assembled,

adjusted, and tested as a unit per the latest revision of ANSI/AWWA C504, by the valve manufacturer.

- 2.12.10 Manually actuated valves shall be designed and tested per the requirements of ANSI/AWWA C504. Actuators shall be available in both weatherproof and buriable constructions with handwheel, chainwheel, or 2" (51mm) square AWWA nut inputs. All units shall have independently adjustable open and closed position stops that are adjustable under full line pressure and flow. Open and closed position stop adjustments shall not require the removal of any load or torque transmitting components.
- 2.12.11 Two Year Warranty shall be provided for all valves and actuators.
- 2.12.12 Acceptable Supplier and model:
 - .1 DeZurik ANSI / AWWA Butterfly Valve (BAW) Class 150 and Class 250B, or Engineer approved equal.

2.13 Tilted disc Check Valve

- 2.13.1 Supply and install tilted disc check valves as shown on the drawings and/or as specified herein. The sizes and locations are as shown on the Contract Drawings.
- 2.13.2 The Check valves shall be of the Tilted Disc metal seated, full body type capable of accepting optional bottom or top, suitable for pressures up to 300 psi (2,070 kPa) water service.
- 2.13.3 The valves shall be certified to NSF/ANSI 61 Drinking Water System Components - Health Effects and certified to be Lead-Free in accordance with NSF/ANSI 372.
- 2.13.4 The valves shall be provided with drilled flanges in accordance with ANSI B16.42 Class 300 iron flanges. Ductile iron flanges shall be flat faced.
- 2.13.5 Flanged inspection ports shall be provided upstream and downstream of the valve disc for inspection or use with optional dashpots on 6 in. and larger valves.
- 2.13.6 The valve body shall consist of two sections bolted together as a central diagonal flange inclined at an angle of 55 degrees. The inlet body section shall contain a seat ring positioned and captured by the diagonal flange. The outlet body section shall accept eccentrically located pivot pin trunnions with sealed covers and lubrication grease fittings.
- 2.13.7 The eccentric pivot trunnions shall be located to divide the disc into approximately 1/3 and 2/3 proportions and also allow the seating surface of the disc to rotate away from the seating surface of the seat ring without contact. Clearance shall be provided between the pivot pin and bushing when the disc is seated to prevent binding and to ensure a tight seal.

- 2.13.8 The flow area through the valve body inlet and outlet shall be equal to the nominal pipe size and gradually increase to an area 40 percent greater at the valve seat.
- 2.13.9 A position indicator shall be supplied on 6 in. and larger valves and visually show disc position at all times.
- 2.13.10 The valve disc and seat shall have a seating surface finish of 32 micro-inch or better to ensure positive seating at all pressure. The leakage rate shall not exceed one-half of the allowable rate allowed by AWWA Standard C508 or 0.5 oz (15 ml) per hour per inch (25.4 mm) of valve size.
- 2.13.11 The valve flow way shall be contoured and unrestricted to provide full flow areas at all locations within the valve. Full flow shall be based on an open stroke of 40 degrees to assure stabilization of the disc when open. Cv flow coefficients shall be verified by an independent testing laboratory.
- 2.13.12 The valve body shall be constructed of ASTM A126 Class B cast iron for Class 250 valves up to 10 in. (250mm). 12 in. (300mm) and larger Class 250 valves shall be constructed of ductile iron ASTM A536 Grade 65-45-12.
- 2.13.13 The disc in sizes up to 10 in. (250mm) shall be one-piece construction with integral seat and constructed of ASTM B148 Alloy C95400 aluminum bronze. 12 in. (300mm) and larger discs shall be ASTM A536 Grade 65-45-12 ductile iron. The disc seating ring shall be ASTM B271 Alloy C95500 centrifugally cast aluminum bronze. The mating seat ring located in the body shall be ASTM B271 Alloy C95400 centrifugally cast aluminum bronze.
- 2.13.14 The pivot pins shall be ASTM B505 Alloy C95500 aluminum bronze and shall be guided by a bushing constructed of ASTM B505 Alloy C95400 aluminum bronze (12 in./300mm and larger valves).
- 2.13.15 A NEMA-4 machine tool type limit switch with DPDT contacts shall be provided when specified. The switch shall be mounted to the inspection cover and have an adjustable trip arm for sensing the closed position.
- 2.13.16 O-ring seals and rod wiper scrapers shall make contact with the lower portion of the disc during closure.)
- 2.13.17 A top mounted oil dashpot shall be factory installed in the downstream inspection port when specified to provide independent hydraulic control of the valve opening and closing strokes to reduce water hammer normally associated with pump operation. The dashpot shall consist of a high pressure hydraulic cylinder and with internal cushion adjustment, two external flow control valves, a pressurized oil reservoir, a stainless steel non-pressurized reservoir, and piping. The unit shall independently control the

opening and closing stroke in the range of 5-30 seconds. Additionally, the closing stroke shall be two-stage with the last 10% of closing travel dampened with the internal cylinder cushion. A dashpot spacer which connects the cylinder to the valve shall have an air gap to prevent hydraulic fluid from entering the valve and contaminating the water system. A connecting rod and fitted with O-ring seals and rod wiper scrapers shall be linked to an integrally cast clevis on the disc. The connecting rod shall be attached to the cylinder rod with a quick change coupling constructed of 17-4 PH stainless steel. The cylinder rod, connecting rod, and coupling shall be held in place by coupling retainer to allow decoupling of the cylinder while the check valve is under pressure.

2.13.18 The valve interiors and exteriors shall be coated with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWA C550 when specified.

2.13.19 The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure. Additional tests shall be conducted per AWWA, ANSI, MSS or API standards when specified. The manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.

2.13.20 The exterior of the valve shall be coated with a universal alkyd primer. The valve interior shall be coated with an epoxy coating approved for potable water.

2.13.21 Acceptable manufacturer and model:

- .1 Val-Matic Tilted Disc Check valve 9700T or Engineer approved equal.

2.14 Swing Check Valve

2.14.1 Supply and install swing 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 Check valves shall suitable for pressures up to 150 psi (1050 kPa) water service.

2.14.3 The valves shall be certified to NSF/ANSI 61 Drinking Water System Components - Health Effects and certified to be Lead-Free in accordance with NSF/ANSI 372.

2.14.4 The valves shall be provided with drilled flanges in accordance with ANSI B16.42 Class 150 iron flanges. Ductile iron flanges shall be flat faced.

2.14.5 The flow area through the valve body inlet and outlet shall be equal to the nominal pipe size and gradually increase to an area 40 percent greater at the valve seat.

- 2.14.6 A position indicator shall be supplied on 6 in. and larger valves and visually show disc position at all times.
- 2.14.7 The valve flow way shall be contoured and unrestricted to provide full flow areas at all locations within the valve. Full flow shall be based on an open stroke of 40 degrees to assure stabilization of the disc when open. Cv flow coefficients shall be verified by an independent testing laboratory.
- 2.14.8 The valve body shall be constructed of ASTM A216-WCB
- 2.14.9 The disc material shall be 316L SS.
- 2.14.10 The pivot pins shall be 316L SS.
- 2.14.11 Where available the valve shall be 316L SS
- 2.14.12 A NEMA-4 machine tool type limit switch with DPDT contacts shall be provided when specified. The switch shall be mounted to the inspection cover and have an adjustable trip arm for sensing the closed position.
- 2.14.13 O-ring seals shall be EPDM or approved equivalent.
- 2.14.14 The valve interiors and exteriors shall be coated with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWA C550 when specified.
- 2.14.15 The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure. Additional tests shall be conducted per AWWA, ANSI, MSS or API standards when specified. The manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.
- 2.14.16 The exterior of the valve shall be coated with a universal alkyd primer. The valve interior shall be coated with an epoxy coating approved for potable water.
- 2.14.17 The valve shall be equipment with External compression spring, weight, lever and position indicator.
- 2.14.18 Acceptable manufacturer and model:
 - .1 Bray/ Rite Swing Check Valve SA- 40A or Engineer approved equal.

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
 - .4 Acceptable Manufacturer:
 - .5 Apollo 85R-100 Series
 - .6 Trueline
 - .7 Pinnacle

2.16 Air release valves

- 2.16.1 Provide air release valve. Location and size are as shown on the Contract Drawing.
 - .1 The air release valve shall automatically exhaust large quantities of air from the header during filling.
 - .2 The valve shall have threaded inlet and NPT threaded outlet.
 - .3 Valves shall be certified to NSF 61 for drinking water.
 - .4 Valves shall be manufactured and tested in accordance with AWWA C512.
 - .5 Design and Construction:
 - .6 Pressure Ratings: 1050 kPa (150 psi);
 - .7 Float and Internal Parts: Type 316 Stainless Steel;
 - .8 Body and Cover: Cast Iron;
 - .9 Seal: Buna-N Rubber;
 - .10 Temperature Range: water to 80 degree Celsius.
 - .11 Acceptable Manufacturers:
 - .1 Val-Matic
 - .2 CLA-VAL

.3 APCO

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 City, 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 Brush clean steel pipe exterior to SSPC-P3 standard prior to painting. Also refer to Section 09900 Painting.
- 3.8.3 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

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.

1.2 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 Site Inspection or Contractor Administrator 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 Owner. 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 Site Inspector or Contractor Administrator.
- 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 Site Inspector or Contractor Administrator.

3. EXECUTION

3.1 General

- 3.1.1 At least two (2) weeks prior to commencing any hydrostatic testing, the Contractor shall submit a test plan to the Engineer for review and acceptance.

3.2 Filling and Venting

- 3.2.1 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.

3.3 Station Piping Leakage

- 3.3.1 All piping installed 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.

3.4 Blocking and backfilling

- 3.4.1 Piping shall be adequately blocked, anchored, and supported before the test pressure is applied.

3.5 Pressure Testing

- 3.5.1 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 four (4) hours plus any additional time required for Site Inspector or Contract Administrator to examine all piping being tested and for Contractor to locate any defective joints and pipe materials
- 3.5.2 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.
- .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].
- 3.5.3 Plant Piping Test Pressure. Unless otherwise noted, piping shall be subjected to the test pressure as indicated in the specific piping sections, or 1.5 times the rated working pressure.
- 3.5.4 All specified tests shall be made by and at the expense of the Contractor in the presence, and to the satisfaction, of the Site Inspector or Contract Administrator.
- 3.5.5 Leakage may be determined by loss-of-pressure, soap solution, chemical indicator, or positive and accurate method acceptable to the Site Inspector or Contractor Administrator.
- 3.5.6 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.
- 3.5.7 Unless otherwise required by the applicable codes, drainage and venting systems shall be tested with compressed air.
- 3.5.8 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.

- 3.5.9 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.
- 3.5.10 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.
- 3.5.11 After pipeline pressure and leakage testing, water inside the pipeline shall be completely drained.
- 3.5.12 Gas piping: test as required by authorities having jurisdiction.

3.6 Pipeline leakage testing

- 3.6.1 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.
- 3.6.2 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.
- 3.6.3 No visible leakage will be accepted.

END OF SECTION

1. GENERAL

1.1 Scope

- 1.1.1 This Section applies to all process and building mechanical pipe welding.
- 1.1.2 Do all work associated with the welding process, such as procedure qualification, welder qualification, line-up, welding, and weld inspection, examination and testing, in accordance with the latest edition of ANSI/ASME B31.3 Category D fluid service, except when the terms of this standard are added to or modified by these specifications.

1.2 Related Sections

- 1.2.1 Section 11101 – Piping, Valves and Fittings

1.3 References

- 1.3.1 ANSI/ASME B31.3 Process Piping Code (ASME B31.3)
- 1.3.2 ASME Boiler and Pressure Vessel Code (ASME BPVC):
 - .1 Section V, Nondestructive Examination
 - .2 Section IX, Welding and Brazing Qualifications
- 1.3.3 CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding:
 - .1 Note: CSA W48.3 (Low Alloy Steel Covered Electrodes) has been substituted by CAN/CSA W48, which also includes additional five previous W48.x Standards.
- 1.3.4 CSA W178.1, Certification of Welding Inspection Organizations
- 1.3.5 CSA W178.2, Certification of Welding Inspectors
- 1.3.6 CAN/CGSB 48.9712, Non-destructive Testing: Qualification and Certification of Personnel.

2. PRODUCTS

2.1 Stainless Steel Piping and Fittings

- 2.1.1 Details as described in the contract drawings and Section 11101 – Piping, Valves and Fittings.

2.2 Filler Material

- 2.2.1 Shielded metal arc electrodes (manual welding) to conform to CSA W48. Grade to be of tensile strength equivalent to or greater than the ultimate tensile strength of the parent metal, and to be suitable for the electric current characteristics, position of welding, and other conditions of intended use.

2.3 End Bevels

- 2.3.1 Provide pipe ends with mill bevels. Bevels to be 30° with a vertical lip of 1.60 mm unless specified otherwise. Field bevels to be reasonably smooth and uniform, and dimensions shall be in accordance with the qualified welding procedure.

2.4 Equipment

- 2.4.1 Welding equipment to be 200 A or larger DC machines, and to be designed and maintained in an acceptable condition to obtain the specified results.

3. EXECUTION

3.1 General

- 3.1.1 Welding to be performed using procedures qualified to ASME B31.3. Surfaces to be welded shall be smooth, uniform, free of fins, lamination, tears, slag, grease, paint, and other deleterious conditions which might adversely affect welding. All aspects of the process as outlined in ASME B31.3 shall conform to the welding procedure specification.
- 3.1.2 Contractor to submit five (5) copies of proposed welding procedure to the Engineer using the forms provided at the end of this section. Procedure to be used to prepare the test joints required for qualification.

3.2 Welder Qualification

- 3.2.1 Welders engaged on the work to possess valid certificates of qualification from the appropriate governing authority for pipeline welding in the flat, vertical, and overhead positions. Certificates to be for the shielded metal arc method of welding. Provide copies of certificates to the Engineer when qualification test results are submitted.
- 3.2.2 Welders to qualify under ASME BPVC Section IX, American Welding Society (AWS) or Canadian Welding Bureau (CWB).
- 3.2.3 A record shall be made of the test given to each welder and of the detailed results of each test. Record to be maintained by Contractor and a list of qualified welders and procedures in which they are qualified to be provided to the Engineer. Welders may be required to requalify if there is a question about their ability.

3.3 Qualification of the Welding Procedure

- 3.3.1 Contractor to prepare test joints in accordance with the proposed welding specification and as stated in the proposed welding procedure submitted to the Engineer. Contractor to give the Engineer written notice of when and where the welding of the test joints will take place so that the Engineer can be present. Test joints to be tested at Owner's expense, and in accordance with

ASME B31.3. Upon qualification, no change in the procedure will be permitted without the Engineer's written approval.

3.4 Weather Conditions (Field Welding)

- 3.4.1 Welding shall not be done when the quality of the completed weld would be impaired by prevailing weather conditions, including but not limited to moisture, blowing sands, high winds, or low temperatures. Windshields may make conditions for welding satisfactory.
- 3.4.2 If, in the opinion of the Engineer, protection from prevailing weather conditions is necessary, then welding shall cease until this protection has been placed correctly. The Contractor will not be compensated for "downtime" delays of this nature.
- 3.4.3 Metal surfaces in and adjacent to the welding groove to be dry before welding commences and while welding is in progress.
- 3.4.4 When ambient temperature is below 0°C, welding operations to cease, unless an appropriate welding procedure has been qualified.

3.5 Production Welding

- 3.5.1 Production welding to conform to the following stipulations:
- 3.5.2 No pup (intermediated pull-up piece of pipe) shorter than 1m or 3 pipe diameters, whichever dimension is greater to be installed in the line. There shall be at least 1 full joint of pipe installed between pups which are shorter than 5m. All pups must be moved ahead on a current basis and installed in the line.
- 3.5.3 No two weld beads shall be started or stopped in the same location. Each weld pass shall be visually examined and any defects (i.e., pin holes, slag inclusions, gas pockets, and undercutting, etc.) shall be repaired prior to welding the next pass.
- 3.5.4 Striking the arc on the pipe at any point other than the welding groove shall not be allowed. Any section of pipe which has been arc burned may, at the Engineer's discretion, be cut out and replaced at the Contractor's expense.
- 3.5.5 No weld to be subjected to sudden variations in temperature and no welded sections to be subjected to stresses, due to movement of pipe, loading on pipe, etc., until the welds have cooled below 380°C. Damage caused by the welded pipe being subjected to stresses before complete cooling of welds to be corrected at the Contractor's expense.
- 3.5.6 All temperatures to be measured by pyrometric crayons or other suitable devices approved by the Engineer.
- 3.5.7 All passes to have no more than 5 minutes elapse between the previous pass termination and the commencement of the next

pass. When ambient temperature is below 0oC, maximum lapse time allowable is 4 minutes.

- 3.5.8 Use inert gas backing for stainless steel welding. Solar flux prohibited for liquid commodity piping.
- 3.5.9 For stainless steel pipes carrying solids-containing liquids or slurries pickle all joints and heat affected zones on interior and exterior. Use of pickling paste subject to the Engineer's review. Observe regulatory requirements for disposal of acid.
- 3.5.10 Passivate exterior of all stainless-steel welds after completion. Neutralize and rinse joints.
- 3.5.11 For pickling and passivation detail refer to ASTM A380 or Section 15200, Line Code H1.

3.6 Lineup Clamps

- 3.6.1 Internal lineup clamps to be used whenever practicable and when used shall not be removed until root bead is complete. External lineup clamps may be used only when use of internal lineup clamps is not practicable. Root bead segments used in connection with external lineup clamps to be uniformly spaced around the circumference of the pipe, and to have an accumulative length of not less than 50% of the pipe circumference before the clamp may be removed. Pipe to remain supported and stationary until root bead is completed.

3.7 Clearance

- 3.7.1 When the pipe is welded in a trench, bell hole to be of sufficient size to provide the welder or welders ready access to the joint so that their skill is not impaired. When pipe is welded above ground, the working clearance around the pipe at the weld shall be not less than 400 mm.

3.8 Pipe Handling

- 3.8.1 Extreme care to be exercised to prevent damage to pipe. Damage to be repaired as directed by the Engineer and at the expense of the Contractor. Bevel ends to be repaired if damaged.
- 3.8.2 All dents in the pipe deeper than 3.2mm to be removed by cutting dented portion of the pipe out, re-bevelling the cut ends, welding, and recoating.

3.9 Inspection

- 3.9.1 After completion of the welding operation, pipe to be left uncoated for a period sufficient to permit the independent third-party Inspector approved by the Owner to carry out inspection (as defined by ASME B31.3, section 340.1) on the welds. Contractor to allow a reasonable time for the Inspector to conduct examination of the tie-in welds.

- 3.9.2 Work performed will be rigidly inspected. Such inspection shall not relieve Contractor of responsibility for performing work in conformance with the specifications. Contractor to notify the Inspector in advance of performing any work in order that inspection may be arranged. The Inspector may reject any work that does not comply with the specified requirements. Contractor to furnish the Inspector with reasonable facilities and space for inspection and obtaining any information the Inspector desires respecting the character of material used and progress and condition of the work.
- 3.9.3 The Inspector may use any method of examination necessary to establish quality control and ensure adherence to welding procedures. The Inspector has the right to accept or reject any weld not meeting the approved procedures and/or specified requirements.
- 3.9.4 Specified percentage of welds is subject to visual examination, liquid penetrant examination, and random radiographic examination, the cost of which will be borne by the Contractor. Radiographic inspection to be carried out by operators certified in conformance with CSA W178.
- 3.9.5 Non-destructive examination standards specified in Section V of ASME BPVC to be used as basis for examination procedures.

3.10 Repair or Removal of Weld Defects

- 3.10.1 Repair or removal of weld defects to be in accordance with Section IX of ASME BPVC. Back welding is not allowed without qualification of the welding procedure used.
- 3.10.2 Repair of welds shall follow ASME B31.3, Section 328.6, Weld Repair.
- 3.10.3 All costs for repairing defective welds, including radiographic and other examination of the corrected work, shall be borne by the Contractor.

3.11 Coated Pipe Protection and Field Coating

- 3.11.1 Protect and prepare for field welding all carbon steel pipe which has been previously coated.
- 3.11.2 After field welding, pipe coating of welded joints to be completed as follows:
 - .1 Coating of welded joints in the field to be done in accordance with AWWA (American Water Works Association) C210, Section 3.5. Primer and field coating of bare surfaces to be the same materials as used for shop coating of pipe.
- 3.11.3 If damage of the coating occurs in the field, repair damaged portions in accordance with AWWA C210, Section 3.4.

3.12 Specialist Inspection, Examination and Testing

- 3.12.1 Examination by the manufacturer, fabricator, or erector (as defined by ASME B31.3, section 341.1) shall follow section 341.4.2 of that code for Category D Fluid Service. Examination methods shall follow Table 341.3.2 for Category D Fluid Service. The Contractor shall keep a record of weld numbers that were examined. Where applicable, different welds shall be examined by different methods. The cost of this examination shall be borne by the Contractor.
- 3.12.2 In addition to the above Contractor examination, the Inspector shall visually examine not less than 15% of all welds. In addition, not less than 10% of fillet welds shall be examined by liquid penetrant. In addition to this, not less than 10% of circumferential butt welds shall be examined by random radiography. The cost of this examination shall be borne by the Contractor.
- 3.12.3 The Inspector shall keep a record of weld numbers that were visually examined, of welds that were examined by liquid penetrant, and of welds examined by random radiography. Different welds shall be examined by different methods.
- 3.12.4 Examination procedures:
 - .1 Perform examinations by specialist qualified in accordance with CSA 178.1 and CSA 178.2 and approved by the Engineer,
 - .2 And according to ASME BPVC, Section V, CAN/CGSB 48.9712, and authority having jurisdiction.
- 3.12.5 Visual examination: include entire circumference of all welds externally.
- 3.12.6 Failure of examinations:
 - .1 Upon failure of any weld by visual examination, the Inspector shall perform additional visual examination as directed by the Engineer of a total of 20% of all welds, selected at random by the Engineer. The cost of this examination shall be borne by the Contractor.
 - .2 Upon failure of any weld by penetrant examination, the Inspector shall perform additional penetrant examination as directed by the Engineer of a total of 15% of all welds, selected at random by the Engineer. The cost of this examination shall be borne by the Contractor.
 - .3 Upon failure of any weld by random radiography, the Inspector shall perform additional radiography as directed by the Engineer of a total of 15% of all welds selected at random by the Engineer. The cost of this examination shall be borne by the Contractor.

- 3.12.7 For leak (pressure) testing refer to 11170 Pipeline Pressure and Leakage Testing.

3.13 Defects Causing Rejection

- 3.13.1 Acceptance criteria for welds shall follow ASME B31.3, section 341.3.2, Table 341.3.2 in particular, for Category D Fluid Service.
- 3.13.2 Any rejected welds shall be repaired or replaced.

3.14 Pressure Testing

- 3.14.1 For additional pressure testing of completed sections of pipe refer to 11170 Pipeline Pressure and Leakage Testing.

END OF SECTION

PROPOSED WELDING PROCEDURE

DATE _____

JOB TITLE _____

ASSOCIATED ENGINEERING PROJECT NO. _____

CLASSIFICATION OF PIPE _____

MAXIMUM TENSILE STRENGTH _____

MAXIMUM YIELD STRENGTH _____

PERCENTAGE ELONGATION IN 50 mm _____

MILL TEST FORWARDED TO ASSOCIATED ENGINEERING (YES/NO) _____

LADLE ANALYSIS FORWARDED TO ASSOCIATED ENGINEERING (YES/NO) _____

CARBON CONTENT _____

CARBON EQUIVALENT _____

EXTERNAL COATING _____

INTERNAL COATING _____

PROCESS _____

DIAMETER AND WALL THICKNESS _____

JOINT DESIGN _____

FILLER METAL

Pass Size AWS Classification Voltage Amperage Polarity Brand

1
2
3
4
5

POSITION _____

DIRECTION OF WELDING _____

NUMBER OF WELDERS _____

TIME LAPSE BETWEEN PASSES _____

INTER-PASS HEATING (IF REQUIRED) _____

METHOD OF HEATING _____

CLEANING BETWEEN PASSES _____

PREHEAT _____

MINIMUM AMBIENT TEMPERATURE

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 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 316L 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 The specific products for pipe supports shall be as indicated in Table 1 for the specified type and size of support.

TABLE 1 - TYPES OF SUPPORTS				
Description and Service		Type		
		MSS SP 69 (Note 1)	Other	
Hangers				
	75 through 250 mm [3 Through 10 inch] pipe			
	For cold insulated piping			
	Clevis	1	B-Line "B3100" or Anvil "260" for steel pipe B-line "B3102" or Anvil "590" for cast iron pipe.	
	For uninsulated cold piping			
	Clamp	4	B-Line "3140" or Anvil "212".	
	Clevis	1	B-Line "B3100" or Anvil "260" for steel pipe B-line "B3102" or Anvil "590" for cast iron pipe.	
	300mm [12 inch] and larger Pipe			
	Clevis or saddle	1	Anvil "260" or "590"	
Concrete Inserts, Steel				
	300 mm [12 inch] and smaller pipe	18	Channel 2.66 mm [12 ga [2.66 mm] thick, galv, 41.3 by 34.9 mm [1-5/8 by 1-3/8 inches], min. 200 mm [8 inches] long, anchor lugs on 100 mm [4 inch] centres, at least three lugs, end caps, and filler strip.	
	350 mm [14 inch] and larger pipe, fabricated insert, except as noted	--	See drawings.	
Beam Clamps, Malleable Iron or Steel, 300 mm [12 inch] and smaller pipe		21	B-Line "3050" and "3055" or Anvil "133" and "134".	
		28, 29	Anvil "292".	
		30	B-Line "3054" or Anvil "228".	

TABLE 1 - TYPES OF SUPPORTS			
Description and Service		Type	
		MSS SP 69 (Note 1)	Other
Side Beam Bracket		34	B-Line "B3062" or Anvil "202".
Wall Supports and Frames, Steel, 300 mm [12 inch] and smaller pipe (Note 2)			
	Brackets	32	B-Line "B3066" or Anvil "195".
		33	B-Line "B3067" or Anvil "199".
	Prefabricated channels	--	2.66 mm [12 ga] thick, galv, 1-5/8 inches [41.3 by 41.3 mm], with suitable brackets and pipe clamps.
	Offset pipe clamp, 38 mm [1-1/2 inch] and smaller pipe	--	Galv, 32 by 4.7 mm [1-1/4 by 3/16 inch] steel, with 9.5 mm [3/8 inch] bolts.
	Offset pipe clamp, 2 to 50 to 88 mm [3-1/2 inch] pipe	--	Galv, 32 by 6 mm [1-1/4 by 1/4 inch] steel, with 9.5 mm [3/8 inch] bolts.
Floor Supports, Steel or Cast Iron			
	150 mm [6 inch] and smaller pipe	37 (with base)	B-Line "B3090" or Anvil "259".
	200 to 600 mm [8 through 24 inch] pipe	38	B-Line "B3093" or Anvil "264".
Pipe Alignment Guides		--	B-Line "B3281" through "B3287" or Anvil "255".
Turnbuckles Steel		13	B-Line "B3202" or Anvil "230".
Hanger Rods, Carbon Steel, Threaded Both Ends, 10 mm [3/8 inch] minimum size		--	B-Line "B3205" or Anvil "140".
Weldless Eye Nut, steel		17	B-Line "B3200" or Anvil "290".
Insulation Protection Saddle		39	B-Line "B3160 Series" or Anvil "160 Series".
Insulation Protection Shield		40	B-Line "B3151" or Anvil "167".

3.2.2 Table 1 Notes:

- 3.2.3 Typical MSS SP-69 supports and hangers are illustrated on 11190 - F1 . The Contractor may modify the supports and hangers based on the typical ones, but the Engineer's approval shall be required.
- 3.2.4 Pipe clamps or other devices which rely on the application of a clamping force to the supported pipe in order to maintain the clamp position or location in a prefabricated channel or track will not be acceptable for use with non-metallic pipe or tubing.
- 3.2.5 Galvanize the carbon steel plate after welding. The pipe supports for stainless steel pipeline shall be made of stainless steel.

TABLE 2 - MAXIMUM PIPE SUPPORT SPACINGS AT STANDARD TEMPERATURES AND SERVICES					
Type of Pipe		Pipe Support Max Spacing	Max Run Without Expansion Joint, Loop, or Bend (Note 1)	Expansion Joint Max Spacing (Note 2)	Type of Expansion Joints
		m [ft]	m [ft]	m [ft]	
Stainless steel					
	31 mm [1-1/4 inch] and smaller	2.1 [7]	9.1 [30]	30.5 [100]	Note 3
	38 to 100 mm [1-1/2 to 4 inch]	3.0 [10]	9.1 [30]	30.5 [100]	Note 3
	100 to 250 mm [4 to 10 inch]	4.5 [15]	24.4 [80]	24.4 [80]	Note 3
	Over 250 mm [10 inch]	5.5 [18]	24.4 [80]	24.4 [80]	Note 3
PVC, Schedule 40 & 80, for services at a maximum temperature of 100°F [38°C], and a maximum specific gravity of 1.0.					
	3 and 6 mm [1/8 and 1/4 inch]	Continuous Support	6.1 [20]	18.3 [60]	Note 3
	13 mm [1/2 inch]	1.0 [3-1/2]	6.1 [20]	18.3 [60]	Note 3
	19 and 25 mm [3/4 and 1 inch]	1.2 [4]	6.1 [20]	18.3 [60]	Note 3

TABLE 2 - MAXIMUM PIPE SUPPORT SPACINGS AT STANDARD TEMPERATURES AND SERVICES					
Type of Pipe		Pipe Support Max Spacing	Max Run Without Expansion Joint, Loop, or Bend (Note 1)	Expansion Joint Max Spacing (Note 2)	Type of Expansion Joints
		m [ft]	m [ft]	m [ft]	
	31 and 38 mm [1-1/4 and 1-1/2 inch]	1.3 [4-1/2]	6.1 [20]	18.3 [60]	Note 3
	50 mm [2 inch]	1.5 [5]	6.1 [20]	18.3 [60]	Note 3
	65 mm [2-1/2 inch]	1.6 [5-1/2]	6.1 [20]	18.3 [60]	Note 3
	80 mm [3 inch]	1.8 [6]	6.1 [20]	18.3 [60]	Note 3
	100 mm [4 inch]	1.9 [6-1/2]	6.1 [20]	18.3 [60]	Note 3
	150 mm [6 inch]	2.2 [7-1/2]	6.1 [20]	18.3 [60]	Note 3
	200 mm [8 inch]	2.4 [8]	6.1 [20]	18.3 [60]	Note 3
	250 mm [10 inch]	2.5 [8-1/2]	6.1 [20]	18.3 [60]	Note 3
	300 mm [12 inch]	2.9 [9-1/2]	6.1 [20]	18.3 [60]	Note 3

3.3 Support and Expansion Joint Spacings

3.3.1 Pipe supports and expansion joints shall be spaced in accordance with Tables 2. The types of pipes to be supported are as required. Table 2 covers spacings for the standard operating conditions specified for each pipe material.

3.3.2 Table 2 Notes:

- .1 Unless otherwise acceptable to Engineer, an expansion joint shall be provided in each straight run of pipe having an overall length between loops or bends exceeding the maximum run specified herein.

- .2 Unless otherwise acceptable to Engineer, the spacing between expansion joints in any straight pipe run shall not exceed the maximum spacing specified herein and contract drawings.
- .3 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.
- 3.3.3 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.
- 3.3.4 The Contractor shall provide the detailed piping layout and submit the shop drawings stamped by a professional engineer who shall coordinate the expansion joint installation with the manufacturer.
- 3.3.5 One of sliding supports between fixed supports shall be a pipe guide as per Process Details in the Contract Drawings.
- 3.3.6 Provide a one (1) Victaulic Style 77S flexible coupling at every 90 degree bends to allow for deflection.

3.4 Installation

- 3.4.1 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.

3.4.2 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 horizontal cast iron and no-hub piping systems adjacent to each joint.
- .7 Support vertical piping at every floor using riser clamps.
- .8 Support riser piping independently of connected horizontal piping.
- .9 Hanger and hanger components shall be sized specifically for the pipe size it is to be used on.

3.5 Placement

- 3.5.1 Unless closer spacing is indicated on the drawings, the maximum spacing for pipe supports and expansion joints shall be as indicated in Tables 2.
- 3.5.2 Rubber hose and flexible tubing shall be provided with continuous angle or channel support.

- 3.5.3 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

- 1.1.1 This section covers furnishing manual and powered valve actuators and accessories.

1.2 General

- 1.2.1 Equipment provided under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
- 1.2.2 Actuators shall be furnished with all necessary parts and accessories indicated on the drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of actuators.
- 1.2.3 General Equipment Requirements: The General Equipment Requirements shall apply to the equipment furnished under this section.
- 1.2.4 Governing Standards: Except as modified or supplemented herein, all powered actuators shall conform to applicable requirements of ANSI/AWWA C541 and C542, Class 150B:
- .1 Except as modified or supplemented herein, all manual and cylinder actuators for butterfly and eccentric plug valves shall conform to the applicable requirements of ANSI/AWWA C504.
 - .2 Except as modified or supplemented herein, all manual actuators for ball valves shall conform to the applicable requirements of ANSI/AWWA C507.
- 1.2.5 Power Supply: Power supply to electric actuators will be as indicated on the valve schedule or as indicated on the drawings.
- 1.2.6 Marking: Each actuator shall be marked with the manufacturer's name, model number, and the country of origin. An identifying serial number shall be stamped on a corrosion-resistant plate attached to the actuator.
- 1.2.7 Temporary Number Plates: Each actuator shall be factory tagged or marked to identify the actuator and the applicable valve by number or service as indicated in the valve schedule.

1.3 Submittals

- 1.3.1 In accordance with Section 01330 - Submittals.
- 1.3.2 Complete drawings, details, and specifications covering the actuators and their appurtenances shall be submitted in

accordance with the submittals section. Submittal drawings shall clearly indicate the country of origin of each actuator and its components.

- 1.3.3 The drawings shall include separate wiring diagrams for each electrically operated or controlled actuator and the electrical control equipment. Each actuator drawing shall be identified with the respective valve number or name.
- 1.3.4 For electric or cylinder actuators, certified copies of reports covering proof of design testing of the actuators as set forth in Section 5 of ANSI/AWWA C541 and C542, together with an affidavit of compliance as indicated in Section 6.3 of ANSI/AWWA C541 and C542, shall be submitted to Engineer before the actuators are shipped.

1.4 Delivery, Storage, and Handling

- 1.4.1 Shipping shall be in accordance with the shipping section. Handling and storage shall be in accordance with the handling and storage section.

2. PRODUCTS

2.1 Performance and Design Requirements

- 2.1.1 General: Actuators and appurtenances shall be designed for the conditions and requirements as indicated in the respective valve and gate sections.
- 2.1.2 Liberal factors of safety shall be used throughout the design, especially in the design of parts subject to intermittent or alternating stresses. In general, working stresses shall not exceed one third of the yield point or one fifth of the ultimate strength of each material.
- 2.1.3 Valve Actuators: Each actuator shall be designed to open or close the valve under all operating conditions. Actuators shall be designed for the maximum pressure differential across the valve and maximum velocities through the valve where indicated in the valve schedule:
 - .1 Valve actuators shall be provided and adjusted by the valve manufacturer. Actuator mounting arrangements and positions shall facilitate operation and maintenance and shall be determined by the valve manufacturer unless indicated otherwise on the drawings or directed by Engineer.
 - .2 When valves are to be buried, submerged, or installed in vaults, the actuators and accessories shall be sealed to prevent the entrance of water. The design water depth shall be as indicated in the valve schedule but not less than 6.1 m [20 feet].

2.1.4 Limit Switches: Limit switches shall be provided as indicated in the valve schedule:

- .1 For manual or cylinder type actuators, each limit switch shall be heavy duty type, with a cast NEMA Type 4 enclosure, a spring return roller lever, and four isolated contacts (two normally open and two normally closed) rated 10 amperes at 120 to 480 volts ac and 5 amperes at 125 volts dc. The switches shall be Allen Bradley "802T" or Square D "9007 Type C".
- .2 Limit switches for programmable and standard electric actuators shall be as indicated in their respective paragraphs.

2.2 Materials

2.2.1 Except as modified or supplemented herein, materials used in the manufacture of actuators shall conform to the requirements of ANSI/AWWA C504, C541 and C542.

2.3 Valve Manual Actuators

2.3.1 General: Manual actuators of the types listed in the valve schedule shall be provided by the valve manufacturer:

- .1 Unless otherwise indicated or specified, each geared manual actuator shall be equipped with an operating handwheel.
- .2 The direction of rotation of the wheel, wrench nut, or lever to open the valve shall be to the left (counterclockwise). Each valve body or actuator shall have cast thereon the word "Open" and an arrow indicating the direction to open.
- .3 The housing of traveling nut type actuators shall be fitted with a removable cover which shall permit inspection and maintenance of the operating mechanism without removing the actuator from the valve. Travel limiting devices shall be provided inside the actuator for the open and closed positions. Travel limiting stop nuts or collars installed on the reach rod of traveling nut type operating mechanisms shall be field adjustable and shall be locked in position by means of a removable roll pin, cotter pin, or other positive locking device. The use of stop nuts or adjustable shaft collars which rely on clamping force or setscrews to prevent rotation of the nut or collar on the reach rod will not be acceptable.
- .4 Each actuator shall be designed so that shaft seal leakage cannot enter the actuator housing.
- .5 Actuators shall produce the required torque with a maximum pull of 356 N [80 lbs] on the lever, handwheel, or chain. Actuator components shall withstand, without damage, a pull of 890 N [200 lbs] on the handwheel or chainwheel or an input of 407 J [300 foot lbs] on the operating nut.

- 2.3.2 Handwheels: Handwheel diameters shall be at least 200 mm [8 inches] but not more than 600 mm [24 inches] for 750 mm [30 inch] and smaller valves and not more than 750 mm [30 inches] for 900 mm [36 inch] and larger valves.
- 2.3.3 Chain wheels: Unless otherwise specified in the valve schedule, all valves with center lines more than 2.0 m above the floor shall be provided with chainwheels and operating chains. Each chainwheel operated valve shall be equipped with a chain guide which will permit rapid handling of the operating chain without "gagging" of the wheel and will also permit reasonable side pull on the chain. Suitable extensions shall be provided, if necessary, to prevent interference of the chain with adjacent piping or equipment. Operating chains shall be hot dip galvanized or zinc plated carbon steel and shall be looped to extend to within 1.2 m [4 feet] of the floor below the valve.
- 2.3.4 Levers: Levers shall be capable of being locked in at least five (5) intermediate positions between fully open and fully closed. In any building or structure containing lever operated valves, at least two operating levers shall be provided for each size and type of lever operated valve.
- 2.3.5 Wrench Nuts: Unless otherwise specified in the valve schedule or on the drawings, wrench nuts shall be provided on all buried valves and on all valves that are to be operated through floor boxes. Unless otherwise directed by Owner, all wrench nuts shall comply with Section 3.15 of AWWA C500. At least two operating keys shall be furnished for operation of the wrench nut operated valves.
- 2.3.6 Operating Stands: Operating stands shall be provided in the locations indicated on the drawings. Operating stands shall support the handwheel approximately 900 mm [36 inches] above the floor. A sleeve made from standard weight galvanized steel pipe shall be provided for the opening in the floor beneath each operating stand. When stems are 3 m [10 feet] or longer, a suitable thrust bearing shall be provided in each operating stand to carry the weight of the extension stem.

2.4 Standard Electric Actuators

- 2.4.1 General: Standard electric actuators as listed in the valve schedule shall be provided by the valve manufacturer:
- .1 Unless otherwise specified actuators to have an operational temperature range of -30°C to 60°C.
 - .2 Standard electric actuators for 300 mm [12 inch] and smaller butterfly valves and eccentric plug valves shall be quarter-turn type.
 - .3 All other standard electric actuators shall be multiturn type and shall be Rotork.

- .4 Standard electric actuators produced by other manufacturers are not acceptable.
 - .5 Each standard electric actuator shall be furnished complete with a motor, gearing, handwheel, limit switches and torque sensors, lubricants, heating elements, wiring, and terminals. Each actuator shall be constructed as a self-contained unit with a cast iron or aluminum alloy housing, of a type as indicated in the valve and gate schedules, and shall be integrally assembled on the applicable valve or gate by the valve or gate manufacturer.
 - .6 Actuators shall be sized to guarantee valve closure at the specific differential pressure.
 - .7 Actuators shall be designed to cycle the valve from the fully open to the fully closed position or the reverse in approximately 60 seconds or as indicated in the valve schedule.
 - .8 Actuator motors may be mounted horizontally adjacent to or vertically above the reduction gearing. All gearing shall be oil or grease lubricated.
 - .9 Acceptable Suppliers: Rotork
- 2.4.2 Motors: Motors shall be totally enclosed, high torque design made expressly for valve actuator service, capable of operating the valve under full differential pressure for two complete strokes or one complete cycle of travel without overheating. Motors shall be designed in accordance with NEMA standards and shall operate successfully at any voltage within 10 percent above or below rated voltage. Motor bearings shall be permanently lubricated. Motors shall be CSA approved and of explosion-proof design.
- 2.4.3 Power Gearing: Power gearing shall consist of hardened steel spur or helical gears and alloy bronze or hardened steel worm gear, all suitably lubricated, designed for 100 percent overload, and effectively sealed against entrance of foreign matter. Steel gears shall be hardened to at least 350 Brinell. Planetary or cycloidal gearing or aluminum, mild steel, or nonmetallic gears will not be acceptable. Gearing shall be designed to be self locking so that actuation of a torque switch by a torque overload condition will not allow the actuator to restart until the torque overload has been eliminated. If a secondary gear box is required, it shall be designed to withstand the locked rotor torque of the actuator.
- 2.4.4 Handwheel Mechanism: The handwheel shall not rotate during motor operation. During handwheel operation the motor shall not affect the actuator operation. The actuator shall be responsive to electrical power and control at all times and, when under electrical control, shall instantly disengage the handwheel. The handwheel shall rotate counterclockwise to open the valve. An arrow indicating

the opening direction and the word "Open" shall be cast on the handwheel. The force required to operate the handwheel shall not exceed 350 N [80 lbs]. The handwheel shall have a padlockable declutch lever.

- 2.4.5 Torque Sensing: Torque and thrust loads in both closing and opening directions shall be limited by a torque sensing device. Each torque sensing device shall be provided with an adjustment setting indicator. The adjustment shall permit a variation of approximately 40 percent in torque setting. Switches shall have a rating of not less than 6 amperes at 120 volts ac and 0.5 ampere at 115 volts dc.
- 2.4.6 Limit Switches: Each standard electric actuator shall be designed to be readily field adaptable for four limit switch assemblies. Each switch assembly shall consist of at least three separate limit switches, shall be operated by the driving mechanism, and shall be independently adjustable to trip at any point at and between the fully open and fully closed valve positions. All switches shall have an inductive contact rating of not less than 6 amperes at 120 volts ac, 3 amperes at 240 volts ac, 1.5 amperes at 480 volts ac, and 0.5 ampere at 115 volts dc.
- 2.4.7 Each quarter turn actuator shall be provided with end of travel limit switches in addition to four (4) SPDT switches, each independently adjustable at any point of valve travel.
- 2.4.8 Heating Elements: Space heating elements shall be provided to prevent condensation in the motor and limit switch housing. Heating elements shall be rated 120 volts ac. Heaters shall be continuously energized.
- 2.4.9 Terminal Facilities: Terminal facilities for connection to motor leads, switches, position transmitter, and heating elements shall be provided in readily accessible terminal compartments. Each terminal compartment shall have at least two openings for external electrical conduits, one sized at least 19 mm [3/4 inch] and the other at least 31 mm [1 1/4 inches]. Each terminal compartment shall be large enough to allow easy routing and termination of fifteen 12 AWG [4 mm²] conductors.
- 2.4.10 Controller: Each valve shall be furnished with a reversing controller located inside the actuator enclosure and shall have controller devices as indicated in the valve schedules. The controller shall be equipped with:
 - .1 A motor overload protective device in each phase or solid state motor protection.
 - .2 A space heater element, rated 120 volts ac, sized to be continuously energized for prevention of condensation within the controller enclosure.

- .3 A fused control power circuit taken from one power lead on the load side of the breaker and line side of the reversing starter to ground. If power supply is greater than 120 volts ac, a control power transformer with fused secondary, with volt-ampere capacity suitable for starter control plus continuous service to space heater elements in motor housing, limit switch compartment, and controller enclosure.
- .4 A terminal block with connectors for all external controls. All leads from the actuator motor and limit switch assembly shall be routed to terminal connections in the controller for external connections to all other control devices.
- .5 Auxiliary control contacts as indicated in the electrical schematics.
- .6 Reversing controllers shall be both mechanically and electrically interlocked and shall be provided with the necessary direct-operated auxiliary contacts for required interlocking and control.
- .7 Valve controllers shall be expressly selected for long life and reliable, low maintenance service under rugged service conditions.

2.4.11 Control Module:

- .1 Control Performance: For any operating torque within the specified range of the valve actuator, the valve and actuator shall perform within these specified limits:
- .2 Linearity: Linearity of actual valve position as compared to demand signal shall be within ± 4 percent of span over the entire operating range.
- .3 Repeatability: For any repeated demand signal to the valve actuator, the actual valve position shall be repeated.
- .4 Deadband: Deadband of the valve actuator shall be adjustable from 1 to 10 percent of span.
- .5 Hysteresis: For any repeated demand signal to the valve actuator, from either an increasing or a decreasing direction, the actual valve position shall be repeated within 1 degree of valve shaft rotation.

2.4.12 Communication and System Integration and Connectivity:

- .1 Provide hardwired communication for each actuator for connectivity to the communication system provided at the facility.
- .2 Actuator shall be capable of providing/accepting the following minimum digital input/outputs"

- .1 Control Mode – Digital Output
 - .2 Fault Status – Digital Output
 - .3 Open Status – Digital Output
 - .4 Closed Status – Digital Output
 - .5 Open Command – Digital Input
 - .6 Close Command – Digital Input
 - .3 Provide all required hardware, software and programming so as to provide full integration and connectivity into the system.
- 2.4.13 The actuator shall be rated for 600V, 3 phase operation.
- 2.4.14 Enclosures:
- .1 Enclosure ratings:
 - .1 EEMAC 4X for indoor applications.
 - .2 Actuator enclosure to be watertight with external fasteners on the actuator made of stainless steel. Fasteners on limit switch and terminal compartments to be captured to prevent loss while covers are removed.
 - .3 The actuator to have an integral, separately sealed wire termination compartment and utilize 'O' ring seals at removable cover joints. The actuator to maintain its non-hazardous enclosure ratings even with the wiring compartment access cover removed.

2.5 Actuator Sizing

- 2.5.1 The actuator to be size based on information provided by the valve supplier to guarantee valve closure at the specified flow velocity and differential pressure and include a 50% margin of safety.
- 2.5.2 Design the actuator to provide rated torque with supply voltage variations of plus or minus 10% of the nominal supply value.

2.6 Actuator Accessories

- 2.6.1 Extension Stems: Extension stems and stem guides shall be furnished when indicated in the respective valve schedules, indicated on the drawings, or otherwise required for proper valve operation. Extension stems shall be of solid steel and shall be not smaller in diameter than the stem of the actuator shaft. Extension stems shall be connected to the actuator with a single Lovejoy "Type D" universal joint with grease filled protective boot. All stem connections shall be pinned:
- .1 At least two stem guides shall be furnished with each extension stem, except for buried valves. Stem guides shall

be of cast iron, bronze bushed, and adjustable in two directions. Stem guide spacing shall not exceed 100 times the stem diameter or 3m [10 feet], whichever is smaller. The top stem guide shall be designed to carry the weight of the extension stem. The extension stem shall be provided with a collar pinned to the stem and bearing against the stem thrust guide.

- .2 Extension stems for chemical resistant butterfly valves located in drainage sumps shall be the two-piece type with stainless steel stem, PVC housing, wall support, and collar. Unless otherwise indicated on the drawings, the length of the stem extension shall be as necessary to position the valve operator 300mm [12 inches] above the maximum liquid level in the immediate area.
- .3 Extension stems for buried valve actuators shall extend to within 150mm [6 inches] of the ground surface, shall be centered in the valve box using spacers, and shall be equipped with a wrench nut.
- .4 Extension stems for buried valve actuators shall be provided with position indicators as specified in the valve schedules.

2.6.2 Position Indicators: Unless otherwise specified, each valve actuator shall be provided with a position indicator to display the position of the plug or disc relative to the body seat opening:

- .1 For quarter turn plug, ball, or cone type valves installed in interior locations, the indicating pointer shall be mounted on the outer end of the valve operating shaft extension and shall operate over an indicating scale on the operating mechanism cover. Where the shaft passes through the cover, a suitable stuffing box or other seal shall be provided to prevent the entrance of water.
- .2 Each actuator for butterfly valves, except where located in manholes, buried, or submerged, shall have a valve disc position indicator mounted on the end of the valve shaft. A disc position indicator shall also be provided on each operating stand or the actuator mounted thereon.

2.7 Shop Painting

- 2.7.1 All ferrous metal surfaces, except bearing and finished surfaces and stainless steel components of valve actuators and accessories, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting.
- 2.7.2 The following surfaces shall be painted:

- | | | |
|----|--------------------------------|---------------------------|
| .1 | Polished or Machined Surfaces: | Rust Preventive compound. |
| .2 | Other Surfaces: | Epoxy enamel. |
| .3 | Actuators and Accessories: | Universal primer. |

3. **EXECUTION**

3.1 **Installation**

- 3.1.1 Actuators will be installed with valves in accordance with Section 11101.

END OF SECTION

1. GENERAL

1.1 Intent of Section

- 1.1.1 This section covers the supply, delivery, installation, testing and commissioning of one (1) horizontal split case pump with 350 mm discharge, 450 mm suction, 111 Kw (150 hp), 1180 RPM, 575V / 3 phase / 60 Hz motor, operating point 0.45 m³/s at 17 m TDH, NSF61 compliance.
- .1 An individual pumping unit comprises a pump, flexible coupling and electric motor mounted on a welded (fabricated) steel baseplate with all necessary tubing for supply of seal water (when seal water provided from external source, tubing shall be provided by installation contractor).
 - .2 The Equipment Supplier is responsible for the supply of the pumps, couplings and motors. All pumps, couplings and motors shall be preassembled on baseplates in the manufacturer's factory.
 - .3 The Equipment Supplier is responsible for overall coordination of the packaged pumping unit, compatibility of the motor and all associated equipment, spare parts, tools, operation and maintenance manuals to be supplied as part of the contract.
 - .4 The Equipment Supplier is to coordinate closely with the General Contractor and Engineer to expedite the design

review, manufacture, testing and delivery to the site to complete the project in the time specified.

1.2 Related Sections

- 1.2.1 DIVISION 1 – GENERAL REQUIREMENTS
- 1.2.2 DIVISION 3 – CONCRETE
- 1.2.3 Section 11010 – Equipment General Requirements
- 1.2.4 Section 11090 – Identification and Labelling of Equipment
- 1.2.5 DIVISION 13 – INSTRUMENTATION, CONTROL AND SCADA
- 1.2.6 DIVISION 16 – ELECTRICAL

1.3 Reference Standards

- 1.3.1 ANSI/AWWA Standard E103
- 1.3.2 ANSI/HI 1.1 – 1.5 Standards
- 1.3.3 ANSI/HI 1.6 Standard
- 1.3.4 ANSI/NSF Standard 61
- 1.3.5 ANSI/NEMA Standard MG-1
- 1.3.6 ANSI/NEMA Standard MG-2
- 1.3.7 CSA Standard C22.2 No. 100
- 1.3.8 IEEE Standard 112
- 1.3.9 Ontario Electrical Safety Code
- 1.3.10 ASME Codes
- 1.3.11 ASTM Standards

1.4 Equipment List

Item no.	Equipment name	Tag no.
1	Backwash Pump No. 2	500-P-14

1.5 Service Conditions

- 1.5.1 The following site operating and water quality conditions are to be used for all design calculations:
 - .1 Potable treated water
 - .2 pH: 6.5 to 8.0

- .3 Water temperature: 5°C to 25°C
- .4 Ambient temperature: 0°C to 35°C
- .5 Plant floor elevation: Approximately 272.03 m ASL
- .6 Fully enclosed facility

1.6 Shop Drawings

- 1.6.1 In addition to the submittals specified in Section 01330 – Submittals, provide the following information in accordance with Division 1:
- 1.6.2 Shop drawings of pumps specified in this section, including
 - .1 Certified performance curves developed for each individual pump for specified operating conditions indicating relationship between speed, capacity, head, shaft and input horsepower, pump and overall efficiency, and required NPSH; indicate the rated operating points on the curves.
 - .2 Detailed calculations of the pumping unit and motor.
 - .3 The foundation requirement design drawing including all loads static and dynamic and method of construction of apparatus and the general arrangement thereof, and, detailed assembly drawings.
 - .4 Detailed assembly drawings indicating materials to be used.
 - .5 Detailed drawing of the bearings and wearing rings.
 - .6 Detailed shop drawing for the impeller including all dimensions.
 - .7 Parts list complete with recommended parts list.
 - .8 Equipment weight.
 - .9 Factory certified test results as specified in this document.
 - .10 Provide all electrical equipment and control information.
- 1.6.3 Submit the above list of drawings, curves, specifications and other information for review to the Engineer prior to order. No fabrication order is to be given for such work unless the shop drawings are returned marked either 'Reviewed' or 'Reviewed as Noted'. Amend as required and resubmit for review any drawings marked "revise and resubmit" at no cost to the Owner prior to proceeding or ordering. The Owner will neither accept nor pay for any work unless the final review has taken place.
- 1.6.4 Submit all the above required drawings, curves, specification together at the same time in one (1) complete submittal.

1.7 SUBMITTALS FOR INFORMATION ONLY

- 1.7.1 Submit the following information in one complete submittal in accordance with Section 01330:
- .1 Operating and maintenance information in accordance with Section 01783 for each piece of equipment.

1.8 QUALITY CONTROL

- 1.8.1 To ensure unity of responsibility the complete pumping unit shall be supplied, tested and warranted by the Equipment Supplier.
- 1.8.2 The equipment specified under this section is to be standard pumping equipment manufactured by a company with no less than fifteen (15) years experience in the manufacturing of pumping equipment.
- 1.8.3 The manufacturer of the pumping units shall have a quality management system in place and shall be ISO 9001 certified.

1.9 Maintenance Data

- 1.9.1 Refer to Section 01780 – Closeout Procedures

2. PRODUCTS

2.1 FUNCTION

- 2.1.1 Filter backwash.

2.2 Acceptable Manufacturer

- 2.2.1 Goulds, Ruhrpumpen or approved equivalent.
- 2.2.2 The Contractor shall be responsible to ensure the selected pump's dimensions can be accommodated within the available space and shall adjust the piping configuration to suit.

2.3 Capacity and Performance

Rated Condition Duty point	Capacity [L/s]	TDH [m]	Speed (RPM)	Efficiency (%)	Motor (HP)
Primary	450	17	1180	75.5	150

Notes:

- a) Primary duty point will determine impeller diameter at Full speed.
- b) Best Efficiency Point (BEP) to be at/around the Primary duty point, preferably to the left of it.

- .1 Pump efficiency (hydraulic) at the BEP shall be guaranteed not be less than 75%. Overall efficiency (VFD excluded) at the BEP shall not be less than 70%.
- .2 Supply products modified as necessary to provide the specified features and to meet above specified operating conditions per each single pump.
- .3 The pumps shall be suitable for continuous operation.
- .4 Net Positive Suction Head (NPSHA) can be taken as “flooded suction” at normal operation.
- .5 The head-capacity curve to have a single flow rate for each pumping head value and have a continuously rising head characteristic to shut-off, sufficient to ensure stability and control for individual and parallel operation.
- .6 Proposed impeller diameter to be minimum 5% and maximum around 95% of the overall impeller diameter range for a given pump size.
- .7 The maximum speed specified for each pump shall not exceed the maximum specific speed recommended in the Hydraulic Institute Standards, for the specified total dynamic head and the suction head at design minimum suction head conditions. Notwithstanding this requirement, the pump shall be free from cavitation throughout the specified operating range.
- .8 The first critical speed of the pump shaft shall be at least 125% more than any pump operating speed.

2.4 Vibration Limit

- 2.4.1 Pumps have to satisfy requirements of ANSI/HI 9.6.4 Standard.
- 2.4.2 Field test, take, and record vibration measurements after new equipment is installed.
- 2.4.3 Balance all electrical motors and rotating mechanical equipment.
- 2.4.4 Without exception, all rotating equipment shall be checked and tested for vibration level to be within specified limit. Generally, the peak vibration velocity shall not exceed the limit indicated in the Figure 9.6.4.2.5.1b in ANSI/HI 9.6.4 – 2009. Measurement shall be carried out with a Real Time analyzer, Nicolet 100A or equal.
- 2.4.5 Provide hard copy Vibration Signature Spectrum showing vibration velocities over a frequency range of 0 to 2000 Hz, measured in a filter-in mode. Include this in each set of the Operations & Maintenance Manual.

2.5 Materials

- 2.5.1 Volute Casing: ASTM A48 Cast Iron, Class 35, 175 psi (12bar)
- 2.5.2 Impeller and impeller wear rings: ASTM A743 CF8M 316 SS
- 2.5.3 Volute casing: ASTM A48 Cast Iron Class 35 fitted with ASTM B584 C90300 Bronze wear rings.
- 2.5.4 Casing flanges: drilled to Class 125 or Class 250 per ANSI B16.1 standards.
- 2.5.5 External flush lines: ASTM A743 CF8 (304) stainless steel.
- 2.5.6 Dry shaft configuration, shaft sleeves made of ASTM A743 CF8M 316 SS.
- 2.5.7 Pump sealing: MR3 metal pusher seal.
- 2.5.8 Baseplate: structural carbon steel as per ASTM A36.
- 2.5.9 NSF/ANSI 61 & NSF/ANSI 372 – CSA Group Certified. All materials in contact with water shall be “acceptable materials” as per NSF 61 Annex C Table C1 or NSF 61 approved.
- 2.5.10 Heat treatment where necessary.
- 2.5.11 Material test pieces and test results
 - .1 Test pieces and samples of castings or forgings used in the pumping unit casing, shaft, impeller, wear rings, sleeves and glands shall be prepared and tested at no additional cost to this contract. Test pieces for castings shall be cast integral with the parts they represent, unless otherwise specially allowed. Test pieces for forgings shall be cut from full size prolongations of forgings, and shall receive the same treatment as forgings.
 - .2 Four (4) certified copies of chemical analyses and physical test results of materials entering the work shall be submitted to the Owner, with copies to the Engineer, immediately after the completion of each test.

2.6 Equipment Components

- 2.6.1 General
 - .1 All equipment shall be designed and built for the highest class of service.
 - .2 The unit shall be complete in every respect and shall include every part or adjunct customary or necessary for the highest degree of strength, durability and reliability and for absolutely continuous and efficient operation and most convenient maintenance. Its design shall embody the latest

developments of the art but shall possess adequate factors of safety. All parts of the pumping unit shall be designed to withstand the maximum mechanical and structural stresses to which they may be subjected in the course of the operation of the plant and shall withstand all such stresses without failure, fatigue, distortion or injury.

- .3 Design shown on the contract drawings is based on the first named equipment model. Site constraints may preclude other pumps. Contractor to verify field conditions and identify constraints before selecting a pump.

2.6.2 Design, Workmanship and Construction

- .1 The pump shall be designed and proportioned to have ample strength, stability and stiffness, and the arrangement of parts must be such as to allow ready accessibility for erection, inspection and repairs.
- .2 The pump shall be of rugged construction with a minimum number of parts and shall be designed in accordance with modern engineering theory and practice with high efficiency, dependable performance and low upkeep as the foremost desired results. The unit shall be designed for continuous operation at full rated capacity and at the highest guaranteed efficiency over a range of total head as indicated above.
- .3 The pump shall be well finished throughout. Both materials and workmanship shall be the best of their respective kinds. All materials used shall be selected because of their suitability for each particular duty. Castings shall be free from flaws and imperfections and machined surfaces shall be spot-faced for nuts. All similar parts shall be made to gauge wherever possible.
- .4 The inside and outside comers and edges of all castings shall, wherever possible, be rounded off with filler or chamfer.
- .5 Upon completion of the work in the shop, immediately furnish the Owner and the Engineer with a complete detailed list of the finished weight of the unit. The materials used for all parts of the units shall be the best available for the purpose intended. They shall comply with the ASTM Standards, unless otherwise provided.
- .6 The design shall be such that installation, replacements and general maintenance may be undertaken with the minimum of time and expense.
- .7 No patching, plugging, shimming or other means of overcoming defects, discrepancies or errors will be permitted without the written permission of the Owner. All threads, screws, flanges, bolts and nuts and other fittings of the

pumps shall be American Standard. ISO metric threads are acceptable.

2.6.3 Casing

- .1 The volute shall be of horizontal split case design with mounting feet integral cast into the bottom half of the casing. Suction and discharge flanges shall be on a common centerline in both horizontal and vertical planes. The volute shall include a priming port, gauge ports at inlet and discharge nozzles, drain ports, and a venting port. The upper casing shall be capable of being removed without disturbing piping connections or electrical motor connections.
- .2 The casing shall be of sufficient strength, weight, and thickness to ensure long life and reliable operation. The volute shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller and provide smooth unobstructed flow. The casing shall be hydrostatically tested to 1.5 times the maximum working pressure for 10 minutes.
- .3 Volute shall be made of ASTM A48 Cast Iron Class 35.
- .4 The casing shall be fitted with ASTM B584 C90300 bronze wear rings as standard.
- .5 Casing flanges shall support the max working pressure and design condition of the pump. Flange shall be drilled to Class 125 or Class 250 per AWWA C207 (Classes D and F) standards.

2.6.4 External Flush Lines

- .1 The pump shall be furnished with external flush lines mounted to the vent port located atop the upper casing. Flush lines shall feed directly to the seal chamber to lubricate and cool seal elements. Flush line elements shall be made of ASTM A743 CF8M (316) stainless steel.

2.6.5 Shaft and Shaft Sleeves

- .1 The impeller shaft shall be rigid with a non-stepped design and provide high resistance to shaft deflection. The impeller shaft shall be AISI standard 4140 steel and protected by 304 stainless steel shaft sleeves. The shaft sleeves shall completely protect the shaft from fluid handled by the pump. A seal shall be established by an FKM rubber O-ring and PTFE gasket. The shaft sleeve shall be locked into place with a sleeve nut that is threaded onto the shaft.
- .2 Shaft sleeve made of ASTM A743 CF8M (316 SS).

2.6.6 Bearing Housings:

- .1 Bearing housings shall support heavy duty, single-row, ball bearings. Bearings shall be regreasable. The inboard bearing will absorb thermal expansive forces while the outboard bearing will be locked into place to absorb radial and thrust loads. Bearings shall be replaceable without disturbing the system piping.
- .2 Both bearing housings shall contain two drilled ports for temperature monitoring and three ports for dual-axis vibration monitoring.
- .3 Bearings shall be designed for an L10 life of 100,000 hours at shutoff point.
- .4 Bearing housings shall be sealed with cast iron labyrinth seals.
- .5 The gap between the bearing housing and pump shall be fitted with a sheet metal shaft guard.
- .6 Bearings as standard shall be grease lubricated.

2.6.7 Baseplate

- .1 Baseplate shall be structural steel or fabricated steel channel with fully closed sides and ends. Cross members shall be securely welded and the grouting area shall be fully open.
- .2 Baseplate shall be field grouted.
- .3 The combined pump, motor and baseplate assembly shall be sufficiently stiff to limit vibration.
- .4 Baseplate shall be fitted with (8) motor alignment screws for standard motors above 215 frame size.

2.6.8 Coupling and Guard

- .1 Couplings shall be flexible non-spacer type, as TB Woods Duraflex®.
- .2 Couplings shall be shielded by an ANSI B11.19-2010, OSHA 1910.219, and ISO 14120:2015 compliant coupling guard. The guard shall be sheet metal, painted orange and completely protect all rotating elements between the motor and pump.
- .3 Coupling shall be factory aligned prior to shipment.

2.6.9 Pump Sealing

- .1 MR3 Metal Pusher Seal.

- .2 Pump shall be equipped with a pair of externally flushed mechanical seal assemblies.
- .3 Seal assemblies shall be balanced metal pusher type.
- .4 Seal assemblies as standard shall be Carbon/Silicon Carbide/EPDM where a carbon face rotates against a stationary Silicon Carbide face. Seal elastomers shall be made of EPDM rubber. Seal housing shall be 316 stainless steel construction.
- .5 The seal shall be rated up to 450 psig (31 BAR) working pressure.

2.6.10 Paint

- .1 Pump shall be painted with at least one coat of high-grade Gould Blue Water Reducible Air Dry Enamel paint under product code 72-3162 prior to shipment.

2.6.11 Accessories

- .1 Tapped Openings
 - .1 The pumps shall have tapped openings of ample size for the air relief, seal water, and drainage pipe connections. Also provide a total of two 12 mm (1/2 inch) diameter (or sized to suit the inserted devices as specified) tapped openings on the inside and outside pump sleeve line bearings for temperature measuring Resistance Temperature Detectors (RTD).
- .2 Pump Bearings Temperature Monitoring
 - .1 Provide Resistance Temperature Detectors (RTDs) along with their associated assemblies for each pump, to monitor the temperature of the pump bearings (inboard, outboard and thrust). These RTDs shall be a complete assembly.
 - .1 Provide oil seal adaptor, C/W grommet high temperature fitting(s) as required to attach the wiring to the sensor, flexible armour length and 90 degree bend, along with the RTD wires cut and end-protected at a length to suit the connection to the RTD junction box at the motor but not shorter than 3 meters. The cables shall be coiled and enclosed in a protective cover for the duration of the handling and shipping of the motor.
 - .2 It is suggested that the complete assembly be shipped by the Equipment Supplier loose for field installation by the General Contractor, so that any damage in transition would be avoided.

- .3 RTDs shall be headless.
- .4 The complete RTD assembly and cross section of connection to bearing shall be included in the shop drawings submittal.
- .2 Performance Test Pressure Measurement Taps
 - .1 Four pressure measurement taps shall be furnished by the installation contractor on each suction and discharge piping of each pump in accordance with the ANSI/HI 1.6 Standard. The pressure taps will be used for the measurement of head for the official acceptance tests for capacity and overall efficiency required for each pumping unit.
- .3 Vibration Monitoring
 - .1 Provision shall be made on the bearings to mount a vibration pickup as specified.
- .3 Small Pipe and Fittings
 - .1 All small piping associated with the pumping unit shall be of brass and installed in the shop. All tapped holes shall be fitted with bronze plugs.
- .4 City Water Piping
 - .1 The General Contractor shall provide piping as per Division 11.
- .5 Foundation Bolts
 - .1 Furnish and install all necessary 316L stainless steel bolts, nuts, plates and washers.
 - .2 Foundation bolts shall be provided and to set in concrete in accordance with contract drawings and the Equipment Supplier's printed recommendations.
- .6 Eyebolts
 - .1 Provide all necessary eye bolts for handling the various parts of the units, which parts shall include the pump case cover, bearing covers, pedestals and motor if special lifting hooks or arms etc. are required. Eye bolts shall be corrosion resistance.
- .7 Anchor Bolts
 - .1 Anchor bolts shall be supplied delivered and installed and shall be 304 stainless steel having ample size for the purpose intended.

- .8 Priming Control System
 - .1 There is no priming system in this arrangement.
- .9 Lubrication
 - .1 Provide approved lubricating devices of ample capacity for lubrication of all parts of the equipment furnished under this Contract.
 - .2 Lubrication and grease fittings, nipples, boxes, etc., shall be arranged so that they are readily accessible for routine greasing. The babbitt bearings shall be grease lubricated and sample tapping shall be supplied with a pet cock and shall be indicated on the Shop Drawings submitted by the Equipment Supplier.
 - .3 External oil pumping/piping lubrication system is not acceptable.
 - .4 Grease leakage splashing from pump/motor bearings will not be acceptable.
 - .5 Lubrication manuals in bound form shall be furnished. Material Safety Data Sheets (MSDS) are to be supplied with any lubricant on site.
- .10 Special Tools and Accessories
 - .1 With each different piece of equipment or machine having wearing parts and requiring periodical repairs and adjustment, there shall be furnished all special tools, wrenches and accessories required for removing worn parts, for carrying out maintenance for making such adjustments. There shall also be furnished all gauges, indicators, and lubricating devices necessary for the proper operation of machines whether or not such accessories are specified. Eye bolts or hooks shall be provided for the handling of equipment.

2.7 Control

- 2.7.1 Pump system shall be equipped with local control panel as shown on the drawings to be provided by the general contractor.
- 2.7.2 The local control panel shall be equipped with NEMA 4X enclosure and mounted adjacent to the pump.

2.8 Factory Testing

- 2.8.1 The following non-witnessed tests shall be performed:
 - .1 Performance test
 - .2 Hydrostatic test

2.8.2 The Owner reserves the right to witness tests by the Owner or Owner's representative. The Owner will bear the cost of travel and accommodation of witnessing person(s) to and at the manufacturer's test facility. The manufacturer will bear any internal additional cost to conduct witnessed tests. Provide at least (4) four weeks' notice to the Owner of impending pump tests so that proper travel arrangement can be made if required.

2.8.3 Performance Tests on Pumping Equipment

- .1 The official pump acceptance tests for capacity, head, overall efficiency, and the required net positive suction head as specified, will be undertaken. Performance tests shall be judged at specific impeller diameter (as per applicable Rated Condition Point), full job motor speed and rated capacity versus total head (TDH), efficiency and NPSHR.
- .2 Develop reduced speed performance data using full speed test results and pump affinity laws.
- .3 The pump performance tests shall be carried out in accordance with Hydraulic Institute Standards. The Equipment Supplier shall give notice of a shop test date.
- .4 Five (5) certified copies of the performance test report for the pump shall be submitted to the Owner, with one (1) copy to the Engineer, immediately following completion of the tests. The Owner will review the report and advise if it is acceptable. Do not ship the pumping equipment until the Owner has notified that the report is acceptable.

2.8.4 Pump Test Measurements

- .1 The official tests shall be conducted in accordance with the ANSI/HI 14.6 Standard Grade 1U.
- .2 Measurements of head will be made by means of calibrated gauges connected to piezometer connections as indicated in this section. No allowance will be made for losses of pressure that may occur between the gauges and the pump. Such losses will be considered as part of the pump performance.
- .3 Measurement of the torque input to pump will be made by measuring the electrical power input to the pump motor.
- .4 Measurement of the pump speed will be made by a tachometer or revolution counter and stopwatch or stroboscope.

2.8.5 Interior Inspection after Test

- .1 Provide a spare gasket (between the upper and lower half) with the supplied equipment.

2.8.6 Capacity Guarantees

- .1 The capacity of the unit shall be at least the capacity stated in this section when pumping against the pressures stated therein, and when operating at a speed stated by the Equipment Supplier herein.

2.8.7 Rejection of Pumping Unit

- .1 If the capacity of the pump, as shown by the official test, is less than the specified capacity when operating at the specified rated total head and rated speed, the Owner may, at his option, reject the unit.
- .2 If the overall efficiency of the pumping equipment, as shown by the official test, is more than three 3 percent below the minimum acceptable guaranteed overall efficiency, the Owner will reject the unit.
- .3 In the case of the rejection of the unit, the Equipment Supplier shall, without compensation, procure, install, commission, test, and provide a new unit that would comply with all the requirements in the contract document.

2.9 **Motor**

2.9.1 General

- .1 The design and construction of the motors shall be coordinated with the driven equipment (pump) manufacturer. The Equipment Supplier shall supply the electric motors along with the pumps as one fully functional assembly. Approved motor manufacturers:
 - .1 General Electric
 - .2 Toshiba
 - .3 Teco-Westinghouse
 - .4 Baldor
 - .5 Nidec
 - .6 Siemens
 - .7 WEG
- .2 The equipment shall be manufactured and tested in accordance with the following standards, where applicable:
 - .1 ANSI/NEMA Standard MG-I

- .2 ANSI/NEMA Standard MG-2
- .3 CSA Standard C22.2 No. 100
- .4 Institute of Electrical and Electronics Engineers (IEEE)
- .5 The American Standards Association (ANSI)
- .6 The American Standards Testing and Materials (ASTM)
- .3 All equipment shall be fully CSA approved or ULC listed for use in Ontario with certification label attached and will comply with the OESC.
- .4 Motor designed to rotate in one direction only shall have the direction of rotation marked by an arrow mounted visibly on the stator frame.
- .5 The leads shall be marked for phase sequence T1, T2 and T3, to correspond to the direction of rotation and supply voltage sequence.
- .6 The motor shall be horizontal shaft, totally enclosed fan cooled (TEFC), fully guarded, squirrel-cage induction type.

2.9.2 Power Supply ~ Characteristics

- .1 The motor shall be suitable to be connected to 600 V supply, 3 phase, 60 Hz. The normal and acceptable variances of the power supply characteristics shall be in accordance with Canadian Standards Association (CSA) Standards for utility companies operating in the Province of Ontario.
- .2 All motors shall be specifically suited for use with variable frequency drives.
- .3 The winding insulation shall be rated for inverter duty in accordance with NEMA MG1-Part 31 404.2.
- .4 Pumps and motors are expected to operate continuously in 60%-100% range of pump nominal speed.
- .5 Allowable maximum number of starts per hour – 6.

2.9.3 Motor Capacity

- .1 The rated brake horsepower of the motor shall be such that it will not be exceeded by the brake horsepower requirements of the pump at any point on the Equipment Supplier's head-discharge curves for the pumps specified in section 2.3 of this specification (non-overloading design).

2.9.4 Motor Operation

- .1 The motor shall be approved for inverter duty service and stamped accordingly on the motor name plate.

2.9.5 Motor Code Letter

- .1 The Motor Code Letter relates to the starting current, inrush or locked rotor current. The Motor Code Letter shall be Code G, 5.6-6.5 kVA per horse power, as defined by MG1. A code F motor shall be considered.

2.9.6 Motor Design

- .1 The Motor Design relates to the speed/torque characteristic. The Motor design shall be Design B as defined by MG1.

2.9.7 Motor Insulation

- .1 Insulation shall be IEEE Class "F". The stator coils shall be of the form wound type, and shall be continuously taped over the entire coil with mica and glass tape. The complete wound stator shall be impregnated with resilient synthetic resin by a post vacuum and pressure process or equivalent.

2.9.8 Power Connection Box

- .1 The motor shall be equipped with an approved **oversized** connection box, gasketed CSA Type 12 enclosure, which can be field-rotated, suitable hubs and have provision for connection of ground cable.
- .2 All motor leads and their terminals shall be sized, rated and permanently marked according with NEMA MG-I standard.

2.9.9 Grounding Ring

- .1 Provide shaft grounding ring for each motor.

2.9.10 Service Factor and Temperature Rise

- .1 The motor shall be designed for 1.15 service factor (SF). When operating at service factor, and at a standard ambient temperature of 40°C, the risen temperature of the hottest windings shall not exceed 105°C measured by resistance.

2.9.11 Efficiency

- .1 Testing methods shall be done in accordance with IEEE 112 - Test Method B, and NEMA MG1 for establishing the value of the motor's efficiency.
- .2 The NEMA nominal motor efficiency at full load shall be not lower than 95%.

2.9.12 Bearings Grease System

- .1 Antifriction Type 100,000 hours L-10 bearing life. Provide grease lubricated bearings with alemite type fittings and relief plugs. Design bearings with adequate allowance for thrust and vibration.
- .2 Grease leakage or splashing from motor bearings will not be acceptable.
- .3 Grease shall meet requirements for NSF 61.

2.9.13 Winding - Temperature Monitoring

- .1 Provide a total of six (6) stator mounted resistance temperature detectors (RTD), two per phase, each embedded in the stator winding of the motor.
- .2 Each RTD shall be Platinum - 100 ohm @ 0°C (PT100), class B accuracy, single 3-wire sensor, minimum 200°C rated. Each RTD will include a sufficient length of lead wire for factory termination to a motor mounted terminal box.

2.9.14 Vibration

- .1 The motor design shall be such that the motor vibrations (dynamic balance) shall be limited in accordance with the latest NEMA Standard Specification for Balance of Motors, MG1-20.22, when measured in accordance with MG1-20.S3.

2.9.15 Quiet Operation

- .1 Motor shall be specially designed and constructed for quiet operation.
- .2 Motors sound pressure level shall be determined from:
 - .1 The overall sound pressure level measurements taken on 'A' weighting network, at eight or more locations evenly spaced around the motor and 1.5 metres from the nearest part of the motor.
 - .2 The frequency analysis for the highest of the eight locations mentioned under Item I, using C-weighting network of an octave band analyzer over a range from 125 Hz to 8,000 Hz centre frequency, or wider range.
- .3 The sound pressure level of 85 dB shall not be exceeded by any of the readings, corrected for instrument calibration, ambient noise and test room acoustic constant. The noise tests shall be conducted, recorded and evaluated in accordance with IEEE "Test Procedure for Airborne Noise Measurement on Rotating Electric Machinery", Publication No. 85, latest issue, or NEMA MG1/ANSI S12.51. Complete

test data, including mounting and location sketches, shall be forwarded in certified form with the other motor test documents.

2.9.16 Design, Construction Feature and Special Requirements

- .1 The design and manufacture shall be in accordance with the highest standards of modern practice. The design and construction of stator, rotor, frame and shaft shall be such as to secure mechanical rigidity, to prevent distortion. Limit the vibration on the shaft and bearings to less than two mil, to minimize noise, to secure static and dynamic balance in rotating parts, and to provide ample margins of safety under all conditions of operations.
- .2 The motor shall be self-ventilating by means of suitable fan located on the rotor. The fan shall be rigidly secured in position and designed to meet the sound level limitations specified in this specification.
- .3 Both end shields shall be split on the horizontal centre line of the motor and both halves of each end shield shall be removable without the necessity of removing either bearing off its pedestal or provide split end shields suitable to remove top half only without removing motor bearings.
- .4 The motor shaft shall be of high tensile, rolled steel, turned all over and designed with an ample margin for all stresses.

2.9.17 Painting

- .1 All surfaces shall be clean and smooth and all casting shall be thoroughly cleaned and smoothed before painting. Surface preparation shall conform to Specification SSPC-SP-6 "Commercial Blast Cleaning". All external surfaces shall be given one shop coat of an approved inorganic zinc rich primer to be compatible with a finish coat of component epoxy finish paint before shipment. Finished painting will be performed by others. All internal surfaces of the motor shall be cleaned and given one shop coat of an approved primer and three approved finish coats.
- .2 Finished surfaces shall be well coated with grease or anti-rust compound before shipment.
- .3 Any unpainted metallic fittings shall be of stainless steel or other approved non-rusting material.

2.9.18 Motor Factory Testing Requirements

- .1 Perform complete Factory Acceptance Testing (FAT). All tests shall be performed at the factory or in such location where all the required electrical facilities are present and full

access to the participants to safely participate and/or witness the FAT is allowed. The FAT protocol shall be designed such that it will be able to determine that the motor is free from electrical or mechanical defects and to provide assurance that it meets the specified requirements.

- .2 Since the motor is supplied at a voltage in excess of 600 VAC, it shall be tested by routine tests listed in NEMA MG-1 standards under the large machine testing. In addition to that, the following tests shall be performed and documented by the Equipment Supplier as part of the Factory Acceptance Test:
- .3 Locked-rotor current at fractional voltage.
- .4 Length of time of bearing tests and final bearing temperatures.
- .5 A statement that the bearings have been inspected and approved for shipment.
- .6 Final value of noise levels including a statement that there is no objectionable single frequency level.
- .7 Efficiency at 50%, 75% and 100% load.
- .8 Power factor at 50%, 75% and 100% load.
- .9 Winding Temperature (the hottest winding RTD per phase shall be identified).
- .10 Motor temperature (resistance) chart.
- .11 Slip RPM and percent slip at full load.
- .12 No load saturation curve.
- .13 Measured vibration at critical points.
- .14 Phase and ground insulation resistance.
- .15 Starting kW and kVA at rated voltage and frequency.
- .16 Temperature rise following six (6) hours of operation at rated voltage and full load.
- .17 Submit motor data including acceptable operating ranges for bearing and winding temperatures, voltage, current, etc. for approval by the Owner prior to construction. The Equipment Supplier shall submit a full scope motor data report complete with FAT results to the Owner. The shipment of equipment shall be released only when approved by the Owner and only based on the successful completion of the FAT.

- .18 Submit FAT report test results in a spreadsheet format that includes Test Description, Actual Test Measurements, Acceptable Standardized Values, Reference to Testing Standard used and any other pertinent information. In addition to the results of all required tests, the FAT report shall include the full load characteristics of the motor which shall be determined by calculation based on the input measurements, from non-witnessed complete initial test per IEEE Standard 112, Method B.
- .19 The test results shall meet the limits specified herein.
- .20 Present the proper documentation to indicate that measurement was taken during the tests and recorded on the outline drawing showing the position of the rotor in the magnetic centre of the motor. It shall be measured from the coupling end of the shaft to the outside face of the nearest bearing.
- .21 Submit five (5) certified copies of the FAT report promptly to the Owner, with one (1) copy to the Engineer. In addition, take measurements during the tests and record on the outline drawing showing the position of the rotor in the magnetic centre of the motor. It shall be measured from the coupling end of the shaft to the outside face of the nearest bearing.

2.9.19 Testing

- .1 The supplier shall inform the Owner of the full testing scope of work (full FAT protocol shall be submitted, reviewed and agreed to by the Owner as a pre-requisite to scheduling the FAT) including site and the dates/times that they will take place so that the Owner's representative may witness the tests. The Equipment Supplier shall give the Owner at least (4) four weeks' notice of the date on which the motor testing will take place. Witnessing of the factory tests by the Engineer shall not absolve the Equipment Supplier of responsibilities under this contract.

3. **EXECUTION**

3.1 **Installation of Equipment**

- 3.1.1 Physical installation will be performed by the General Contractor, with supervision by the pump Equipment Suppliers.
- 3.1.2 Equipment Supplier to
 - .1 Be responsible for ascertaining and confirming the exact pump unit setting length. The setting length shall be confirmed by site measurement prior to manufacturing the pumps.

- .2 Certify in writing when the installation and operation is satisfactory, and that the units are available for operation.
 - .3 Be responsible for coordinating the work with the Owner, the General Contractor, and the Engineer, in advance, when each phase of the work is to be started to ensure that the Equipment Supplier's representative is on site.
 - .4 Provide the services of a qualified technical Equipment Supplier's representative, skilled and experienced in the manufacture, assembly, installation, testing and operation of all equipment supplied to supervise the installation of the pumping equipment for a minimum of five (5) days.
- 3.1.3 After the installation of pump, during start-up and commissioning phase of the project, General Contractor shall commission an independent third party specialist to carry out vibration analysis of the pump, with pump running and under load. A report shall be submitted to confirm that the installation meets current City tolerances and manufacturer's requirements.

3.2 Testing

- 3.2.1 After installation, test pumps at full speed to demonstrate compliance with operating requirements as specified in this Section.
- 3.2.2 Provide the services of a qualified technical Equipment Supplier's representatives for the pumps and motors. Provide for a minimum of five (5) days for witness testing of the pump units and the associated VFD equipment.
- 3.2.3 Once the Equipment Supplier's technical representatives have advised that equipment installation is in order then advise in writing that the system can be operated.
- 3.2.4 The Owner will directly engage services of an independent third party to witness and participate in the site testing.
- 3.2.5 Conduct pump performance test using field instruments and over the full range of anticipated pump operating conditions, including various positions of discharge valve and at various pump speeds, generally to simulate conditions of the factory test.
- 3.2.6 Make necessary provisions to improve pump performance if the pump test falls below the factory test results.

3.3 Start-up and Commissioning

- 3.3.1 The General Contractor shall disinfect the installed pump with sodium hypochlorite solution according to Division 1 before putting the pumps in service.
- 3.3.2 Commission in accordance with Section 01810.

- 3.3.3 Arrange with the equipment suppliers for the provision of qualified technical representatives, skilled and experienced in the manufacture, assembly, installation, testing and operation of all equipment supplied to fully commission the pumping equipment. Allow for a minimum of fourteen (14) days for commissioning.

3.4 Training

- 3.4.1 Follow training requirements specified in Section 01820.

END OF SECTION

1. GENERAL

1.1 Intent of Section

- 1.1.1 This Section covers the installation and commissioning pre-purchased new High Lift Pumps 6 and 7, as manufactured by Ruhrpumpen and represented by Nevtro.
- 1.1.2 The work includes the supply, delivery, installation, on-site testing, commissioning and training for the specified equipment in accordance with attached "Request for Proposal No. PW-002 High Lift Water Pump 06-REV1" and "Request for Proposal No. PW-002 High Lift Water Pump 07-REV0" documents and as shown on drawings.
- 1.1.3 To maintain pump warranty from pump manufacturer "Ruhrpumpen", general contractor must retain a Ruhrpumpen certified installer and to oversee installation.
- 1.1.4 Contractor shall carry the cost to provide manufacturer services for installation, commissioning, testing, and training.
- 1.1.5 Contractor shall carry the cost to provide a 1-year warranty from the date of substantial performance of the contract.

1.2 Related Sections

- 1.2.1 Division 1 – General Requirements
- 1.2.2 Section 01810 – Testing and Commissioning
- 1.2.3 Section 11010 – Equipment General Requirements
- 1.2.4 Section 11101 – Piping, Valves and Fittings
- 1.2.5 Division 13 – Instrumentation, Control and SCADA
- 1.2.6 Division 16 - Electrical
- 1.2.7 Specification Technical Appendices:
 - .1 Request for Proposal No. PW-002 High Lift Water Pump 06-REV1
 - .2 Request for Proposal No. PW-002 High Lift Water Pump 07-REV0
 - .3 Ruhrpumpen Drawing-General Arrangement ZW 12X10X20A Dwg. # 77087670868 Rev. C for HLP#7 (to use for dimensions)
 - .4 Ruhrpumpen Drawing-General Arrangement ZW 12X10X20A Dwg. # 7708670882 Rev. E for HLP#6 (rotation of suction/discharge)

- .5 GE Industrial Motors Outline Quantum Rev. 002 (motor dimensions)

1.3 Scope

- 1.3.1 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.
- 1.3.2 In general, the Contractor shall provide the following work:
 - .1 Coordinate with the pre-purchased equipment Supplier, the scope of work for all requirements specified herein and Contract Document for pre-purchase.
 - .2 Inspect with manufacturer condition of pre-purchased equipment on site.
 - .3 Take receipt of and be responsible for pre-purchased equipment.
 - .4 Installation of the pre-purchase 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.

1.4 Storage of Equipment

- 1.4.1 Assume the costs incurred from the date that the pre-purchased equipment is accepted by the contractor and maintain the equipment in proper storage.
- 1.4.2 After receipt and acceptance, provide routine maintenance on all pre-purchased equipment as required by the equipment supplier.

1.5 General

- 1.5.1 Equipment provided under this section shall be fabricated, assembled, 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 the Engineer.
- 1.5.2 General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section in accordance with Section 01610 – Basic Product Requirements.

- 1.5.3 Equipment Schedule. Manufacturer's field services, operation and maintenance manuals, and certificates of compliance shall be provided for all items of equipment furnished under this contract.
- 1.5.4 The Equipment Supplier shall coordinate with the General Contractor during installation to verify functionality and performance of the pumps.
- 1.5.5 The General Contractor will be responsible for the complete installation and coordinate with the pump manufacturer for installation checks, start-up, commissioning, and training.
- 1.5.6 Power Supply. Power supply to equipment will be 575 volts, 60 Hz, 3 phase, and 3 wire.

1.6 Coordination

- 1.6.1 Contractor shall review equipment submittals and coordinate with the requirements of the Work and the Contract Documents. Contractor accepts sole responsibility for determining and verifying all quantities, dimensions, and field construction criteria.
- 1.6.2 Flanged connections to equipment including the bolts, nuts, and gaskets are covered in the appropriate pipe specification section.
- 1.6.3 Refer to the manufacturer's shop drawings to confirm the Contractor's scope of work which may not be specified in the tender drawings or specifications. Except for the items specified on the shop drawings, the Contractor shall supply the required pipes, valves, fittings, insert sleeves, spools and all other appurtenances to install the complete high lift pumping systems presented on the tender drawings.

1.7 Applicable Codes and Standards

- 1.7.1 Comply with the applicable reference codes, standards and specifications as specified in Division 1 – General Requirements.
- 1.7.2 Requirements from the following organizations shall be considered as a minimum. The Contract Documents represent the minimum acceptable standards for the pump equipment for this project.
- 1.7.3 Where noted, refer to the latest edition of reference and standards.
 - .1 American Society for Testing and Materials (ASTM).
 - .2 American Society of Mechanical Engineers (ASME).
 - .3 Canadian Standards Association (CSA).
 - .4 Institute of Electrical and Electronic Engineers (IEEE).
 - .5 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

- .6 American Gear Manufacturers Association (AGMA).
- .7 Instrument Society of America (ISA)
- .8 Ontario Electrical Safety Code (OESC).
- .9 Short Circuit Current Rating (SCCR)

2. PRODUCTS

2.1 General

- 2.1.1 The Contractor will be free issued Equipment originally supplied as per Technical Appendix Documents
- 2.1.2 Equipment layout shall comply with process drawings and P&IDs.
- 2.1.3 Provide all products required to complete the work under this section, except where specifically designated as provided by pump manufacturer. This designation is described in the Drawings and Procurement Contract Documents.
- 2.1.4 Provide a set of spare parts as recommended by the pump manufacturer.

2.2 Electrical Components and Accessories

- 2.2.1 Provide all necessary electrical components and wiring for a complete and functional system. Electrical components shall be provided in accordance with the requirements of Division 16 – Electrical.
- 2.2.2 The Contractor shall be responsible for supply, installation, landing, terminating, labelling, testing, and connecting all cables and conductors from the electrical power source to furnished PLC control panels.
- 2.2.3 The Contractor shall be responsible for supply and installation of all power and instrumentation wiring, conduit and associated appurtenances as required between the field devices, Plant PLC control panels, and furnished PLC control panels. Refer to Division 13 – Instrumentation and Control.

3. EXECUTION

3.1 Product Delivery, Storage and Handling

- 3.1.1 In accordance with Section 11010 – Equipment General Requirements.
- 3.1.2 All parts shall be properly protected so that no damage or deterioration will occur during handling and installation.

- 3.1.3 Finished surfaces of all exposed flanges shall be protected by fiberboard blank flanges strongly built and securely bolted thereto.
- 3.1.4 The Contractor shall ensure that the equipment is stored indoors.

3.2 Installation and Field Quality Control

- 3.2.1 Installation of equipment as per Section 11000 and Manufacturer's installation manual and instructions.
- 3.2.2 To maintain pump warranty from pump manufacturer "Ruhrpumpen", general contractor must retain a Ruhrpumpen certified installer. Recommended certified installer contact: Nevtro (Steve Foster, account manager: steve@nevtro.com)
- 3.2.3 High Lift Pump 6 and 7 are identical except the opposite suction and discharge orientation. The weight of pump components are as follows:
 - .1 Pump = 2,000 lbs (907 kg)
 - .2 Motor = 5,102 lbs (2314 kg)
 - .3 Baseplate = 1,175 lbs (533 kg)
- 3.2.4 Both pumps have been disassembled into the above components and are being stored onsite. Logistics on moving the parts to their respective rooms to be installed are the responsibility of the contractor.
- 3.2.5 For High Lift Pump 7, the overhead crane capacity is 2 tonnes (4,400 lbs). There is a 990 x 990 mm (39" x 39") squared skylight above the HLP area that may be used to bring in the motor using a crane.
- 3.2.6 For the High Lift Pump 6, an outer wood entryway in that room can be dismantled temporarily during installation. The gantry crane capacity is 2 tonnes (4,400 lbs). However, due to the roof structure, the gantry crane capacity has to consider snow loads during winter season.
- 3.2.7 Contractor is responsible to verify measurements and confirm methods of bringing all related pump components into their respective rooms for installation.
- 3.2.8 Field Evaluation Tests. A performance test shall be run on the pumps and electrical control panels after the installation is completed to ensure the pumps are operating properly as determined by the representative of the equipment manufacturer. The Owner's operating personnel shall assist the manufacturer's representative in the performance test. A designated representative of the Owner and/or the Site Inspector / Contractor Administrator shall observe the performance test.

- 3.2.9 At least two (2) weeks prior to the proposed testing date, the Contractor shall notify the Site Inspector / Contractor Administrator of the testing date and shall submit a report from the equipment manufacturer detailing the proposed performance testing procedure and analyses. Testing shall be performed between 8:00 a.m. and 5:00 p.m. and shall begin on Monday or Tuesday. If more than one (1) day of testing is required, the testing shall be done on consecutive days. The Site Inspector / Contractor Administrator's initial observation of tests shall be at the Owner's expense. All costs of subsequent visits by the Site Inspector / Contractor Administrator to witness or observe additional tests necessary because of failure of the initial tests or inability to conduct the initial tests will be at no extra cost to the Owner.
- 3.2.10 The following field-testing shall be conducted:
- .1 The contractor shall retain a third party vibration specialist to conduct a vibration analysis.
 - .2 Startup, checks, and operates the pump system over its entire speed range. Vibration shall be within the amplitude limits recommended by the ANSI/HI 9.6.4 at a minimum of three pumping conditions between design flow and minimum continuous stable flow.
 - .3 Obtain concurrent readings of motor voltage, amperage, pump discharge head for at least three pumping conditions at each pump rotational speed. Check each power lead to the motor for proper current balance.
 - .4 Bearing Temperature: Bearing temperature not to exceed 180 degrees F.
 - .5 Test Duration: Not less than two hours of continuous operation at each condition specified and indicated.
 - .6 Run each pump for minimum 30 minutes prior to taking temperature readings of the pumps, motors, and shafting.
 - .7 Each pump shall be tested through a single project flow meter.
 - .8 The pumps will be tested and monitored during 14 days of performance and reliability run test period.
- 3.2.11 Should the equipment not achieve consistent compliance during the tests, and then the manufacturer shall modify the equipment and repeat the field evaluation tests. Costs of modifying equipment, reducing or furnishing additional equipment, or subsequent retesting shall be borne by the manufacturer. Additional equipment shall include all items specified or indicted to be part of the conveying system. Should the equipment fail to

meet all the design requirements after retesting, the equipment shall be rejected and shall be replaced by the Construction Contractor at the manufacturer's expense with acceptable equipment at no additional cost to the Owner.

- 3.2.12 Performance Test and Field Evaluation Report. The manufacturer shall prepare a formal test report, including all measured data and other recorded data and observations. Six (6) copies of the report shall be submitted to the Engineer within 30 days after completion of the tests.

3.3 Training

- 3.3.1 Training shall be provided in accordance with the general requirements specified as per Section 01820 – Demonstration and Training.

3.4 Certificate of Installation

- 3.4.1 On satisfactory completion of installation, start-up, Commissioning, testing and training, submit to the Engineer the Equipment Supplier's certification of the correctness of installation for each piece of equipment.
- 3.4.2 Certification from the Equipment Suppliers to state that the equipment is installed correctly, is in full operating condition, and is operating in accordance with its design rating.
- 3.4.3 Submit the original certificates to the Engineer. Certificates is to include a statement to the effect that any adjoining pipe is properly and independently supported so as not to cause undue stress that would, otherwise, be detrimental to the equipment performance.

3.5 Warranty

- 3.5.1 Refer to the Supplementary Terms and Conditions for Warranty. As stated, the 2-year warranty will start at the end of substantial performance of the work. Contractor to obtain extended warranty from pump manufacturer and carry corresponding costs in their bid.
- 3.5.2 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 any 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.
- 3.5.3 First Year Inspection. Each unit shall be inspected at the end of the first year 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.

- 3.5.4 Final Inspection. Each unit shall be inspected at the end of the 2 year 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.
- 3.5.5 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 – CONTROL AND INSTRUMENTATION

DIVISION 13 – CONTROL AND INSTRUMENTATION

Section No.	Title
13110	SCADA Integration Services
13560	Instrumentation General Requirements
13563	Pressure and Level Instruments
13566	Ultrasonic Flow Meter

1. GENERAL

1.1 RELATED SECTIONS

- 1.1.1 Section 13560 – Instrumentation General Requirements

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 Work shall be coordinated with the work from the Control System Supplier (CSS) as required.
- 1.2.3 The contractor shall retain Lakeside Process Controls as CSIP and CSS.
- 1.2.4 It is the intent of this section to provide an industrial control system (i.e. SCADA) 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.
- 1.2.5 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 Automation System Control Narrative (ASCN), based on the process performance requirements outlined in the Process Control Narrative. The ASCN is to include but not be limited to the following information:
1. Describe each process to be monitored and/or controlled by the Timmins WFP 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 Operator Interface Terminal (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, 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.
- 1.3.7 The CSIP shall provide the software, programs, parameter and hardware settings as required to integrate the following new systems into the City of Timmins overall SCADA system:
 1. PLC Control Panel CP-A, CP-B, CP-C.
 2. Flow Meter
 3. Backwash pump and control valves
 4. High lift pump 6 and 7
 5. Misc. Instrumentation

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 CSS and executing the verification of the SCADA system including all DSC control panels, communication panels, and associated communication links provided as part of this project.
 - .2 Providing and implementing test DSC programming to verify and demonstrate that all new DSC'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 Control Narrative.
 - .7 Development of the custom graphical user interface application for the purpose of control and monitoring.
 - .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 City of Timmins.
- .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 Timmins WFP or another location specified by the City of Timmins.
- .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 City of Timmins 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 Timmins WFP.
- .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 as per the City of Timmins Standards and Specifications.
- .4 Graphical animations shall conform to the City of Timmins Standards and Specifications.
- .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 the City of Timmins Standards and Specifications.

1.7.5 Reports:

- .1 Reporting files shall conform to the City of Timmins Standards and Specifications.

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 facilities 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 (Produced by the CSS)
 - .2 Equipment submittals for PLC's, SCADA HMI, communications modules (Produced by the CSS)
 - .3 List of SCADA HMI software and software licences in the name of the City of Timmins.
 - .4 CSIP control narrative.
 - .5 Listing of all CSIP and/or CSS supplied equipment & instrumentation
 - .6 Listing of all CSIP PLC I/O.
- .4 Meeting One (1)
 - .1 Establish PLC programming conventions that will facilitate the remote control and monitoring of the processes via Timmins WFP HMI SCADA computer application.
 - .1 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 the City of Timmins Water and Wastewater SCADA System Standards.
 - .2 Discuss and determine if the established HMI conventions for the Timmins WFP HMI computer application are within technical limits of the HMI software.
 - .3 The CSIP shall produce preliminary 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 City of Timmins and/or the Engineer can request changes to the HMI and ask for additional meetings.
 - .4 Confirm that the tagging conventions are in accordance with the project requirements.
 - .5 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.
 - .1 Provide proposed tagging convention for all real/virtual signals, to be included in the PLC programming, and SCADA HMI application
 - .2 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.
 - .3 The CSIP shall implement all final comments identified by the Owner and Engineer.
 - .4 The PLC programming coordination will be held during the same trip as the integration meetings described in this document.
 - .5 If necessary, the CSIP shall move data to contiguous memory locations within the PLC for more efficient Timmins WFP system access.
 - .6 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.
 - .7 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 City of Timmins for their non-exclusive, royalty-free 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 a ASCN 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 pre-approved system integrator for this project is:

Lakeside Process Controls Ltd

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 Timmins WFP (or another location that may be specified by the City of Timmins) 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
New SCADA System	Two (2) separate sessions each for PLC/SCADA, HMI applications, Historian, Reporting, alarming and vendor supplied packages; duration as required

END OF SECTION

1. GENERAL

1.1 Related Sections

- 1.1.1 Section 01330 – Submittal Procedures
- 1.1.2 Section 01820 – Demonstration and Training
- 1.1.3 Section 11190 – Pipe and Valve Supports
- 1.1.4 Section 16010 – Electrical General Requirements

1.2 Scope

- 1.2.1 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.
- 1.2.2 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.
- 1.2.3 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.

1.3 General

- 1.3.1 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.
- 1.3.2 Refer to Division 1 specifications for general equipment requirements which shall apply to all equipment furnished under this section.
- 1.3.3 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.
- 1.3.4 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.
- 1.3.5 Elevation and Temperature. All instruments shall be designed to operate within a range of elevation and temperature as required.

- 1.3.6 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.
- 1.3.7 Unless otherwise indicated, all transmitted electronic analog instrument signals shall be 4-20 mA DC and shall be linear with the measured variable.
- 1.3.8 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.
- 1.3.9 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.
- 1.3.10 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 City of Timmins at completion of startup.
- 1.3.11 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. Refer to specification section 16090 for more information.
- 1.3.12 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 wet areas shall be NEMA 4.
- 1.3.13 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

- 1.4.1 Submittals shall be as required in Section 01330 – Submittal.
- 1.4.2 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

- 1.5.1 Delivery, storage and shipping shall be as required in Division 1.

1.6 Spare Parts

- 1.6.1 Spare parts shall be provided as following: duplicated full set of lamps for indicating lights, terminal blocks, fuses, breakers, relays and timers.
- 1.6.2 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

- 2.1.1 Individual instruments and related devices shall be provided as specified in the following sections:
- 2.1.2 Section 11190 – Pipe, Valve and Instrument Supports

3. EXECUTION

3.1 Instrumentation Installation Requirements

- 3.1.1 Instrumentation field wiring shall be continuous, no splices.
- 3.1.2 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.
- 3.1.3 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.
- 3.1.4 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.
- 3.1.5 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.
- 3.1.6 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 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.
 - .2 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.

- .3 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.
- .4 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.
- .5 When drilling or installing conduit entry points in instruments, protect internally mounted equipment from vibration, shock and metal filings. Conduit entries must maintain the equipment or panel EEMAC rating.
- .6 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.
- .7 All instruments shall be provided with isolation valves.
- .8 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.
- .9 Sensing and sample lines shall be run in ½" stainless steel tubing with "Swagelok" compression type fittings.
- .10 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.
- .11 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.
- .12 Instrument support brackets shall not be welded to process piping or equipment, but should generally be pedestal or wall mounted.
- .13 Field cables for analogue signals shall be TECK90 from 120V AC/24VDC control or 120VAC power supply cables.
- .14 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.

- .15 Junction boxes may be FRP (fiberglass 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.
- .16 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. Keepers shall be installed immediately on all panel circuit breakers powering instruments.
- .17 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.

3.2 Customer Training

- 3.2.1 Provide Instrumentation training in accordance with Section 01820 Demonstration and Training.

3.3 Forms

- 3.3.1 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 (Supply and 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			
<u>START-UP</u>			
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	
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Contractor

Supplier

Date

Date

Consultant

Region/Operator

Date

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	
Differential Pressure		Density	
Flow		Dissolved Oxygen	
Level		Gas monitoring	
Weight		Others	
Type			
4-20 mA		0-100 VDC	
0-20 mA		Digital Input	
1-5 VDC			
Power Source			
120 VAC		Dry Contact	
24 VDC			

[illegible]

Inspection Result	Passed Installation and Start-up checkout. Equipment certified ready for service		Failed – Contractor to schedule equipment re-inspection	
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Contractor

Supplier

Date

Date

Consultant

Region/Operator

Date

Date

END OF SECTION

1. GENERAL

1.1 Related Sections

- 1.1.1 Division 1 – All Sections
- 1.1.2 Section 13100 – Control & Instrumentation
- 1.1.3 Section 13560 – Instrumentation General Requirements
- 1.1.4 Section 16010 – General Electrical Requirements

1.2 Scope

- 1.2.1 This section covers the furnishing of all pressure and level instruments and accessories required for the Control and Instrumentation System as indicated on the drawings or on the Instrument Device Schedule.
- 1.2.2 Equipment and services provided under this section shall be subject to the General Instrumentation Requirements specified in Section 13560. This section shall be used and referenced only in conjunction with Section 13560. Supplementing Section 13560, instrument data, special requirements, and options are indicated on the drawings or the Instrument Device Schedule.

- 1.2.3 The Contractor shall install the instruments on the locations as shown on the Contract Drawings and provide all signal and power cables. If the cables are not presented on the Contract Drawings, the Contractor shall coordinate with the Engineer, the installation location, but no extra cost of the installation is allowed.

1.3 Design Criteria

- 1.3.1 Instrumentation is to be wired in the manner shown in the Instrumentation Loop Drawings in the Contract Drawings set and Specs. In the event of a wiring discrepancy between the instrumentation and the Contract Drawings, the Contractor is to ask the Engineer for Direction.
- 1.3.2 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.
- 1.3.3 Primary elements shall derive any required power from the transmitter, unless otherwise indicated.
- 1.3.4 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.
- 1.3.5 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 13100.

1.5 Shipment, Protection, and Storage

- 1.5.1 Equipment provided under this section shall be shipped, protected, and stored in accordance with the requirements of Section 13560. Identification of packaging shall be as described in Section 13560.
- 1.5.2 Cleaning. Instruments indicated to be utilized in oxygen, ozone, or similar service shall be cleaned for oxygen service, labeled appropriately, and bagged or packaged as necessary to ensure the instrument will remain suitable for insertion in the process during installation. Any special mounting or installation requirements

associated with such instruments shall be detailed on tags attached to the instrument.

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 for the City facility. 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.
- 2.1.4 The programming device shall be complete, newly purchased for this project, and shall be in like-new condition when turned over to the City at completion of startup.
- 2.1.5 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 the City facility. Software shall be capable of running under Microsoft's Windows 11, Windows 10, Windows 8, Windows 7, and Windows XP operating system.

2.2 Pressure Transmitters

- 2.2.1 "Smart" Pressure Transmitters. Transmitters shall have "smart" electronic circuitry and shall be of the two-wire type. Process fluid shall be isolated from the sensing elements by AISI Type 316 stainless steel, and the transducer may use a silicone oil fluid fill. Transmitters shall have self-diagnostics and electronically adjustable span, zero, and damping. Transmitters shall at minimum be enclosed in a NEMA Type 4 housing. Transmitters shall meet the following performance/operation conditions:

Accuracy:	+/- 0.1% of calibrated span
Repeatability:	+/- 0.5% of range
Response time:	0.5 seconds for one time constant
Warm up time:	< 5 seconds
Temperature effects:	+/-0.5% of span for 56°C
Vibration effect:	+/-0.05% of range per g to 200Hz in any axis
Power Supply effect:	Less than 0.005% of calibrated span per volt
Rangeability:	100:1
Sensor Temperature Range:	-40 to 150°C
Electronic Temperature Range:	-40 to 85°C
Relative Humidity:	5 to 100%
Transmitter Span:	Determined by the process

- .1 All parts shall be cadmium plated carbon steel, stainless steel, or other corrosion-resistant materials. Process flanges, adapters, isolating diaphragm, drain and vent valves shall be 316 stainless steel for all applications. Transmitters shall have over-range protection to maximum line pressure. Transmitter output shall be 4 to 20 mA dc without the need for external load adjustment. Transmitters shall not be damaged by reverse polarity. Transmitters shall have an elevated or suppressed zero as required by the application. For calibrated spans of less than 55 kPa gauge a differential pressure type transmitter with side vents shall be utilized. Transmitters shall be provided with brackets for wall and pipe-stand mounting.
- .2 Transmitters shall be factory calibrated to the required range and provided with the manufacturer's standard hand held communications/calibration device. One hand-held communications device shall be furnished for every ten (10) transmitters provided by a single manufacturer. Minimum of one (1) and maximum of four (4) hand-held communications device(s) shall be furnished.
- .3 Transmitters tagged on the drawings or specified to be indicating type shall be furnished with LCD type digital indicators.
- .4 Seals, when indicated in Device Schedule, shall be standard equipment from the primary element supplier. Pancake or flanged seals as required to suit the process connections

shall be provided. Seals shall be 316 stainless steel housing, S.S. diaphragm material, Teflon coated, 50mm process connection unless noted otherwise, 6mm flushing connection in bottom housing, DC 200 fill fluid, 1.75 mm PVC coated armored capillary minimum 4 meters length, rated from vacuum to 2500 psig and -40° to 200°C, continuous duty.

- .5 Wetted O-rings shall be Viton, Glass Filled TFE, or Graphite Filled PTFE.
- .6 Cover O-rings shall be Buna-N.
- .7 Electrical connections shall be ½" -14 NPT weather proof conduit.
- .8 Process connections shall be ¼" 18 NPT on flanges, ½" NPT on adapters.
- .9 Transmitter shall allow over-pressure/under-pressure alarms to drive signal to high or low full scale (selectable).
- .10 Transmitter shall allow failure mode alarm to drive analog signal to high or low full scale (selectable).
- .11 Transmitter shall have internal security switch preventing unauthorized changes to calibrated configuration.
- .12 Transmitter shall have adjustable damping 0 to 16 seconds.
- .13 Acceptable Product:
 - .1 Rosemount 3051T (Part Number: 3051TG2A2B21AB4KBM5S5) with 2 way valve manifold (Part Number: 0306RT22AA11) with the NSF61 documentation package

2.3 Pressure Gauges (for Potable and Clean Water System)

- .1 Supply and install pressure gauges size and location as shown on the Contract Drawings and/or specified herein.
- .2 Pressure gauges shall be 114mm dial size with fiberglass reinforced polypropylene case, threaded ring, solid front, blow out back, molded acrylic window.
- .3 Movement shall be stainless steel and Bourdon tube shall be stainless steel.
- .4 Dial face shall be white with black figures, pointer shall be micrometer adjustable type.
- .5 Dual scale and operating range 0 to be suitable to design range specified (both kPa and PSI units shall be provided).
- .6 Pressure gauges shall be liquid filled food-grade silicone oil.

- .7 Acceptable Products:
 - .1 Terice Type 450 LFSS
 - .2 Winters
 - .3 WIKA
 - .4 Ashcroft
 - .5 Approved Equal.

3. EXECUTION

3.1 Field Services

- 3.1.1 Manufacturer's field services shall be provided for installation, field calibration, startup, and training as specified in Sections 13100 and 13560.
- 3.1.2 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 any common construction or cleaning chemicals that may affect instrument operation.

END OF SECTION

1. GENERAL

1.1 Intent of Section

- 1.1.1 This section covers the work necessary to furnish ultrasonic flow meters, to measure Backwash water at Timmins WFP.

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 Ultrasonic Flow meter 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 General Requirements

- 2.1.1 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.
- 2.1.2 Mounting brackets, hooks, plates, screws, bolts, anchors, etc., shall be stainless steel and of sufficient size to permanently mount the equipment.
- 2.1.3 Each instrument mechanism shall be within a CSA rated NEMA 4X enclosure.

- 2.1.4 The flowmeter shall be a Ultrasonic type, complete with transducer and transmitter.
- 2.1.5 The meter shall be manufactured to the highest standard available for ultrasonic flowmeters.
- 2.1.6 The ultrasonic 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.
- 2.1.7 The flowmeter 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.
- 2.1.8 Installation Requirements: Not less than the required upstream and downstream pipe diameters recommended by the manufacture to obtain rated accuracy.
- 2.1.9 Performance requirements:

Current Output	0/4-20mA DC
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- 2.1.10 Flowmeters shall be installed in the following locations and be sized as follows:

Location	Tag Number	Liquid type	Pipe Size, mm	Number of units	Design Flow, L/s
Backwash Line	FE/FIT – 14	Water	400	1	450

- 2.1.11 All flow transmitters supplied shall have latest firmware from manufacturer.
- 2.1.12 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.
- 2.1.13 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.

2.2 Transmitter

- 2.2.1 Each flow meter shall come with remote display option.
- 2.2.2 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.

- 2.2.3 Power Supply: 120VAC/60Hz.
- 2.2.4 Output: 4–20mA with HART isolated, additional 24VDC scaled pulse output contact for totalizing flow, One (1) Form C SPDT fault relay
- 2.2.5 1 Form C SPDT fault relay.
- 2.2.6 Pulse Output: 1Pulse/m³.
- 2.2.7 Calibration Range: As indicated above.
- 2.2.8 Accuracy:
 - .1 Sludge line application: ± 0.25 percent of measured value, maximum error over entire velocity range.
 - .2 Water line application: ± 0.3 percent of measured value, maximum error over entire velocity range
- 2.2.9 Repeatability: plus or minus 0.05 percent.
- 2.2.10 Local Display: LCD, rate of flow and flow totalized displayed in engineering units, flow (L/s) and totalized flow (L on m³).
- 2.2.11 Continuous automatic re-zeroing calibration and auto ranging.
- 2.2.12 Flow meters are to include HART communication
- 2.2.13 Flowmeter shall perform self-calibration through Hart.
- 2.2.14 Refer to drawings for cable length, 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.
- 2.2.15 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.
- 2.2.16 Shop testing shall be performed to ensure that the Ultrasonic flow meter is free of defective parts, cracks or any other defects.
- 2.2.17 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.

2.3 Acceptable Manufacturers

- 2.3.1 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.

2.3.2 Flexim (FLUXUS F72x) or Agency Approved Equal.

2.4 Warranty

2.4.1 The Ultrasonic 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 Ultrasonic flow meter shall be installed in accordance with the manufacturer's drawings and instructions. Suitable Ultrasonic flow meter mounting configurations shall be specified and determined by the vendor with the Engineer's approval.

3.1.2 The Ultrasonic 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 ultrasonic 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 $\pm 0.5\%$ 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 Ultrasonic 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 2 trips, 2 days total

3.3.2 Training. Training shall be in accordance with Section 01820 – Demonstration and Training.

END OF SECTION

Timmins WTP High Lift and Backwash
Pump Replacement
City of Timmins

DIVISION 16
ELECTRICAL

DIVISION 16 – ELECTRICAL

DIVISION 16 – ELECTRICAL

Section No.	Title
16010	Electrical General Requirements
16015	Electrical Systems Analysis
16020	Sequence of Activities
16021	Demolition of Electrical Systems
16062	Grounding - Secondary
16090	Equipment Identification
16111	Cable Tray Systems
16122	Wires and Cables 0-1000V
16131	Splitters, Junction Boxes, Pull Boxes & Cabinets
16132	Outlet Boxes, Conduit Boxes & Fittings
16133	Conduits, Conduit Fastenings & Fittings
16141	Wiring Devices
16223	Motor Starters to 600V
16224	Variable Frequency Drives to 600V
16271	Dry Type Transformers
16400	Basic Electrical Equipment & Materials
16412	Moulded Case Circuit Breakers
16414	Disconnect Switches-Fused & unfused
16423	Control Devices
16441	Panelboards Breaker Type
16671	Surge Protective Devices

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 13 and 15

1.2 Scope of Work

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 Electrical equipment shop drawings will not be reviewed unless they are accompanied with a copy of the electrical protection and coordination study,
- 1.3.5 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.
- 1.3.6 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the Work.
- 1.3.7 Work which is indicated, but not completely detailed shall be installed by common practice or as directed by the Construction Manager.
- 1.3.8 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.).
- 1.3.9 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.

- 1.3.10 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.
- 1.3.11 Confirm on the site the exact location of outlets and fixtures. Confirm location of outlets for equipment supplied by other trades.
- 1.3.12 Remove existing equipment made obsolete by this project and also disconnect/reconnect existing equipment either relocated or serviced from new equipment.
- 1.3.13 Visually inspect the existing building conditions, prior to the project award to suit the installation of the new power and controls distribution.
- 1.3.14 Modify existing High Lift North Pump Room MCC by removing the three Sections as noted on the drawings.
- 1.3.15 Provide new panel DP-1 (400A, 120/208V) and a 75 kVA transformer to re-feed panels A, B and C. Provide temporary power to panels A, B and C while MCC is being modified and new DP-1 is being installed.
- 1.3.16 Provide a new 1200A 600V panel L fed from main switchgear.
- 1.3.17 Provide a new 1200A 600V panel K fed from main switchgear.
- 1.3.18 Provide a new 30kVA transformer and 225A, 120/208V panel LP-G and re-feed existing circuits from MCC-3N.
- 1.3.19 Re-feed existing HLP-8 soft starter as noted.
- 1.3.20 Provide power connection to new backwash pump P-14. Provide a new RVSS floor standing cabinet as required.
- 1.3.21 Provide power connection to new HLP-7. Provide a new VFD complete with floor standing cabinet as required.
- 1.3.22 Re-feed existing HLP-5 soft starter as noted on the drawings.
- 1.3.23 Provide power connection to new HLP-6. Provide a new VFD complete with floor standing cabinet as required.
- 1.3.24 Provide modifications to DCS cabinets CP-C and CP-B as required.
- 1.3.25 Complete all other scope as noted on drawings.

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 from the Construction Manager 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 from the Construction Manager.

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.
- 1.5.2 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.
- 1.5.3 All references to regulations, codes and standards shall be made to the latest edition.
- 1.5.4 Equipment and material must be certified to a recognized Canadian standard (CSA, CULcUL, etc.).
 - .1 Where listed equipment is not available, obtain special approval acceptable to the ESA and pay all associated fees.
 - .2 CSA Listing labels shall be visible and legible after equipment is installed without opening enclosure doors.
- 1.5.5 Unless otherwise indicated all equipment shall conform to customary North American standards (e.g. NEMA, ANSI, ASTM, CSA, etc).

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:
 - .1 The Electrical Safety Authority (ESA)
 - .2 The local building inspector
 - .3 The local fire inspector
- .3 "OESC" is defined as CSA C22.1, Canadian Electrical Code, Part 1, and the Ontario Amendments to that Code.
- .4 "Provide" is defined as to supply install, verify, test and commission.
- .5 "Supply Authority" is defined as the local electrical distribution company. For this project the Supply Authority is Hydro One Networks Inc.
- .6 "Wiring" means wiring of power and control conductors to lighting, receptacles, as well as any controlling or controlled devices associated with them.

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.
- 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 Power Supply Authority

- 1.8.1 Arrange for inspection 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 the Construction Manager 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 Construction Manager 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 Construction Manager.

- 1.9.5 Arrange for inspection of all work by the Authorities having jurisdiction over the work. On completion of the work, present to the Owner the final unconditional certificate of approval of the Inspection Authorities.
- 1.9.6 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 Construction Manager immediately of such changes for proper processing of the requirements. Prepare and furnish any additional drawing details for information as may be required.
- 1.9.7 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, MCC, switchboards rated over 400A.
 - .2 Short Circuit and Protection Coordination Study Refer to specification section 16015 for approved providers.

1.10 Contract Drawings and Specifications

- 1.10.1 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, it shall be referred to the Construction Manager for clarification and rectification before any material is purchased or work commences. 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. If, having examined all documents pertaining to Division 16, concerning the nature and extent of the work being performed under other sections, clarification of the item and/or items in question will come from the Construction Manager.
- 1.10.2 Follow the Contract Drawings to become familiar with all conditions affecting the work, and verify spaces in which the work will be installed.
- 1.10.3 The drawings for electrical work are performance drawings, diagrammatic, intended to convey the scope of work and indicate general arrangement and approximate location of apparatus, fixtures and approximate sizes and location of equipment and outlets. The drawings do not show complete architectural, process and structural details.
- 1.10.4 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.

- 1.10.5 Review existing drawings as available at the site during the tender period. Become familiar with the condition of the existing drawings and related equipment. Allow for errors and omissions in the existing drawings and ensure that the tender price includes the provisions to make the necessary field reviews, field verifications, field changes, and drawing changes to suit the intent of the modification required.
- 1.10.6 Work which is indicated, but not completely detailed shall be installed by common practice or as directed by the Construction Manager.
- 1.10.7 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.).
- 1.10.8 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.
- 1.10.9 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.
- 1.10.10 Confirm on the site the exact location of outlets and fixtures. Confirm location of outlets for equipment supplied by other trades.
- 1.10.11 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the Work.
- 1.10.12 If discrepancies or omissions in the drawings or specifications are found, or if the intent or meaning is not clear, advise the Construction Manager for clarification before submitting tender.
- 1.10.13 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 – Submittals.
- 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 Assume responsibility for accuracy of equipment dimensions related to available space and accessibility for maintenance and service, and compliance with codes and inspection authorities.
- 1.11.5 Show all details of construction, dimensions, capacities, weights, and electrical performance characteristics of equipment or material.
- 1.11.6 Obtain manufacturer's installation directions to aid in properly executing the work. Submit two copies of such directions to the Construction Manager prior to installation, for use in inspecting the work.
- 1.11.7 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.
- 1.11.8 Prepare drawings of equipment bases, anchors, slabs, floor and roof curbs, if needed, for the electrical work.
- 1.11.9 In addition to the requirements of Section 01330, provide working drawings with, but not necessarily limited 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 Bill of Materials for all assemblies.
 - .5 Number identifying item on the drawings and/or in the specifications such as equipment, item number, panel identification letters, etc.
 - .6 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
 - .7 Where applicable, include wiring, single line and schematic diagrams.
 - .8 Include wiring diagrams or diagrams showing interconnections with work of other sections.

- .9 Lighting fixtures, including photometric data.
- 1.11.10 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. Construction Manager reserves the right to request more detailed drawings if those provided are deemed insufficient.
- 1.11.11 Submit samples of material and equipment where specified or as may reasonably be requested by the Construction Manager for review before ordering same in accordance with Division 1. The Construction Manager may retain the samples until the completion of the contract.
- 1.11.12 Complete all work in accordance with reviewed shop drawings.
- 1.11.13 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.
- 1.11.14 Update single line electrical diagrams to include any modifications to the electrical distribution system.
- 1.11.15 Indicate the number, letter or equipment tag used on the drawings/specifications as an identification symbol on product data for MCCs, transformers, panelboards, light fixtures, and other equipment submitted.
- 1.11.16 Bind one complete set of construction/shop drawings showing “as built” conditions in each operating and maintenance instruction manual.
- 1.11.17 Electrical equipment shop drawings will not be reviewed unless they are preceded by or accompanied with a copy of the electrical protection, coordination and arc flash study. The electrical equipment shop drawings will be returned as rejected, if submitted prior to the protection, coordination and arc flash study

1.12 Record Drawings

- 1.12.1 Comply with requirements for record drawings stated in 01330 – Submittals.
- 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 Construction Manager 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, light fixture locations, equipment, 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 Construction Manager 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: CAN2-C235-83

1.14.2 Control and distribution devices and equipment to operate satisfactorily under the extreme operating conditions established in the above standard without mis-operation or damage to equipment.

1.15 Site conditions

1.15.1 Voltage Supply, 600 V: 3-phase, 3-wire, solidly grounded.

1.15.2 Voltage Supply, 120/208 V: 3-phase, 4-wire, solidly grounded

1.15.3 Voltage Supply, other: as shown on drawings.

1.15.4 Temperature range:

.1 Indoor: 10°C to 40°C

.2 Outdoor: -35°C to +40°C

1.15.5 Altitude: <1000 m ASL

1.15.6 The project contains damp, wet and classified areas as shown on the drawings.

1.16 Quality Assurance

1.16.1 Wherever possible, equipment shall be of a manufacturer's standard design.

1.16.2 Factory-assemble control panels and component assemblies.

1.17 Finishes

- 1.17.1 Unless otherwise noted in the equipment sections or drawings, finish all equipment as follows.
- 1.17.2 Break and deburr all edges prior to painting.
- 1.17.3 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.
 - .1 Apply all finishes in accordance with the finish-suppliers' instructions.
 - .2 Provide copies of the application instructions and/or finish test reports as indicated or upon request.
 - .3 Paint and primer application shall be power coat unless otherwise specified or approved in writing by the Engineer.
- 1.17.4 Colours:
 - .1 Paint outdoor electrical equipment "equipment green", semi-gloss - "equipment green" - Munsell 9 GY 1.5/2.6.
 - .2 Paint indoor electrical equipment ANSI grey # 61, semi-gloss light grey - Munsell 8.3G 6.1/0.5.
 - .3 Paint the interior of control compartments semi-gloss white.
 - .4 Paint enclosures for life safety systems red except exit sign and exit lamp enclosures.
- 1.17.5 Stainless steel enclosures shall not be painted.
- 1.17.6 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.
- 1.17.7 Clean and prime exposed non-galvanized and non-stainless hangers, racks and fastenings to prevent rusting.

1.18 Classified Areas

- 1.18.1 Provide Class 1, Division 1, distribution and electrical equipment for classified areas indicated on the drawings.
- 1.18.2 Provide conduit fittings, outlets, wall sleeves, etc. to suit the power distribution applications, and in accordance with the area classification
- 1.18.3 Provide Class I, Division 1 and/or 2, rated electrical distribution and equipment to suit all hazardous area's where indicated on the drawings.

- 1.18.4 Equipment located in a class 1, Division 1 or Division 2 explosive environments shall be rated to suit.
- 1.18.5 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. For areas designated as Class I Division 1 or 2 include appropriate conduit seals, junction boxes, materials, and all other appurtenances as necessary and installation techniques as required by applicable codes and regulations.
- 1.18.6 Raceways originating from non-classified areas that transition through classified spaces shall be continuous and rated to suit.
- 1.18.7 Provide E.Y.S seals for all distribution conduit that transitions into a classified area.

1.19 Warning Signs

- 1.19.1 As specified and to meet requirements of Electrical Inspection Department and Construction Manager.
- 1.19.2 Decal signs, minimum sized 175 x 250mm.
- 1.19.3 Protect exposed live equipment during construction for personnel safety.
- 1.19.4 Shield and mark live parts with appropriate voltage values in English.

1.20 Single Line Electrical Diagrams

- 1.20.1 Provide single line electrical diagrams under Plexiglas as follows:
 - .1 Electrical distribution system: Locate in main all electrical rooms. Coordinate location with the construction manager.
 - .2 Single line shall include 600V distribution complete with all protection equipment settings, cable sizes, raceways, and distribution equipment specifications
 - .3 Single line diagram shall include the as as-built ratios or all CTs. For multi-tap CTs, indicate the as-left tap settings.
- 1.20.2 Drawings: 600 x 600mm minimum size.
- 1.20.3 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, CT ratios, PTs, and main cable sizing information. Drawing is to be reviewed by Construction Manager for accuracy and completeness.

2 PRODUCTS

2.1 Not Used

3 EXECUTION

- 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.

3.2 General

- 3.2.1 The use of permanent electrical system for temporary construction service shall be only with written permission of the Construction Manager.
- 3.2.2 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.
- 3.2.3 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 Construction Manager promptly where information is required.
- 3.2.4 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.
- 3.2.5 Equipment, conduit, etc., installed but not coordinated with the work of other trades shall be relocated as directed by the Construction Manager without extra cost to the Owner.
- 3.2.6 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance and to function properly to the satisfaction of the Construction Manager. 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.
- 3.2.7 The Contractor is required to remove all power distribution, conduit and control wiring for all items that are identified for

demolition on the contract drawings. The Contractor shall correlate the demolition requirements on the electrical drawings with all other drawings and disciplines to ensure that all power and control wiring distribution is removed for any equipment identified for demolition. The contractor is required to remove all wiring and raceways that are rendered redundant as a result of the demolition and/or equipment removals

- 3.2.8 Remove and return all field instrumentation to the owner in good condition.

3.3 Workmanship

- 3.3.1 Install all equipment, conduit and cables in a workmanlike manner to present a neat appearance and to function properly.
- 3.3.2 Install exposed systems and equipment neatly and grouped to present a neat appearance, without conflict to other services.
- 3.3.3 Install equipment and apparatus requiring maintenance, adjustment or eventual replacement with due allowance therefore, in terms of space and accessibility.
- 3.3.4 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.
- 3.3.5 Replace without extra cost work unsatisfactory to the Construction Manager.
- 3.3.6 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.

3.4 Pre-Construction Inspection

- 3.4.1 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.

3.5 Temporary Power

- 3.5.1 The Contractor shall be responsible for all costs associated with servicing the site with temporary power (i.e.: Electricity) for the purpose of construction as well as maintaining a site office.

3.6 Excavation and Backfill

- 3.6.1 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.

3.7 Cutting, Patching and Welding

- 3.7.1 Conform to the requirements of Division 1 in respect to cutting, patching, and fitting electrical equipment.
- 3.7.2 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 Construction Manager.
- 3.7.3 Locate and provide holes and sleeves required for electrical work. Relocate improperly located holes and sleeves at no cost.
- 3.7.4 Finish sleeves flush with wall finish (each side) or the ceiling to curb top.
- 3.7.5 No cutting or welding of beams, columns or structural surfaces is permitted without approval of the Construction Manager and all damage to finished or unfinished surfaces shall be made good to the satisfaction of the Construction Manager.
- 3.7.6 Pay all costs for cutting and patching resulting from failure to co-ordinate timely installation of electrical inserts, sleeves, etc., into masonry structures.

3.8 Securing of Equipment

- 3.8.1 Secure equipment to poured concrete with expandable inserts, properly sized for the load to be carried.
- 3.8.2 Secure all equipment to resist all applicable loading including start up loads, dead loads, live loads, thrust loads, and post disaster wind and earthquake loads as defined under the OBC 2012.
- 3.8.3 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.
- 3.8.4 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields, properly sized for the load to be carried.

3.9 Mounting Heights

- 3.9.1 Mounting height of equipment is from finished floor to centreline of equipment
- 3.9.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- 3.9.3 Install electrical equipment at following heights unless indicated otherwise.

- .1 Local switches: 1400mm.
 - .2 Wall receptacles
 - .1 General: 300mm.
 - .2 Above top of continuous baseboard heater: 200mm.
 - .3 Above top of counters or counter splash backs: 175mm.
 - .4 In mechanical rooms: 1400mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 300mm.
 - .5 Wall mounted telephone and interphone outlets: 1500mm.
 - .6 Disconnect switches: 1400mm.
- 3.9.4 No controls shall be mounted at greater than 1800 mm above finished floor or grade.

3.10 Location of Outlets

- 3.10.1 Do not install outlets back-to-back in wall; allow minimum 150mm horizontal clearance between boxes.
- 3.10.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.
- 3.10.3 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.11 Conduit and Cable Installation

- 3.11.1 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.
- 3.11.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- 3.11.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.12 Wiring - General

- 3.12.1 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 – Conduits, Conduit Fastenings & Fittings.

- 3.12.2 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.
- 3.12.3 Provide space for 20% additional conductors in each low voltage power and control conduit and box.
- 3.12.4 All conductors are to be continuous with no splices for each application.
 - .1 Marrettes are not permitted.
- 3.12.5 All conductors shall be stranded copper unless otherwise indicated.
- 3.12.6 All wiring shall be identified in accordance with 16090.
- 3.12.7 Provide a dedicated green jacket bond conductor in all raceways including PVC and metallic conduits.
- 3.12.8 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.

3.13 Wiring Terminations

- 3.13.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.
- 3.13.2 Where stranded conductors terminate on a screw terminal, the conductor will be terminated with a full ring terminal.
- 3.13.3 Under no circumstances will more than one (1) conductor or ground be installed in a screw type connector, lug or terminal block.

3.14 Demolition

- 3.14.1 Removals shall include all equipment, distribution, raceways, wiring that is redundant as a result of the equipment removals.
- 3.14.2 Restore all surfaces and fill all voids that are left as a result of the removals. Items identified for removal and redundant infrastructure are to be disposed of from the site by the contractor.

- 3.14.3 Remove all unused surface-mounted raceway. Cap and tag all abandoned, embedded raceway.
- 3.14.4 Do not remove or demolish existing systems until the replacement systems are installed, commissioned and accepted by the Contract Administrator.
- 3.14.5 Coordinate demolition work with other divisions. It remains the Contractor's responsibility to coordinate the demolition work.

3.15 Cleaning

- 3.15.1 Comply with Section 01000 – General Requirements.
- 3.15.2 Before energizing any system, inspect and clean all the inside of switchgear, MCC, etc. to ensure that they are free from dust and debris.
- 3.15.3 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.
- 3.15.4 Clean all polished, painted and plated work brightly.
- 3.15.5 Remove all debris, surplus material and all tools.

3.16 Field Quality Control (Testing)

- 3.16.1 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 Construction Manager to ensure that the operation of the system and components satisfy the requirements of the Contract Documents.
- 3.16.2 Comply with requirements of:
 - .1 Section 01810 – Testing and Commissioning
 - .2 Section 01820 – Demonstration and Training
- 3.16.3 Refer to specific equipment sections and section 16015 "Electrical Systems Analysis" for additional details and requirements.
- 3.16.4 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 Construction Manager.
- 3.16.5 Tests requiring initial power-up of a system shall not be made without notification of the Construction Manager.
- 3.16.6 Carry out tests in presence of Construction Manager.
- 3.16.7 Furnish labour, materials, instruments and bear all costs for tests as requested by the Construction Manager.

- 3.16.8 Conduct all testing by fully qualified personnel only.
- 3.16.9 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 Construction Manager.
- 3.16.10 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.
- 3.16.11 Clean all equipment prior to testing.
- 3.16.12 Ensure that the system and its components are ready prior to the inspection and test for acceptance.
- 3.16.13 All testing shall be scheduled and coordinated through the Construction Manager. No testing of any kind shall be done without this clearance. Give three (3) working days' notice of proposed tests.
- 3.16.14 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.
- 3.16.15 Manually operate alarms and control devices to check whether their operation during normal and abnormal operating conditions causes the proper effect.
- 3.16.16 Document all testing. Record test procedures, acceptable results, actual results, remedial work performed and final outcome.
- 3.16.17 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.
- 3.16.18 Submit two (2) copies of test results for Construction Manager's review in addition to copies included in maintenance data.
- 3.16.19 Replace at no additional cost all fuses, relays, or other devices destroyed during field quality control testing.

3.17 Care, Operation, and Start-up

- 3.17.1 Instruct Engineer and operating personnel in the operation (testing), care and maintenance of equipment.
- 3.17.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

- 3.17.3 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.

3.18 Trial Usage

- 3.18.1 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.
- 3.18.2 Trial usage by the Owner shall not waive the Contractor/Sub-Contractor of any responsibility because of trial usage.
- 3.18.3 Trial usage shall not be construed as acceptance by the Owner.

3.19 Demonstration and Training

- 3.19.1 Instruct Owner's personnel in the operation, care and maintenance of equipment. Perform demonstration and training in accordance with Section 01820 – Demonstration and Training.

END OF SECTION

1 GENERAL

1.1 Purpose

1.1.1 The specification describes the requirements for the following studies:

- .1 Short circuit analysis, device evaluation and coordination study (SCCS)
- .2 Arc flash hazard analysis study (AFHS)

1.1.2 The specification describes the requirements for:

- .1 Setting and verifying the operation of protective devices
- .2 Arc flash hazard labelling

1.1 Scope of Work

1.1.1 The Contractor and/or their supplier of analysis services shall, as defined in this section:

- .1 Investigate the existing system to gather data for the analysis.
- .2 Obtain the necessary characteristics of equipment supplied under the contract
- .3 Obtain utility fault data from the Supply Authority
- .4 Prepare a short circuit analysis
- .5 Verify all equipment duties and make recommendations where equipment is underrated
- .6 Prepare a coordination study
- .7 Prepare an arc flash hazard analysis and prepare recommendations to reduce arc flash hazards
- .8 Set all protective devices
- .9 Apply Arc Hazard labels
- .10 Field test, inspect and verify all protective devices

1.1.2 The Short Circuit Analysis, Protection Coordination Study and Arc Flash Hazard Analysis shall include all new 600V power distribution system equipment under this project as well as all upstream equipment affected by the project including:

- .1 New equipment and power distribution system
- .2 New Panel K
- .3 New Panel L
- .4 New Panel DP-1

.5 Existing Panel J

1.2 General Requirements

- 1.2.1 The Contractor shall provide all labour, supervision, tools, equipment, materials, services and miscellaneous expenses necessary to complete the work as outlined in this Section.
- 1.2.2 Equipment and component titles used in the studies shall be identical to the equipment and component titles shown on the drawings.
- 1.2.3 The Contractor is responsible for providing all services in accordance with the Ontario Electrical Safety Code – Latest Addition and ESA latest bulletins. The Contractor shall provide licensed and appropriately trained electricians where required for data gathering and device settings.
- 1.2.4 The Contractor is responsible for providing appropriate arc flash safety equipment and procedures when opening live equipment.
- 1.2.5 The analysis shall be performed with the aid of a digital computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.
- 1.2.6 This Section covers items common to Sections of Division 16. This section supplements requirements of Division 1.

1.3 Definitions

- 1.3.1 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 “Provide” means to supply, implement, test, verify and implementation of recommendations related to analysis works.
 - .3 “Electrical Code” means Ontario Electrical Safety Code, 25th edition, 2012.
 - .4 “Indicated” means as shown on contract drawings or noted in contract documents.
 - .5 “Supply Authority” means the local electrical distribution company. For this project the Supply Authority is Hydro One Networks Inc..

1.4 Codes and Standards

- .1 Perform work and supply equipment in compliance with the latest editions of the Ontario Electrical Safety Code and all local codes and requirements, which govern the installation.
- .2 Perform SCCS in accordance with IEEE 242

- .3 Perform arc flash analysis and prepare labels in accordance with CSA Z462.
- .4 Perform harmonic analysis in accordance with IEEE 519.

1.5 References

- 1.5.1 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.
- 1.5.2 The following is a list of standards which may be referenced in this section:
 - .1 Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - .1 IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
 - .2 IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
 - .3 IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
 - .4 IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
 - .5 IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
- 1.5.3 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.0 for “Definitions and General Requirements”.
 - .2 CSA Z85 for abbreviations for electrical terms:

1.6 Co-ordination – Supply Authority

- 1.6.1 Co-ordinate with the power supply authority to obtain utility fault contribution data.
- 1.6.2 Obtain specific fault contribution data for each utility feeder circuit that supplies power to the Pumping Station. Where feeders can be fed from multiple stations, obtain the fault current from each station
- 1.6.3 Obtain the design short circuit level from the supply authority for the device evaluation.
- 1.6.4 Arrange for access to equipment controlled by the supply authority as required to suit the analysis works.
- 1.6.5 Pay all costs levied by the supply authority for site assistance or access to equipment that is under the care and control of the supply

authority. Pay for, schedule and obtain station guarantees from the supply authority as required to suit data gathering.

1.7 Coordination – Electrical Safety Authority

- 1.7.1 Provide copies of the approved studies to ESA as required.
- 1.7.2 Make all changes required by ESA and resubmit the study to the Owner and the ESA. All changes required to satisfy ESA shall be made at no cost to the owner.
- 1.7.3 Arrange for and pay for any ESA Inspections that are required to re-energize equipment.

1.8 Coordination - General

- 1.8.1 Coordinate with the owner's staff for access to fenced areas, buildings, and rooms for the purpose of data gathering and verification.
- 1.8.2 The Contractor shall provide a schedule to the owner indicating the locations that will require access by the contractor's staff. The contractor shall provide a schedule 5 business days in advance of the proposed location access for review and approval by the owner.
- 1.8.3 In case of a discrepancy between statement(s) or value(s) between the specifications, contract drawings, codes and referenced standards, the more stringent statement or value shall take precedence and shall govern.
- 1.8.4 The shop drawings for electrical equipment operating at 600 V and above shall not be reviewed without the device evaluation study

1.9 Quality Assurance

- 1.9.1 One firm shall be employed to perform the data gathering, analysis and verification.
- 1.9.2 The study agent shall not perform device settings. All device settings shall be performed by the manufacturer or their designated representative.
 - .1 The Contractor may perform device settings where properly trained and when authorized by the manufacturer.
 - .2 Where existing device settings are modified, the study agent shall make the changes and the Contract Administrator shall verify the changes.
- 1.9.3 The firm should be currently involved in the preparation of high and low voltage power system studies of the type required herein.
- 1.9.4 The firm performing the study shall demonstrate experience and training in the following:
 - .1 The relevant analysis procedures

- .2 Use of the required analysis software
 - .3 Operation of the required testing instruments
 - .4 Operation, setting and verification of the protective devices covered by the studies
- 1.9.5 All studies and verification reports shall be supervised, stamped and signed by a Professional Engineer registered in the Province of Ontario.
- .1 The stamping Engineer shall have a minimum of five (5) years of experience in power system analysis.
- 1.9.6 All testing devices shall be calibrated in accordance with the manufacturer's requirements and, where applicable, to a NIST recognized standard.
- .1 All equipment shall have up-to-date calibration marks.
 - .2 Any testing done with uncalibrated equipment shall be repeated at no cost to the Owner.
- 1.9.7 Approved Coordination Study and Arc Flash Hazard Analysis Providers
- .1 Brosz Technical Services Inc.
 - .2 Eaton Cutler Hammer Engineering Service
 - .3 ABB Electric Services
 - .4 Siemens Engineering Services
 - .5 K-Tech
 - .6 Rondar

1.10 Submittals

- 1.10.1 Provide the following submissions to the Contract Administrator:
- .1 Preliminary information
 - .2 Short Circuit Study and Protective Device Evaluation
 - .3 Protection Coordination Study
 - .4 Arc Flash Hazard Analysis
 - .5 Protective device setting sheets
 - .6 Settings and device verification report
 - .7 As-set device files
- 1.10.2 The purpose and format of the submissions shall be as follows:

Submission	Purpose		Format		
	Review & Approval	Info	Electronic (pdf)	Electronic (native)	Paper
Preliminary information	x		x		
Short Circuit Study and Protective Device Evaluation	x		x		x
Protection Coordination Study	x		x		x
Arc Flash Hazard Analysis	x		x		x
Protective device setting sheets	x		x		x
Settings and device verification report		x	x		x
As-set device files		x		x	

1.10.3 Paper Submissions Requirements

- .1 The studies shall be separately bound in individual binders.
- .2 Pages that contain colour, including charts, graphs, warning labels, shall be printed in colour.
- .3 All diagrams, tables and charts shall be printed on a suitable size to allow clear reading.

1.11 Submittals - Preliminary Information

1.11.1 Provide the following information:

- .1 Credentials of the firm and stamping Engineer
- .2 Proposed distribution system arrangements for the SCCS and AFHS
- .3 The software used for the analysis

1.11.2 Submit for approval prior to commencing any work under the section.

1.12 Submissions - Short Circuit Study and Protective Device Evaluation

1.12.1 Provide a report containing the following:

- .1 Descriptions, purpose, basis and scope of the study
- .2 Calculation methods and assumptions, the base per unit quantities selected, source impedance data including power company system characteristics
- .3 Fault current calculations including a definition of terms and guide for interpretation of computer printout
- .4 Input data tables showing:

- .1 Short circuit reactance of rotating machines
- .2 Cable and conduit material data
- .3 Bus data
- .4 Transformer data
- .5 Circuit resistance and reactance values
- .5 Calculation tables showing:
 - .1 Symmetric and asymmetric fault current for 3 phase faults and ground faults
 - .2 Fault contribution from all motors greater than or equal to 100hp at all voltages.
 - .3 Fault contribution from all generators and utility sources
 - .4 Maximum available fault currents, 3 phase and phase-to-ground for all busses
 - .5 Maximum available fault current RMS symmetrical at each protective device.
 - .6 Fault impedances.
 - .7 X to R ratios.
 - .8 Asymmetry factors.
- .6 Evaluation tables showing:
 - .1 Interrupt ratings of all existing distribution equipment showing protective devices ratings versus calculated short circuit duties, and commentary, and commentary regarding same.
 - .2 Equipment "Pass" or "Fail" given available fault levels
 - .3 The name, description, locations and voltage level of the respective equipment in the summary table.
 - .4 Fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.
- .7 Establish settings to all protective devices in the distribution system, including devices with fixed protection characteristics.
- .8 A Single Line Diagram from the analysis software showing the parameters for all new and existing electrical distribution system devices used in the analysis and the names and/or tags of all distribution equipment

- .9 Single Line Diagrams from the analysis software showing the worst case interrupting and withstand short circuit current levels at each bus.

1.12.2 Provide a copy of the analysis model in its native format.

1.13 Submissions - Protection Coordination Study

1.13.1 Provide a report containing the following:

- .1 Descriptions, purpose, basis and scope of the study
- .2 The approved Short Circuit Study and Protective Device Evaluation
- .3 Time-current curves (TCC) graphically indicating the coordination proposed for the system, centred on conventional, full-size, log-log forms.
- .4 Include with each TCC sheet complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet.
- .5 Tabulations of all protection and configuration settings for each microprocessor based protection relays including multifunction protection relays for branch feeders and motor protection relays.

1.13.2 Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics.

1.13.3 Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

1.13.4 Include on the curve sheets power company relay and fuse characteristics, system medium voltage equipment relay and fuse characteristics, low voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in each motor control centre, and main breaker in branch panel-boards. Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and 150, 400 or 600% currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault current to which the device is exposed.

- .1 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
- .2 Fault contribution from the Emergency Generator System.
- .3 Feeder cables thermal short circuit damage curve.
- .4 Primary fusing for protection of the transformers.

- .5 Power transformer thermal short circuit damage curve, 3 phase, phase to ground.
 - .6 Largest 600V moulded case distribution breaker and characteristics.
 - .7 Largest distribution transformer thermal short circuit damage curve.
 - .8 Main 120/208V distribution breaker and characteristics.
- 1.13.5 Provide a copy of the analysis model in its native format.

1.14 Submissions - Arc Flash Hazard Analysis

- 1.14.1 Provide a report containing the following:
- .1 Descriptions, purpose, basis and scope of the study.
 - .2 The approved Short Circuit Study and Protective Device Evaluation
 - .3 The approved Protection Coordination Study
 - .4 Tabulations of the arc flash hazard data and incident energy for each bus and distribution point.
 - .5 Recommendations to reduce arc flash hazard levels.
 - .6 Colour printouts on paper of the application specific Arc Flash Hazard warning labels that will be applied in the field.
 - .7 A sample arc hazard label for approval
 - .8 A Single Line Diagram from the analysis software showing the Incident energy levels at each bus, distribution point
- 1.14.2 Provide a copy of the analysis model in its native format.

1.15 Submissions - Protective Device Setting Sheets

- 1.15.1 Provide detailed data sheets for all relays and monitors within the scope of this study, including all multifunction relays, feeder protection relays, motor protection relays showing:
- .1 Protective device setting parameters
 - .2 Allowable parameter ranges
 - .3 Parameter setpoints
 - .4 Output relay functions
 - .5 Parameters for input devices
 - .6 Internal logic settings
 - .7 Communications parameters and addresses

1.16 Submissions - Settings and Device Verification Report

1.16.1 Provide a report for each tested device that shows the following:

- .1 The operator and equipment used including equipment make, model, serial number and calibration information.
- .2 Environmental conditions at time of testing
- .3 Test procedure
- .4 Expected and/or acceptable test result
- .5 Actual test results
- .6 Remedial action taken to achieve compliance with the test goals
- .7 Outstanding deficiencies and recommended remedial action required.

1.17 Submissions - As-set Device Files

- 1.17.1 Provide all as-built multifunction solid state relay files in their original format on compact disk.
- 1.17.2 Provide a pdf of the as-left device setting sheets on the same compact disk.

1.18 Products

- 1.18.1 The Contractor shall utilize a reputable software product to produce the respective analysis works, including the Short Circuit Study and Protective Device Evaluation, Protection Coordination, and Arc Flash Hazard Analyses
- 1.18.2 The studies shall include all portions of the electrical distribution system from the normal power source or sources down to and including the smallest adjustable trip circuit breaker in the distribution system. Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.
- 1.18.3 The Contractor shall gather all required data prior to commencing analysis.

1.19 Short Circuit and Protective Device Evaluation and Coordination Study

- 1.19.1 Calculate the short circuit interruption and momentary (when applicable) duties for an assumed 3-phase bolted fault at each:
 - .1 Supply Authority point of common coupling
 - .2 Primary voltage equipment including aerial fused interrupters, underground distribution switchgear, unit substation primary and secondary terminals, etc

- .3 Secondary equipment including switchgear, switchboards, motor control centres, distribution panel-boards, generators, motors or loads, etc. operating at greater than 300 V L-L
- .4 Pertinent branch circuit panel-board operating at less than 300 V L-L.
- .5 Other significant locations throughout the system
- 1.19.2 Calculate the ground fault current study for the same system areas, including the associated zero sequence impedance data.
- 1.19.3 Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on drawing one-lines.
- 1.19.4 Source combination may include present and future power company supply circuits, large motors, or generators.
- 1.19.5 Include fault contribution of all motors in the study. Notify the Construction Manager in writing of circuit protective devices not properly rated for fault conditions.
- 1.19.6 Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendums issued prior to bid openings.
- 1.19.7 Verify:
 - .1 Equipment and protective devices are applied within their ratings.
 - .2 Adequacy of switchgear and motor control centres bus bars to withstand short circuit stresses.
 - .3 Adequacy of transformer windings to withstand short circuit stresses.
 - .4 Cable and busway sizes for ability to withstand short circuit heating, besides normal load currents.
- 1.19.8 When an emergency generator is provided, include phase and ground coordination of the generator protective devices. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.

1.20 Coordination Study

- 1.20.1 Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics; including a point equal to 58% of the ANSI withstand point to provide secondary line-to-ground fault protection.

- .1 Where the primary device characteristic is not within the transformer characteristics, show a transformer damage curve.
- .2 Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16% current margin to provide proper coordination and protection in the event of secondary line-to-line faults.
- 1.20.2 Separate medium voltage relay characteristic curves from curves for other devices by at least 0.4 second time margin.
- 1.20.3 Ratios of all Current Transformers (CT's), utilized in the electrical distribution system, are to be verified by the protection coordination study to ensure compatibility of the proposed protection coordination settings. The contractor is required to coordinate all ratios identified on the respective electrical distribution equipment shop drawings with the protection coordination study
- 1.20.4 Evaluate proper operation of the ground relays in 4-wire distributions with more than one (1) main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.
- 1.20.5 The study shall provide analysis and coordination to suit all possible operational configurations of the 600V distribution systems that will supply the new 600V loads.

1.21 Arc Flash Hazard Analysis

- 1.21.1 Provide an Arc Flash Hazard Analyses to suit the new electrical distribution systems. The analysis shall include all new distribution systems and existing distribution equipment that will supply the new electrical installations.
- 1.21.2 The Arc Flash Hazard analysis shall be an Incident Energy Analysis per CSA Z462 and the calculations shall be performed according to IEEE 1584.
- 1.21.3 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented for approval.
- 1.21.4 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centres, panelboards, busway and splitters and motors) where work could be performed on energized parts.
- 1.21.5 The Arc-Flash Hazard Analysis shall include all significant locations in 600V and 208V systems fed from transformers equal to or greater than 125 kVA.

- 1.21.6 Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2.
- 1.21.7 Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering incident energy of 1.2 Cal/cm².
- 1.21.8 Where the Hazard/Risk Category exceeds 2 (8 cal/cm²), make recommendations to reduce the incident energy.
- 1.21.9 The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
- 1.21.10 Arc flash computation shall be performed for both line and load side of main breakers for all MCCs, Switchboards and Switchgear.

1.22 Arc Flash Warning Labels

- 1.22.1 The Contractor shall provide 90mm x 130mm thermal transfer type label of high adhesion polyester for each work location analysed.
- 1.22.2 The label shall have an orange header with the wording, "WARNING, ARC FLASH HAZARD", and shall include the following information:
 - .1 Location designation
 - .2 Nominal voltage
 - .3 Flash protection boundary
 - .4 Hazard risk category (PPE level)
 - .5 Incident energy
 - .6 Working distance
 - .7 Engineering report number, revision number and issue date.
- 1.22.3 Labels shall be machine printed in colour, with no field markings.
- 1.22.4 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
 - .1 For each 600V, and applicable 208V panelboards, one arc flash label shall be provided.
 - .2 For each motor control centre, one arc flash label shall be provided.
 - .3 For each low voltage switchboard, one arc flash label shall be provided.

- .4 For each switchgear, one flash label shall be provided.
- .5 For medium voltage switches\breakers one arc flash label shall be provided
- .6 For medium voltage starters one arc flash label shall be provided.

2 EXECUTION

2.11 Data Gathering

- 2.11.1 Prior to analysis, the examine the existing electrical distribution system and obtain and/or verify all background information required by the analysis services including:
 - .1 New and existing distribution equipment ratings
 - .2 All distribution system loads
 - .3 All distribution cable ratings & lengths
 - .4 Locations of all distribution equipment and related loads
 - .5 Location, nameplate data and settings of all overcurrent protection devices, including breakers, electromechanical relays, fuses, and solid state multifunction relays.
- 2.11.2 Verify the accuracy of any information and/or documentation that is obtained from the owner or other sources in the course of data collection to suit the analysis works.
- 2.11.3 Provide a licensed electrician to gain access to any existing distribution equipment to suit verification of existing electrical name plate data as required.

2.12 Protective Relay Settings

- 2.12.1 The Contractor shall adjust existing relay and protective device settings according to values established by the approved coordination study.
- 2.12.2 The equipment manufacturer and/or their representative shall adjust all new relay and protective device settings according to values established by the approved coordination study.
- 2.12.3 Provide all necessary equipment and/or software to setup new and existing Electronic, Solid-state Multifunction Protection Relays.

2.13 Protective Relay Verification

- 2.13.1 Perform functional testing for the following types of protective device:
 - .1 Protective relays with adjustable settings, new and existing.
 - .2 Devices with fixed protection settings (e.g. Thermal-Magnetic breakers) with ratings in excess of 200A

- .3 All ground-fault alarm or trip devices
- .4 Ancillary protective devices including transformer overcurrent devices, temperature sensors, etc.
- 2.13.2 Perform visual inspection for all protective devices supplied under the contract and for existing devices including within the coordination and/or arc flash hazard studies.
- 2.13.3 General Procedure
 - .1 Carry out tests in the presence of the Construction Manager and a representative of the owner
 - .2 Notify the Construction Manager of the protection system testing. Provide 5 business days advanced notice prior to scheduling testing.
 - .3 Carry out the work with trained personnel, experienced in the particular type of testing and procedures required for each protection application.
 - .4 Ensure suitable power supply is available for test equipment.
 - .5 Record make, model and calibration date of test instrument.
 - .6 Conduct inspection and tests and compile test results on approved relay test sheets.
 - .7 Make minor modifications (relay setting changes, fuse changes) to equipment as required to accomplish conformance with the short circuit and protective device coordination studies.
- 2.13.4 Deviations and Defects:
 - .1 Ensure that any defects discovered are noted and corrected before continuing work.
 - .2 Mark any deviations found, initially on one set of the report analysis documents. Revise the protection coordination study report as required to suit as-left conditions.
 - .3 Revisions, further test results and clarifications of comments shall be incorporated into the test reports.
 - .4 Notify Construction Manager in writing of any required major equipment modifications.
- 2.13.5 Functional Testing
 - .1 Ensure all protective and metering devices are set-up as per the coordination study settings. These settings include relay protective settings, output and input relay assignments.

- .2 Conduct tests on all protective relays including relays, auxiliary voltage and current relays, overloads, speciality protection relays, trip supervisory relays and trip relays.
- .3 Tests to include all protective features, verification of current transformer, voltage/potential transformer settings, relay input and output functions, communication acceptance.
- .4 Use special test set and test methods as available from relay manufacturer. Take all recommended manufacturer's precautions.
- .5 Provide all necessary equipment and/or software to test existing Electronic, Solid-state Multifunction Protection Relays.
- .6 Simulate all inputs to test for correction output operation.
- .7 Verify all interlocks.
- .8 Prove all logic, both hardwired and internal.
- .9 Perform secondary current and/or voltage injection testing for all over current protection devices, including breakers and/or relays to simulate all fault conditions to demonstrate the coordination study settings.
- .1 Use three-phase test sets where required.

2.13.6 Visual Inspection

- .1 Inspect all devices not covered by the functional testing requirements.
 - .1 Verify the presence of the device and that the rating and type matches the approved coordination study.
 - .2 Verify the condition of all devices and ensure that wiring is correct and check for conditions that would impair operation.
 - .3 Verify that identification tags match the approved study and/or single line diagram.
- .2 Record results in a log book or worksheet and submit with record drawings.

2.14 ARC Flash Hazard labels

2.14.1 The Contractor shall install the arc Flash Hazard Labels.

- .1 Clean all surfaces prior to installing labels.
- .2 Labels shall be neatly installed with their edges parallel to the equipment.
- .3 Labels shall not mask other labels or operating controls.
- .4 Labels that are installed in a manner deemed unsuitable by the Contractor Administrator shall be replaced at no cost to the Owner.

- 2.14.2 The supplier of analysis services shall verify that the labels are installed on the correct equipment and shall provide a verification report stating same.

END OF SECTION

1. GENERAL

1.1 Intent of Section

- 1.1.1 This section is intended to describe the suggested minimum requirements pertaining to the sequencing of construction activities such that the operation, reliability, and security of the existing Timmins Water Filtration Plant is not reduced or otherwise compromised during the construction and commissioning.
- 1.1.2 The process pumping systems must remain in continuous operation for the duration of this contract.
- 1.1.3 The suggestions as provided in this section are not intended to describe all details that may be required to effect the safe, orderly, and secure electrical system services during existing electrical distribution system modifications, existing MCC replacement. The Contractor is required to submit his own detailed plan as part of his contract.
- 1.1.4 The Contractor shall clearly identify any differences between his proposed schedule and sequence of activities, and the suggested sequence of activities set forth in this section.

1.2 General

- 1.2.1 For coordination with plant operations, refer to Section 01110 – Summary of Work.
- 1.2.2 For scheduling constraints and requirements, refer to Section 01120 – Coordination and Sequence of Work.

1.3 Sequencing Constraints

- 1.3.1 The constraints indicated herein and Section 01120 – Coordination and Sequence of Work describe minimum operating requirements of the plant and have been incorporated within the sequence of electrical work presented in this section. Any modifications of the sequence of work, must adhere to these constraints, and meet the approval of the Construction Manager.
- 1.3.2 Additional requirements are as follows:
 - .1 All process systems are essential, circumstances may arise that work has to be delayed, or rescheduled. Other work may have to be performed during the delay, and the Contractor shall have no claim for extra compensation.

1.4 Demolition

- 1.4.1 Coordinate all demolition work with the Owner, Construction Manager, and other contractors working at the site.

- 1.4.2 The Contractor shall perform the work in a manner that demolition work will not damage parts of the facility and electrical installations not intended to be removed or modified. If, in the opinion of the Construction Manager, the method of demolition used may endanger or damage parts of the structure or affect the satisfactory operation of the facilities, promptly change the method when so notified by the Construction Manager. The Contractor shall examine the existing electrical distribution system and make a determination of demolition methods required for the conditions that may be encountered in order to accomplish the Work.
- 1.4.3 Demolition of electrical equipment can only start after complete survey has been completed on the electrical equipment.
- 1.4.4 The contractor is not permitted to remove any equipment that will impact the pumping process, until new power distribution systems are installed and commissioned that are intended to ensure continuity of process operations.

1.5 Coordination

- 1.5.1 Coordinate all trades involved when shutdown and/or switchover of any process or electrical systems are required. Coordinate with plant operating staff through the Construction Manager.
- 1.5.2 Coordinate delivery, on-site storage and installation of equipment.
- 1.5.3 Coordinate the activities of the inspection and testing sub-contractor. Indicate time duration in the schedule.
- 1.5.4 Coordinate with inspection authority as required.
- 1.5.5 Coordinate with the equipment suppliers regarding installation, supervision and testing.

2. SEQUENCE OF WORK

2.1 General

- 2.1.1 The Contractor may sequence the work differently, however must satisfy all constraints, and subject to review by the Construction Manager.
- 2.1.2 The Owner reserves the right to change the sequence of work due to operational constraint at no additional cost to the contract.
- 2.1.3 Any shutdowns or process interruptions must be approved by the Construction Manager in writing. Process conditions may force shutdowns to be rescheduled. The Contractor is to allow for delays due to rescheduling and carry sufficient costs to suit.
- 2.1.4 Submit a detailed description of the proposed sequence of work to the Construction Manager for review and approval. Include a Gantt

chart indicating the start and duration of all activities, including testing and commissioning. Identify any interruptions to existing electrical distribution sub-systems, process systems or individual equipment. Specify the proposed lengths of interruption durations.

- 2.1.5 Long duration power outages to the existing pumping systems are not permitted.
- 2.1.6 Individual pump power outages are limited to a time duration identified by operations staff. The contractor is required to obtain approval two weeks advance notice for each shutdown.
- 2.1.7 No claim for delays or cost will be allowed whether or not the suggested sequence of work is followed.
- 2.1.8 The installation and removal of equipment must be done without damage to the facility.
- 2.1.9 Coordinate all trades involved when shutdown and/or switchover of any process or electrical systems are required. Coordinate with plant operating staff through the Construction Manager.
- 2.1.10 Coordinate delivery, on-site storage and installation of equipment.
- 2.1.11 Coordinate the activities of the inspection and testing sub-contractor. Indicate time duration in the schedule.
- 2.1.12 Coordinate with inspection authority as required.
- 2.1.13 Coordinate with the equipment suppliers regarding installation, supervision and testing.

3. EXECUTION

3.1 General

- 3.1.1 Contractor shall familiarize themselves with the work areas and constraints to construction. Submission of a bid means that the Contractor has verified and included all costs associated with a construction sequence that allows installation of the proposed new equipment while still maintaining power to the affected areas as required and at all times.
- 3.1.2 It is expected that, except for the hours required at designated transition period, and during interconnection of the parts of the new and existing equipment as specified hereafter, the facility shall be capable of normal operation without any interruptions. Contractor is to ensure minimum interruption to the facility during replacement.
- 3.1.3 The contractor must obtain written approval from the owner and the Construction Manager prior to de-energizing any existing distribution equipment. A request for de-energization of any equipment does not ensure that the request will be approved by

the contractor. The request for de-energization is approved at the discretion of the owner and including time durations for the request, if approved.

- 3.1.4 The sequences described here are predicated on the requirement for all equipment to be fully tested and approved before it can be energized.

3.2 Maintenance of Existing Work

- 3.2.1 Maintain access to all existing equipment and facilities, which are to be kept in operation during modification work.
- 3.2.2 The durations of proposed power outages will at the discretion of the Construction manager and the Engineer. The duration of any proposed outages must be approved by the Construction Manager.
- 3.2.3 Plan and schedule the work to minimize power outages, and to coordinate with all other aspects of the project including equipment. All shutdowns must be pre-approved by the Construction Manager.

3.3 Sequence Of Stages

- .1 Refer to 'Phasing of Work' on drawings.

3.4 Tests

- 3.4.1 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 to be made prior to requesting inspection by the Engineer.
- 3.4.2 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.
- 3.4.3 Insulation resistance tests shall be performed for all wiring and equipment installed under this division. Insulation resistance tests shall be performed with a 500 V megger instrument for equipment up to 350 V and with 1000 V megger for 350 – 600 V circuits and recorded in a formal letter and provided to the Consultant for review and approval. Lighting and power circuit feeders shall be meggered and the insulation resistance between live parts and ground shall not be less than 2 mega ohms. During the performance of the test the neutral conductor shall be disconnected from the ground and reconnected afterwards.
- 3.4.4 Conduits or ducts which are required to be installed but left empty shall be tested for clear bore using a ball mandrel of approximately 85% of the conduit or duct inside diameter. Any conduit or duct which rejects the ball mandrel shall be cleared at no additional cost

to the Owner. Provide a letter to the Consultant stating that this task is completed.

- 3.4.5 Single phase loads shall be connected so that there is the least possible imbalance of the supply. Common neutral shall be used for maximum 3 of 1-phase circuits, each circuit on a different phase.
- 3.4.6 Furnish labour, materials, instruments and bear all costs for tests as requested by the Engineer.
- 3.4.7 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

END OF SECTION

1. GENERAL

1.1 Description

- 1.1.1 This section describes the procedures for electrical demolition work.

1.2 General Conditions

- 1.2.1 Refer to all other Divisions of the Specifications and these documents to determine their effect upon the work of this section.
- 1.2.2 Treat the demolishing equipment containing designated substances (e.g. PCBs, asbestos, etc.) in accordance with all applicable regulations and codes. Certificates for destruction of equipment containing such substances are required for performing the work.

1.3 Scope

- 1.3.1 Furnish all labour, materials, equipment, transportation, services, facilities and supervision necessary to demolish all equipment, systems and materials specified herein and on the drawings.
- 1.3.2 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
- 1.3.3 Furnish all labour, equipment and supervision necessary to surrender (hand over) to the Owner all equipment, systems and materials specified herein and on the drawings
- 1.3.4 Prepare drawings, stamped and signed by a licensed professional engineer, indicating temporary bracing and/or supporting structures required during the demolition as described herein.
- 1.3.5 In general, the demolition of the electrical systems comprises, but is not limited to:
- .1 Removal of backwash Pump #1 fed from MCC2E.
 - .2 Removal existing MCC-3N.
 - .3 Removal existing ATS and emergency generator connection box.
 - .4 Removal of HLP#6.
 - .5 Removal of three sections of High Lift North Pump Room MCC.

1.4 Coordination

- 1.4.1 Coordinate demolition work with the Construction Manager and Owner staff to ensure no disruption of station operation.
- 1.4.2 Refer to section 16010 – Electrical General Requirements of this specification for coordination with all other trades.

1.5 Submittals

- 1.5.1 Provide stamped and signed drawings for all structural demolition and temporary supporting works.
- 1.5.2 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.

1.6 Procedures and Stages

- 1.6.1 Demolition and removal of the existing electrical equipment will not begin prior to the installation and commissioning and satisfactory operation of all new and temporary equipment.
- 1.6.2 Demolition and/or removal of equipment must follow the approved sequencing schedules.
- 1.6.3 Perform the demolition of electrical systems such that availability and continuity of supply, monitoring and control of the common systems and auxiliaries are kept and secured.
- 1.6.4 Demolition procedures outlined herein are suggestions only. The contractor is to take full responsibility for all procedures employed.

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 Owner 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 as not to damage other services and equipment and not to affect the use and function of any process equipment and any services (electrical power, lighting, communication, and heating) for the rest of the facility.
- 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 Remove abandoned conductors to these circuits must be removed. This also applies to all abandoned conductors that exist within the construction zones identified in the contract drawings.
- 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 – Equipment Identification.
 - .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 Demolition and disposal
 - .1 Unless noted otherwise all power distribution identified for demolition is to be removed and disposed of from site.
 - .2 The Contractor shall correlate the demolition requirements on the electrical drawings with all other drawing drawings and disciplines to ensure that all power and control wiring distribution is removed for any equipment identified for demolition.
 - .3 Remove all power distribution and/or control wiring and related infrastructure that are rendered redundant as a result of the required equipment removals. Remove power distribution and make safe up to the first over current protection device that is to remain in service.
 - .4 Remove the equipment or material from site and dispose in accordance with all applicable regulations and codes. The contractor is to pay all associated fees for disposal.
 - .5 The Contractor shall take all reasonable steps to ensure that equipment removed from site is reused or recycled.

- .6 Remove surface-mounted conduits made obsolete by this project and remove from site. Tag, seal and cap unused, embedded conduits.

END OF SECTION

1. GENERAL

1.1 Description

- 1.1.1 This section describes the requirements for the new building ground and general grounding and bonding requirements.

1.2 Scope

- 1.2.1 Provide a complete grounding system for the new electrical distribution, including panelboards, switchboards, transformers, and all equipment supplied by the distribution system.
- 1.2.2 Provide bonding conductors for all electrical equipment. Unless otherwise indicated provide a dedicated bond conductor for to 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 metallic raceway power distribution application sized in accordance with Table 16 of the Ontario Electrical Safety Code. Ground conductor to be installed adjacent to the current carrying conductors.

1.3 References

- 1.3.1 ANSI/IEEE 837-1988, Qualifying Permanent Connections used in Substation Grounding.
- 1.3.2 IEEE Standard 142™-1991 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 Rod electrodes: copper clad steel 19mm diameter, by 3m long.
- 2.1.3 Grounding conductors: bare stranded copper, tinned, soft annealed size as indicated.
- 2.1.4 Insulated grounding conductors: green, size: #4/0 AWG.
- 2.1.5 Ground bus: copper bus with insulated supports complete with fastenings, connectors.
- 2.1.6 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 Install connectors in accordance with manufacturer's instructions.
- 3.1.3 Provide a dedicated bonding conductor in all metallic and non-metallic raceways.
- 3.1.4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- 3.1.5 Soldered joints not permitted to suit ground connections.
- 3.1.6 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.
- 3.1.7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- 3.1.8 Connect building structural steel and metal siding to ground by welding copper to steel.
- 3.1.9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- 3.1.10 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- 3.1.11 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 system.

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, 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., 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.
- 3.4.3 Disconnect ground fault indicator during tests.

END OF SECTION

1. GENERAL

1.1 Description

- 1.1.1 The section describes the identification requirements for electrical equipment including distribution equipment, wire and conduit and loads.
- 1.1.2 Process equipment identification requirements and requirements for client asset management tagging are found elsewhere.

1.2 Scope

- 1.2.1 Provide identification nameplates for all electrical apparatus including switchgear, distribution panels, motor starters , transformers, disconnect switches, conduit, wiring, junction boxes, breakers, contactors, system control panels, telephone panels, etc.
- 1.2.2 All power and systems wiring shall be colour coded in accordance with this Section and be provided with appropriate wire markers identifying panel circuits.

1.3 General

- 1.3.1 Nameplates for outdoor locations shall be UV resistant.
- 1.3.2 Nameplates shall be oil and water resistant.
- 1.3.3 All materials shall be suitable for the temperatures and contaminants present in the area the equipment is located in.
 - .1 Refer to the equipment specifications and drawings for the environmental conditions for each equipment.
- 1.3.4 All adhesives shall be designed to adhere permanently to the equipment.
- 1.3.5 Unless otherwise indicated, allow for average of 25 letters per nameplate
- 1.3.6 Identification to be English

1.4 Submittals

- 1.4.1 Provide samples of all nameplate materials.
- 1.4.2 Provide data sheets for all adhesive labels indicating the following:
 - .1 Dimensions and colours
 - .2 Suitable substrates
 - .3 Resistance to contaminants and environmental conditions
 - .4 Application requirements
- 1.4.3 Issue nameplates lists for review prior to manufacture

- .1 The final wording of all nameplates shall be reviewed and approved by the Owner and Consultant prior to fabrication.

2. PRODUCTS

2.1 Lamicoid Nameplates

- 2.1.1 All identification nameplates and nametags unless otherwise specified shall be engraved white letters on black background Lamicoid stock with bevelled edges. The Lamicoid stock shall be 3 mm minimum thickness.
- 2.1.2 For equipment in dry, indoor areas, lamicoid nameplates shall be drilled for mechanical attachment
- 2.1.3 In wet, outdoor and/or classified locations, provide lamicoid nameplates with pressure-sensitive adhesive suitable for the material and environment.
- 2.1.4 Where equipment surfaces prevent mechanical or adhesive fastening, mount lamicoid nameplates with stainless steel chains
 - .1 In classified areas, provide non-sparking chains.

2.2 Wire Markers

- 2.2.1 Provide pre-printed, permanent, heat-shrink, labels for wires less than #1 AWG.
 - .1 Colour: Black letters on white body unless otherwise indicated.
- 2.2.2 Provide cable markers for all wires #1 AWG and larger.
- 2.2.3 All wire markers shall be fire retardant.
- 2.2.4 Acceptable Products:
 - .1 Brady Perma-sleeve
 - .2 Panduit Military Grade Heat Shrink Labels
 - .3 Approved equivalent

2.3 Cable Markers

- 2.3.1 Provide pre-printed, plastic, clip-on wire markers.
 - .1 Colour: White letters on black body
- 2.3.2 Acceptable products:
 - .1 Thomas & Betts type SM markers
 - .2 Approved equivalent

2.4 Phasing Tape

- 2.4.1 Coloured polyvinyl chloride (PVC) electrical tape with pressure-sensitive adhesive.
- 2.4.2 The tape shall be 7 mils thick (min)
- 2.4.3 The tape shall meet CSA C22.2 No.197 and shall be marked as "Flame-Retardant."
- 2.4.4 The tape shall be compatible with synthetic cable insulations, jackets and splicing compounds.
- 2.4.5 Continuous operating temperature: 105 °C (min)
- 2.4.6 Voltage Rating: 600 V (min)

2.5 Distribution Equipment – General

- 2.5.1 Engrave nameplates for switchgear, switchboards, distribution panels, MCCs splitters and other distribution equipment as follows:
 - .1 First line: Equipment Name per single line in 25 mm high lettering
 - .2 Second line: Voltage in 13 mm high letters
 - .3 Example:
 - .1 SWG-0100
 - .2 600 V

2.6 Lighting Panels and Splitters

- 2.6.1 Engrave nameplates for lighting panels and splitters as follows:
 - .1 First line: Equipment Name per single line in 13mm high lettering
 - .2 Second line: Voltage in 8 mm high letters
 - .3 Third Line: Source in 8 mm high letters
 - .4 Example:
 - .1 LP-A
 - .2 120/240V

2.7 Disconnect switches, Combination Starters and Field-Mounted VFDS

- 2.7.1 Engrave nameplates for disconnect switches, combination starters, field-mounted VFDs as follows:
 - .1 Equipment description per the single line diagram in 13 mm high letters

- .2 Equipment number per the single line diagram in 13 mm high letters
- .3 Example:
 - .1 Sanitary Lift Pump
 - .2 SLP No. 1

2.8 Loads

- 2.8.1 Engrave nameplates for all loads as follows:
 - .1 Equipment description per the single line diagram in 13 mm high letters
 - .2 Equipment number per the single line diagram in 13 mm high letters
 - .3 Voltage in 8 mm high letters
 - .4 Example:
 - .1 Sanitary Lift Pump
 - .2 SLP No. 1
 - .3 600 V
 - .5 Comply with the owner's equipment identification requirements.

2.9 Junction boxes, Terminal Cabinets, Pull Boxes, etc.

- 2.9.1 Terminal cabinets and pull boxes: indicate equipment being controlled and its voltage
- 2.9.2 Nameplates for junction boxes, terminal boxes, pull boxes, etc. larger than a 100mm square to indicate system voltage characteristics.
- 2.9.3 Engrave nameplates for all loads as follows:
 - .1 Equipment description per the single line diagram in 13 mm high letters
 - .2 Equipment number per the single line diagram in 13 mm high letters
 - .3 Voltage in 8 mm high letters
 - .4 Example:
 - .1 Sanitary Lift Pump
 - .2 SLP No. 1
 - .3 600 V

- .5 Comply with the owner's equipment identification requirements.

2.10 Transformers

2.10.1 Engrave nameplates for all transformers as follows:

- .1 Equipment description per the single line diagram in 25 mm high letters
- .2 Primary and Secondary voltage in 13 mm high letters
- .3 Example:
 - .1 TR-1
 - .2 600-208/120 V

2.11 Control Stations

2.11.1 Panel Label:

- .1 Provide Lamicoid nameplate indicating panel name and number in 13 mm high letters.

2.11.2 Pilot devices:

- .1 Provide Lamicoid plates indicating the device function.
- .2 Lettering shall be 6 mm high
- .3 Colour: Black plate with white lettering

2.11.3 Interior Components:

- .1 Provide self-adhesive labels adjacent to all devices including relays, fuses, etc. to indicate the specific device reference number.
- .2 Label devices according to the manufacturer's drawings.
- .3 Mark the fuse rating on all fuse labels.
- .4 Mark the transformer primary and secondary voltages and kVA rating for all transformers.

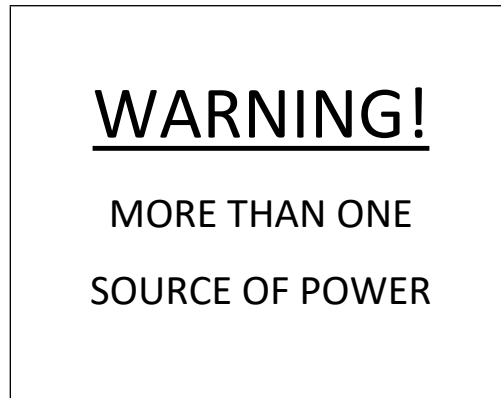
2.12 Warning Signs

- 2.12.1 Provide warning signs as specified or to meet requirements of the Electrical Safety Authority (ESA) and Engineer.
- 2.12.2 Unless otherwise specified, signs shall comply with CAN/CSA-Z321-96 Signs and Symbols for the workplace.
- 2.12.3 Decal signs, minimum sized 175x50mm.
- 2.12.4 Protect exposed live equipment during construction for personnel safety.

- 2.12.5 Shield and mark live parts "LIVE 600 VOLTS", or with appropriate voltage in English.

2.13 Warning Labels – Contract Drawings

- 2.13.1 Provide warning lamicoid labels as specified in the contract drawings for control panels.
- 2.13.2 Inscribe WHITE letters on a RED background stating:



- 2.13.3 Overall label dimensions: H = 30 mm approx., W = 70 mm approx.
- 2.13.4 Line 1 text: 6.5 mm high approx.
- 2.13.5 Line 2 and 3 text: 3.5 mm high approx.

3. EXECUTION

3.1 General

- 3.1.1 Plates shall be installed after all painting has been completed.

3.2 Lamicoid Nameplates

- 3.2.1 Lamicoid nameplates shall be mounted behind the panel door, mechanically fastened or secured with contact cement.

3.3 Adhesive Labels

- 3.3.1 Clean all surfaces in accordance with manufacturer's recommended procedure prior to applying adhesive nameplates.
- 3.3.2 Do not apply adhesive labels when the temperature is outside the manufacturer's recommended range.
- 3.3.3 Feeder cables shall be colour coded in each terminal panel and junction box with phasing tape.

3.4 Wiring Identification

- 3.4.1 Identify wiring at both ends and at all points that the conductors is accessible (i.e. distribution panels, MCC, junction boxes, elbows, etc.)

- 3.4.2 Identify each control conductor in accordance with the Region Standards.
- 3.4.3 Identify all power conductors according to the application and/or circuit number.
- 3.4.4 Identify spare wiring with unique tag number and record on record drawings.
- 3.4.5 Wiring identification shall match the drawings.
- 3.4.6 Apply phasing tape where the wire jacket does not indicate phase.

3.5 Conduit and Armoured Cable Identification

- 3.5.1 Apply conduit marking tape at points where conduit or cable enters equipment, walls, ceilings, or floors, and at 10m intervals.

3.6 Manufacturers and CSA Labels

- 3.6.1 Visible and legible after equipment is installed

END OF SECTION

1. GENERAL

1.1 Description

- 1.1.1 The section describes the products and installation methods for cable trays.

1.2 Scope of Work

- 1.2.1 Provide new cable tray systems to suit the 600V power distribution feeders from the new MCC to respective process applications, emergency generation and distribution equipment.

1.3 References

- 1.3.1 CSA C22.2 No.126 Cable Tray Systems.
- 1.3.2 NEMA VE-1, Cable Tray Installation Guidelines

1.4 Design Requirements

- 1.4.1 Comply with Division 1 – General Requirements and Section 16010 – General Electrical Requirements.
- 1.4.2 CSA Class C1 load carrying capability, ladder, aluminium, 75mm minimum side rail height, width to suit the design drawings.
- 1.4.3 All installation and mounting hardware shall be stainless steel.
- 1.4.4 All cable tray dimensions shown on the drawings are minimum requirements. The Contractor is required to increase the cable tray dimensions as required to ensure that all single conductor installations maintain a free air ampacity ratings in accordance with the Ontario Electrical Safety Code.

1.5 Site Conditions

- 1.5.1 The Contractor shall travel to site prior to tender closing to examine the pumping station. The Contractor is required to verify the existing building conditions and locations of existing building services that are in the path of the proposed cable tray installations.
- 1.5.2 The Contractor is responsible for obtaining all measurements and clearances to suit the design and installation of the new cable tray.

1.6 Product Data

- 1.6.1 Submit shop drawings in accordance with Section 01330 – Submittal Procedures.
- 1.6.2 Drawings to include individual product sheets for each type of cable tray section, quantity, and dimensions.

1.7 Submittals

- 1.7.1 A detailed submittal package identifying the equipment to be supplied shall be furnished.
- 1.7.2 The submittal package shall identify all cable tray components to be installed to suit the specific cable tray applications.
- 1.7.3 Provide a drawing for each application that identifies the cable tray routing for each, including horizontal and vertical bends and/or transitions.

2. PRODUCTS

2.1 Materials

- 2.1.1 Acceptable cable tray manufacturers:
 - .1 Cooper B-Line
 - .2 Thomas & Betts
 - .3 Electro Tray
 - .4 Canstrut Inc.
 - .5 Pursley Inc.
- 2.1.2 Provide ventilated aluminium cable trays to facilitate free air cable ratings unless otherwise indicated.
- 2.1.3 Ladder type cable tray: 300mm rung-spacing.
- 2.1.4 Solid type cable tray: For unarmoured and instrumentation cables in the electrical room, complete with solid cover.
- 2.1.5 Barriers: Solid metal, of same material as cable tray.
- 2.1.6 Fitting bending radius: 600mm minimum
- 2.1.7 Anchors: Type HKD by HILTI (Canada) Ltd., type Redhead Multi-set II Anchors by Phillips.
- 2.1.8 Hanger rods and hardware to be stainless steel 12mm minimum diameter.
- 2.1.9 Provide stainless steel mounting hardware.

2.2 Cable Cleats

- 2.2.1 Material: Cleats should be made from non-magnetic material.
- 2.2.2 Provide cleats with integral low-smoke, zero halogen pads.
- 2.2.3 Single conductor cable cleats shall be short circuit rated to 50 kA RMS minimum.

3. EXECUTION

3.1 Installation - General

- 3.1.1 Provide cable tray raceway systems as indicated with fittings, accessories and hangers required.
- 3.1.2 Do not suspend or support the cable tray from existing building services or service equipment. All cable trays are to be supported from the building structure.
- 3.1.3 Coordinate location of supports and runs with other trades.
- 3.1.4 Install cable tray and duct runs to avoid interferences with process or service equipment, piping and ducting. Install trays and ducts parallel to building lines and conserve head room.
- 3.1.5 Space tray supports 1200mm maximum and duct supports 1500mm maximum. Mechanically bolt tray connections. Install supports within 300mm of either side of bends and T fittings.
- 3.1.6 Provide support system adequate to accommodate stresses imposed by cable pulling.
- 3.1.7 Support tray with gusseted or strut cantilever supports where trays run adjacent and parallel to walls and with strut supports hung from pairs of threaded rods where elsewhere.
 - .1 Centre-hanger or single-channel supports shall not be used unless shown on the drawing.
- 3.1.8 Arrange tray so that splice joints are at the first or third quarter point of the span.
- 3.1.9 Anchor support system to concrete, concrete block and other masonry surfaces. Do not drill into concrete beams without written authorization from Contract Administrator. Do not crack masonry surface when drilling.
- 3.1.10 Fasten support systems to structural steel with beam clamps. Do not weld, drill or cut structural steel without written authorization from Contract Administrator.
- 3.1.11 Fasten vertical cable trays terminating at equipment enclosure to top of enclosure.
- 3.1.12 Touch-up field cut steel trays and ducts with zinc rich galvanizing primer.

3.2 Fittings

- 3.2.1 Use appropriate fittings for all bends, junctions and conduit take-offs.
- 3.2.2 Close off dead ends of cable tray and duct with fittings recommended by manufacturer.

3.3 Outdoor Trays

- 3.3.1 All trays installed outdoors shall have peaked roofs of ventilated or non-ventilated construction to match the tray specification.

3.4 Clearances

- 3.4.1 Allow 300 mm clear space between trays on parallel runs.
- 3.4.2 Allow 150 mm clear space between trays at crossings.
- 3.4.3 Vertical clearances are from top of lower tray to bottom of upper tray.
- 3.4.4 Allow for unobstructed clamping of cables or conduits in cable trays.

3.5 Expansion Joints

- 3.5.1 Provide expansion joint type coupling connectors and bonding jumpers at building expansion joints and on straight runs exceeding 30m.

3.6 Drop Ceilings

- 3.6.1 Install trays above drop ceilings where drop ceilings are present.

3.7 Transits through Walls and Floors

- 3.7.1 Install tray and duct systems continuous through non-fire rated walls and floors.
- 3.7.2 Trays shall be non-continuous through fire-rated walls and floors.
- 3.7.3 After installation of trays, and cables seal openings in walls and floors to original fire rating with fire resistant material. Refer to Section 16010 – Fire Transits.
- 3.7.4 Provide vertical tray sections with removable solid covers to 3000mm minimum from finished floor level.

3.8 Bonding

- 3.8.1 Install a bare copper conductor in each tray for equipment grounding. Comply with Inspection Authority requirements. Attach ground conductor to each tray section and fitting with an accepted ground clamp. Alternatively, connect tray sections and fittings together utilizing a mechanical bonding method acceptable to Inspection Authority.
- 3.8.2 Bond trays and ducts to building grounding system at 15m maximum intervals and at ends.

3.9 Installation of Cables

- 3.9.1 Securely clamp cables in circuit groups using fault rated cable cleats.

- 3.9.2 Secure three conductor cables in horizontal runs with zip ties except at the ends of trays. At all tray ends, clamp cables to tray with cable cleats.
- 3.9.3 Clamp all cables to tray in vertical runs.
- 3.9.4 Form drip loops in cables prior to cable entry into equipment.
- 3.9.5 Remove burrs and uneven edges prior to installing cable.
- 3.9.6 Unless otherwise indicated, space cables to allow free air rating.
- 3.9.7 When pulling cables into tray, use rollers and/or guides as necessary to prevent rubbing between cables.

END OF SECTION

1. GENERAL

1.1 Description

- 1.1.1 This section describes the requirements for wire and cable up to 1000V for power, control and communications circuits.
- 1.1.2 This section does not apply to special-application wiring such as festoon cables, wiring provided by manufacturers to run between parts of packaged systems, or to wiring inside equipment and panels. Refer to the individual equipment specifications.
- 1.1.3 Refer to Division 13 for wiring associated with SCADA systems and for communications wiring.

1.2 General

- 1.2.1 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.
- 1.2.2 Where cable constructions are shown on drawings, the drawings shall take precedence.
- 1.2.3 All cables to be sized and installed in accordance with the OESC.
- 1.2.4 All conductors shall be stranded copper unless otherwise noted.
- 1.2.5 All exposed wiring should have flame test rating FT4 unless otherwise indicated.
 - .1 All wiring in plenums including areas above drop ceilings acting as plenums shall have flame test rating FT6. .
- 1.2.6 Wire and cable for all applications shall meet the equipment suppliers requirements and the OESC. Where this section does not contain specific requirements, refer to the manufacturer's instructions and the OESC.

1.3 Related Sections

- 1.3.1 Section 13010 – Process Control - General

1.4 References

- 1.4.1 CSA C22.2 No.0.3-92, Test Methods for Electrical Wires and Cables.
- 1.4.2 CSA - 600 V AWM I/II A/B – For VFD Applications
- 1.4.3 CSA C22.2 No. 131 Type TECK 90 Cables.
- 1.4.4 CSA C22.2 No. 38 Thermoset Insulated Wires and Cables.

- 1.4.5 CSA C22.2 No. 174 Cables and Cable Glands for use in Hazardous Locations.
- 1.4.6 CSA C22.2 #239 Control and Instrumentation Cable
- 1.4.7 NEMA WC 70 Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.

1.5 Submittals

- 1.5.1 Submit product data in accordance with Section 01330-Submittals.
- 1.5.2 Provide data sheets indicating the following:
 - .1 Manufacturer's name
 - .2 Cable type and ratings
 - .3 Approval listings
 - .4 Conductor, insulation, shield and jacket materials (as applicable)
 - .5 Temperature ratings for conductors and installation
 - .6 Weight/unit length
 - .7 Allowable pulling tension and sidewall bearing pressure
 - .8 Minimum bend radius
 - .9 Manufacturer's handling and installation requirements.

2. PRODUCTS

2.1 Colours

- 2.1.1 Colour Coding, three phase systems:
 - .1 Phase A – Red
 - .2 Phase B – Black
 - .3 Phase C – Blue
- 2.1.2 Colour Coding, single phase systems:
 - .1 Live – Black
 - .2 Neutral – White
- 2.1.3 Insulated ground wires: green.
- 2.1.4 Colour Coding, Control Wiring
 - Blue - DC control

Red	-	AC control
Black	-	PT secondary connections
Orange	-	CT secondary connections
Green	-	Non-current carrying ground
White	-	Neutral
		Current carrying ground
Yellow	-	Interlocks
Brown	-	Generator excitation system

2.2 Minimum Conductor Sizing

2.2.1 The minimum conductor sizing shall be as follows:

- .1 Motor or branch circuit feeders: 12 AWG.
- .2 Lighting panel home runs exceeding 25 m: #10 AWG
- .3 Remote DC emergency fixtures: 10 AWG.
- .4 Digital control wiring, 24 to 120 VAC/VDC: 14 AWG
- .5 CT Secondaries: #10 AWG.
- .6 Fire alarm circuits: #14 AWG
- .7 PA circuits: #16 AWG

2.3 Size telephone wiring conductors in accordance with telephone utility standards. Identification

- 2.3.1 Identify all wiring with wire markers at both ends.
- 2.3.2 All branch circuit wiring and all systems wiring shall be identified at all panels and terminal boxes with Thomas & Betts SM markers.
- 2.3.3 All wiring shall be identified with Brady Markers at junction boxes and termination points.

2.4 Terminations

- 2.4.1 All wiring connections shall be made with T & B StaKon pressure connector, or approved equal, applied with a ratcheting pressure tool.

- 2.4.2 Wiring connections, where required, shall be made with CSA approved compression tool with a nylon cap equal to Buchanan "Pres Sure".
- 2.4.3 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.

2.5 Unarmoured Power Wire

- 2.5.1 System Description: 600 V solidly grounded, 120/208 and/or 120/240 solidly grounded power conductors.
- 2.5.2 Allowable Construction:
 - .1 Wire in conduits, above grade: 1/C, RW90
 - .2 Wire in conduit, underground and/or wet locations: 1/C, RWU90
 - .3 Insulated ground wires for cable tray and above-ground, dry area conduit: 1/C, RW90
 - .4 Insulated ground wires, below grade conduits and wet areas: 1/C, RWU90
 - .5 All conductors copper unless otherwise noted
 - .6 Wire in conduits shall have minimal application, TECK90 is preferred. Refer to the drawings for additional information.
- 2.5.3 Insulation: XLPE, 1000V, 90°C or 105°C as required.
- 2.5.4 Shielding: Non-shielded
- 2.5.5 Jacket: abrasion, oil and acid resistant.
- 2.5.6 cUL Flame test: FT4
- 2.5.7 Type RW90 and RWU90 construction shall meet CSA C22.2 No. 38.
- 2.5.8 Acceptable manufacturers: Prysmian, Nexans, Southwire, United Wire of Canada.

2.6 Armoured Power Wire and Cable

- 2.6.1 System Description: 600 V solidly grounded, 120/208 and/or 120/240 solidly grounded power conductors.
- 2.6.2 Environmental Conditions: damp indoor areas with temperatures ranging between -10 °C and 40 °C.
- 2.6.3 Shielding: non-shielded cable unless otherwise noted.
- 2.6.4 Allowable Construction:
 - .1 Wire in tray in dry, damp or wet areas: TECK90, FT4

- .2 Wire in classified areas: TECK90, HL, FT4
- .3 Direct buried wiring: TECK 90, -40 °C
- .4 Concealed wiring in office areas: AC90
- 2.6.5 Insulation: XLPE, 1000 V, 90 °C (wet)
- 2.6.6 Shielding; none
- 2.6.7 Inner and outer jacket: moisture and oil resistant, low-acid gas, sunlight resistant,
 - .1 Outer jacket colour: black
- 2.6.8 Flame Spread Rating: FT4.
- 2.6.9 Acceptable manufacturers: Prysmian, Nexans, Southwire, United Wire of Canada.

2.7 VFD Cables

- 2.7.1 VFD cables shall have continuous copper or aluminium sheaths.
- 2.7.2 Acceptable cable type
 - .1 Belden VFD Cable Series 295 CSA-1000 V AWM I/II A/B, dedicated armoured cable
 - .2 Approved, CSA C22.2 No. 123-96 equal
- 2.7.3 Provide product shop drawing submissions that confirm the cable is rated to suit VFD applications.
- 2.7.4 Acceptable manufacturers: Prysmian, Nexans, Southwire, United Wire of Canada.

2.8 Digital Control Wire

- 2.8.1 Conform to the requirements of Division 13.
- 2.8.2 System Descripton: field wiring, 24 to 120 V digital signals for control circuits when run in conduit
- 2.8.3 Allowable Construction
 - .1 TECK90
- 2.8.4 Insulation: XLPE, 600V, 90°C
- 2.8.5 Shielding: Non-shielded
- 2.8.6 Jacket: abrasion, oil and acid resistant.
- 2.8.7 cUL Flame test: FT4
- 2.8.8 Type RW90 and RWU90 construction shall meet CSA C22.2 No. 38.

- 2.8.9 Acceptable manufacturers: Prysmian, Nexans, Southwire, United Wire of Canada.

2.9 Analog Control Wire

- 2.9.1 Conform to the requirements of Division 13.
- 2.9.2 System description: 0-10 V and 4-20 mA signal wiring for control setpoints and feedback. Does not apply to speciality signal conductors such as flow meters.
- 2.9.3 Allowable Construction:
- .1 Cables in conduit: ACIC
- 2.9.4 Conductor: #18 AWG, 7x26 stranded, copper or to match required cable impedance
- 2.9.5 Cable: individual wires formed into pairs or triads as required by the application. Provide multi-pair/multi-triad cables where indicated.
- 2.9.6 Insulation: PVC, 300 V, 90°C (dry and wet)
- 2.9.7 Shielding:
- .1 Inner Shield: Aluminium/polyester tape shield over individual pairs or triads.
 - .2 Inner Drain Wire: 7-strand tinned copper drain wire.
 - .3 Outer Shield: Aluminium/polyester tape shield over cable.
 - .4 Outer Drain Wire: 7-strand tinned copper drain wire.
- 2.9.8 All cables to have a ripcord.
- 2.9.9 Jacket: 90°C (-40°C) PVC
- 2.9.10 cUL Flame test: FT4
- 2.9.11 Control cables shall meet CSA, C22.2 No. 239.
- 2.9.12 Acceptable manufacturers: Shawflex, Belden.

2.10 Thermocouple/RTD Wire

- 2.10.1 Conform to the requirements of Division 13.
- 2.10.2 System description: field wiring for thermocouples between thermocouple junction box on equipment to monitoring instrument.
- 2.10.3 Allowable Construction:
- .1 ACIC in armoured flex conduit.
- 2.10.4 Conductor: #18 AWG, 7x26 stranded, copper or to match required cable impedance

- 2.10.5 Cable: individual wires formed into pairs or triads as required by the application.
- 2.10.6 Insulation: PVC, 300 V, 105°C
- 2.10.7 Shielding:
 - .1 Outer Shield: Aluminium/polyester tape shield over cable.
 - .2 Outer Drain Wire: 7-strand tinned copper drain wire.
- 2.10.8 Jacket: 105°C (-40°C) PVC, Low-Acid Gas
- 2.10.9 cUL Flame test: FT4
- 2.10.10 Control cables shall meet CSA, C22.2 No. 239,
- 2.10.11 Acceptable manufacturers: Shawflex, Belden.

3. EXECUTION

3.1 Shipping and Storage

- 3.1.1 Wire and cable shall be maintained in dry environment with ends sealed at all times.
- 3.1.2 Protect reels from damage.
- 3.1.3 Damaged reels shall be removed from site. Prior to removal from site reels shall be marked by the Contract Administrator to prevent reuse.

3.2 Power Wiring - General

- 3.2.1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 16133 – Conduits, Conduit Fastenings & Fittings
 - .2 In underground ducts in accordance with Section 16051 – Installation of Cables in Ducts and Trenches
- 3.2.2 All feeders shall run in continuous length between power supply point and the load. No splices will be allowed in feeder cable.
- 3.2.3 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.
- 3.2.4 Install 20% spare control wiring capacity in each controls conduit.

3.3 Armoured Cables

- 3.3.1 Group cables wherever possible in channels.
- 3.3.2 Use sheeves/shoes or other guides to ensure smooth changes in direction and to minimize cable tension.

- 3.3.3 Install cable in trenches in accordance with Section 16051 – Installation of Cables in Ducts and Trenches.
- 3.3.4 Group cables wherever possible.
- 3.3.5 Install cable in trenches in accordance with Section 16051 – Installation of Cables in Ducts and Trenches.

3.4 VFD Cables

- 3.4.1 Supply and install all VFD motor cables in dedicated armoured cables, including underground and aboveground applications.
- 3.4.2 VFD Cable terminations are to be inspected by the VFD manufacturer's representative prior to energizing the VFD starter.

3.5 Control Wiring

- 3.5.1 Conform to the requirements of Division 13.
- 3.5.2 All cables and wires to be continuous runs.
- 3.5.3 Use TECK90 cable unless otherwise specified. Refer to this division and to the drawings for additional information, requirements and details.
- 3.5.4 Provide minimum 20% spare wiring or two (2) conductors (1 pair) whichever is greater for each run.
- 3.5.5 All wires must be tagged with pre-numbered slip-on markers. Allow for up to ten (10) characters per individual wire. No wrap around markers will be accepted.
- 3.5.6 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 Contract Administrator or unless a specific requirement of the equipment manufacturer.
 - .3 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.
 - .4 Coordinate with the manufacturer and other sections of these specifications to ensure proper conduit type (ie: metal) and sizes are provided.

- .5 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.

3.6 Communications Cables

- 3.6.1 Supply and install all communications cables to suit the communications system connection requirements.
- 3.6.2 All communications cables located outdoors or in classified areas are to be TECK90 unless otherwise indicated.

3.7 Testing

3.7.1 General

- .1 Test all wire and cables prior to energization.
- .2 Clean and dry ends of wire and cable prior to test.
- .3 Provide a written (typed) report to suit the test results for each cable indicating:
 - .1 Equipment make/model and calibration data
 - .2 Operator name or employee number and initials
 - .3 Environmental conditions including temperature and approximate humidity (e.g. dry/damp/wet)
 - .4 Cable tag number, description (e.g #10AWG, 3/C, TECK90) and length under test
 - .5 Results in MΩ/unit length
 - .6 Reports may be handwritten in logbook or typed.
- .4 Where power factor correction equipment is installed, it may be necessary to disconnect the capacitors from the system prior to testing to avoid overvoltage.
- .5 Disconnect sensing and protection equipment from the respective circuits to be megger tested including PT's and Surge Protectors.
- .6 Do not perform megger tests on control circuits containing transistorized or solid-state components.
- .7 Conduct tests in accordance to NETA standards.
- .8 The Contractor shall repeat the test in the presence of the Contract Administrator for any cable listed in the test report, at the request of the Contract Administrator.

3.7.2 Power cables (types TECK, RW, RWU, STJ, AC90, etc)

- .1 Perform 1000V DC insulation resistance test.
- .2 Test each circuit with equipment disconnected.
- .3 Test phase-to-phase and phase-to-ground.
- .4 Take test results after one (1) minute at full voltage.
- .5 Cables with an insulation resistance > 50 MΩ shall be considered acceptable.
- .6 Cables with an insulation resistance of less than 50 MΩ shall be reported to the Contract Administrator for investigation and remedial action shall be taken by the Contractor after discussion with the Contract Administrator.
- .7 Cables with an insulation resistance <2 MΩ shall be removed and replaced.

3.7.3 Control cables ()

- .1 Perform 500V DC insulation resistance test.
- .2 Test each control circuit to ground only.
- .3 Take test results after one (1) minute at full voltage
- .4 Cables with an insulation resistance > 50 MΩ shall be considered acceptable.
- .5 Cables with an insulation resistance of less than 50 MΩ shall be reported to the Contract Administrator for investigation and remedial action shall be taken by the Contractor after discussion with the Contract Administrator.
- .6 Cables with an insulation resistance <2 MΩ shall be removed and replaced.
- .7 Submit the testing results as a formal shop drawing submission

3.7.4 Instrumentation and Thermocouple Wiring

- .1 Check continuity of each wire using ohm meter or DC buzzer. Megger or 120 V filament lamp testing is not acceptable.
- .2 Test thermocouple wiring for continuity and polarity in accordance with manufacturer's recommendations.

END OF SECTION

1. GENERAL

1.1 Description

- 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 Shop Drawings and Product Data

- 1.2.1 Submit shop drawings and product data for junction and pull boxes in accordance with Section 01330 – Submittal Procedures.

1.3 General Requirements

- 1.3.1 All mounting hardware shall be of non-corrosive type material including:
 - .1 Stainless steel
 - .2 Aluminium
 - .3 PVC encapsulated metal
- 1.3.2 Splitter, Junction Boxes, Pull Boxes and Cabinets installed indoors or outdoors shall be ULC & UL listed.

1.4 Enclosure Ratings

- 1.4.1 Dry, non-corrosive areas: NEMA 12, sprinklerproof
- 1.4.2 Wet, damp and/or corrosive areas: NEMA 4X
- 1.4.3 Splitter, Junction Boxes, Pull Boxes and Cabinets installed indoors in classified areas shall be rated NEMA 7 to suit hazardous environments.

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 twist latch fasteners and seamless gasket all around.
- 2.1.3 Acceptable manufacturer: same as conduit system.

2.2 Aluminum 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 twist latch fasteners and a seamless gasket all around.
- 2.2.3 Acceptable manufacturer: same as conduit system.

2.3 Cabinets

- 2.3.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- 2.3.2 Type T: sheet steel cabinet, with hinged door, latch, lock, two (2) keys, containing Unistrut backing flush mounted.
- 2.3.3 Cabinets to be rated NEMA 4X unless indicated otherwise on the drawings.

3. EXECUTION

3.1 Junction, Pull Boxes and Cabinets Installation

- 3.1.1 Boxes shall be surface mounted in unfinished areas and flush mounted in finished (e.g. office) areas.
- 3.1.2 Install pull boxes in inconspicuous but accessible locations.
- 3.1.3 Mount cabinets with top not higher than 2m above finished floor.
- 3.1.4 Install terminal block as indicated in Type T cabinets.

3.2 Identification

- 3.2.1 Provide equipment identification in accordance with Section 16090 – Equipment Identification.

END OF SECTION

1. GENERAL

1.1 References

1.1.1 Ontario Electrical Safety Code – Latest applicable edition and ESA latest bulletins.

1.1.2 Coduits shall have minimal use, as TECK90 shall be preferred method, refer to drawings for additional information.

~~1.1.1~~

1.2 General Requirements

1.2.1 All mounting hardware shall be of non-corrosive type material including:

- .1 Stainless steel
- .2 Aluminium
- .3 PVC encapsulated rigid steel

1.2.2 Outlet and Conduit Boxes must be of the same material as the conduit application.

1.2.3 Outlet boxes, conduit boxes and fittings installed indoors in classified areas shall be rated NEMA 7 to suit hazardous environments.

1.2.4 All outlet boxes, conduit boxes and fittings installed indoors or outdoors shall PVC encapsulated rigid metal type to match PVC encapsulated rigid steel conduit applications.

1.2.5 All Junction Boxes, Pull Boxes and Cabinets installed outdoors shall be of the same manufacturers as the conduit application and rated NEMA 4X.

2. PRODUCTS

2.1 Outlet and Conduit Boxes General

2.1.1 Size boxes in accordance with code requirements.

2.1.2 102mm 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.

2.1.5 347 V outlet boxes for 347 V switching devices.

2.1.6 Combination boxes with barriers where outlets for more than one (1) system are grouped.

- 2.1.7 All boxes used with exposed conduits to be galvanized rigid metal. Boxes to be as same as the associated conduit manufacturer.
- 2.1.8 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.
- 2.1.9 One outlet box shall be installed per switch, receptacle, light, etc.
- 2.1.10 Provide PVC encapsulated outlet and conduit boxes to suit all PVC encapsulated conduit applications. Acceptable product: Plasti-Bond, ABB (Ocal) or Atkore (Calbond)

2.2 Sheet Steel Outlet Boxes

- 2.2.1 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 (1) conduit enters one (1) side with extension and plaster rings as required.
- 2.2.2 Electro-galvanized steel utility boxes for outlets connected to surface mounted EMT conduit, minimum size 102 x 54 x 48mm.
- 2.2.3 102mm square or octagonal outlet boxes for lighting fixture outlets.
- 2.2.4 102mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

2.3 Masonry Boxes

- 2.3.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 Concrete Boxes

- 2.4.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 Conduit Boxes

- 2.5.1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.6 Outlet Boxes for Non-Metallic Sheathed Cable

- 2.6.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63mm with two (2) double clamps to take non-metallic sheathed cables.

2.7 Fittings - General

- 2.7.1 Bushing and connectors with nylon insulated throats.
- 2.7.2 Knock-out fillers to prevent entry of debris.

2.7.3 Conduit outlet bodies for conduit up to 32m and pull boxes for larger conduits.

2.7.4 Double locknuts and insulated bushings on sheet metal boxes.

2.8 Service Fittings

2.8.1 'High tension' receptacle fitting made of two (2) piece stainless steel housing finish for one (1) single receptacle(s). Bottom plate with two (2) knockouts for centred or offset installation. 12 x 102mm extension piece as indicated.

2.8.2 Pedestal type 'low tension' fitting made of two (2) piece stainless steel housing finish to accommodate two (2) Amphenol jack connectors.

3. EXECUTION

3.1 Installation

3.1.1 Support boxes independently of connecting conduits.

3.1.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

3.1.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6mm of opening.

3.1.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

1. GENERAL

1.1 Description

- 1.1.1 This section describes the requirements for conduits and associated fittings.

1.2 Scope

- 1.2.1 Utilize armored cables whenever possible, Refer to drawings for cable types.
- 1.2.2 Provide a complete conduit system to in accordance with the drawings and specifications.
- 1.2.3 Seal conduits against propagation of water, corrosive gases, fire and/or smoke.

1.3 General Requirements

- 1.3.1 The requirements of this section are generic and details and/or requirements shown on the drawings shall take precedence.
- 1.3.2 Provide conduits per the following:

Location	Area Classification	Application	Conduit Material
Indoors	Unclassified, ordinary non-corrosive or Wet/Damp	Power & control wiring, fibre optic cables.	PVC
Indoors	Unclassified, Ordinary or Wet/Damp	Telecom, VFD cables to motors, Ultrasonic Level Transmitter, Level Element wiring.	Aluminum
Indoors/Outdoors	All	Life safety	Aluminum, colour: red.
Indoors	Class I, Div 1 or 2	Power, Control & Telecom	Aluminum
Outdoors, Above Grade	Unclassified	All	Aluminum
Direct Buried	Unclassified	All	PVC
Concrete Encased	Unclassified	All	PVC
Concrete Encased	Class 1, Div 1 or 2	All	Rigid Galvanized Steel

- 1.3.3 Conduit located below grade shall be Rigid PVC, except for applications that require specific continuous conduits types as specified herein. Below grade conduit that transitions above grade to the outdoors shall be PVC Encapsulated Rigid Metal Conduit type.

1.3.4 The conduit sizes shown on the drawing are a minimum and are for a single feed. Size all conduits for multiple feeders in accordance with the Electrical Code and the spare space requirements of 16010 – Electrical General Requirements.

1.3.5 Minimum conduit size for lighting and power circuits: 19mm.

1.4 References

1.4.1 Canadian Standards Association (CSA)

- .1 CSA C22.2 NO 18.4 Hardware for the support of conduit, tubing, and cable
- .2 C22.2 NO. 45.1-07 (R2017), Electrical Rigid Metal Conduit - Steel
- .3 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit
- .4 CSA C22.2 No. 83-M1985 (R2017), Electrical Metallic Tubing
- .5 CSA C22.2 No. 211.2, Rigid PVC (Un-plasticized) Conduit
- .6 CSA - C22.2 NO. 227.3-21, Mechanical protection tubing (MPT) and fittings

2. PRODUCTS

2.1 General

2.1.1 Fittings: manufactured for use with conduit specified. The fitting material and coating shall be the same as conduit used in the application.

2.2 Rigid Aluminium Conduit

2.2.1 Meet requirements of CSA C22.2 No. 45.2

2.2.2 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

2.2.3 Fittings:

- .1 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 aluminum with integral insulated throat.
 - .2 UL listed for use in wet locations.
 - .3 Manufacturers and Products:
 - .1 O-Z/Gedney: Type CHA
 - .2 Thomas & 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
 - .2 Manufacturers (For hazardous Locations)
 - .1 Appleton
 - .2 Crouse-Hinds
 - .3 Killark
- .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
 - .3 Killark; Type EYD
- .9 Drain/Breather Fittings Manufacturers and Products
 - .1 Appleton: Type ECDB

- .2 Crouse-Hinds; ECD
- .3 Killark; Type KDB/KB
- .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

2.3 Rigid Galvanized Steel Conduit (RGS)

- 2.3.1 Meet requirements of CSA C22.2 No. 45.1
- 2.3.2 Material: Hot-dip galvanized, inside and outside, with chromated protective layer.
- 2.3.3 Fittings:
 - .1 Type: Threaded, galvanized - Set screw and threadless compression fittings not permitted.
 - .2 Bushing
 - .1 Material: Malleable iron with integral insulated throat, rated for 150°C.
 - .2 Manufacturers and Products:
 - .1 Appleton: Series BU-1
 - .2 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:
 - .1 Appleton: Series GIB
 - .2 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
 - .1 Appleton: Series HUB-B
 - .2 O-Z/Gedney: Type CH
 - .3 Meyers: ST Series
- .5 Conduit Bodies
 - .1 Sized as required by OESC.
 - .2 Manufacturers and Products (For normal Conditions)
 - .1 Appleton: Form 35 threaded unilets
 - .2 Crouse-Hinds; Form 7 or 8 threaded condulets
 - .3 Killark: Series O electrolets
 - .4 Thomas & Betts: Form 7 or 8
 - .3 Manufacturers (For hazardous Locations)
 - .1 Appleton
 - .2 Crouse-Hinds
 - .3 Killark
- .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 EYS, 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 13 mm or less; Neoprene bushing at connector entry.
 - .3 Manufacturers and Products
 - .1 Appleton: CG-S
 - .2 Crouse-Hinds: CGBS

2.4 PVC Conduit

- 2.4.1 Meet requirements of CSA C22.2 No. 211.2 and NRMA TC 2.
- 2.4.2 Suitable for areas NOT exposed to physical damage, underground direct burial, concealed or direct sunlight exposure and 90°C insulated conductors.
- 2.4.3 Unless shown otherwise on drawings or required by code, provide schedule 80 under equipment pads and schedule 40 conduit elsewhere.
- 2.4.4 PVC Conduit and Tubing
 - .1 Meet requirements of NEMA TC-3.
 - .2 Type: PVC, slip-on

2.5 PVC Coated Rigid Galvanized Steel Conduit

- 2.5.1 Meet requirements of NEMA RN 1.
- 2.5.2 Material

- .1 Meet requirements of CSA C22.2 No. 45.
- .2 Exterior finish: PVC coated, 40 mils nominal thickness, bond to metal shall have tensile strength greater than PVC.
- .3 Interior finish: Urethane coating, 2 mils nominal thickness.
- 2.5.3 Threads: Hot-dipped galvanized and factory coated with urethane.
- 2.5.4 Bendable without damage to either interior or exterior coating.
- 2.5.5 Acceptable Manufacturers: "Plasti-Bond Red", ABB (Ocal) or Atkore (Calbond)
- 2.5.6 Fittings:
 - .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 Overlapping pressure sealing sleeves.
 - .5 Conduit Hangers, Attachments, and Accessories: PVC-coated
 - .6 Manufacturers:
 - .1 Plasti-Bond
 - .2 ABB (Ocal)
 - .3 Atkore (Calbond)
 - .7 Expansion Fitting Manufacturer and Product: Ocal; OCAL-BLUE XJG, Plasti-Bond and Atkore (Calbond)

2.6 Conduit Fastenings

- 2.6.1 One (1) hole steel straps to secure surface conduits NPS 2 50mm and smaller. Two (2) hole steel straps for conduits larger than NPS 2 50mm.
- 2.6.2 Beam clamps to secure conduits to exposed steel work.
- 2.6.3 Channel type supports for two (2) or more conduits at 15m oc.
- 2.6.4 Threaded rods, 6mm dia., to support suspended channels.
- 2.6.5 All mounting hardware used outdoors and in corrosive and/or classified areas shall be of non-corrosive type material compatible with the conduit material including:

- .1 Stainless steel
- .2 Aluminium
- .3 PVC encapsulated steel

2.7 Flexible, Non-metallic, Liquid-Tight Conduit

- 2.7.1 Type: High strength plastic body, complete with lock nut, O-ring, threaded ferrule, sealing ring, and compression nut.
- 2.7.2 Body/compression nut (gland) design to assure high mechanical pull-out strength and watertight seal.
- 2.7.3 Manufacturers and Products
 - .1 Carlon: Type LT
 - .2 O-Z/Gedney: Type 4Q-P
 - .3 Thomas & Betts: Series 6300

2.8 Flexible Metallic Conduit

- 2.8.1 Meet requirements of CSA C22.2 No. 56, liquid-tight flexible metal.

2.9 Watertight Entrance Seal Device

- 2.9.1 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
- 2.9.2 Cored-Hole Application
 - .1 Material: Assembled dual pressure disks, neoprene sealing ring, and membrane clamp.
 - .2 Manufacturer and Product: O-Z/Gedney: Series CSM.

2.10 Expansion Fittings for Rigid Conduits

- 2.10.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200mm linear expansion.
- 2.10.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19mm deflection in all directions.
- 2.10.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.11 Fish Cord

- 2.11.1 6mm polypropylene in all empty conduits.

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 Install sleeves where conduits pass through slab or wall.
- 3.1.4 Do not pass conduits through structural members except as indicated.
- 3.1.5 Install conduit sealing fittings in hazardous areas in accordance with the Electrical Code. Fill with compound.
- 3.1.6 Install fish cord in empty conduits.
- 3.1.7 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- 3.1.8 Dry conduits out before installing wire.
- 3.1.9 Install conduits with minimum clearances as follows:
 - .1 To parallel steam or hot water line: 75mm
 - .2 To steam or hot water line crossover: 25mm
 - .3 To infrared or gas fired heaters: 1.5m
 - .4 To any building surface in Damp/Wet and/or Corrosive areas: 12 mm
 - .5 Between conduits containing copper communication lines and any power circuit rated at more than 600 V or 1000 A: 600 mm

3.2 Concealed Conduits

- 3.2.1 Run 2-25mm spare conduits up to ceiling space and 2-25mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

3.3 Surface Conduits

- 3.3.1 Run parallel or perpendicular to building lines.
- 3.3.2 Run conduits in flanged portion of structural steel.
- 3.3.3 Group conduits in parallel runs.

3.4 Conduits in Cast-In-Place Concrete

- 3.4.1 All cast in place conduit installations not specified on the drawings must be approved by the Contract Administrator.
- 3.4.2 Locate to suit reinforcing steel. Install in centre third of slab.
- 3.4.3 Protect conduits from damage where they stub out of concrete.
- 3.4.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- 3.4.5 Do not place conduits in slabs in which slab thickness is less than four (4) times conduit diameter.
- 3.4.6 Encase conduits completely in concrete with minimum 50mm concrete cover.
- 3.4.7 Organize conduits in slab to minimize crossovers.

3.5 Conduits in Cast-In-Place Slabs on Grade

- 3.5.1 All cast in place conduit installations not specified on the drawings must be approved by the Contract Administrator.
- 3.5.2 Run conduits 25mm and larger below slab and encased in 75mm concrete envelope. Provide 50mm of sand over concrete envelope below floor slab.

3.6 Conduits Underground

- 3.6.1 Slope conduits to provide drainage.
- 3.6.2 Waterproof joints (except PVC) with heavy coat of bituminous paint.
- 3.6.3 Provide horizontal expansion joints at building foundations and vertical expansion joints where conduits rise out of ground.

3.7 PVC Conduit

- 3.7.1 Debur all ends prior to making joints.
- 3.7.2 Solvent Weld all joints using manufacturer's recommended solvent.
- 3.7.3 Install such that joint is watertight.
- 3.7.4 Adapters:
 - .1 PVC to metallic fittings: PVC terminal type
 - .2 PVC to rigid metal conduit: PVC female adapter
- 3.7.5 Belled End Conduit: Bevel the unbelled end of the joint prior to joining.

3.7.6 PVC Conduit:

- .1 Bends 30° and larger: provide factory-made elbows.
- .2 Use manufacturer's recommended method for forming smaller bends and kicks.

3.7.7 Do not install conduit with scorch marks.

3.8 PVC Coated Rigid Galvanized Steel Conduit

- 3.8.1 Do not install conduit with major scratches or damage to the coating.
- 3.8.2 Repair minor scratches coating using manufacturer's touch-up paint.

3.9 Aluminum Conduit

- 3.9.1 Bend conduit cold.
- 3.9.2 Do not install kinked or flattened conduit.
- 3.9.3 Protect aluminum conduits in contact with concrete with:
 - .1 Apply bituminous Paint, shrink wrap or other protective coating acceptable to the Engineer and AHJ.
 - .2 Apply protective coatings in accordance with the manufacturer's recommendations
 - .3 Extend protection to 100 mm minimum from concrete.
- 3.9.4 Field threads must be of sufficient length to draw conduits up tight.

3.10 Connections to Equipment, Unclassified Areas

- 3.10.1 Make rigid connection to equipment
- 3.10.2 In unclassified areas and where the conduit size is 103mm or less use flexible, liquid-tight conduit.
- 3.10.3 Conduit size over 103mm: nonflexible.
- 3.10.4 Wet or Corrosive areas: flexible, non-metallic, liquid-tight.
- 3.10.5 Dry Areas: flexible, metallic liquid-tight.

3.11 Connections to Equipment, Classified Areas

- .1 Use TECK-HL cable for power connection between disconnect switches and explosion proof motors
- .2 Use explosion proof flexible, liquid-tight conduit for other connections to equipment containing motors or subject to vibration or other motion.

3.12 Penetrations

- 3.12.1 Make penetrations at right angles, unless otherwise shown.
- 3.12.2 Notching or penetration of structural members, including footings and beams, is not permitted.
- 3.12.3 Fire-Rated walls, floors, or ceilings: fire stop openings around penetrations to maintain fire-resistance rating as specified in Section 16010 – Fire Transits.
- 3.12.4 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.
- 3.12.5 Where conduits protrude through floor slabs in areas subject to mechanical damage, provide heavy steel guards around conduits from grade to a height of 1200 mm above grade.
 - .1 Leave drainage holes at base of guards.
- 3.12.6 Concrete walls, floors, or ceilings (aboveground): provide non-shrink grout dry-pack or use watertight seal device.
- 3.12.7 Entering Structures
 - .1 General: Seal raceway at the first box or outlet with listed water-stopping sealant to prevent the entrance of gases or liquids from one area to another.
 - .2 Arrange conduits to allow water to drain away from seals.
 - .3 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.
 - .4 Heating, Ventilating, and Air Conditioning Equipment
 - .1 Penetrate equipment in area established by manufacturer.

- .2 Terminate conduit with flexible PVC encapsulated metallic conduit at junction box or conduit attached to exterior surface of equipment prior to penetrating equipment.
- .3 Seal penetration with a Type 5 sealant.
- .5 Corrosive-Sensitive Areas
 - .1 Seal all conduits passing through chlorine/chemical room walls.
 - .2 Seal conduit entering equipment panel boards and field panels containing electronic equipment.
 - .3 Seal penetration with a Type 5 sealant.
- .6 Existing or Precast Wall (Underground): Core drill wall and install a watertight entrance seal device.
- .7 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.
- .8 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.

3.13 Support

- 3.13.1 Support from structural members only, at intervals not exceeding Canadian Electrical Code requirements and in any case not exceeding 2.5 metres. Do not support from piping, pipe supports or other raceways.
- 3.13.2 Provide supports that are impervious to galvanic reaction between dissimilar metals.
- 3.13.3 Support aluminum conduit on concrete surfaces with spacers or framing channel constructed of stainless steel, aluminum or non-metallic material.
- 3.13.4 Do not overtighten supports against conduit. Allow for conduit expansion and contraction.

- 3.13.5 Multiple Adjacent Raceways: Provide ceiling trapeze. For trapeze-supported conduit allow 25 percent extra spaces for future conduit.
- 3.13.6 Application/Type of Conduit Strap
 - .1 Rigid Steel or EMT Conduit: Zinc coated steel, pre-galvanized steel or malleable iron.
 - .2 PVC Coated Rigid Steel Conduit: PVC coated metal.
 - .3 Non-metallic Conduit: Non-metallic or PVC coated metal.
- 3.13.7 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
- 3.13.8 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

3.14 Bends, General

- 3.14.1 Install concealed raceways with a minimum of bends in the shortest practical distance.
- 3.14.2 Make bends and offsets of longest practical radius.
- 3.14.3 Bends in conduits and ducts for fiber optic cables shall be not less than 20 times cable diameter, 375mm minimum.
- 3.14.4 Make bends and kicks in parallel or banked runs from same center or centerline with same radius so that bends and kicks are parallel.

3.15 Expansion/Deflection Fittings

- 3.15.1 Provide at all structural expansion joints.
- 3.15.2 Provide on all interior conduits where required to suit a 14°C maximum temperature variation.

3.15.3 Provide on all exterior, above-grade conduits. Design for temperature range of 75°C. Each straight run shall have a minimum of one (1) fitting.

3.15.4 Install in accordance with manufacturer's instructions.

3.16 Liquid-Tight Flex

3.16.1 Control wiring terminations to be in Liquid tight, PVC encapsulated steel armoured flex to suit the transition from conduit or junction box to the respective process equipment and instrumentation.

3.16.2 Liquid tight flex shall not exceed 2m in length.

3.16.3 Bends shall exceed the minimum allowable conductor bending radius and shall allow conduit flexibility.

3.16.4 Length: 450mm minimum, 1500mm maximum.

3.17 Conduits for Ultrasonic Level Elements

3.17.1 All Ultrasonic Level Element wiring shall be installed in dedicated Rigid Aluminium conduit.

3.17.2 Install in accordance with manufacturer's instructions.

END OF SECTION

1. GENERAL

1.1 Shop Drawings and Product Data

- 1.1.1 Submit shop drawings and product data in accordance with Section 01330 – Submittals.

1.2 General Requirements

- 1.2.1 Provide Class 1, Division 1 and Division 2 switches and receptacles for hazardous area indicated on the drawings.
- 1.2.2 Provide junction boxes, cover plates and fittings for Provide Class 1, Division 1 and Division 2 hazardous area applications.

2. PRODUCTS

2.1 Colours

- 2.1.1 Provide wiring device bodies and faceplates in the following colours unless otherwise noted on the drawings:
 - .1 Switches & receptacles in process areas: Brown
 - .2 Switches & receptacles in office areas: White
 - .3 Isolated-ground receptacles: Orange

2.2 Switches

- 2.2.1 15A and 20A, 120V, single pole, double pole, three-way, and four-way switches.
- 2.2.2 Switches to be suitable for connected loads i.e.: 15A or 20A as required and/or shown on the drawings.
- 2.2.3 Manually operated general purpose AC switches with the following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
- 2.2.4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- 2.2.5 Switches of one (1) manufacturer throughout project.
- 2.2.6 Acceptable Suppliers:
 - .1 Hubbell
 - .2 Pass and Seymour

.3 Smith and Stone

2.3 Receptacles – Non Hazardous

- 2.3.1 Provide duplex receptacles, CSA type 5-15 R, 125 V, 15A, U ground with the following features where shown on drawings:
 - .1 Suitable for 10 AWG for back and side wiring.
 - .2 Break off links for use as split receptacles.
 - .3 Eight (8) back wired entrances, four (4) side wiring screws.
 - .4 Nickel-plated contacts
 - .5 Triple wipe contacts and riveted grounding contacts.
- 2.3.2 Single receptacles CSA type 5-15R, 125V, 15A, U ground with the following features:
 - .1 Ivory, brown urea moulded housing.
 - .2 Suitable for 10 AWG for back and side wiring.
 - .3 Four (4) back wired entrances, two (2) side wiring screws.
- 2.3.3 Other receptacles with ampacity and voltage as indicated.
- 2.3.4 Receptacles of one (1) manufacturer throughout project.
- 2.3.5 Receptacles to be sized according to related lighting panel branch circuit breaker.
- 2.3.6 Non-Hazardous Products - Acceptable Suppliers:
 - .1 Hubbell
 - .2 Leviton
 - .3 Cooper

2.4 Receptacles – Hazardous

- 2.4.1 Duplex receptacles, CSA type 5-20 R, 125 V, 20A, Class I, Div. 1 & 2, Groups B, C, D with the following features:
 - .1 Three spring-loaded slide keys that prevent the receptacle face plate from being rotated until the ENP plug is fully inserted into the receptacle.
 - .2 To make the connection, the compatible (twist lock) plug is inserted, and the receptacle face moved inward by pushing the plug forward. The compatible plug is then rotated, closing the circuit. As rotation begins, the plug becomes locked in the receptacle and cannot be accidentally disengaged. In making or breaking the circuit, any resulting electrical arc is confined in the factory- sealed chamber.

- 2.4.2 Provide a compatible plug for each receptacle application by the same manufacturer
- 2.4.3 Receptacles of one (1) manufacturer throughout project.
- 2.4.4 Receptacles to be sized according to related lighting panel branch circuit breaker.
- 2.4.5 Hazardous Products - Acceptable Suppliers:
 - .1 Cooper Crouse Hinds – Model ENR Arc Guard
 - .2 Approved equal

2.5 Ground Fault Circuit Interrupter Receptacles

- 2.5.1 Provide ground fault receptacles to meet NEMA 5-15 or 5-20 as shown on drawings and with the following features:
 - .1 Red or yellow trip indication light
 - .2 Terminals suitable for #10 to #14 AWG stranded conductors
 - .3 Weather resistant
 - .4 Suitable for back and side wiring
 - .5 Body Material: Nylon
 - .6 Strap material: Nickel-plated steel
 - .7 Contacts material: Brass
 - .8 Terminal clamp & screw material: Nickel-plated, brass
- 2.5.2 GFCI Receptacles - Acceptable Suppliers:
 - .1 Cooper
 - .2 Hubbell
 - .3 Approved equal

2.6 Receptacles, Other

- 2.6.1 Supply and install 240/208V receptacles where shown on drawings.

2.7 Cover Plates

- 2.7.1 Provide cover plates for wiring devices.
- 2.7.2 Cover plates from one (1) manufacturer throughout project.
- 2.7.3 Provide Class I, Div. 1 & 2, Groups B, C, D cover plates, integral to the application, for hazardous area applications
- 2.7.4 Sheet steel utility box cover for wiring devices installed in surface mounted utility boxes.

- 2.7.5 Stainless steel, 1mm thick cover plates, thickness 2.5mm for wiring devices mounted in flush mounted outlet box.
- 2.7.6 PVC cover plates for wiring devices mounted in surface mounted FS or FD type conduit boxes.
- 2.7.7 Receptacles and switches in unfinished areas shall be complete with cover plates to match related boxes.
- 2.7.8 Cover plates shall be provided for all blanked off outlets.
- 2.7.9 One (1) piece gang plates shall be used at locations where more than one (1) device is to be mounted adjacent to each other.
 - .1 Weatherproof double lift spring loaded cast aluminium cover plates, complete with gaskets for duplex receptacles as indicated.
 - .2 Weatherproof cover plates complete with gaskets for single receptacles or switches. Cover plates to be Scepter type VSC 15/10 or WDR 15/10.

3. EXECUTION

3.1 Installation

- 3.1.1 Switches:
 - .1 Install single throw switches with handle in “UP” position when switch closed.
 - .2 Install switches in gang type outlet box when more than one (1) switch is required in one (1) location.
 - .3 Mount toggle switches at height specified in Section 16010 – Electrical General Requirements or as indicated.
- 3.1.2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one (1) receptacle is required in one (1) location.
 - .2 Mount receptacles at height specified in Section 16010 – Electrical General Requirements or as indicated.
 - .3 Where split receptacle has one (1) portion switched, mount vertically and switch upper portion.
- 3.1.3 Cover Plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.

- .3 Do not use cover plates meant for flush outlet boxes on surface mounted boxes.

END OF SECTION

1. GENERAL

1.1 Description

- 1.1.1 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.
- 1.1.2 This section describes starters with a nominal voltage of 600 V or less.
- 1.1.3 Refer to 16224 – Variable Frequency Drives to 600V, for variable frequency drives to 600V.

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 Section 16010 – Electrical General Requirements
- 1.3.4 Section 16225 – Motor Control Centres
- 1.3.5 Section 16423 – Control Devices
- 1.3.6 Section 16671 – Surge Protective Devices
- 1.3.7 Driven equipment sections
- 1.3.8 Associated equipment section (e.g. MCC, control panels)

1.4 References

- .1 CSA C22.2 No. 14 Industrial Control Equipment
- .2 CSA C22.2 No. 60947-1 Low-Voltage Switchgear and Controlgear - Part 1: General Rules
- .3 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 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 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 01330 – 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

1.9 Operations & Maintenance Manual

- 1.9.1 Provide operation and maintenance data for motor starters for incorporation into manual, specified in Section 01330 – Submittals.
- 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

1.11 Site Conditions

- 1.11.1 Refer to Section 16010 – Electrical General Requirements.

2. PRODUCTS

2.1 Design Criteria

- 2.1.1 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.
- 2.1.2 Contactors shall break all poles simultaneously.
- 2.1.3 All starters shall be lockable in the off position.
- 2.1.4 All starters shall have type 2 coordination per IEC 947.
- 2.1.5 Provide auxiliary contactor and overload contacts where indicated on drawings or required by application.
- 2.1.6 Incoming line terminals shall be shielded to provide operator protection level of !P20.
- 2.1.7 Starters shall be suitable for operation at full motor load including service factor at ambient temperatures between -5 °C and 50 °C.

2.2 Operator Interface, All Starters

- 2.2.1 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.

2.2.2 Provide the following visual indications on the enclosure exterior unless otherwise indicated:

- .1 Running
- .2 Overload.

2.3 Enclosure

2.3.1 Supply and install the respective motor starters in the respective MCC's and/or in dedicated motor starter enclosures as indicated on the drawings.

2.3.2 Refer to Section 16010 – Electrical General Requirements for enclosure requirements.

2.4 Manual Motor Starters

2.4.1 Provide single or three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

- .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.
- .2 Three overload heaters, manual reset, trip indicating handle.
- .3 Class 10 overload
- .4 Fixed short circuit trip.
- .5 Adjustable motor overload.
- .6 Screw terminals for line and load side.

2.4.2 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).

2.5 Full Voltage Starters

2.5.1 Provide starters of the Full Voltage (FV) type as specified and shown on the drawings.

2.5.2 Provide NEMA starter size to suit the electrical name plate data of the respective motor application.

2.5.3 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.

- 2.5.4 Control power transformers shall be adequately rated to carry continuously the control circuit burdens and intermittently, the inrush currents imposed by the contactor coil.
- 2.5.5 One (1) side of coil shall be connected to the grounded side of the C.P.T. secondary.
- 2.5.6 Provide a minimum of two (2) normally open and two (2) normally closed auxiliary contacts for control and interlocking.
- 2.5.7 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.
- 2.5.8 Provide heavy duty oil tight pushbutton, or selector stations in the covers of those starters as indicated on the drawings.
- 2.5.9 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.
- 2.5.10 Provide all control wiring, interlocking, auxiliary contacts, timers, double voltage relays called for on the drawings or required for proper operation.
- 2.5.11 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.

2.6 Reversing Starters

- 2.6.1 Reversing starters shall consist of a two contactors and one overload.
- 2.6.2 Reversing starters shall be mechanically and electrically interlocked to prevent closing both contactors simultaneously.
- 2.6.3 Contactors shall meet the requirements for full-voltage, non-reversing starters and shall also:
 - .1 Be rated for plugging duty.

2.7 Two-Speed Starters

- 2.7.1 Provide two contactors and two overloads.
 - .1 Contactors shall meet the requirements for full-voltage, non-reversing starters.
- 2.7.2 All starters shall be closed transition type.

2.8 Reduced Voltage Soft Starters

- 2.8.1 Provide reduced-voltage, soft starters (RVSS) where shown on the drawings and/or in the specifications.
- 2.8.2 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.
- 2.8.3 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.
- 2.8.4 The logic board shall be identical for all ampere ratings and voltage classes and shall be
- 2.8.5 Conformally-coat logic boards.
- 2.8.6 Provide integrated, 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.
- 2.8.7 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.
- 2.8.8 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.
- 2.8.9 The starter shall be capable of the following soft-starting modes, all with adjustable kick start current limits:
 - .1 Constant current

- .2 Linear acceleration
- .3 'S' or pump curve acceleration
- 2.8.10 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 Over-temperature of the power electronics
- 2.8.11 Starter shall be capable of either an automatic or manual reset after a fault.
- 2.8.12 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
- 2.8.13 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).
- 2.8.14 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
- 2.8.15 Where adjustments are made via computer software, provide one programming cable and one copy of the software.
- 2.8.16 Supply RVSS with motor circuit protector for short circuit protection and quick disconnect means.
- 2.8.17 Acceptable Products:
- .1 Eaton S801/S811

2.9 Control Power

- 2.9.1 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.
- 2.9.2 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
- 2.9.3 Provide miniature circuit breaker on CPT secondary.
- .1 Circuit breaker shall be CSA C22.2 No. 5 listed.
- 2.9.4 Ground the neutral of the secondary.

2.10 Control Circuits

- 2.10.1 Design complete control circuit to provide control logic described in the drawings or specifications.
- 2.10.2 Incorporate all features and systems required by the supplied components and driven equipment and by code.
- 2.10.3 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).
- 2.10.4 Provide miniature circuit breakers or supplementary protectors for device protection. Do not use fuses.

- 2.10.5 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.
- 2.10.6 Do not switch the neutral side of load devices unless required by design.
- 2.10.7 Refer to 16400 – Basic Electrical Equip & Materials for pilot devices and operator control requirements.
- 2.10.8 E-stops shall directly remove power from electrically held contactors or shall act through safety relays.

2.11 Overloads

- 2.11.1 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
- 2.11.2 Connect overloads directly to contactors.
- 2.11.3 Bimetallic 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
- 2.11.4 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

2.12 Motor Management Relays

- 2.12.1 Provide motor management relays and remote RTD modules where shown on the drawings.
- 2.12.2 Where a specific relay is shown on the drawings, no alternates will be considered.

2.13 Equipment Identification

- 2.13.1 Provide equipment identification in accordance with Section 16090 – Equipment Identification.
- 2.13.2 Indicate sources and levels of remote voltage.

2.14 Spares

- 2.14.1 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.

2.15 Fuses

- .1 10% LED push to test type bulbs.

3. EXECUTION

3.1 General

- 3.1.1 Again, check div 1 and make reference to things you want to highlight.

3.2 Factory Testing

- 3.2.1 The owner reserves the right to witness factory testing for all reduced-voltage soft starters greater than 100 hp.
- 3.2.2 Provide electronic copies of the certified test results for all stand-alone starters prior to arrival of equipment at site.

3.3 Shipping, Handling and Storage

- 3.3.1 Ship in accordance with manufacturer's instructions.
- 3.3.2 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.

3.4 Preparation for Installation

- 3.4.1 Installation locations for indoor equipment shall be dry and heated prior to installation.

3.5 Installation

- 3.5.1 Install starters, connect power and control as indicated.
- 3.5.2 Ensure all components are correctly installed.

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 The section describes the requirements for variable frequency drives (VFDs) 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 VFDs supplied with or as part of equipment supplied by all divisions.
- 1.1.3 This section describes starters with a nominal voltage of 600 V or less.
- 1.1.4 Refer to 16223 for full- and reduced-voltage starters to 600 V.

1.2 General

- 1.2.1 Size VFDs for the driven load.
- 1.2.2 Provide a complete VFD system consisting of inverter, dc-link and rectifier, cabinets and all accessories identified in the specifications and drawings.
- 1.2.3 Provide harmonic mitigation components identified in the specifications and drawings including filters for power-frequency and RF suppression.
- 1.2.4 Install the VFD, power and control wiring conduits, motors and filters so that the overall system does not:
 - .1 Does not cause harmonics of the upstream AC voltage and current sources in excess of 3%.

1.3 Related Sections

- 1.3.1 Section 01330 – Submittals
- 1.3.2 Section 01820 – Demonstration & Training
- 1.3.3 Section 16010 – Electrical General Requirements
- 1.3.4 Section 16122 – Wire and Cable to 1000 V
- 1.3.5 Section 16423 – Control Devices
- 1.3.6 Section 16671 – Surge Protective Devices
- 1.3.7 Refer to the driven equipment sections for additional requirements.

1.4 References

- 1.4.1 CSA C22.2 No. 14 Industrial Control Equipment
- 1.4.2 CSA C22.2 No. 60947-1 Low-Voltage Switchgear and Controlgear - Part 1: General Rules

- 1.4.3 NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems
- 1.4.4 EN 61800-3 Adjustable Speed electrical power drive systems - Part 3: EMC requirements and specific test methods
- 1.4.5 IEEE 519 IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

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 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.
- 1.7.2 The VFD Drive manufacturing facility shall be ISO 9001 certified. The VFD Drive shall be listed, Canadian UL listed or CSA listed.
- 1.7.3 All printed circuit boards shall be completely tested and burned-in before being assembled into the completed VFD Drive. The VFD Drive shall then be subjected to a preliminary functional test, minimum four hour burn-in and computerized final test. The burn-in shall be at 40°C, at full rated load, or cycled load. Drive input power shall be continuously cycled for maximum stress and thermal variation.

- 1.7.4 The drive shall be designed to provide 100,000 hours mean time before failure (MTBF) when the specified preventive maintenance is performed.

1.8 Warranty

- 1.8.1 Refer to 01760 – Warranty Work.

1.9 Submittals

- 1.9.1 Make submittals in accordance with Section 1330 Submittals
- 1.9.2 Indicate on shop drawings:
 - .1 Efficiency at 100, 75, 50 and 25% output.
 - .2 Compliance to IEEE 519 – Harmonic analysis for particular jobsite including total voltage harmonic distortion and total current distortion
 - .1 The VFD Drive manufacturer shall provide calculations, specific to this installation, showing total harmonic voltage distortion is less than five per cent. Input line filters shall be sized and provided as required by the VFD Drive manufacturer to ensure compliance with IEEE standard 519 – 1992, Guide for Harmonic Control and Reactive Compensation for Static Power Converters. The acceptance of this calculation must be completed prior to VFD Drive installation.
 - .2 Prior to installation, the VFD Drive manufacturer shall provide the estimated total harmonic distortion (THD) caused by the VFD Drives. The results shall be based on a computer aided circuit simulation of the total actual system, with information obtained from the power provider and the user.

1.10 Operations & Maintenance Manual

1.11 Training

- 1.11.1 Provide training for each type and configuration of VFD.
 - .1 Refer to 01820 – Demonstration & Training
 - .2 Instruction shall include normal operation, troubleshooting, replacement of failed components, maintenance and testing.

1.12 Site Conditions

- 1.12.1 Refer to 16010.

2. PRODUCTS

2.1 Design Criteria

- 2.1.1 VFDs 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 VFDs to suit the as-supplied driven equipment and the application as described in the contract documents.
- 2.1.2 Isolation or bypass contactors shall break all poles simultaneously.
- 2.1.3 All VFDs shall be lockable in the off position.
- 2.1.4 All VFDs shall have type 2 coordination per IEC 947.
- 2.1.5 Incoming line terminals shall be shielded to provide operator protection level of IP20.
- 2.1.6 VFDs shall be suitable for operation at full motor load at ambient temperatures between -5 °C and 50 °C.
- 2.1.7 The VFD assembly with input protection device shall have a short circuit interrupt and withstand as follows unless a higher rating is shown on the drawings:
 - .1 600 V VFDS: 42 kA
- 2.1.8 Provide fuses to protect the VFD where recommended by the manufacturer.
 - .1 Where fuses are installed, provide minimum one set of spare fuses per VFD.
 - .2 Fuses shall be sized to open only under bolted short circuit conditions.
 - .3 Provide a time-current curve showing the fuse, upstream breaker(s) and motor overload/short circuit protection with the shop drawings to allow the Engineer to verify coordination.
- 2.1.9 A power loss ride through feature will allow the drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.

2.2 Enclosures

- 2.2.1 Supply and install the respective motor starters in the respective in dedicated motor starter enclosures as indicated on the drawings.
- 2.2.2 Refer to 16010 for enclosure requirements. Minimal enclosure rating shall be NEMA 3R.
- 2.2.3 Openings in the enclosure shall be less than 100 mm equivalent diameter. Where larger openings are required, provide conductive paths across opening to maintain enclosure as a faraday cage.
- 2.2.4 Drives mounted in stand-alone enclosures:

- .1 The drive and associated filters and controls shall be housed in an stand-alone cubicle c/w fan ventilated external heat sink assembly with 120VAC fans.
 - .2 Cubicle exterior colour shall be coloured grey. All back/side interior panels shall be enamel white.
- 2.2.5 Top entry conduits/cables shall not be accepted for stand-alone drives. Adequate spacing must be provided between power and control cable entry/exit points. Sufficient room shall be provided within the drive enclosure, to ensure external wiring is not obstructed by or in contact with power or control devices. The cable entry shall be arranged to be suitable for single conductor cables as noted on the drawings.

2.3 Variable Frequency Drive

- 2.3.1 The drive shall be an open loop voltage source type, with sinusoidal Pulse Width Modulated (PWM) output inverter control, suitable for use with standard or high efficiency squirrel cage induction motors.
- 2.3.2 The drive shall be a direct torque control (DTC) AC to AC converter utilizing isolated gate bipolar transistor (IGBT) technology. The DTC Drive shall employ Direct Torque Control (DTC) inner loop torque control strategy that mathematically determines motor torque and flux every microsecond (40,000 times per second). The drive must also provide an optional operational mode for scalar or V/Hz operation.
- 2.3.3 Rating
- .1 The DTC Drive shall be rated to operate from three phase power at 380V AC to 690V AC +5/-10 per cent and 48Hz to 63Hz. The DTC Drive shall employ a full wave rectifier to prevent input line notching and operate at a fundamental input power factor of 0.98 at all speeds and loads. The DTC Drive efficiency shall be 97 per cent or better at full speed and load. An internally mounted line reactor shall be provided to reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions.
 - .2 Output voltage and current ratings shall match the adjustable frequency operating requirements of standard 575VAC, three-phase, 60Hz, NEMA design B motors. The overload current capacity shall be 120 per cent of rated current for one minute out of 10 minutes and 200 per cent for two seconds out the 15 seconds with an instantaneous overcurrent trip at 350 per cent or higher. Output frequency shall be adjustable between 0Hz and 300Hz. Operation above motor nameplate shall require programming changes to prevent inadvertent high speed operation. The drive's switching pattern shall be

continually adjusted to provide optimum motor flux and avoid the high-pitched audible noise produced by motors energized by conventional PWM drive from AC line transients.

- 2.3.4 The drive shall be designed to facilitate testing while the drive is operating as well as when the drive disconnect switch is de-energized (with auxiliary control power applied). In addition, the drive shall be capable of operation without a motor connected, for set-up and testing purposes.
- 2.3.5 Provide an input non-automatic circuit breaker with a door interlock mechanism capable of being padlocked in the open position. In addition, provide input line fuses whose characteristics are coordinated with the drive's electronic protection circuits, so as not to blow under normal output faults.

2.4 Protective Functions

- 2.4.1 The VFD controller shall be equipped with electronic protective relay features as follows:
 - .1 Motor/Cable protection:
 - .1 Ground overcurrent and instantaneous fault
 - .2 Motor overload (thermal)
 - .3 Mechanical Jam
 - .4 Underload
 - .5 Loss of output phase.
 - .2 Internal protections:
 - .1 DC bus over-voltage
 - .2 DC bus under-voltage
 - .3 Power electronics over-temperature
 - .4 Output overload
 - .5 Input over-current
 - .6 Input over-voltage
 - .7 Incorrect input phase sequence
 - .8 Low AC input voltage.
- 2.4.2 All protective functions shall have adjustable time and pickup settings and shall be capable of disabling all functions not required by the OESC or device approval standards.
- 2.4.3 For each programmed protection function, the drive shall display a message in complete English words or English abbreviations. The

five most recent fault messages and times shall be stored in the drive's fault history.

- 2.4.4 Input terminals shall be provided for connecting a motor thermistor (PTC type) to the drive's protective monitoring circuitry. An input shall also be programmable to monitor an external relay or switch contact.

2.5 Communications

- 2.5.1 Provide communication interface module(s) as shown in the control drawings and/or P&ID drawings.
- 2.5.2 Serial communication interface modules shall be available for Ethernet I/P Communication Gateway. A communication port shall also be provided for personal computer interface. Microsoft® Windows based software shall be available for drive setup, diagnostic analysis, monitoring and control. The software shall provide real time graphical displays of drive performance.
- 2.5.3 Where media and/or protocol converters are required, install the converter in a metallic enclosure external and adjacent to the VFD.
- 2.5.4 Provide minimum one (1) drive programming cable and software.

2.6 Filters

- 2.6.1 Where shown on the drawing, provide a passive, tuned (RLC) power line filter circuit to prevent the inverter from causing line voltage disturbances.
- .1 Total Harmonic Distortion (THD) as measured on line side of the filter shall not be more than 3 per cent.
 - .2 Provide a capacitor contactor to isolate the filter capacitor. The capacitor shall open when the external contact is closed.
- 2.6.2 Provide the following filters:
- .1 3% input reactor
 - .2 DC filter
 - .3 Output dv/dt filters for:
 - .1 Drives operating at a nominal output voltage of 600 V, 120/240/208 V where shown on drawings
 - .2 All drives feeding motors located in hazardous locations.
- 2.6.3 Where shown on the drawing, provide surge protective devices on the input power wiring in accordance with section 16671.
- 2.6.4 Provide surge protective devices with sine-wave tracking filters for all internal control power wiring. Refer to 16671 – Surge Protective Devices.

2.7 Controls

- 2.7.1 Provide automatic reset and restart on the first drive fault, the restart being initiated only if the start command is maintained. Should a second drive fault occur within an adjustable time window after the first, the drive shall be locked out and require a manual or remote reset. This feature can be defeated if first fault auto restart is not required.
- 2.7.2 Start-up data entries shall include motor nameplate power, speed, voltage, frequency and current.
- 2.7.3 A motor parameter ID function shall automatically define the motor equivalent circuit used by the sensor-less vector torque controller.
- 2.7.4 Control of the drive shall be possible at the drive panel (Panel Mode with control via start, stop and reset pushbuttons and a speed potentiometer) or externally via a start/stop and reset contacts and 4-20mA speed command (External Auto Mode). The selection of the operating mode shall be done by control switches on the drive's operator control panel.
- 2.7.5 Provide signal isolation and scaling/offset adjustments for the external 4-20mA and potentiometer speed commands.
- 2.7.6 Provide a diagnostic LED panel which displays system status information (i.e.: External Auto Mode, Power On, Ready, Run, Fault etc.), each individual fault status and indication of first fault reset and current limit operation.
- 2.7.7 Provide for two external permissive interlock or E-Stop normally closed contacts.
- 2.7.8 Provide for one normally closed external system fault contact input.
- 2.7.9 Provide metering on the drive operator control panel for motor frequency (or speed), current and voltage.
- 2.7.10 Provide the following signals for remote monitoring:
 - .1 Form C contacts for indicating the Ready, Run and Fault status. Note these status signals must be mutually exclusive (i.e.: only one is active at any time) and the fault status must be failsafe.
 - .2 A status contact to indicate selection of the External Auto Mode
 - .3 An isolated 4-20mA signal proportional to 1-100 per cent frequency

2.8 Conduit and Wiring Systems

- 2.8.1 Provide motor leads consisting of armoured VFD-cables as per 16122

2.9 Acceptable Products

2.9.1 VFDs

- .1 Phoenix DS AC Drive Control with Input Disconnect & Fuses, 500 HP, 600 VAC Disconnect & Fuses, 500 HP, 600 VAC. Epitron Inc Electrical Distributors.

3. EXECUTION

3.1 Factory Testing

- 3.1.1 Perform standard manufacturer's tests.
- 3.1.2 For VFDs of 200 hp and greater, the owner reserves the right to witness the production tests.

3.2 Shipping, Handling and Storage

3.3 Preparation for Installation

- 3.3.1 The area shall be heated, dry and free of dust prior to installation and commissioning of VFDs.

3.4 Installation

- 3.4.1 Bond power and control cable shields and/or armour to the equipment ground at both ends.
- 3.4.2 Ensure bare metal-to-metal contact at all openings, rigid metal conduits, etc.

3.5 Identification

- 3.5.1 Apply equipment nameplates and field wiring identification in accordance with 16090.

3.6 Site Acceptance Testing

- 3.6.1 Test in accordance with NETA/ANSI ATS.
- 3.6.2 Demonstrate that the drive and control system operates in accordance with the PCN and control drawings.
- 3.6.3 Perform site acceptance testing for drives in the presence of the Engineer
- 3.6.4 Make harmonic measurements in accordance with section 16199.

3.7 Post-Installation

- 3.7.1 Clean and replace air filters as required while VFD is in service until the completion of construction.

END OF SECTION

1. GENERAL

1.1 Description

- 1.1.1 This Section describes the requirements for dry type transformers including shielded dry-type transformers and encapsulated transformers. Refer to the drawings for quantities and electrical characteristics.

1.2 Scope

- 1.2.1 Provide dry-type transformers as shown on the drawings and as described herein.

1.3 Related Sections

- 1.3.1 01330 - Submittals
- 1.3.2 16010 - Electrical General Requirements
- 1.3.3 16090 – Equipment Identification

1.4 References

- 1.4.1 CSA C9, Dry-Type Transformers.
- 1.4.2 CSA-C22.2 No. 47-13, Air Cooled Transformers (Dry Type).
- 1.4.3 CSA-C802.2
- 1.4.4 Ontario Electrical Safety Code.
- 1.4.5 All references to be latest revision.

1.5 Quality Assurance

- 1.5.1 Factory tests: to CSA C9
- 1.5.2 Submit production test certificates for:
 - .1 Voltage ratio
 - .2 Polarity or angular displacement
 - .3 No load losses
 - .4 Load loss
 - .5 Impedance voltage
 - .6 Dielectric withstand, applied and induced
 - .7 Exciting current
 - .8 Resistance
- 1.5.3 Submit type test certificates and results for:

- .1 Temperature rise
- .2 No-load and full-load losses
- .3 Sound level
- .4 Radio influence voltage
- .5 Positive sequence impedance
- .6 Power frequency withstand test

1.6 Warranty

- 1.6.1 In addition to the general contract warranty, dry type transformers shall carry a ten (10) year warranty from the manufacturer.
- 1.6.2 The warranty shall cover repair and/or replacement from the completion of the general contract warranty period to the conclusion of the special warrantee period.

1.7 Submittals

- 1.7.1 Submit shop drawings in accordance with Section 01330 – Submittals. Include:
 - .1 Dimensioned drawing showing enclosure, mounting devices, terminals, taps, internal and external component layout.
 - .2 Technical data:
 - .1 KVA rating
 - .2 Primary and secondary voltages
 - .3 Three Phase
 - .4 Polarity or angular displacement
 - .5 Full load efficiency
 - .6 Regulation at unity PF
 - .7 BIL
 - .8 Insulation type
- 1.7.2 Include the following information in the Operation and Maintenance Manual:
 - .1 Tap changing procedure
 - .2 Recommended environmental conditions
 - .3 Recommended periodic inspection and maintenance
 - .4 Commissioning and startup procedure

1.8 Storage

- 1.8.1 Store transformers indoors in a heated, dry location.

2. PRODUCTS

2.1 Transformer Characteristic Up to 75 kVA

- 2.1.1 Type: ANN, Dry Type, Indoor, Convection-Cooled
- 2.1.2 Rating & Voltages: as indicated on drawings
- 2.1.3 Impedance at 150°C: standard
- 2.1.4 Primary and secondary coil material: Copper
- 2.1.5 Core material: high-grade, non-aging, silicon electrical steel
- 2.1.6 Angular displacement: secondary lagging primary by 30° (IEC: Dy1)
- 2.1.7 Voltage taps: 2 – 2½% FCAN, 2 – 2½% FCBN, silver plated. Taps to be bolted-link type and located at front of coils for accessibility
- 2.1.8 Insulation class: 200°C
- 2.1.9 Temperature Rise: 130°C
- 2.1.10 Provide means for securing all conductors within enclosure.
- 2.1.11 Efficiency: to CSA 802.2
- 2.1.12 Enclosure: Minimum NEMA 3R or 4X to suit environment.
- 2.1.13 Sound level: to CSA C9.
 - .1 Transformers located within or adjacent to office areas shall be quieter than the noise requirement by 5 dB.
- 2.1.14 Conductor entry: Side.
- 2.1.15 Provide anti-vibration pads or isolators between the core/coil and enclosure.
 - .1 Provide vibration isolators for all transformers located in or adjacent to office areas and all transformers with ratings in excess of 150 kVA.
- 2.1.16 Provide strip heaters for all transformers in unheated areas.

2.2 Shielded Isolation Transformers

- 2.2.1 As above with the following additions/modifications:
 - .1 Incorporate an effective electrostatic shield consisting of a single turn of copper between the primary and secondary winding and grounded to the transformer core.

2.3 Equipment Identification

- 2.3.1 Provide equipment identification in accordance with Section 16090 – Equipment Identification.

2.4 Acceptable Products:

- 2.4.1 Sentinel by Hammond Power Solutions
- 2.4.2 Eaton/Cutler-Hammer
- 2.4.3 Rex
- 2.4.4 Polygon-Jefferson
- 2.4.5 Marcus

3. EXECUTION

3.1 Installation

- 3.1.1 Mount dry type transformers up to 75kVA as indicated. Transformers may not be mounted below lighting panels.
- 3.1.2 Mount dry type transformers above 75kVA on floor stands.
- 3.1.3 Floor mounted transformers shall have minimum 300 mm clearance between finished floor and any energized part.
- 3.1.4 Ensure adequate clearance around transformer for ventilation.
- 3.1.5 Install transformers in level upright position.
- 3.1.6 Protect transformer against moisture until energized. Method to be approved by Contract Administrator.
- 3.1.7 Remove shipping supports only after transformer is installed and just before being put into service.
- 3.1.8 Loosen isolation pad bolts until no compression is visible.
- 3.1.9 Install equipment identification.
- 3.1.10 Make primary and secondary connections in accordance with wiring diagrams.
- 3.1.11 Make drip loops in all conductors between cable entry and termination point.

3.2 Site Acceptance Testing

- 3.2.1 Do not test transformers until they are ready for energization.
- 3.2.2 Perform tests in accordance with Section 16010 – Electrical General Requirements.
- 3.2.3 Test transformers in accordance with ANSI/NETA ATS-2009.

- .1 Verify bolted electrical connections with calibrated torque wrench and with low-resistance ohmmeter.
- .2 Apply witness marks to all verified connections.
- .3 Perform turns-ratio tests at all tap positions.

3.3 Energization

- 3.3.1 Energize and apply load in accordance with manufacturer's instructions.
- 3.3.2 Energize transformers and check secondary no load voltage.
- 3.3.3 Verify phasing.
- 3.3.4 Adjust primary taps as necessary to produce rated secondary voltage at no load.
- 3.3.5 Check the transformer for dryness before putting into service if it has not been energized for some considerable time.

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 Related Sections

- 1.4.1 Division 1 – General Requirements
- 1.4.2 Division 13 – Process Control
- 1.4.3 Division 11 – Equipment

1.5 Codes and Standards

1.6 Materials and Equipment

- 1.6.1 Equipment and material must be CSA certified.
- 1.6.2 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.

1.7 Quality Assurance

- 1.7.1 Factory-assemble control panels and component assemblies.

2. PRODUCTS

2.1 Local Control Stations

- 2.1.1 Provide control stations as indicated on the drawings or as required by the equipment furnished.
- 2.1.2 Pilot devices shall be heavy-duty, oil tight, and shall perform the functions indicated.
- 2.1.3 All control stations shall have NEMA Type 4 enclosures.
- 2.1.4 Control stations outdoors or indicated to be weatherproof shall have NEMA Type 4X stainless steel enclosures with protective caps on the control devices.
- 2.1.5 All lights to be push to test LED cluster type.

2.2 Miscellaneous Electrical Components

- 2.2.1 Control Relays (Instantaneous)
 - .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 Acceptable Manufacturers.
 - .1 Omron
 - .2 Potter-Bromfield
 - .3 Allen-Bradley
- 2.2.2 Relay Accessories
 - .1 Overlap contact cartridges: supplied in pairs having NO contact that closes before NC contact opens (early make -late break).
 - .2 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.
- 2.2.3 Timing Relays

- .1 General purpose plug-in type relays, low coil current heavy duty contacts with multi-contact poles as indicated. Coil rating: 120 V, 60 Hz.
- .2 Contact rating: 120 V, 10A.
- .3 Potentiometer: self-contained to provide time interval adjustment. Timing range as indicated.
- .4 Acceptable manufacturers:
 - .1 Omron
 - .2 Potter-Bromfield
 - .3 Allen-Bradley

2.2.4 Pushbuttons

- .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 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.
- .3 Pushbutton ratings:
 - .1 NEMA type 13 for indoor control panels
 - .2 NEMA type 4 for outdoor control panels
- .4 Acceptable Manufacturers
 - .1 Allen-Bradley
 - .2 Schneider
 - .3 Cutler Hammer, PB Series

2.2.5 Selector Switches

- .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 Switch ratings:
 - .1 NEMA type 13 for indoor control panels
 - .2 NEMA type 4X for outdoor control panels
- .3 Acceptable Manufacturers
 - .1 Allen-Bradley

.2 Square D

.3 Cutler Hammer

2.2.6 Indicating Lights

.1 Heavy duty – oil tight, LED cluster Push-To-Test type, lens colour: as indicated, supply voltage: 120 V, labels as indicated.

.2 Indicating light ratings

.1 NEMA type 13 for indoor control panels

.2 NEMA type 4X for outdoor control panels

.3 Acceptable manufacturers

.1 Allen-Bradley

.2 Square D (Schneider)

.3 Cutler Hammer

2.2.7 Control Circuit Transformers

.1 Single phase, dry type.

.2 Primary: as indicated, 60 Hz AC.

.3 Secondary: 120V or 24V AC as indicated.

.4 Rating: as indicated plus 20% spare capacity.

.5 Secondary fuse kit (terminal block type chips) and fuse, size as indicated.

.6 Close voltage regulations as required by magnet coils and solenoid valves.

2.3 Enclosures

2.3.1 Enclosure disconnect handles shall be mounted to the frame of the enclosure and not the door except where explicated allowed.

2.3.2 Enclosures shall have heavy-duty hinges.

.1 Piano hinges shall be full height.

.2 Individual hinges shall be stainless steel for wet/damp/corrosive locations and carbon steel for dry areas.

.3 Provide minimum three hinges for full height doors.

2.3.3 Provide door stops for all enclosure doors

2.3.4 Provide hold-open devices at 135-160 degrees.

- 2.3.5 Use low-compression gaskets.
- 2.3.6 Design all doors to withstand a minimum 30 kg load at the top outer corner.
- 2.3.7 Minimum door return: 12 mm

2.4 Enclosure Ratings

- 2.4.1 Enclosure ratings to be as follows unless indicated otherwise indicated in the contract documents:
 - .1 Indoor and dry locations: NEMA 12, sprinklerproof.
 - .2 Below grade, damp or outdoor locations: NEMA 4X, as noted on drawings.
 - .3 Valve chambers and other outdoor, below-grade vaults: NEMA 6P or IP68 rated to submersion at the full depth of the chamber for 120 hours.
 - .4 Classified areas: to suit area classification.

2.5 Smoke Detectors

- 2.5.1 Provide conventional, photoelectric-type, smoke detectors with form 'C' output relay.
- 2.5.2 Voltage source: as shown on drawings
- 2.5.3 Provide magnetically-activated test feature.
- 2.5.4 Acceptable products:
 - .1 GE Edwards 521NCRXT
 - .2 Acceptable equivalent

2.6 Heat Detectors

- 2.6.1 Provide rate-of-rise or fixed heat detectors as indicated on the drawings.
- 2.6.2 Provide led indicator for power on and alarm
- 2.6.3 Provide output contact: 120 VAC, 1A minimum
- 2.6.4 Power supply:
- 2.6.5 Acceptable products:
 - .1 GE Edwards SC20
 - .2 GE Edwards 9600 series for hazardous locations
 - .3 Acceptable equivalent

2.7 Door Contacts

- 2.7.1 Provide surface-mounted industrial, heavy-duty door contacts with form 'C' output contacts and suitable for gaps up to 50mm minimum
- 2.7.2 Contacts shall be 30 VDC, .25 A maximum.
- 2.7.3 Acceptable products:
 - .1 GE Sentrol 2507A for unclassified areas
 - .2 GE Sentrol 2847T-W for hazardous locations
 - .3 Approved equivalent

2.8 Fire Transits

- 2.8.1 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.
- 2.8.2 Provide shop drawing package for fire transits with data sheets and drawings indicating where each product will be used.
- 2.8.3 Fire transit to be ULC listed.
- 2.8.4 Provide manufacturer's letter of proper installation for all fire transits.
- 2.8.5 Approved Manufacturer: HILTI

END OF SECTION

1. GENERAL

1.1 Description

- 1.1.1 The section describes the requirements for moulded case breakers, moulded case switches, motor circuit protectors and supplementary protectors to 1000 V.
- 1.1.2 This section covers moulded case breakers supplied as stand-alone devices in enclosures or as part of a panelboard, MCC, control panel, or other equipment except for:
 - .1 Breakers supplied in SCADA panels supplied under Division 13.

1.2 Coordination

- 1.2.1 The requirements in the section are general requirements. Specific requirements in the associated equipment section or on the drawings and code requirements shall supersede these requirements.

1.3 Related Sections

- 1.3.1 Breakers are typically supply as part of assembled equipment. Refer to the relevant equipment section for additional requirements.
- 1.3.2 Section 01330 – Training
- 1.3.3 Secion16199 – Electrical Inspection & Testing

1.4 References

- 1.4.1 CSA C22.2 No.5 Moulded Case Circuit Breakers.
- 1.4.2 CSA C22.2 No. 235 Supplementary Protectors
- 1.4.3 NEMA AB-1.

1.5 Measurement and Payment

- 1.5.1 16412 – Moulded Case Circuit Breakers will not be measured but considered incidental to work.

1.6 Quality Assurance

- 1.6.1 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.
- 1.6.2 The supplier shall be responsible for ensuring that all breakers supplied as part of that equipment are installed in accordance with the manufacturer's instructions.

1.7 Submittals

- 1.7.1 Provide submittals related to this section with the related equipment.
- 1.7.2 Submit product data in accordance with Section 01330 – Submittals.
 - .1 Include time current characteristic curves for breakers rated over 400 A.

1.8 Training

- 1.8.1 The contractor shall provide training for all breakers with electronic or adjustable trip settings.
- 1.8.2 Training shall be provided as part of the training for the associated equipment.

1.9 Site Conditions

- 1.9.1 Refer to associated equipment section.

2. PRODUCTS

2.1 General

- 2.1.1 All breakers shall be bolt-on type unless otherwise indicated.
- 2.1.2 The equipment supplier shall provide appropriately derated breakers where the ambient temperature will exceed 40 °C
- 2.1.3 Polyphase breakers shall be a single unit with a common type and a single handle for all poles.
- 2.1.4 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.
- 2.1.5 Automatic tripping of the breaker shall be clearly indicated by the handle position.

2.2 Moulded Case Breakers for AC Systems

- 2.2.1 Moulded case breakers shall be listed to CSA C22.2 No. 5.
- 2.2.2 All breakers shall be thermal-magnetic moulded case breakers unless otherwise noted on the drawings or in the equipment specifications or where required by the equipment.
- 2.2.3 Breakers shall be fully coordinated with the exception of redundant breakers such as feeder breakers feeding a single control panel with a main breaker.
 - .1 Series-rated breakers are not acceptable.

- 2.2.4 Where available short circuit currents exceed rating of standard thermal magnetic breakers range, provide a current limiter.
- 2.2.5 Where indicated on the drawings and/or any breakers that are key interlocked, provide a clear viewing window in the front of the breaker case to suit visual verification of contact positions as required to suit Ontario Electrical Safety Code. Contacts are to be painted with a bright colour to enhance the contracts and contact positions.
 - .1 Provide a clear window in the respective MCC and/or Panelboard to allow for breaker contact visual verification.
- 2.2.6 Minimum symmetrical interrupting capacity where not indicated on the drawings
 - .1 120/240 VAC Breakers: 10 kA
 - .2 600 VAC breakers: 35 kA.
- 2.2.7 Unless otherwise indicated, breakers up to and including 250 AF shall have factory installed, non-interchangeable thermal-magnetic trip units.
- 2.2.8 Breakers larger than 250 AF shall have electronic trip units.
- 2.2.9 600 AT and larger circuit breakers shall be listed for use at 100% of their continuous ampere rating in the supplied enclosure
- 2.2.10 Special purpose Breakers
 - .1 Provide moulded case switches where indicated.
 - .2 Breakers for DC circuits shall be clearly marked as suitable for DC circuits.
 - .3 Breakers mounted on equipment with high vibration or shock loading shall be Naval rated.
 - .4 Breakers exposed to ambient conditions below 0 °C including all breakers in outdoor panels shall be rated to -40 °C.
 - .5 Generator breakers shall be listed for the purpose.
- 2.2.11 Acceptable Products
 - ~~.1—ABB Tmax~~
 - .2.1 Eaton Series 'C' or 'G'
 - ~~.3—Rockwell Bulletin 140 U (systems with fault current to 50 kA only)~~
 - ~~.4—Siemens Sentron or VL~~
 - ~~.5—Schneider Powerpact~~

2.3 Moulded case Breakers for DC Systems

- 2.3.1 Provide magnetic trip units only
- 2.3.2 Minimum interrupting rating:
 - .1 120 VDC breakers: 10 kA
- 2.3.3 Acceptable Products:
 - .1 As per AC breakers.

2.4 Motor Circuit Protectors (Magnetic-Only Breakers)

- 2.4.1 Motor circuit protectors shall be listed to:
 - .1 CSA C22.2 No.5
 - .2 CSA C22.2 No. 14
- 2.4.2 Motor circuit protectors shall have instantaneous trip units only.
- 2.4.3 Provide motor circuit protectors in conjunction with motor overloads.
- 2.4.4 Motor circuit protectors shall have adjustable long time pickup and instantaneous pickup settings.
 - .1 Instantaneous trip range: 6 – 13 x full load current
 - .2 Provide higher instantaneous multipliers for high-efficiency motors.
- 2.4.5 Acceptable Products:
 - ~~.1 ABB Tmax~~
 - .2.1 Eaton Series 'C' or 'G'
 - ~~.3 Rockwell Bulletin 140 U (systems with fault current to 50 kA only)~~
 - ~~.4 Siemens Sentron or VL~~
 - ~~.5 Schneider Powerpact~~

2.5 Supplementary Protectors

- 2.5.1 Supplementary protectors shall be listed to CSA C22.2 No. 235.
- 2.5.2 Provide thermal-magnetic trip supplementary protectors in all 120 VAC control circuits.
- 2.5.3 Do not use supplementary protectors ahead of receptacles.
- 2.5.4 The equipment supplier shall select the appropriate protection curve and ampere rating to protect the load without nuisance tripping.

- 2.5.5 Supplementary protectors shall be:
 - .1 DIN-rail mounted
 - .2 Current limiting
 - .3 Finger safe (IP20).
- 2.5.6 Interrupting Rating: 10 kA (min)
- 2.5.7 Minimum Voltage: 240 VAC (single pole)
- 2.5.8 Acceptable Products:
 - .1 Eaton Type
 - ~~.2 ABB Type S200~~
 - ~~.3 Rockwell Type 1492-SP~~
 - ~~.4 Schneider Electric Type Multi 9~~

2.6 Adjustable Trip Units

- 2.6.1 Adjustable trip settings shall have a range of 3-10 times current rating.

2.7 Electronic Trip Units

- 2.7.1 Provide adjustable, solid state, RMS sensing, trip units with the following protections as noted on the single line:
 - .1 Long time trip with adjustable pickup and delay
 - .2 Short time trip with adjustable pickup and delay
 - .3 Instantaneous trip with adjustable pickup
 - .4 Ground fault trip with adjustable pickup and delay
 - .5 Arc fault reduction mode trip with adjustable pickup and delay.
- 2.7.2 Provide a push-to-trip button on the front of the circuit breaker to exercise the trip mechanism.
- 2.7.3 Long-time pickup adjustments shall be sealable to prevent tampering.
- 2.7.4 Provide replaceable batteries for all trip units not powered by a station battery.

2.8 Enclosure

- 2.8.1 Individual wall mounted breakers to be installed in an enclosure complete with a hinged door and a lockable external breaker handle.

- .1 Refer to 16010 – Electrical General Requirements for enclosure requirements.

2.9 Spare Parts and Accessories

- 2.9.1 Provide terminal covers for all main breakers.
- 2.9.2 Provide short circuit trip auxiliary contacts for breakers ahead of transfer switches.

3. EXECUTION

3.1 Shipping, Handling and Storage

- 3.1.1 Protect all breakers from impact and moisture.

3.2 Installation

- 3.2.1 Install circuit breakers as indicated.
- 3.2.2 Circuit breakers are to be installed into equipment at the factory. Field assembly of breakers into equipment is not acceptable unless explicitly requested on the drawings or in the specifications.
- 3.2.3 Ensure that equipment containing circuit breakers will not be exposed to temperatures outside the manufacturers design temperature.
- 3.2.4 Circuit breakers shall be located to allow clear view of the line and load terminals with an infrared scanning camera.
- 3.2.5 100 % Rated breakers
 - .1 Wire insulation for 100% rated breakers must be 90 °C minimum.
- 3.2.6 DC Breakers
 - .1 Wire DC breakers poles in series as required by the manufacturer's instructions.

3.3 Identification

- 3.3.1 All breakers shall be identified to match the equipment supplier's approved shop drawings.

3.4 Site Acceptance Testing

- 3.4.1 Refer to section 16199 – Electrical Inspection & Testing and the enclosing equipment section.

END OF SECTION

1. GENERAL

1.1 Product Data

- 1.1.1 Submit product data in accordance with Section 01330 – Submittals.

1.2 General

- 1.2.1 Provide Class 1 Div 1 and Div 2 disconnects in accordance with the application area classifications.

1.3 References

- 1.3.1 CSA C22.2 No.4 Enclosed and Dead-Front Switches
- 1.3.2 CSA C22.2 No. 14 Industrial Control Equipment

2. PRODUCTS

2.1 Disconnect Switches

- 2.1.1 Supply and install heavy duty safety switches, fused or unfused, as required complete with fuses as shown or required by code. Safety switches shall be quick make and quick break construction with safety interlock and HP ratings as indicated.
- 2.1.2 Provision for padlocking in off switch position by one (1) lock.
- 2.1.3 Mechanically interlocked door to prevent opening when handle in ON position.
- 2.1.4 Provide Fuse performance, rating and type as recommended by the protection coordination study.
- 2.1.5 Fuse holders: re-locatable and suitable without adaptors, for type and size of fuse indicated.
- 2.1.6 Quick-make, quick-break action.
- 2.1.7 ON-OFF switch position indication on switch enclosure cover.
- 2.1.8 Switches to be housed in NEMMA /EEMAC 4X enclosure. Label to indicate switch voltage (e.g. 120C, 600V, etc.) in accordance with ESA requirements.
- 2.1.9 Disconnect switches to be equipped with auxiliary status position contacts to suit switch position. Auxiliary contacts shall be suitable for use with VFD applications. Contacts shall be late make, early break type.

2.2 Equipment Identification

- 2.2.1 Provide equipment identification in accordance with Section 16010 – Electrical General Requirements.

2.2.2 Indicate name of load controlled on size 4 nameplate.

2.3 Acceptable Manufacturer

2.3.1 Cutler Hammer

2.3.2 Hubble

2.3.3 Cooper Crouse – Hinds

2.3.4 Square 'D'

3. EXECUTION

3.1 Installation

3.1.1 Install disconnect switches complete with fuses if applicable.

3.1.2 Provide corrosion resistant mount hardware and stands for free standing disconnect installations.

3.1.3 Wire all disconnect switch auxiliary status contacts into the respective motor starters as required.

END OF SECTION

1. GENERAL

1.1 Related Sections

- 1.1.1 Section 01330 – Submittals
- 1.1.2 Section 16010 – Electrical General Requirements

1.2 General

- 1.2.1 Where an item is shown on the Drawings and is specified in this Section, such item shall conform to this Section.
- 1.2.2 Control devices are to be installed on the local control panels, and on other panels where required and as indicated on the Drawings.

1.3 Shop Drawings

- 1.3.1 Submit Shop Drawings in accordance with Section 01330 – Submittals.
- 1.3.2 Include:
 - .1 Schematic
 - .2 Wiring
 - .3 Interconnection Diagrams

1.4 Colour Coding

- 1.4.1 Pilot lights and control switches to be coloured per CAN/CSA-Z431-96 Colours of Indicator Lights and Push-Buttons.
- 1.4.2 Generally, pilot lights shall be coloured as follows (unless shown otherwise on drawings):
 - .1 Running Red
 - .2 Stopped Green
 - .3 Power On White
 - .4 Fault Amber
 - .5 Auto Bypass White
- 1.4.3 Generally, push-buttons and selector switches shall be coloured as follows:
 - .1 Stop, Off Red
 - .2 Start, Run Green
 - .3 Other Function Black

2. PRODUCTS

2.1 AC Control Relays

- 2.1.1 Universal pole type: electrically held with three poles, convertible from NO to NC by changing wiring connections. Coil rating: 120V, 3VA. Contact rating: 120V, 10A.
- 2.1.2 Allen-Bradley 700HA, Cutler Hammer, Square D.

2.2 Solid State Timing Relays

- 2.2.1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact. Timing circuit and output contact completely encapsulated to protect against vibration, humidity and atmospheric contaminants.
- 2.2.2 Operation: on-delay or off-delay, as indicated on Drawings.
- 2.2.3 Potentiometer: self contained to provide time interval adjustment.
- 2.2.4 Supply Voltage: 120VAC, 60Hz.
- 2.2.5 Temperature range: minus 20 degrees C to 60 degrees C.
- 2.2.6 Output contact rating: maximum voltage 120V ac or dc. Current: EEMAC B300.
- 2.2.7 Timing ranges: minimum 1.0s, maximum 60s, unless otherwise specified.
- 2.2.8 Allen-Bradley 700HT, Omron, Potter and Brumfield, Square D.

2.3 Interposing PLC Panel Relays

- 2.3.1 Entrelec. DIN rail mounted.
- 2.3.2 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
- 2.3.3 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

2.4 Pushbuttons

- 2.4.1 Oil tight. Operator extend type 30mm diameter. Black with NO and NC 120V contacts rated at 720 VA ac, labels as indicated. Stop pushbuttons colored red. Start pushbuttons colored green. Reset buttons colored black.
- 2.4.2 Allen-Bradley 800T, Cutler Hammer, Square D.

2.5 Selector Switches

- 2.5.1 Maintained unless otherwise indicated, labelled as indicated, heavy duty, 30mm diameter oil-tight standard operators, contact arrangement as indicated, rated 120V, 720 VA ac.
- 2.5.2 Provide number of positions as shown on the drawings.
- 2.5.3 LOCAL-REMOTE switches to be make-before-break.
- 2.5.4 Allen-Bradley 800T, Cutler Hammer, Square D.

2.6 Indicating Lights

- 2.6.1 Oil-tight, LED lamp, transformer type, 30mm diameter, lens colour: as indicated, supply voltage: 120V, labels as indicated.
- 2.6.2 Allen-Bradley 800T, Cutler Hammer, Square D.

2.7 Control and Relay Panel

- 2.7.1 CSA EEMAC 4X, or Type Seven, depending on location, enclosure with hinged padlockable access door, accommodating relay timers, labels, as indicated, factory installed and wired to identified terminals.
- 2.7.2 Hammond, Ralston, Rittal

2.8 Control Circuit Transformers

- 2.8.1 Single phase, dry type
- 2.8.2 Primary: 600Vac, 60Hz (fused)
- 2.8.3 Secondary: 120Vac
- 2.8.4 Rating: power rating 20 per cent greater than load
- 2.8.5 Hammond, Rex Power Magnetics, Eaton, Square D

2.9 Control Circuit Breakers

- 2.9.1 Rail mounted, thermomagnetic, toggle operated.
- 2.9.2 Entrelec, Weidmuller, Phoenix.

2.10 Terminal Blocks

- 2.10.1 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.
- 2.10.2 Provide all terminal block accessories including end plates, retainer clips, center post jumper bars, etc., for a complete system.
- 2.10.3 Provide a minimum of 20 per cent spare terminal blocks on all terminal block rails.

2.11 Uninterruptible Power Supply

- 2.11.1 UPS shall be on-line, no-break, batteries continuously in circuit with static bypass loads. Minimum rating 1500 VA, 120Vac, 60Hz and minimum 60 minutes run time, unless otherwise specified.
- 2.11.2 Surge protection shall comply with Category B, ANSI/IEEE C62.41 and 45 and shall have automatic low and high voltage protection.
- 2.11.3 Battery: sealed, maintenance free, minimum six years life and LED warning light for battery replacement.
- 2.11.4 UPS shall have On/Off test pushbutton, maintenance bypass switch, "on" battery LED, "on"-line LED and hardwired input and output.
- 2.11.5 Contractor to use UPS to power communication equipment.
- 2.11.6 Acceptable Manufacturers:
 - .1 Eaton 9PX (1500VA minimum)

2.12 Uninterruptible Power Supply Bypass Switch

- 2.12.1 The UPS is to be installed in conjunction with a UPS maintenance Bypass unit. The UPS bypass will have a manually operated bypass switch that allows for the isolation and removal of the UPS from the PAC Control Panel without interrupting downstream devices. Any equipment requiring UPS power must be plugged into the UPS Bypass, not directly into the UPS.
 - .1 Acceptable UPS Maintenance Bypass Manufacturer:
 - .1 Liebert

2.13 General Purpose Receptacle

- 2.13.1 Specification grade, 15A, 125 Vac, duplex, flush, brown or black, Hubbell 5252-BLB or equal.

2.14 24V Power Supply

- 2.14.1 Input: 120VAC, 60Hz (fused).
- 2.14.2 Output: 24VDC, 4.8A (Output is to be confirmed by the panel manufacturers for the load requirements). Parallel operation, dual redundant. Size so that one power supply can handle the total 24Vdc load.
- 2.14.3 Maximum Output Ripple: 1mV peak to peak.
- 2.14.4 Protection: short circuit, overload.
- 2.14.5 Acceptable Manufacturers:
 - .1 Phoenix Contact
 - .2 Allen Bradley
 - .3 Weidmuller
 - .4 Square D
 - .5 Eaton

3. EXECUTION

3.1 Installation

- 3.1.1 Install control devices and interconnect as indicated.
- 3.1.2 Install instruments and interconnect as indicated.
- 3.1.3 Use lamacoid labels for control switches, lamps and pushbuttons.

3.2 Field Quality Control

- 3.2.1 Perform tests in accordance with Specification 16010 – Electrical General Requirements.
- 3.2.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at a time and check out operation of section.
- 3.2.3 Upon completion of sectional test, undertake group testing.
- 3.2.4 Check out complete system for operational sequencing.
- 3.2.5 Submit to Consultant one copy of test results.

END OF SECTION

1. GENERAL

1.1 Scope

- 1.1.1 The Contractor shall provide and install the panel-boards 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 16010 – Electrical General Requirements

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 – Submittals.
- 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 Key interlock scheme drawing and sequence of operations where applicable

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 panel-board 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 in the state. 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 (1) 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 Panel-boards: product of one (1) manufacturer.
 - .1 Install circuit breakers in panel-boards 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 Panel-boards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- 2.1.4 Two (2) keys for each panel-board and key panel-boards alike.
- 2.1.5 Copper bus with neutral of same ampere rating as mains.
- 2.1.6 Mains: suitable for bolt-on breakers.
- 2.1.7 Trim with concealed front bolts and hinges.
- 2.1.8 Trim and door finish: baked grey enamel.

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.
- 2.2.5 Isolated ground bus.

2.3 Breakers

- 2.3.1 Breakers: to Section 16412 – Moulded Case Circuit Breakers.
- 2.3.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

- 2.3.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- 2.3.4 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 pad lock.

2.4 Equipment Identification

- 2.4.1 Provide equipment identification in accordance with Section 16090 – Electrical Identification.
- 2.4.2 Provide engraved nameplate for each circuit in 600 V panel-boards.
- 2.4.3 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.5 Ratings

- 2.5.1 Panel-boards rated 240V AC or less shall have short circuit ratings as shown on the drawings or as herein scheduled, but not less than 10 kA RMS symmetrical.
- 2.5.2 Series ratings are not acceptable unless explicitly shown on drawings.

2.6 Construction

- 2.6.1 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.
- 2.6.2 Trims for branch circuit panel-boards shall be supplied with a hinged door over all circuit breaker handles. Doors in panel-board trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Doors over 48 inches in height shall have auxiliary fasteners.
- 2.6.3 Distribution panel-board trims shall cover all live parts. Switching device handles shall be accessible.
- 2.6.4 Surface trims shall be same height and width as box. Flush trims shall overlap the box by 20mm on all sides.
- 2.6.5 A directory with a clear plastic cover shall be supplied and mounted on the inside of each door.
- 2.6.6 All locks shall be keyed alike.

2.7 Bus

- 2.7.1 Main bus bars shall be copper sized in accordance with CSA standards to limit temperature rise on any current carrying part to a maximum of 65°C above an ambient of 40°C base.
- 2.7.2 A system and insulated/isolated ground bus shall be included in all panels.
- 2.7.3 Full size (100% 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 busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200% rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

2.8 Branch Circuit Panel-boards

- 2.8.1 The minimum short circuit rating for branch circuit panel-boards shall be as specified herein or as indicated on the drawings. Panel-boards shall be fully rated.
- 2.8.2 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.
- 2.8.3 Circuit breakers shall be thermal magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100 ampere frame and through 100 ampere 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.
- 2.8.4 Circuit breakers shall have a minimum interrupting rating of 5,000 amperes symmetrical at 240V.

2.9 Distribution Panel-boards – Circuit Breaker Type

- 2.9.1 Distribution panel-boards with bolt on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings. Panel-boards shall be full rated.
- 2.9.2 Distribution panel-boards with plug on devices contained therein shall have interrupting ratings as indicated on the drawings. Panel-boards shall be fully rated.
- 2.9.3 Where indicated, provide circuit breakers CSA listed for application at 100% of their continuous ampere rating in their intended enclosure.

2.10 Surge Protective devices

- 2.10.1 Provide surge protective devices in accordance with Section 16671 – Surge Protective Devices and as shown on drawings.

2.11 Enclosure

- 2.11.1 Enclosure shall be at least 250mm 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 (4) interior mounting studs with adjustable nuts shall be provided.
- 2.11.2 Enclosure shall be provided with blank ends.
- 2.11.3 Where indicated on the drawings, branch circuit panel-boards shall be column width type.

2.12 ACCEPTABLE MANUFACTURERS

- 2.12.1 Cutler Hammer – Power R Line
- 2.12.2 General Electric
- 2.12.3 Schneider Electric
- 2.12.4 Siemens

3. EXECUTION

3.1 Related Installation

- 3.1.1 Locate panel-boards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- 3.1.2 Mount panelboards to height specified in Section 16010 – Electrical General Requirements or as indicated.
- 3.1.3 Connect loads to circuits.
- 3.1.4 Connect neutral conductors to common neutral bus with respective neutral identified.

3.2 Panelboard Schedules

- 3.2.1 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

- 3.2.2 All systems distribution cabinets shall be complete with a directory card showing circuit numbers, room locations, and a blank column for "REMARKS".
- 3.2.3 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.
- 3.2.4 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.

3.3 Load Balance

- 3.3.1 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.
- 3.3.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- 3.3.3 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

1. GENERAL

1.1 Description

- 1.1.1 This section describes the requirements for surge protective devices for power, control and communications circuits.

1.2 General

- 1.2.1 Provide surge protective devices (SPDs) as shown in the contract drawings and specifications.

1.3 Related Sections

- 1.3.1 Section 01330 – Submittals
1.3.2 Section 01810 – Testing and Commissioning
1.3.3 Section 16010 – Electrical General Requirements

1.4 References

- 1.4.1 The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:
- .1 Underwriters Laboratories, UL 497, 497A, 497B, 1283, ANSI/UL 1449
 - .2 Institute of Electrical and Electronic Engineers, ANSI/IEEE C62.11, C62.41, C62.45
 - .3 Canadian Standards (CUL, CSA)

1.5 Measurement and payment

- 1.5.1 Where SPDs are supplied as part of another equipment package include the cost of the SPDs in the bid form cost for that equipment.
- 1.5.2 Include costs for stand-alone SPDs in the bid form under Section 16671 – Surge Protective Devices. These costs will not be measured but will be paid for at the price included in the bid form for this section.

1.6 Quality Assurance

- 1.6.1 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.

1.7 Warranty

- 1.7.1 In addition to the contract warranty terms, warrant the equipment for a period of ten years following substantial completion.

- .1 The warrantee shall cover all costs for replacement any unit which fails within the warrantee period.
- .2 The warrantee shall cover failures of units due to lightning strikes.

1.8 Submittals

1.8.1 Make submittals in accordance with Section 01330 - Submittals

1.8.2 Shop drawings

- .1 Provide verification that all devices are listed to ANSI/UL 1449 and relevant CSA standards.
- .2 List and detail all protection systems such as fuses, disconnecting means and protective features.
- .3 Product Data: Provide catalog sheets showing
 - .1 Nominal system voltage and phases
 - .2 Modes of protection
 - .3 Maximum continuous operating voltage (MCOV) and temporary operating voltage (TOV) per mode
 - .4 Voltage Protection Rating (VPR) per ANSI/UL 1449 for each required waveform
 - .5 Nominal Discharge Current (I_n) and peak surge current per mode and per phase
 - .6 Graphs of insertion loss for all EMI/RFI filters.
 - .7 Modes of discrete suppression circuitry,
 - .8 Output contacts (where applicable)
 - .9 Physical size, lifting and support points, enclosure details
 - .10 Warranty period and replacement terms,

1.9 Operations & Maintenance Manual

- 1.9.1 Provide operation and maintenance data for SPDs for incorporation into manual specified in Section 01330 - Submittals.
- 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 SPD.

1.10 Training

1.10.1 Provide training.

.1 Training shall included:

- .1 Frequency and procedure for inspection of SPDs.
- .2 Replacement procedure for control and communication units.

1.11 Site Conditions

1.11.1 Refer to 16010 – Electrical General Requirements.

2. PRODUCTS

2.1 General

- 2.1.1 All SPD assemblies and components shall be CSA and/or ULC approved.
- 2.1.2 Enclosure ratings shall meet or exceed the rating of the equipment it is attached to.
- 2.1.3 The SPD shall be maintenance-free with hardwired components.
- 2.1.4 Internal Fusing - Overcurrent Protection
 - .1 Each Metal Oxide Varistor or other primary suppression component shall be individually fused for safety and performance to allow the SPD to withstand the full rated single pulse peak surge capacity per mode without the operation or failure of the fuses.
 - .2 Fusing shall be present in every mode, including Neutral-to-Ground.
- 2.1.5 All SPDs shall be equipped with a comprehensive monitoring system providing clear indication when the unit is functioning properly and, in the event of loss of protection, clear indication that protection has been lost and which phase has been lost.
- 2.1.6 The SPD shall include Form C dry contacts (N.O. or N.C.) for remote monitoring capability unless otherwise indicated.
- 2.1.7 The SPD shall have an internal audible alarm with mute on front cover unless otherwise indicated.
- 2.1.8 All internal power connections shall be as short and straight as possible and shall be designed to minimize inductance.

2.2 Powerline surge protective devices

- 2.2.1 Powerline (60 Hz) SPDs shall protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-

to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable.

- 2.2.2 The disconnect switch or breaker (when specified) and the SPD as a system shall meet or exceed the fault interrupting and withstand ratings of the equipment it is attached to.
- 2.2.3 All SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.
- 2.2.4 Type 2 SPDs shall include UL 1283 listed EMI/RFI filters.
- 2.2.5 EMI/RFI filters shall provide electric line noise attenuation from 10 kHz to 100 MHz.
- 2.2.6 EMI/RFI insertion loss shall exceed 50 dB using the MIL-STD-220A insertion loss test method at the maximum attenuation frequency.
- 2.2.7 The maximum continuous operating voltage (MCOV) of all components shall not be less than the following values

Nominal Voltage	MCOV (minimum)			
	L-L	L-N	L-G	N-G
208/120 Y, Solidly grounded	300 V	150 V	300 V	150 V
240/120 Solidly Grounded				
600 Y, Solidly Grounded	840 V	420 V	420 V	420 V
600 Y, Resistance Grounded	750 V	n/a	750 V	n/a
600 D				

- 2.2.8 SPDs for 208/120 and 240/120 V Solidly grounded systems shall have let-through voltage of less than the following:

Test	Let-through Voltage (V)			
	L-L	L-N	L-G	N-G
VPR (6 kV, 3 kA)	1000	600	700	700
C3 Impulse (20 kV, 10 kA)	1500	1000	1000	1000
A1 Ringwave (2 kV, 67 A)	50	50	400	400

- 2.2.9 SPDs for 600 V Solidly grounded systems shall have let-through voltage of less than the following:

Test	Let-through Voltage (V)			
	L-L	L-N	L-G	N-G
VPR (6 kV, 3 kA)	2500	1500	1500	1500
C3 Impulse (20 kV, 10 kA)	2500	1800	1800	1800
A1 Ringwave (2 kV, 67 A)	80	80	80	80

2.2.10 SPDs for 600 V resistance-grounded and delta systems shall have let-through voltage of less than the following:

Test	Let-through Voltage (V)	
	L-L	L-G
VPR (6 kV, 3 kA)	2500	2500
C3 Impulse (20 kV, 10 kA)	2500	2500
A1 Ringwave (2 kV, 67 A)	80	1100

2.2.11 600 V Power Distribution Cabinet

- .1 The SPD shall be located within the power distribution cabinet and shall be connected to the bus through a breaker. The breaker and SPD shall be located as close as possible to the splitter.
- .2 All monitoring and diagnostic features shall be visible from the front of the equipment.
- .3 Provide a transient event counter with LCD panel display and reset button on the front cover.
- .4 Device characteristics shall be per contract drawings.

2.3 Acceptable Manufacturers

2.3.1 EATON.

3. EXECUTION

3.1 Shipping, handling and storage

- 3.1.1 Ship in accordance with manufacturer's instructions.
- 3.1.2 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.

3.2 Preparation for Installation

- 3.2.1 System ground and neutral-to-ground connections shall be in place prior to connecting SPDs.

3.3 Installation

- 3.3.1 Install the SPD's with the conductors as short and straight as practically possible.
- 3.3.2 Follow the SPD manufacturer's recommended installation practice as outlined in the equipment installation manual. The electrical contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.
- 3.3.3 Main service entrance units shall be installed on a non-fused disconnect switch.

END OF SECTION



APPENDIX 1B - DRAWINGS

Drawings	1
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TIMMINS

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TIMMINS WATER TREATMENT PLANT
HIGH LIFT AND BACKWASH PUMP
REPLACEMENT

Contract No. 223027

ISSUED FOR TENDER - FEB 2025

DRAWING LIST

GENERAL

G001 SITE PLAN AND LAY DOWN AREA

PROCESS

DD101 HIGH LIFT PUMP ROOM NO.1 REMOVAL PLAN
DD102 HIGH LIFT PUMP ROOM NO.2 REMOVAL PLAN
DD103 FILTER PIPE GALLERY REMOVAL PLAN
DD501 HIGH LIFT PUMP NO. 6 REMOVAL PHOTOS
DD502 HIGH LIFT PUMPS NOS. 7 AND 8 REMOVAL PHOTOS
DD503 BACKWASH PUMP REMOVAL PHOTOS
DD601 P&ID - EXISTING HIGH LIFT PUMPS 6 AND 7 REMOVALS
D-101 OVERALL PLAN AND GENERAL NOTES
D-102 NEW HIGH LIFT PUMP NO. 6 - PLAN AND SECTIONS
D-103 NEW HIGH LIFT PUMP NO. 7, 8 & BACKWASH PUMP PLAN
D-104 NEW HIGH LIFT PUMP NO. 7 SECTIONS
D-105 NEW BACKWASH PUMP SECTIONS
D-106 NEW BACKWASH PIPING PLAN
D-107 NEW BACKWASH PIPING SECTIONS
D-501 PROCESS DETAILS 1
D-502 PROCESS DETAILS 2
D-601 P&ID - HIGH LIFT PUMPS 6 AND 7
D-602 P&ID - NEW BACKWASH PUMP

STRUCTURAL

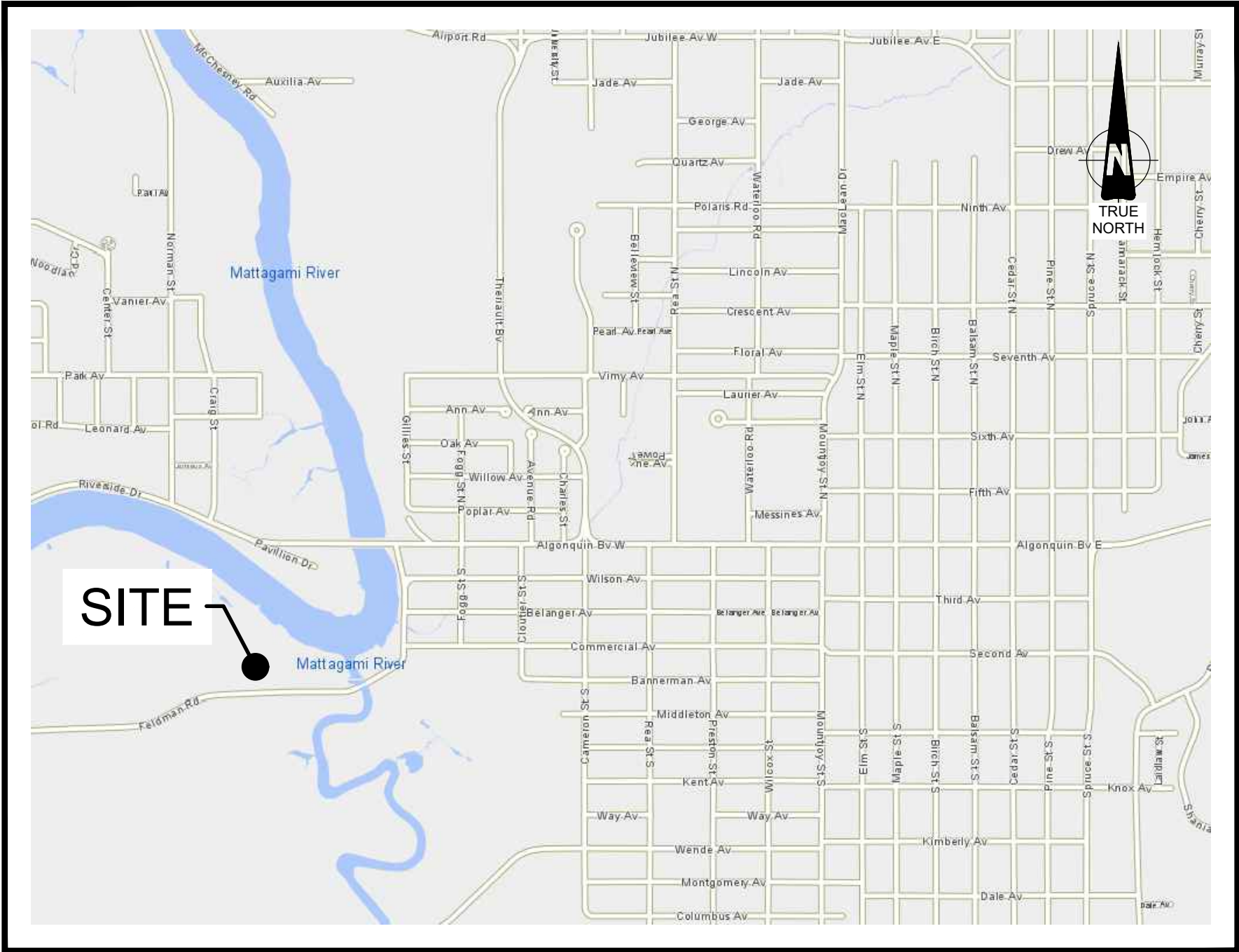
S-501 STRUCTURAL DETAILS

ELECTRICAL

E-001 ELECTRICAL LEGEND & GENERAL NOTES
E-101 FILTER 1, 2, 3 PIPE GALLERY PLAN POWER LAYOUT - REMOVALS
E-102 PUMP ROOM #2 PLAN POWER LAYOUT - REMOVALS
E-103 PUMP ROOM #1 POWER LAYOUT - REMOVALS
E-201 FILTER 1, 2, 3 PIPE GALLERY PLAN POWER LAYOUT - NEW WORK
E-202 POWER DISTRIBUTION PUMP ROOM #2 PLAN -NEW WORK
E-203 PUMP ROOM #1 POWER LAYOUT - NEW WORK
E-210 OVERALL UPPER LEVEL PLAN POWER LAYOUT - NEW MAJOR FEEDERS ROUTES
E-301 EXISTING MAIN PLANT SINGLE LINE DIAGRAM
E-302 PANEL J SINGLE LINE DIAGRAM - REMOVALS
E-303 PANEL J SINGLE LINE DIAGRAM - NEW WORK
E-304 PANEL K SINGLE LINE DIAGRAM - MODIFICATIONS
E-305 HIGH LIFT NORTH PUMP ROOM SINGLE LINE DIAGRAM -REMOVALS
E-306 PANEL L SINGLE LINE DIAGRAM - NEW WORK
E-401 ELECTRICAL STANDARD DETAILS
E-402 SOFT STARTER CONTROL SCHEMATIC FOR BACKWASH PUMP 500-P-14
E-403 VFD CONTROL SCHEMATIC FOR HIGH LIFT PUMPS HLP-6 & HLP-7
E-404 ACTUATOR WIRING DIAGRAMS & PANEL SCHEDULES
E-405 ELECTRICAL DETAILS SHEET 1
E-406 ELECTRICAL DETAILS SHEET 2
E-407 ELECTRICAL DETAILS SHEET 3
E-408 ELECTRICAL DETAILS SHEET 4
E-409 ELECTRICAL DETAILS SHEET 5

INSTRUMENTATION

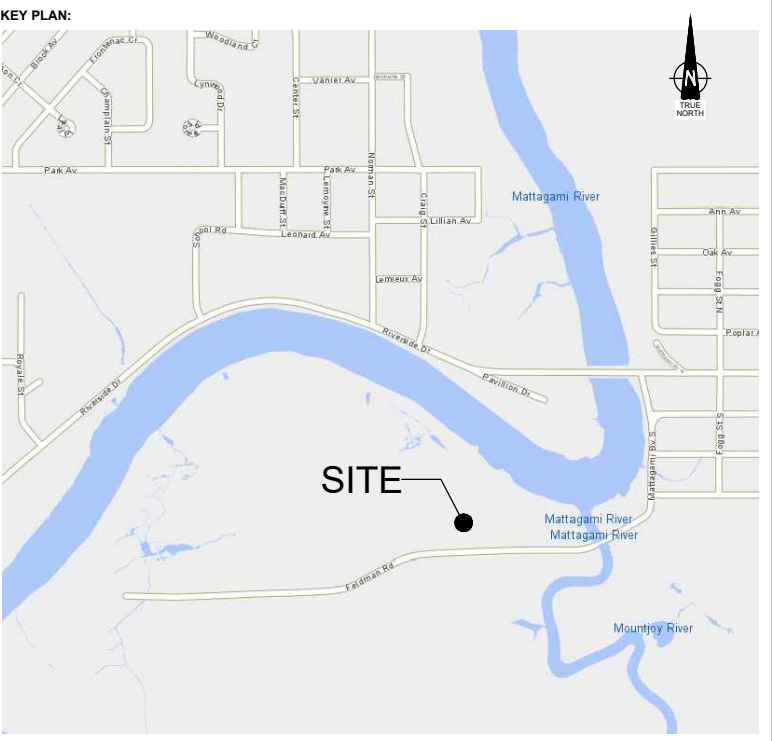
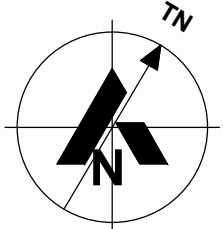
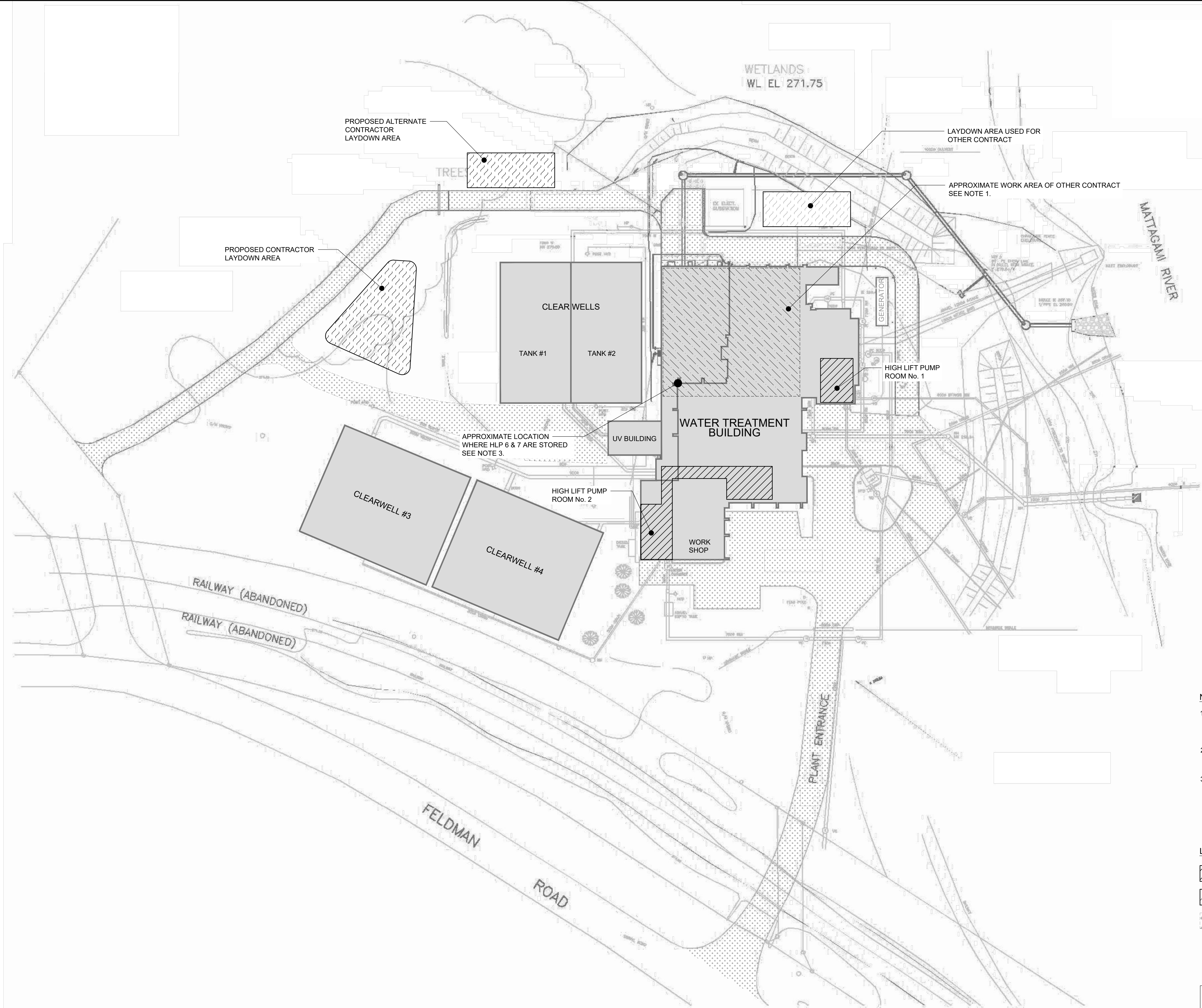
I-101 CP-C: INPUTS/OUTPUTS - REMOVALS
I-111 CP-C: INPUTS/OUTPUTS - NEW WORK - SHEET 1
I-112 CP-B: INPUTS/OUTPUTS - NEW WORK - SHEET 2
I-113 CP-B: INPUTS/OUTPUTS - NEW WORK - SHEET 3
I-114 CP-B: INPUTS/OUTPUTS - NEW WORK - SHEET 4
I-115 CP-B: INPUTS/OUTPUTS - NEW WORK - SHEET 5



LOCATION PLAN

NTS





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0	MAR 2025	ISSUED FOR TENDER	GA
No.	Date	Description	By

STAMPS:

DESIGNED BY: _____ APPROVED BY: _____

CONSULTANT:

CLIENT:

PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

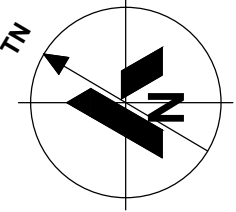
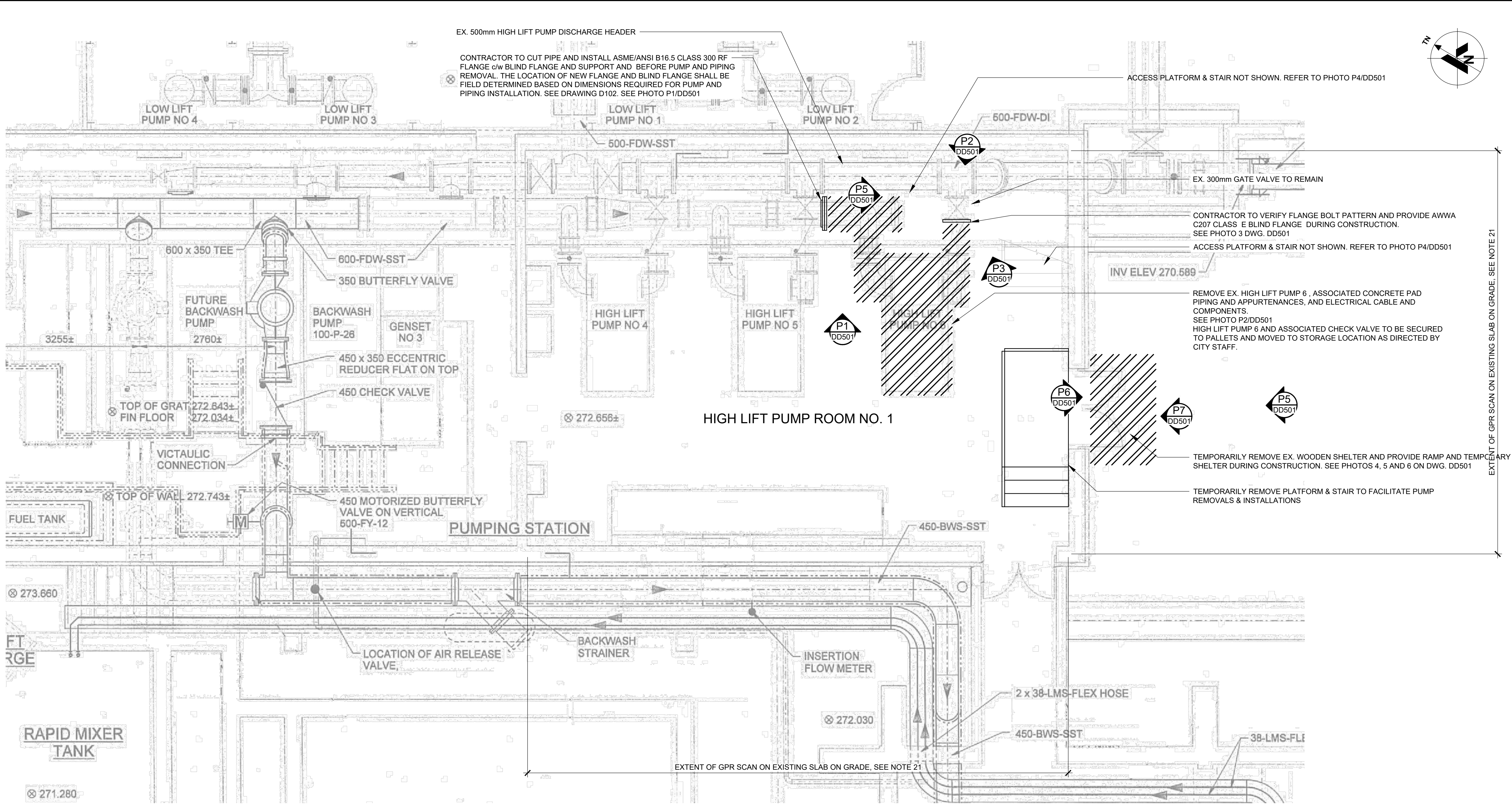
SHEET TITLE:
OVERALL SITE PLAN AND CONSTRUCTION LAYDOWN AREA

DISCIPLINE: GENERAL			
DRAFTER:	SCK	SCALE:	1:500
DESIGNER:	JZ	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	GA
PROJECT No:	T001960A	DRAWING No:	G-001
SHEET No:			

- NOTES**
- THERE WILL BE REQUIREMENT TO COORDINATE WORK BETWEEN CONTRACTS TO MAINTAIN SEPARATION IN TIME AND OR SPACE. AT NO TIME WILL THE CITY ACT AS THE CONSTRUCTOR.
 - ALL DISTURBED AREAS, INCLUDING BUT NOT LIMITED TO LAYDOWN AND PARKING ARE TO BE RESTORED TO EXISTING CONDITIONS OR BETTER
 - THE HLP 6 & 7 PUMPS AND MOTORS ARE STORED IN THE PLANT AT THE LOCATION SPECIFIED ON PALLETES. THE BASES ARE STORED IN A SHIPPING CONTAINER OUT SIDE JUST SOUTH OF CLEARWELL TANK No.1.

- LEGEND**
- CONSTRUCTION LIMITS
 - LAYDOWN AND STORAGE AREA
 - EXIST. ROAD & PARKING

THIS DRAWING WAS ORIGINATED FROM "CITY OF TIMMINS WATER FILTRATION PLANT UPGRADES" PROJECT, CONTRACT NO. W-2007-014, FILE NO. 5900-001, DRAWING NAME "CIVIL - OVERALL SITE PLAN", DRAWING NUMBER "C-01", DATED APRIL 2007.



EXTENT OF GPR SCAN ON EXISTING SLAB ON GRADE, SEE NOTE 21

NOTE:

- THE BACKGROUND DRAWING WAS TAKEN FROM PROJECT "CITY OF TIMMINS, TIMMINS WATER FILTRATION PLANT CONTRACT NO. 2003 - W001" DRAWING P020 DATED JANUARY 2003.
- DRAWING IS ORIGINATED FROM "CITY OF TIMMINS, TIMMINS WATER TREATMENT PLANT CONTRACT NO. 2003-W001. DRAWING NAME "FILTERS 4, 5 AND 6 PIPE GALLERY AND PUMPING STATION PLAN". DRAWING NUMBER "P020", SHEET 43 OF 105, DATED "30/06/03, ISSUED FOR TENDER".
- THE REMOVAL DRAWINGS ARE BASED ON THE AVAILABLE RECORD DRAWINGS. ACTUAL DETAILS OF CONSTRUCTION MAY NOT BE AS INDICATED ON THESE DRAWINGS. CONTRACTOR TO FIELD VERIFY.
- ELEVATIONS SHOWN ON THE REMOVAL DRAWINGS ARE IN METERS.
- REFER TO TECHNICAL SPECIFICATIONS (DIVISION 1) FOR REMOVALS SEQUENCING AND CONSTRUCTION STAGING.
- ALL REMOVALS WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE APPROVED SEQUENCE OF CONSTRUCTION AND SUBJECT TO THE RESTRICTIONS OF PERMISSIBLE OUTAGES OF PARTICULAR COMPONENTS OR SYSTEMS.
- CONTRACTOR TO COORDINATE ALL REMOVALS WITH ALL SUBTRADES.
- ALL ITEMS TO BE REMOVED SHALL INCLUDE REMOVAL OF ALL PIPING, EXHAUSTS, VALVING, TANKS, ELECTRICAL WIRES, CONDUITS, BRACKETS, SUPPORTS AND ANY OTHER ASSOCIATED APPURTENANCES. ELECTRICAL WIRING SHALL BE DISCONNECTED SAFELY AT THE SOURCE. PIPING SHALL BE TEMPORARILY OR PERMANENTLY CAPPED FLUSH WITH SURFACE. THE INTENT IS THAT FOLLOWING REMOVALS AND RESTORATION THAT NO EQUIPMENT RELATED TO THE ITEM IDENTIFIED TO BE REMOVED SHALL REMAIN.
- ANY HOLES OR CAVITIES LEFT BY THE REMOVAL OF EQUIPMENT AND ASSOCIATED APPURTENANCES SHALL BE FILLED WITH GROUT OR OTHER FILLER APPROVED BY THE ENGINEER.
- ALL EMBEDDED, EXPOSED METALS LEFT BY REMOVALS SHALL BE CUT BACK 20mm FROM CONCRETE SURFACE AND REPAIRED WITH NONSHRINK GROUT.
- THERE ARE CAST IN REINFORCING BARS IN EXISTING STRUCTURES THAT ARE TO BE REUSED AS DOWELS FOR NEW CONCRETE WORK. DO NOT DAMAGE THESE BARS DURING SAW CUTTING, CHIPPING AND REMOVAL OF ADJACENT CONCRETE.
- DO NOT USE WRECKING BALLS OR SLEDGE HAMMERS FOR DEMOLITION OF CONCRETE. USE ONLY HAND OPERATED PNEUMATIC CHIPPERS, DRILLS OR SAWS.
- REMOVE ALL ELECTRICAL DISTRIBUTION AND/OR CONTROL WIRING THAT IS RENDERED REDUNDANT AS A RESULT OF EQUIPMENT REMOVAL, INCLUDING SURFACE MOUNT RACEWAYS, FITTINGS, SUPPORTS, AND WIRING.
- REMOVE ALL WIRING FROM CONDUITS THAT ARE EMBEDDED IN THE BUILDING STRUCTURE THAT ARE REDUNDANT AS RESULT OF THE EQUIPMENT REMOVAL. CUT AND SEAL REDUNDANT EMBEDDED CONDUITS AT THE POINTS THEY TRANSITION OUT OF THE BUILDING STRUCTURE.
- REMOVAL OF EQUIPMENT SHALL INCLUDE CONCRETE BASES, SERVICE PIPING CONNECTIONS AND ALL ASSOCIATED ACCESSORIES.
- REMOVAL OF PIPING SHALL INCLUDE ALL HANGERS, GUIDES, ANCHORS, BRACES AND ALL METAL AND CONCRETE SUPPORTS.
- FLOOR AND WALLS TO BE REPAIRED WHERE BASES OR SUPPORTS HAVE BEEN REMOVED. FINISH FLOOR AND WALLS TO MATCH SURROUNDING EXISTING FLOOR AND WALL FINISHES.
- CONTRACTOR IS RESPONSIBLE TO VERIFY MEASUREMENTS AND PROVIDE METHODS OF REMOVING AND INSTALLING ALL RELATED PUMP COMPONENTS. CONTRACTOR TO COORDINATE USE OF EXISTING MONORAIL/HOIST WITH OWNER. CONTRACTOR TO OBTAIN CERTIFICATION REPORT CONFIRMING MONORAIL/HOIST CAPACITIES BEFORE AND AFTER USE.
- FOLLOWING REMOVAL OF EXISTING PUMP & CONCRETE PADS, AND PRIOR TO CASTING NEW PADS, EXISTING SLAB ON GRADE IS TO BE SCANNED BY QUALIFIED CONTRACTOR GROUND PENETRATING RADAR (GPR) TO DETECT VOIDS IN EXISTING BACKFILL UNDER SLAB ON GRADE AND DETERMINE EXISTING REBAR. SUBMIT REPORTS OF FINDINGS TO ENGINEER FOR REVIEW.
- CITY TO HAVE FIRST RIGHT OF REFUSAL ON ALL EQUIPMENT AND VALVES. WHEN DIRECTED BY THE CITY, SALVAGED EQUIPMENT IS TO BE SECURED TO PALLETS AND MOVED TO A STORAGE AREA ONSITE.

KEY PLAN:

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No.	Date	Description	By
0	MAR 2025	ISSUED FOR TENDER	GA

STAMPS:

DESIGNED BY: _____

APPROVED BY: _____

LEGEND

EQUIPMENT TO BE REMOVED / DEMOLISHED

CONSULTANT:

CLIENT:

PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

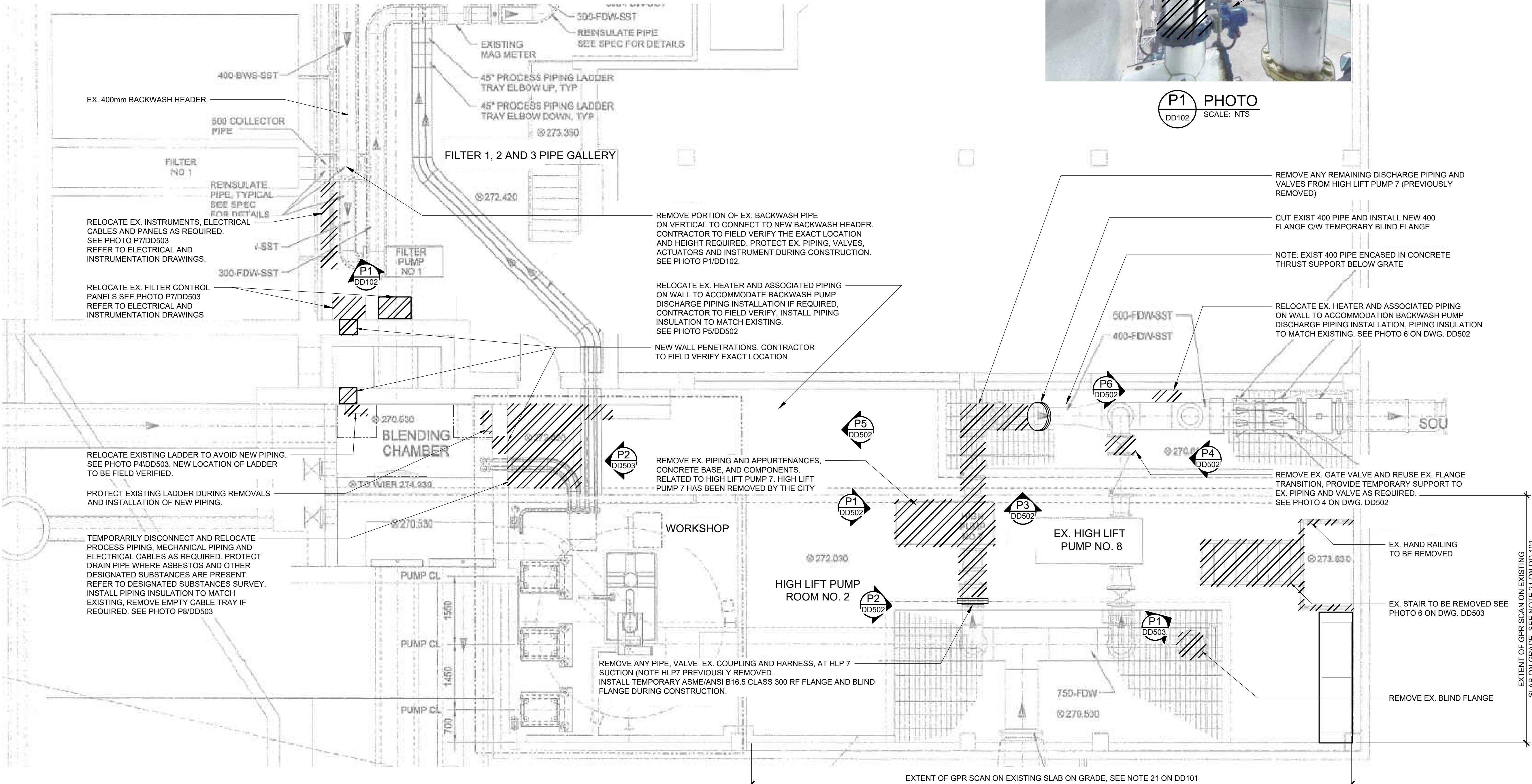
SHEET TITLE:

HIGH LIFT PUMP ROOM NO. 1
REMOVAL PLAN

DISCIPLINE:

PROCESS

DRAFTER:	SCALE:
SCK	NTS
DESIGNER:	DATE:
JZ	FEB 2025
APPROVER:	CHECKER:
GA	GA
PROJECT No:	DRAWING No:
T001960A	DD101
SHEET No:	



1 FLOOR PLAN
SCALE: N.T.S.

- NOTE:
- THE BACKGROUND DRAWING WAS TAKEN FROM PROJECT "CITY OF TIMMINS, TIMMINS WATER FILTRATION PLANT CONTRACT NO. 2003 - W001" DRAWING P013 DATED JANUARY 2003.
 - REFER TO NOTES ON DRAWING DD101.

KEY PLAN:

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No.	Date	Description	By
0	MAR 2025	ISSUED FOR TENDER	GA

STAMPS:

DESIGNED BY: APPROVED BY:

LEGEND

EQUIPMENT TO BE REMOVED / DEMOLISHED

CONSULTANT:

CLIENT:

PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:

HIGH LIFT PUMP ROOM NO. 2
REMOVAL PLAN

DISCIPLINE:

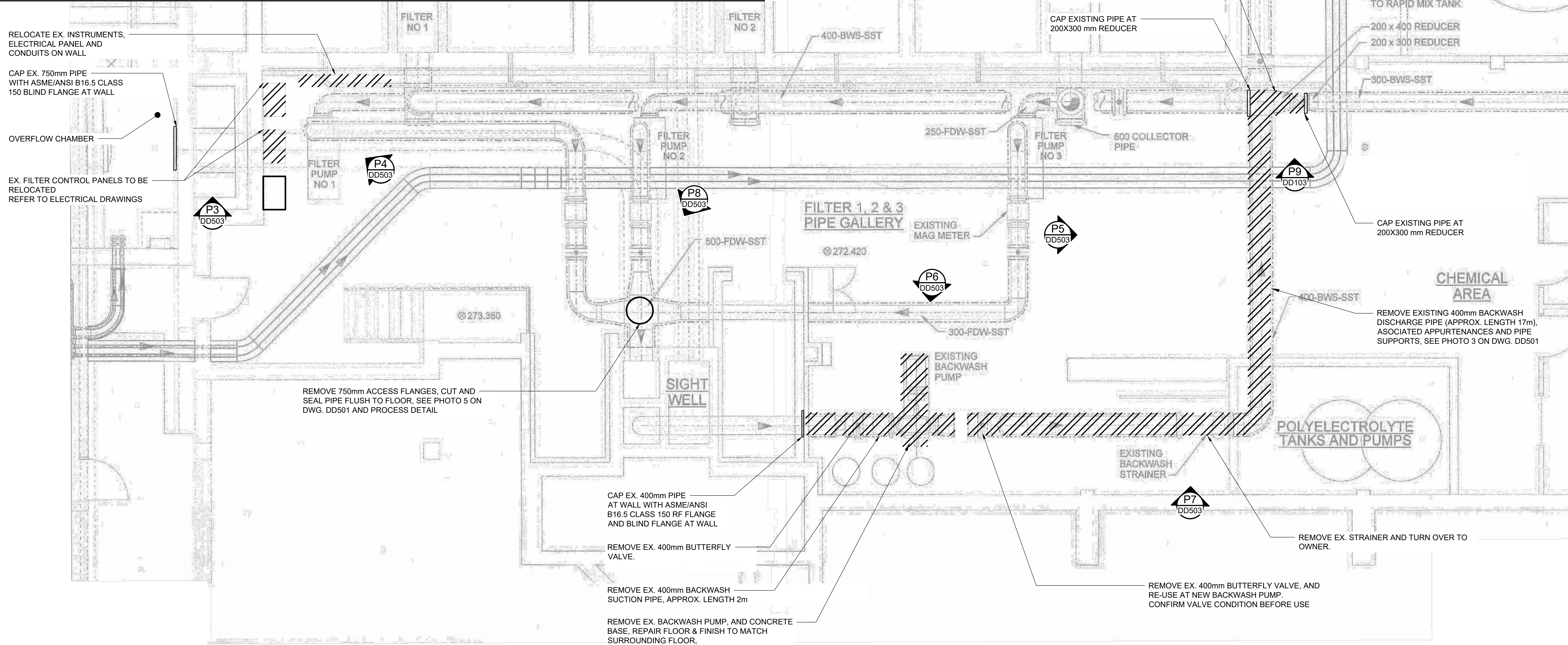
PROCESS

DRAFTER:	SCALE:
AN	NTS
DESIGNER:	DATE:
JZ	FEB 2025
APPROVER:	CHECKER:
GA	GA
PROJECT No:	DRAWING No:
T001960A	DD102
SHEET No:	



P9
DD103 PHOTO
SCALE: NTS

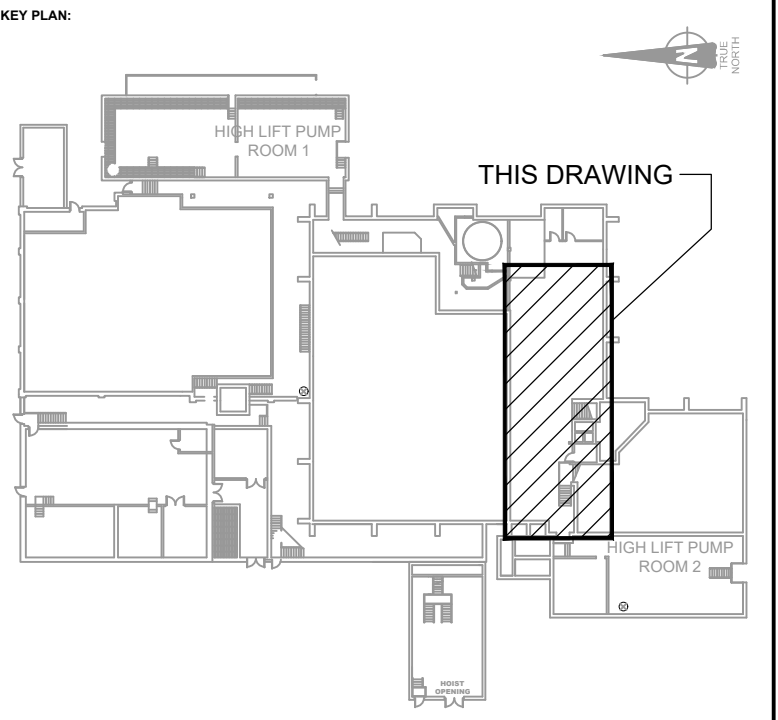
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CONTRACTOR SHALL SUBMIT SHOP DRAWING OF THRUST SUPPORT TO ENGINEER FOR REVIEW.



NOTE:

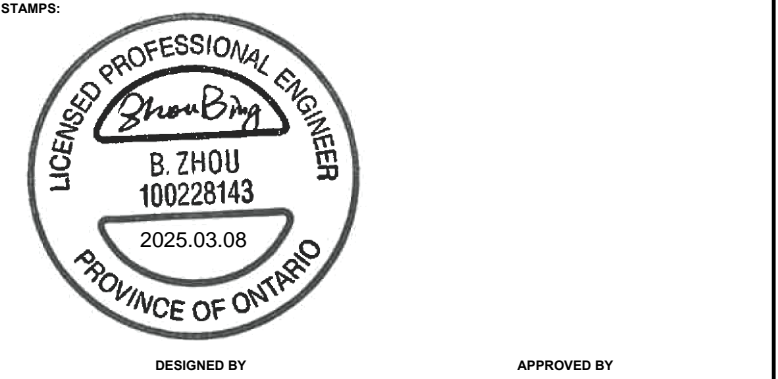
- THE BACKGROUND DRAWING WAS ORIGINATED FROM "CITY OF TIMMINS, TIMMINS WATER FILTRATION PLANT CONTRACT NO. 2003 - W001" DRAWING P019 DATED JANUARY 2003.
- REFER TO NOTES ON DRAWING DD101.

1
FLOOR PLAN
SCALE: 1:50



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No.	Date	Description	By
0	MAR 2025	ISSUED FOR TENDER	GA



LEGEND	
	EQUIPMENT TO BE REMOVED / DEMOLISHED



PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:
FILTER PIPE GALLERY REMOVAL PLAN

DISCIPLINE: PROCESS	
DRAFTER: SCK	SCALE: NTS
DESIGNER: JZ	DATE: FEB 2025
APPROVER: GA	CHECKER: GA
PROJECT No: T001960A	DRAWING No: DD103
SHEET No:	

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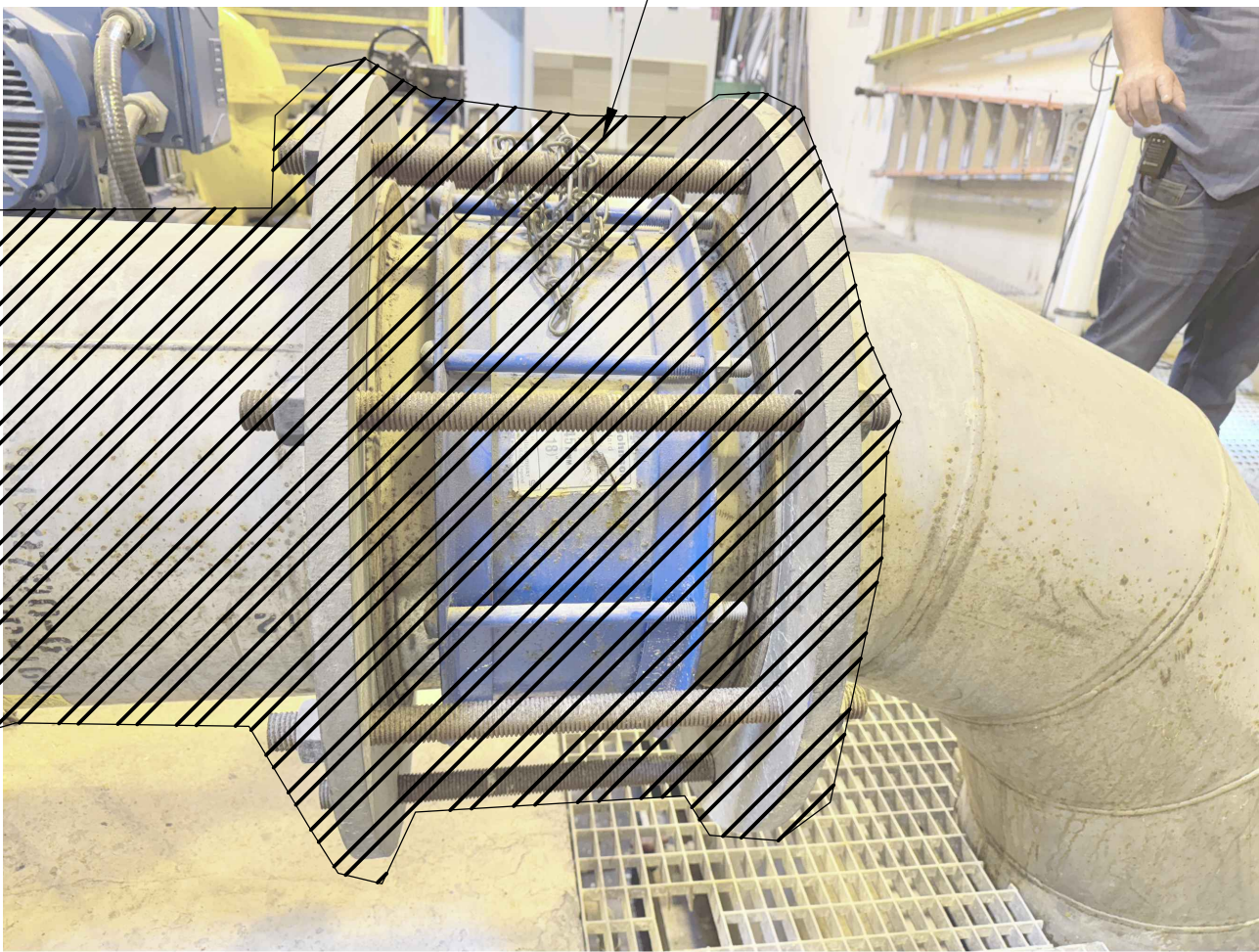
PRINT DATE: AUG 2024
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REMOVE EX. PUMP BASE FROM HIGH LIFT PUMP #7, ASSOCIATED PIPING AND APPURTENANCES, PUMP CONCRETE BASE, AND ELECTRICAL COMPONENTS.



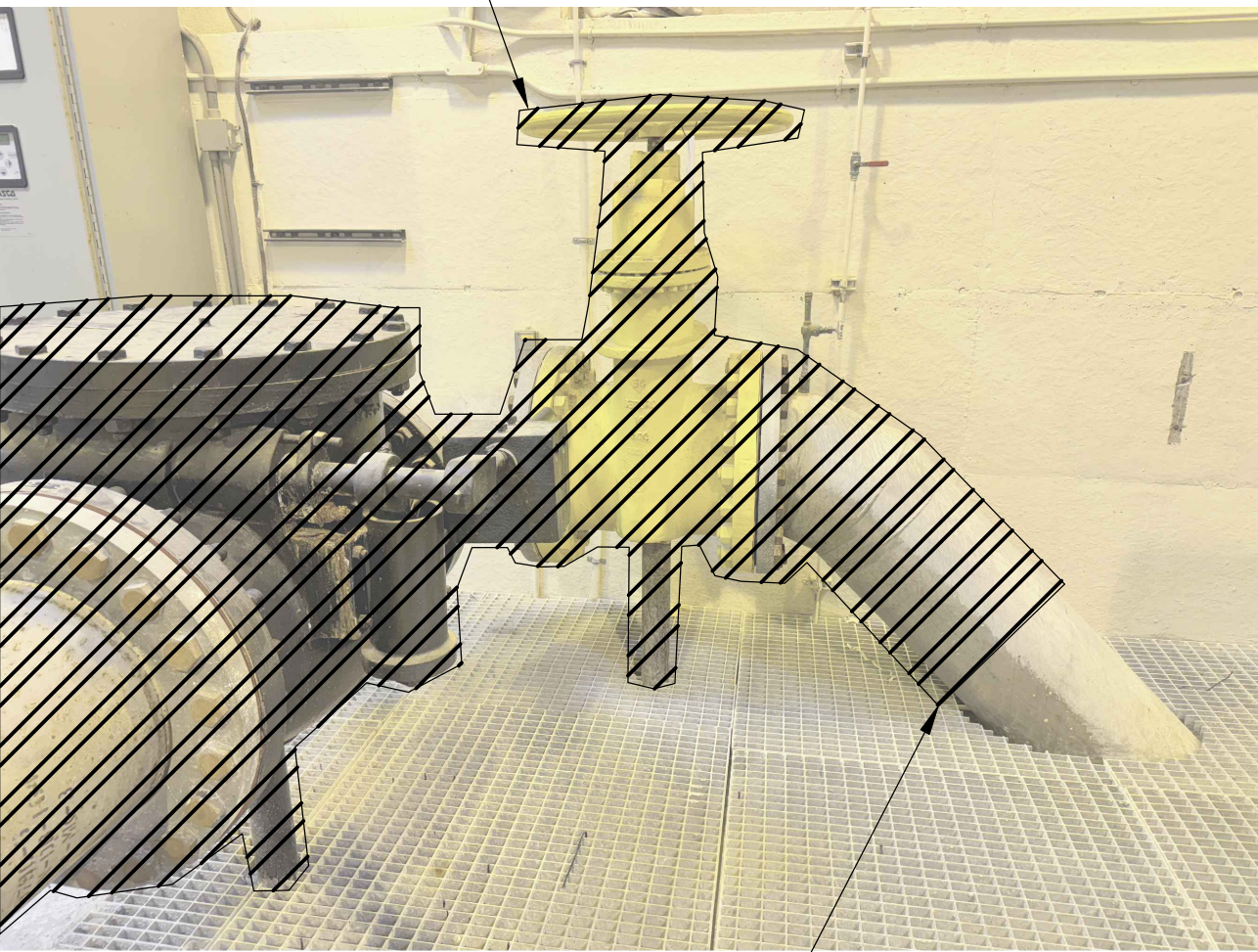
P1 PHOTO - HLP 7 IN HLP ROOM No. 2
DD102 SCALE: NTS

REMOVE EX. COUPLING AND HARDESS, INSTALL ASME /ANSI B16.5 CLASS 300 RF FLANGE AND BLIND FLANGE DURING CONSTRUCTION. PROVIDE FLANGE SUPPORT



P2 PHOTO - HLP 7 IN HLP ROOM No. 2
DD102 SCALE: NTS

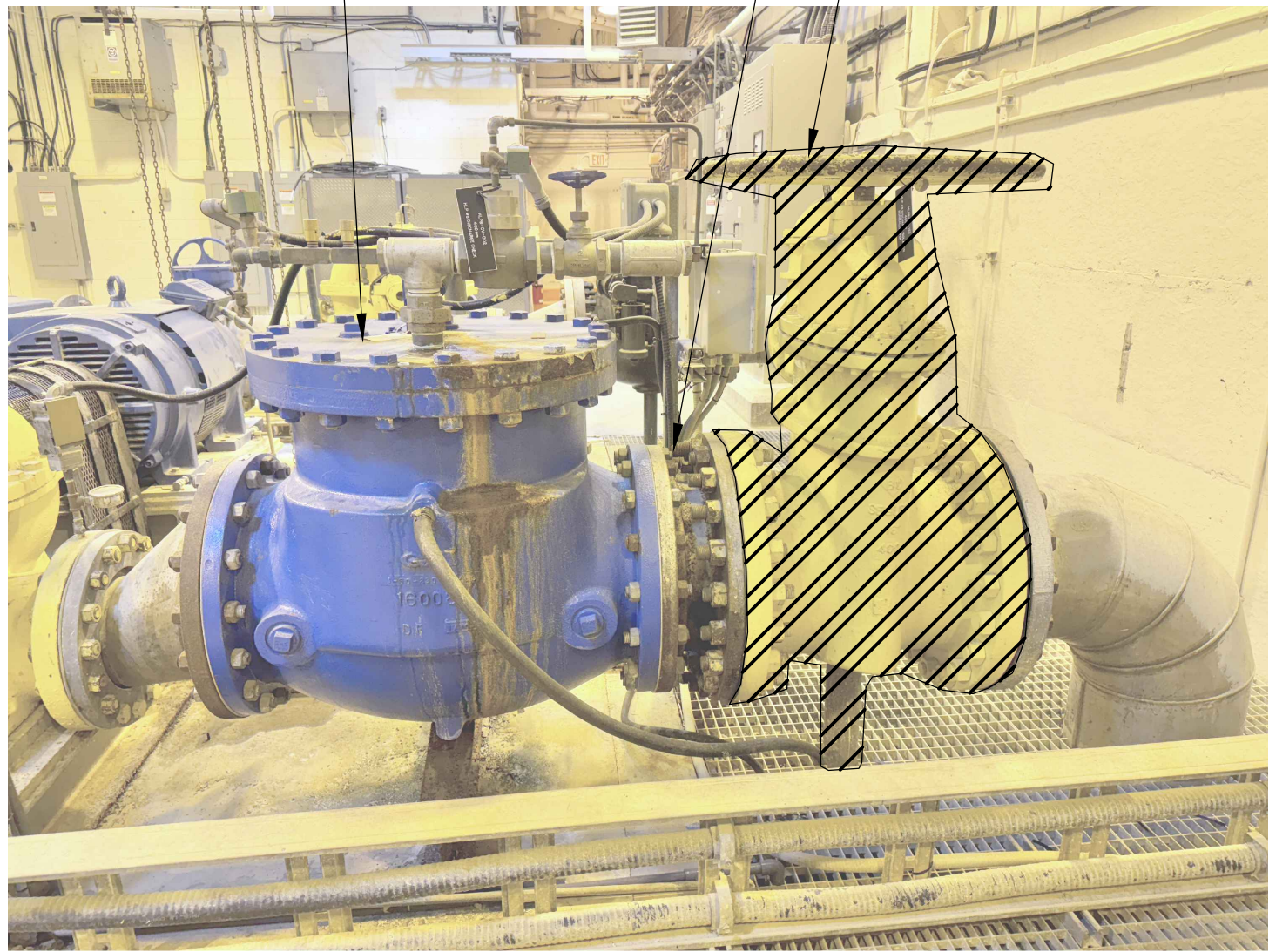
REMOVE EX. HIGH LIFT PUMP 7 DISCHARGE PIPING. SEE DWG. DD102 FOR SCOPE



CUT PIPE AND INSTALL NEW 400 FLANGE & TEMPORARY BLIND FLANGE

P3 PHOTO - HLP 7 IN HLP ROOM No. 2
DD102 SCALE: NTS

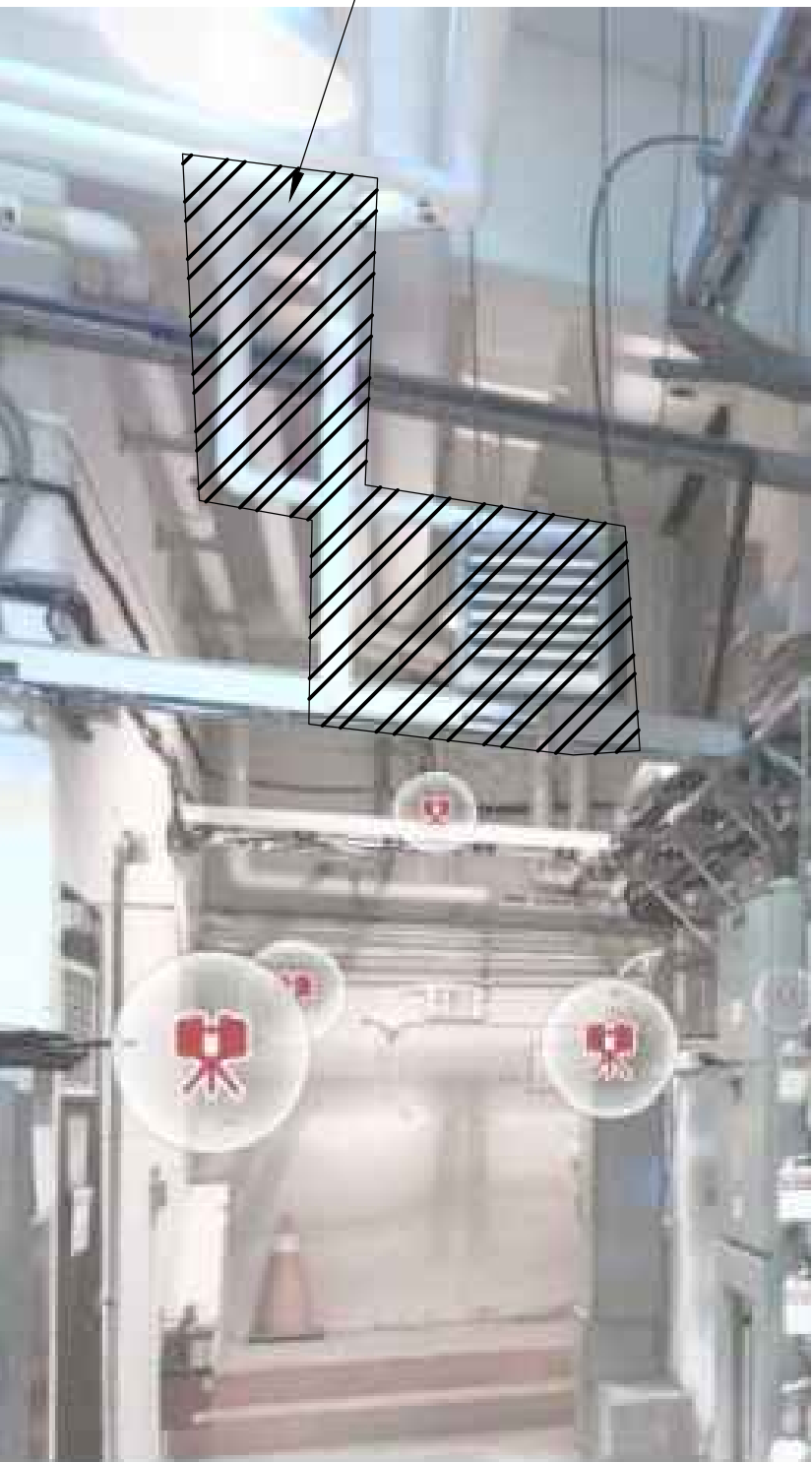
PROTECT EX. VALVE DURING CONSTRUCTION. PROVIDE TEMPORARY SUPPORT TO EXIST. PIPING AND VALVE AS REQUIRED



REMOVE EXISTING FLANGE CONNECTION
REMOVE EX. GATE VALVE

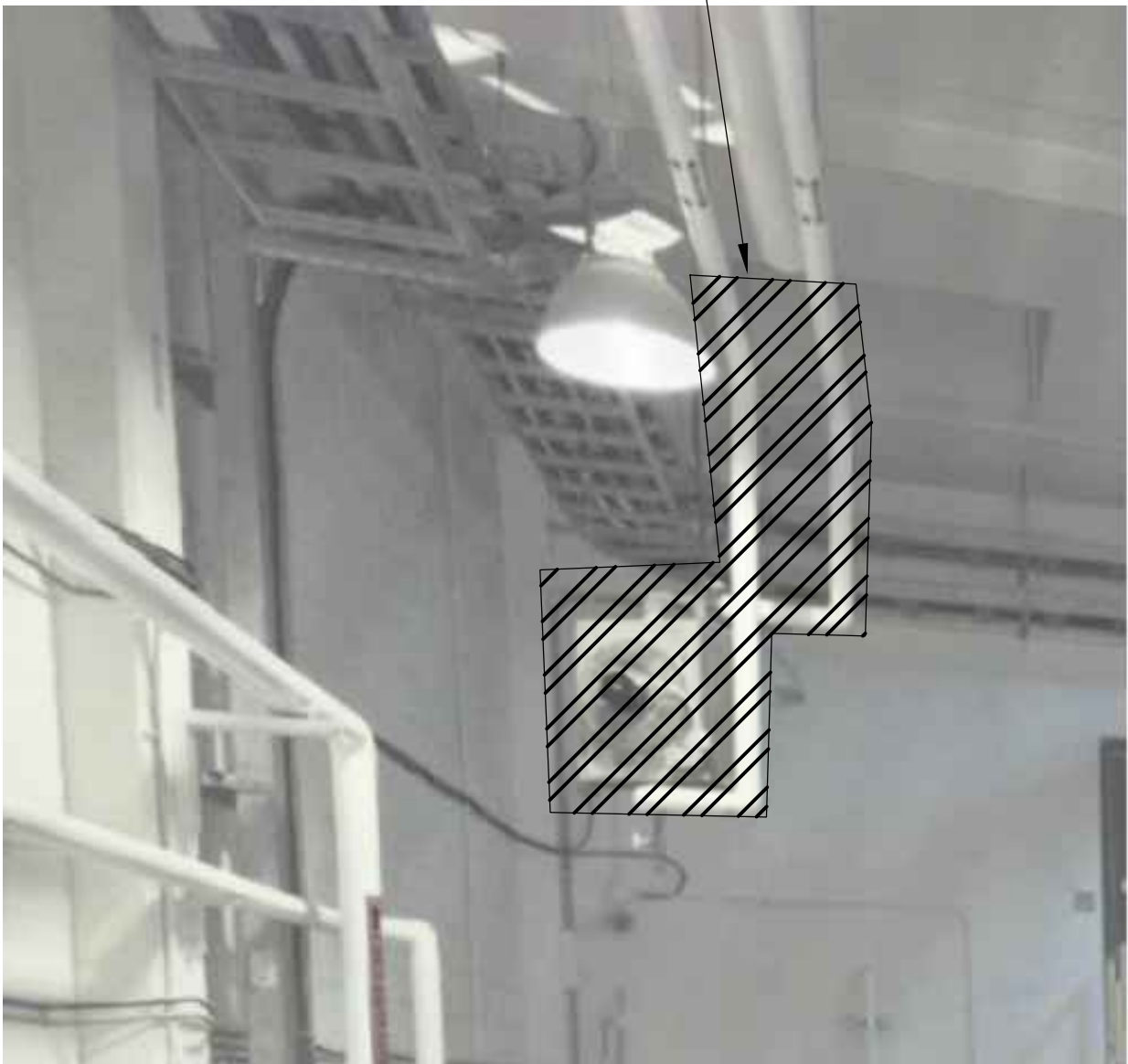
P4 PHOTO - HLP 8 IN HLP ROOM No. 2
DD102 SCALE: NTS

RELOCATE EX. HEATER AND ASSOCIATED PIPING TO ACCOMADATION BACKWASH PUMP DISCHARGE PIPING INSTALLATION, PIPING INSULATION TO MATCH EX.



P5 PHOTO - HLP ROOM No. 2
DD102 SCALE: NTS

RELOCATE EX. HEATER AND ASSOCIATED PIPING TO ACCOMADATE BACKWASH PUMP DISCHARGE PIPING INSTALLATION, PIPING INSULATION TO MATCH EX.



P6 PHOTO - HLP ROOM No. 2
DD102 SCALE: NTS

KEY PLAN:

THIS DRAWING

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No.	Date	Description	By

STAMPS:

DESIGNED BY: APPROVED BY:

LEGEND

EQUIPMENT TO BE REMOVED / DEMOLISHED

CONSULTANT:

CLIENT:

PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

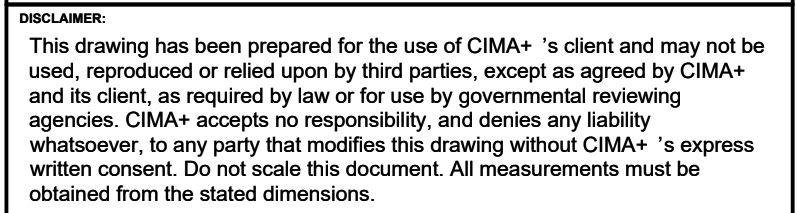
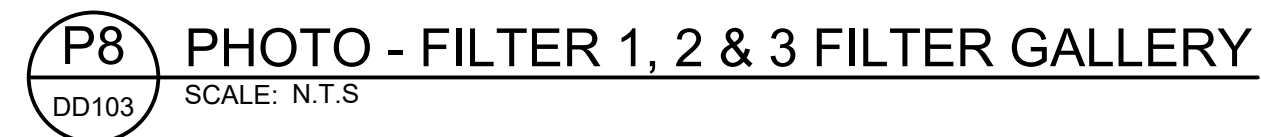
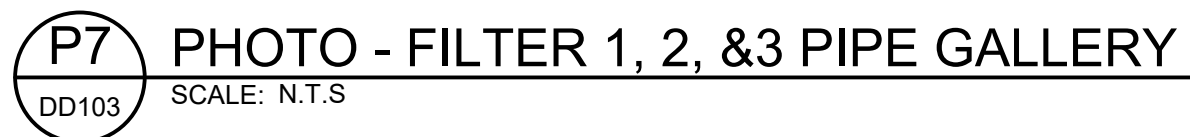
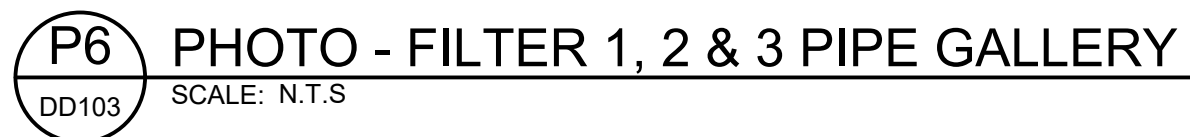
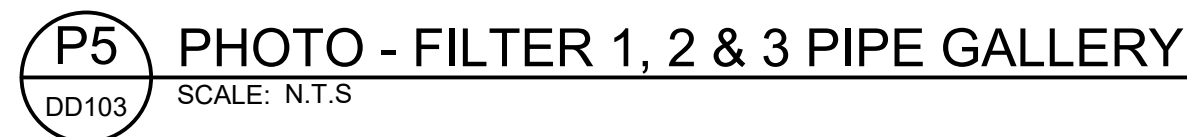
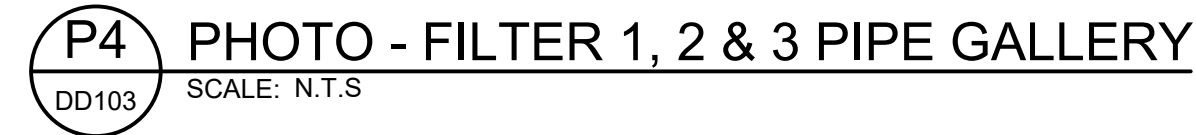
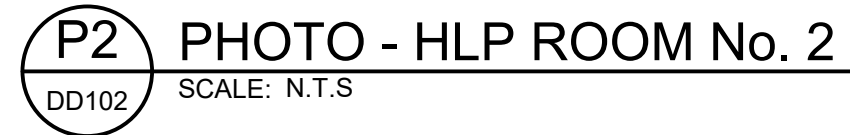
SHEET TITLE:

HIGH LIFT PUMP NOS. 7 AND 8 REMOVAL PHOTOS

DISCIPLINE:

PROCESS

DRAFTER:	AN	SCALE:	NTS
DESIGNER:	JZ	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	GA
PROJECT No:	T001960A	DRAWING No:	DD502
SHEET No:			

[illegible]

LEGEND

 EQUIPMENT TO BE REMOVED / DEMOLISHED

CONSULTANT:



PROJECT NAME:

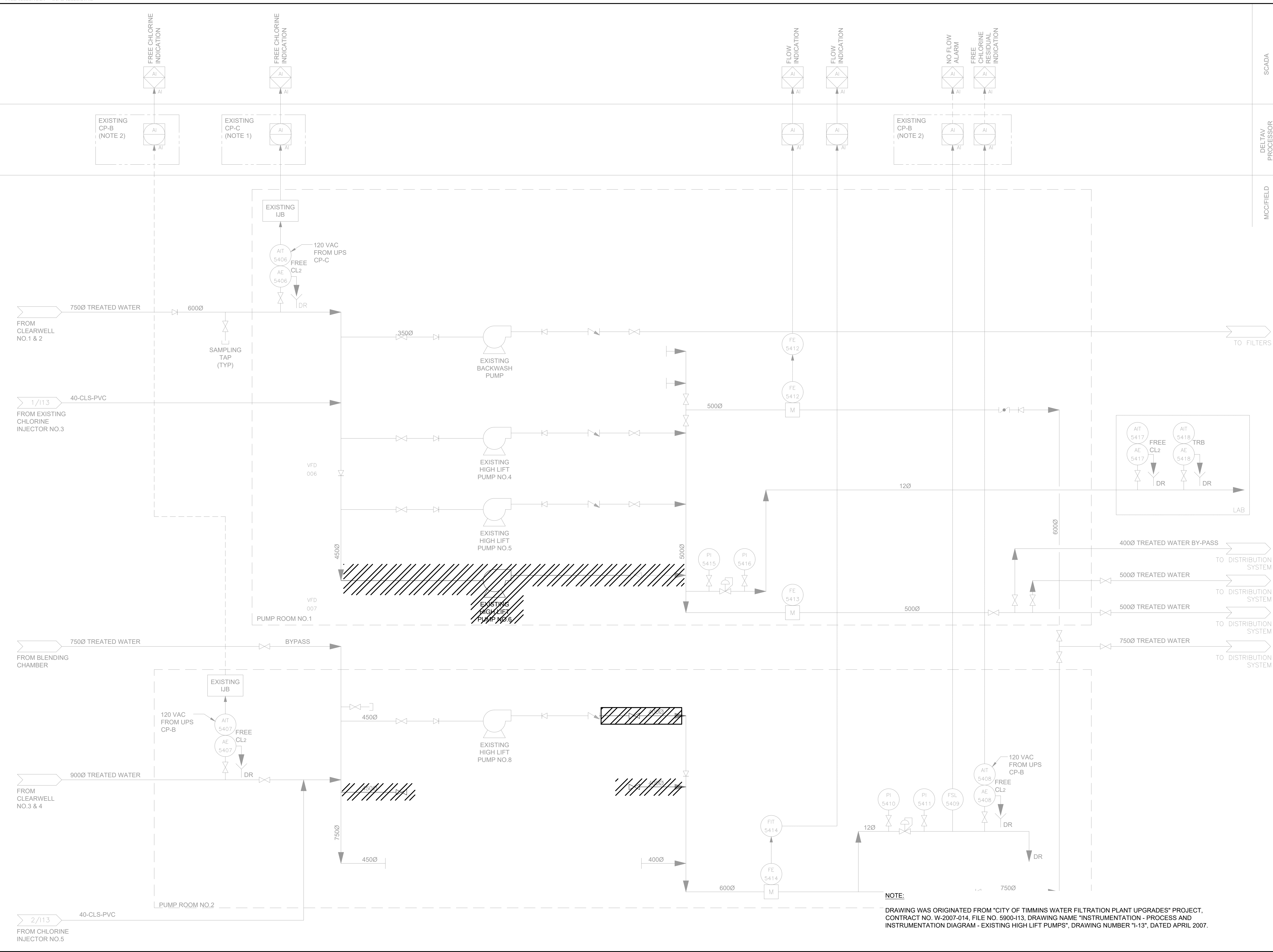
TIMMINS WTP HIGH LIFT AND
BACKWASH PUMP REPLACEMENT

SHEET TITLE:

REMOVAL PHOTOS

DISCIPLINE:	REMOVALS
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DRAFTER:	AN	SCALE:	NTS
DESIGNER:	JZ	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	GA
PROJECT No:	T001960A	DRAWING No:	DD503
SHEET No:			

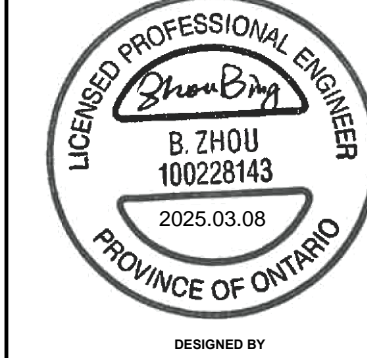


NOTE:

DRAWING WAS ORIGINATED FROM "CITY OF TIMMINS WATER FILTRATION PLANT UPGRADES" PROJECT, CONTRACT NO. W-2007-014, FILE NO. 5900-113, DRAWING NAME "INSTRUMENTATION - PROCESS AND INSTRUMENTATION DIAGRAM - EXISTING HIGH LIFT PUMPS", DRAWING NUMBER "I-13", DATED APRIL 2007

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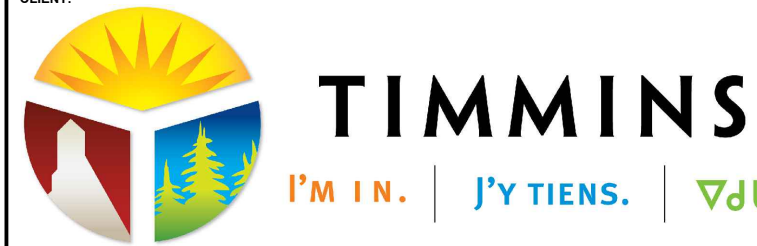
0	MAR 2025	ISSUED FOR TENDER	GA
No.	Date	Description	By

EQUIPMENT TO BE
REMOVED / DEMOLISHED

CONSULTAN



CLIENT



PROJECT NAME:

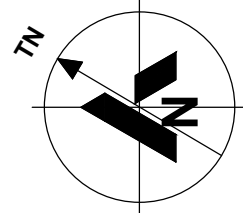
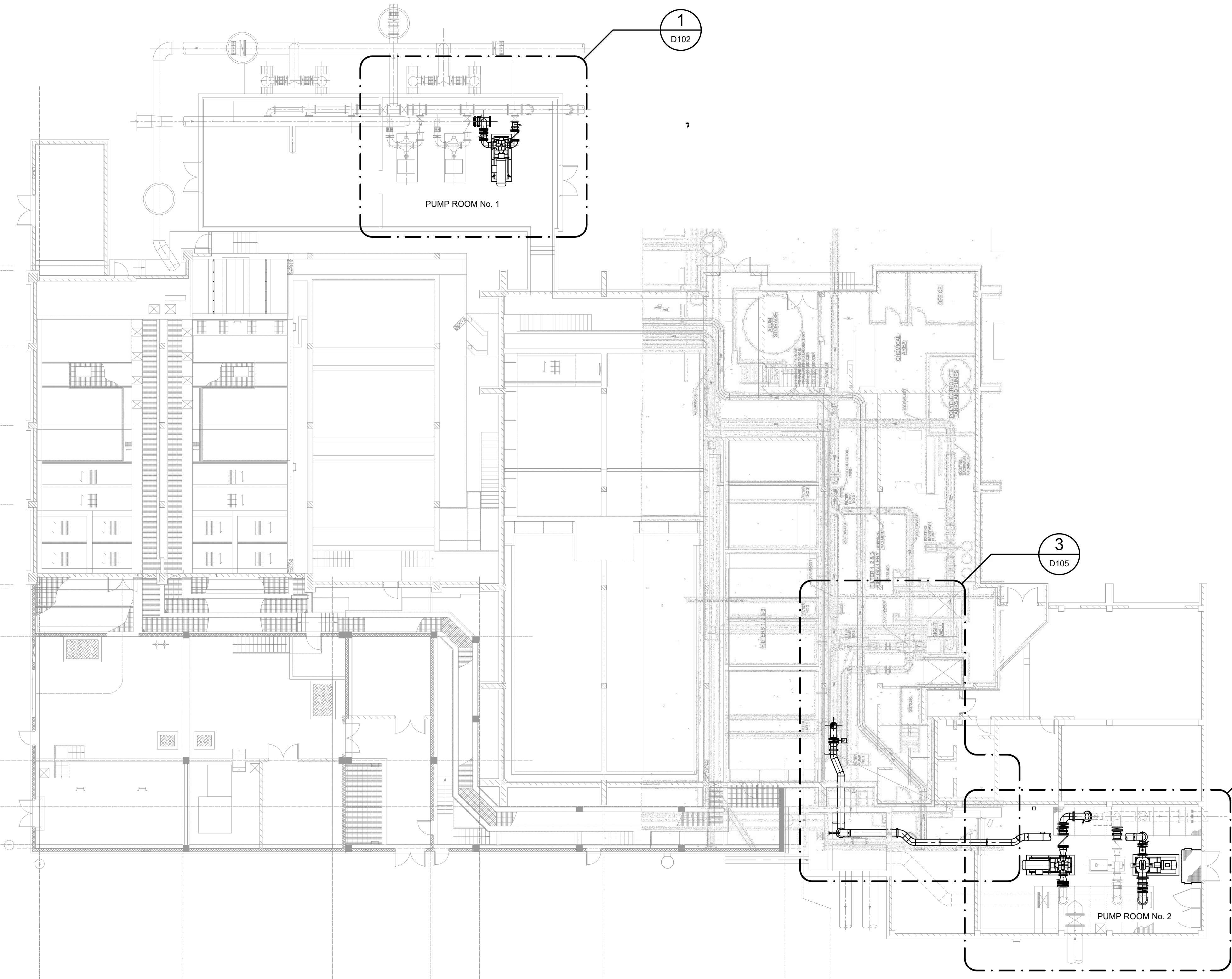
TIMMINS WTP HIGH LIFT AND
BACKWASH PUMP REPLACEMENT

SHEET TITLE

P&ID - EXISTING HIGH LIFT PUMPS 6 AND 7 REMOVAL

DISCIPLINE: INSTRUMENTATION

DRAFTER:	AN	SCALE:	NTS
DESIGNER:	JZ	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	GA
PROJECT No:	T001960A	DRAWING No:	DD601
SHEET No:			



1. GENERAL
- 1.1. ALL WORKS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE CURRENT EDITION OF THE ONTARIO BUILDING CODE (OBC), AND CITY OF TIMMINS MANUAL OF ENGINEERING AND DEVELOPMENT STANDARDS.
- 1.2. CONTRACTOR SHALL FIELD-VERIFY ALL DIMENSIONS AND ELEVATIONS PRIOR TO CONSTRUCTION.
2. MECHANICAL
- 2.1. PUMP AND MOTOR BASE SHALL BE ANCHORED AND GROUTED. PAD USING PRE-MIXED, NON-SHRINK, NON-RUSTING, NON-CORROSIVE, NON-METALLIC CEMENTITIOUS GROUT MIN. 38 mm THICK U.N.O. THE GROUT MUST SHOW NO SHRINKAGE IN ACCORDANCE WITH ASTM C827/C827M AND UNITED STATES CORPS OF ASTM C-1107. THE GROUT MUST NOT CONTAIN ANY METALLIC POWDERS SUCH AS ALUMINUM OR IRON FILINGS. FERROGROUT MUST NOT BE USED. ADHERE TO THE REQUIREMENTS OF CAN/CSA-A23.1 AND TO THE GROUT MANUFACTURER'S INSTRUCTIONS REGARDING HANDLING, MIXING, PREPARATION, PLACING, FINISHING AND CURING. GROUT MUST BE APPLIED TO THE ENTIRE BEARING AREA UNDER THE PUMP AND MOTOR BASE.
- 2.2. PUMP AND MOTOR BASE SHALL BE MADE LEVEL TO WITHIN +/- 3mm AND MEET MANUFACTURER'S REQUIREMENTS.
3. PIPING
- 3.1. CONTRACTOR SHALL CONFIRM LOCATION, ELEVATION, AND MATERIAL OF EXISTING WATERMAINS PRIOR TO CONSTRUCTION OF NEW WATERMAINS AND CONNECTIONS/ TIE-INS.
- 3.2. PIPE SUPPORTS AND STANCHIONS TO BE POWDER COATED WITH NSF/ANSI-61 APPROVED COATING IN ACCORDANCE WITH CITY OF TIMMINS IDENTIFICATION AND LABELING STANDARDS AND AWWA 213.
- 3.3. COATING APPLICATION SHALL BE PERFORMED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS
- 3.4. PIPE STANCHION BASE PLATES SHALL BE ANCHORED AND GROUTED TO THE CONCRETE FLOOR USING MIN. 25 MM NON-SHRINK EPOXY-RESIN BASED GROUT IN ACCORDANCE WITH CAN/CSA A23.1 AND GROUT MANUFACTURER'S INSTALLATION AND CURING INSTRUCTIONS. SOLVENTS SHALL NOT BE USED. GROUTING MUST SHOW NO SHRINKAGE ACCORDING TO ASTM C531.
- 3.5. PIPE STANCHION BASES SHALL BE FASTENED TO CONCRETE USING HILTI HIT-HY 200 ADHESIVE ANCHOR SYSTEM AND HILTI HAS THREADED RODS. INSTALL AS PER MANUFACTURER'S INSTALLATION INSTRUCTIONS. MIN./MAX. EMBEDMENT DEPTH AS PER MANUFACTURER'S INSTALLATION INSTRUCTIONS. ANCHOR SYSTEM TO BE NSF/ANSI-61 APPROVED.
- 3.6. PIPE STANCHIONS TO BE FROM Ø 150mm SCH 40 PIPE.
- 3.7. PIPE SADDLE WITH GALVANIZED STEEL U-BOLT TO MSS-SP-58 TYPE 37 INSTALLED IN ACCORDANCE WITH MANUFACTURERS INSTALLATION INSTRUCTIONS. INSTALL 13mm THK. EPDM RUBBER BETWEEN SADDLE AND PIPE. EPDE TO NSF-61.
- 3.8. SUPPLY ALL PIPE AND FITTINGS OF THE MATERIALS, SIZE, CLASSES AND TYPES AS SHOWN ON THE CONTRACT DRAWINGS AND AS SPECIFIED HEREIN.
- 3.9. THE CONTRACT DRAWINGS MAY NOT PRESENT ALL FLANGE OR COUPLING CONNECTIONS EXCEPT FOR EXPANSION JOINTS. THE CONTRACTOR SHALL DETERMINE THE LOCATION OF FLANGE OR COUPLING CONNECTIONS. SUBMIT SHOP DRAWINGS TO PRESENT CONNECTION TYPES AND LOCATIONS.
- 3.10. CONTRACTOR SHALL HAVE COUPLING AND PIPE SUPPLIERS REVIEW THE ENTIRE PIPELINE AND CONFIGURATION WITH PIPE SUPPORTS AND SUBMIT THEIR REVIEW FOR THE ENGINEERS APPROVAL. AS PER THE COUPLING AND PIPE SUPPLIERS RECOMMENDATIONS, THE PIPE SUPPORT LOCATIONS AND COUPLING/EXPANSION JOINT TYPE MAY BE CHANGED, BUT WITH NO EXTRA COST TO THE OWNER.
- 3.11. INSTALL PIPING AND VALVES AS PER THE P&ID's IF THE PROCESS DESIGN DRAWINGS DO NOT PRESENT ALL INSTALLATION DETAILS OR CONNECTIONS. NO EXTRA COST TO OWNER SHALL BE PERMITTED.
- 3.12. ALL NSF 61 CERTIFIED WATER PIPING, SPOOLS, FITTINGS AND COMPONENTS SHALL BE FABRICATED BY A SHOP THAT CARRIES NSF LOGO WITH A STATEMENT "CERTIFIED TO NSF/ANSI 61". THE FABRICATION SHOP SHALL BE LISTED ON THE OFFICIAL NSF PRODUCT AND SERVICE LISTING THAT IS POSTED ON THE NSF.org WEBSITE.
- 3.13. PRESSURE TESTING OF STAINLESS STEEL PIPING SYSTEMS OR GENERAL WATER SERVICE AT AMBIENT TEMPERATURES SHALL FOLLOW, AS A GUIDE, AWWA C600.
- 3.14. ALL FITTINGS LOCATED ON HIGH LIFT PUMP DISCHARGE PIPING SHALL BE RATED 150 PSI. WHERE Sch 10s DOES NOT PROVIDE MAWP 150 PSI, SUCH AS TEES AND LATERALS, USE BIGGER WALL THICKNESS OR PROVIDE REINFORCE PAD. SUBMIT WITH SHOP DRAWING FOR REVIEW DESIGN STRESS CALCULATIONS SEALED BY A PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO.

KEY PLAN:

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No.	Date	Description	By

STAMPS:

DESIGNED BY: _____ APPROVED BY: _____

CONSULTANT:

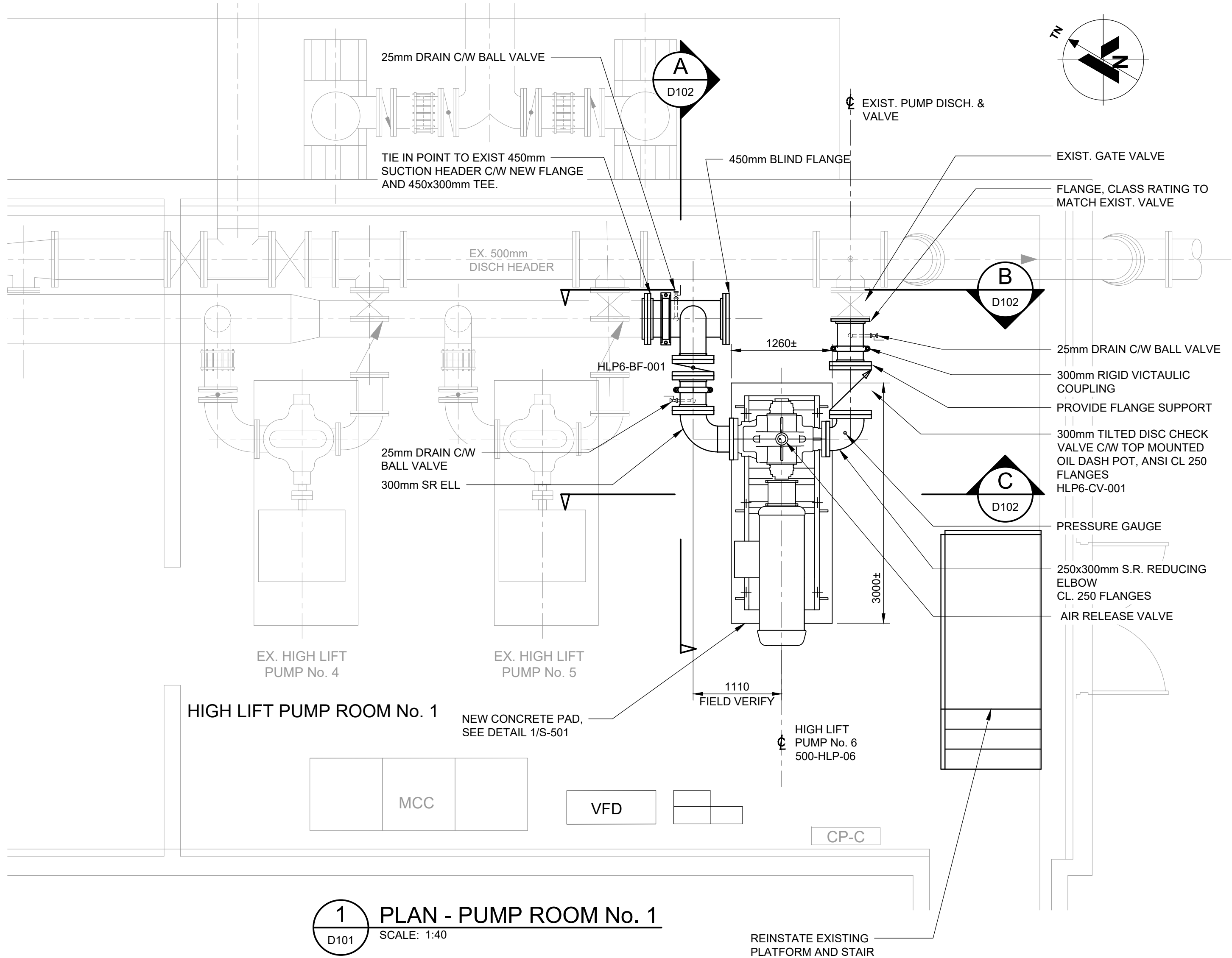
CLIENT:

PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

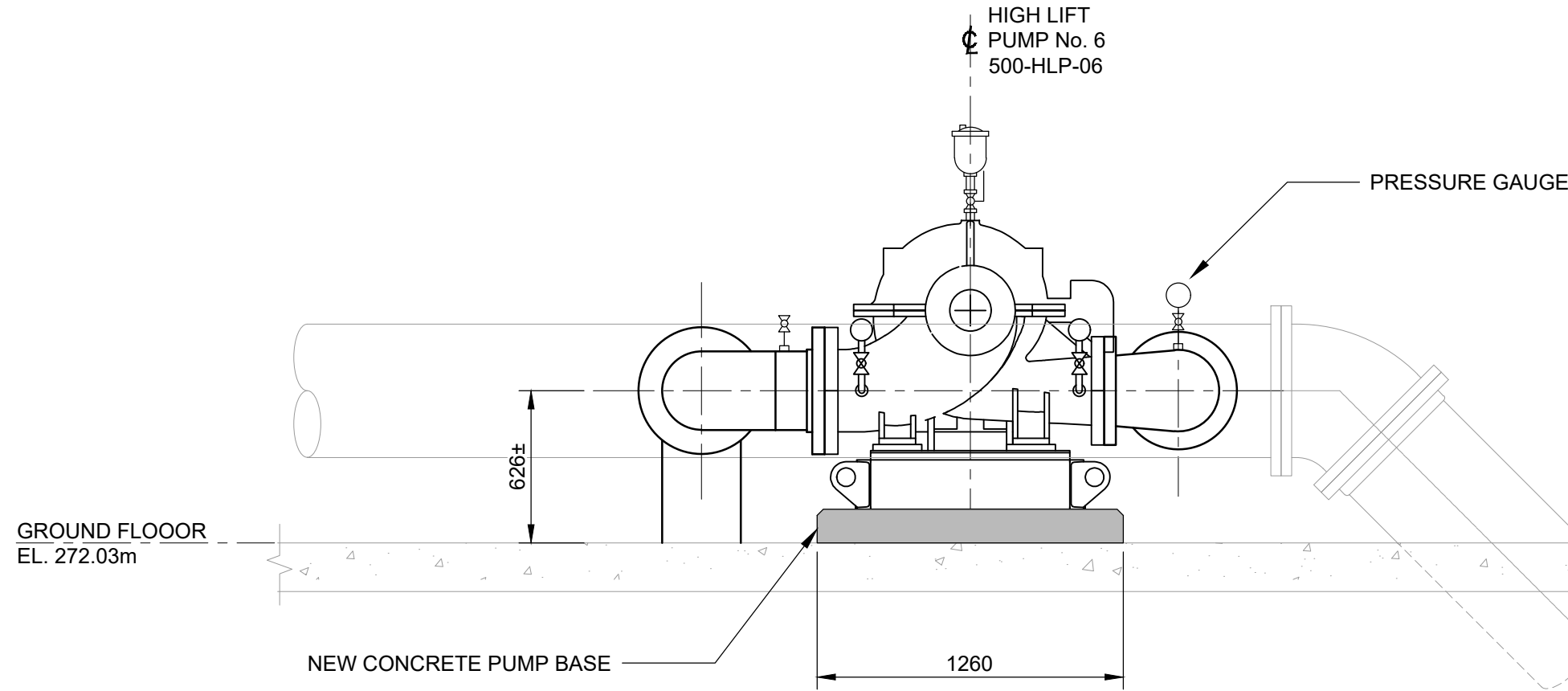
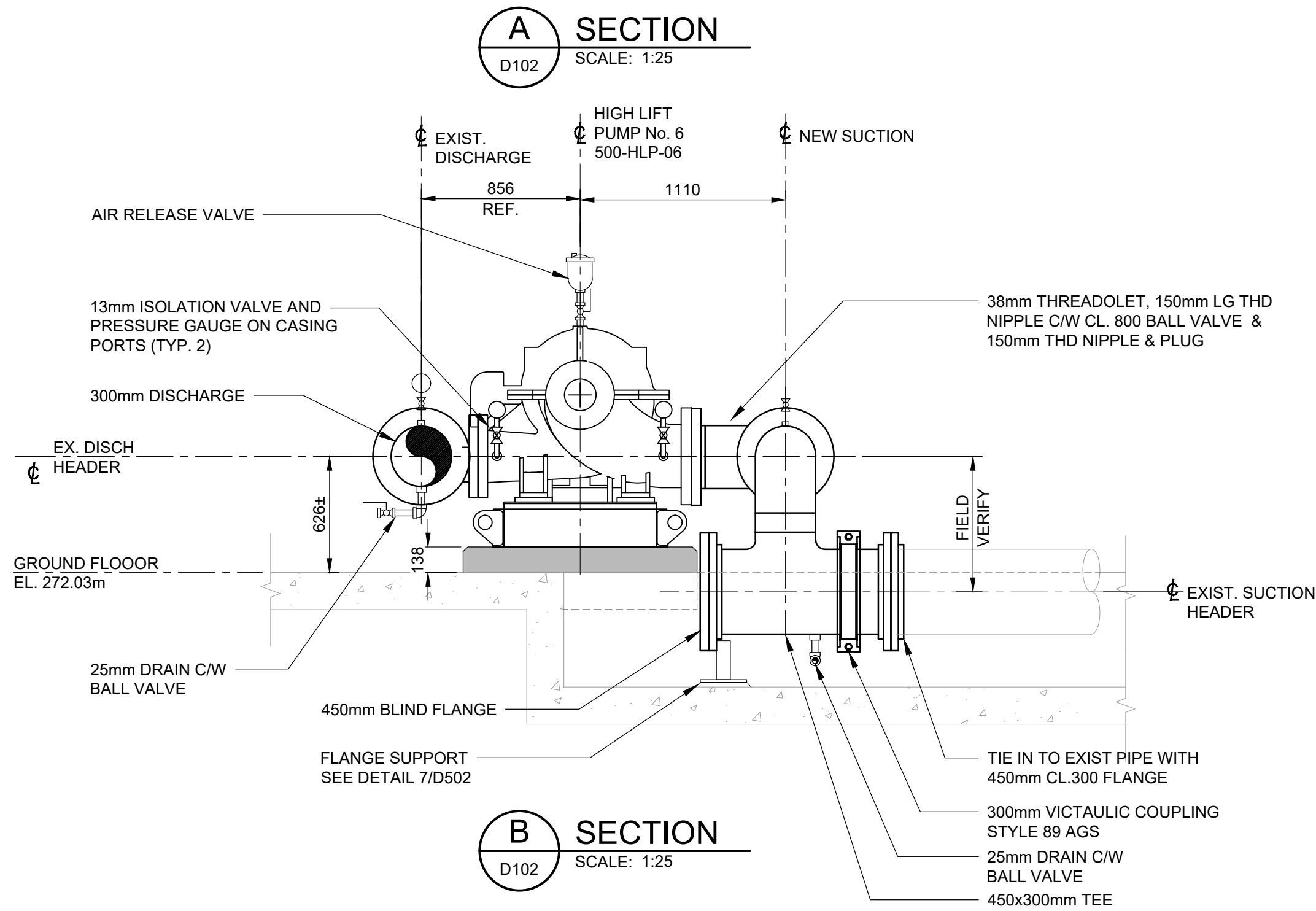
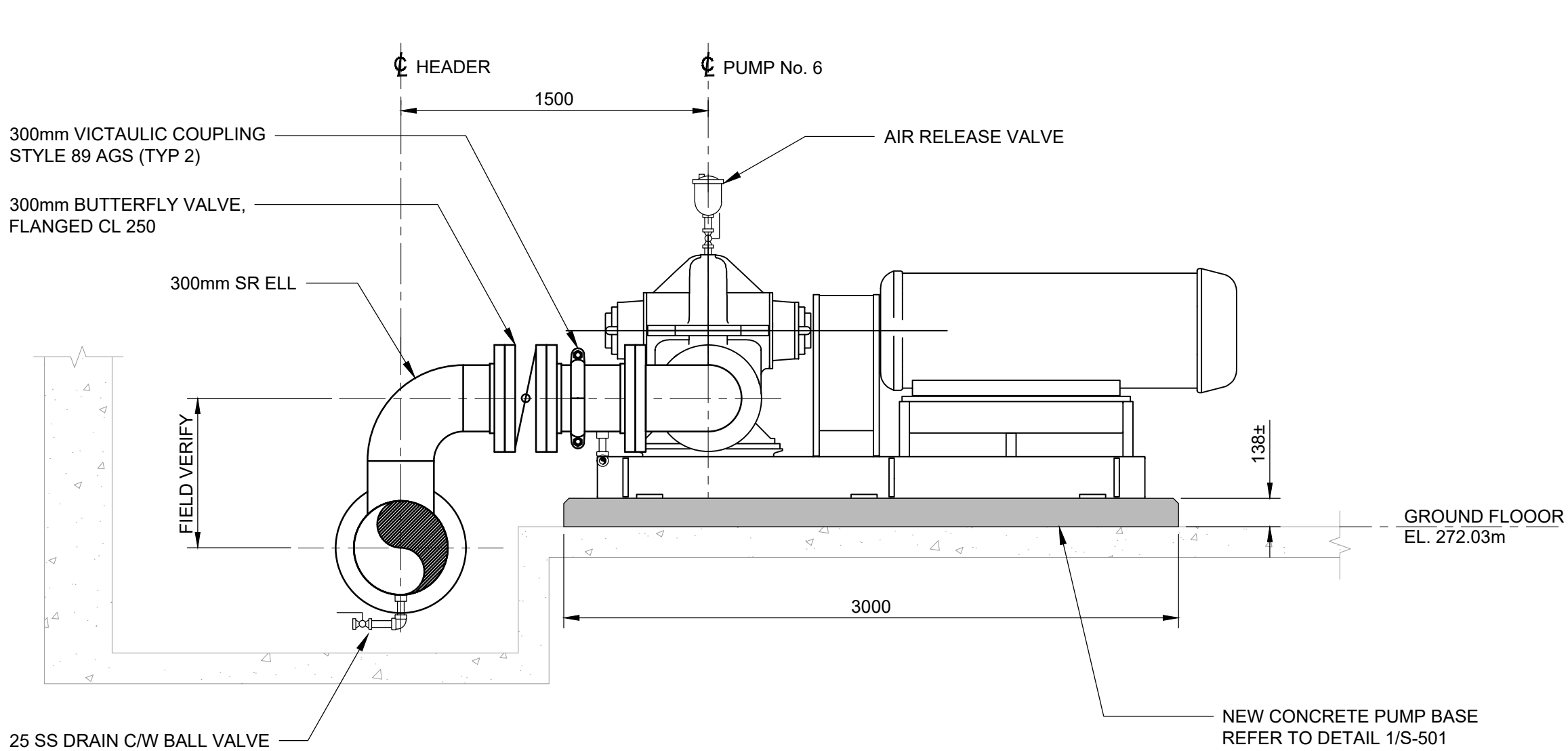
SHEET TITLE:
OVERALL PLAN AND GENERAL NOTES

DISCIPLINE:
PROCESS

DRAFTER:	SCALE:
SKC	1:150
DESIGNER:	DATE:
JZ	FEB 2025
APPROVER:	CHECKER:
GA	GA
PROJECT No:	DRAWING No:
T001960A	D-101
SHEET No:	



- NOTES
- CONTRACTOR TO FIELD VERIFY ALL DIMENSIONS AND CONFIRM BOLT PATTERN ON ALL FLANGES BEFORE CONSTRUCTION.
 - TYPE, NUMBER, SIZE AND LOCATION OF ANCHOR BOLTS FOR PUMP INSTALLATION TO BE DETERMINED BY PUMP SUPPLIER. CONTRACTOR TO COORDINATE. CONTRACTOR IS RESPONSIBLE FOR ANY STRUCTURAL WORK
 - FINAL SIZE OF PUMP CONCRETE PADS TO BE COORDINATED WITH FINAL APPROVED PUMP SHOP DRAWINGS.
 - REFER TO NOTE 20 ON DRAWING DD-101 FOR EXISTING MONORAIL/HOIST INFORMATION. CONTRACTOR IS RESPONSIBLE FOR PROVIDING MEANS AND METHODS TO REMOVE AND INSTALL NEW PUMPS.



KEY PLAN:

THIS DRAWING

HIGH LIFT PUMP ROOM 2

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STAMPS:

LICENSED PROFESSIONAL ENGINEER
B. ZHOU
100228143
2025.03.08
PROVINCE OF ONTARIO

DESIGNED BY

APPROVED BY

CONSULTANT:

CIMA+

CLIENT:

TIMMINS
I'M IN. | J'Y TIENS. | VDU

PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:

NEW HIGH LIFT PUMP No. 6
PLAN AND SECTIONS

DISCIPLINE:

PROCESS

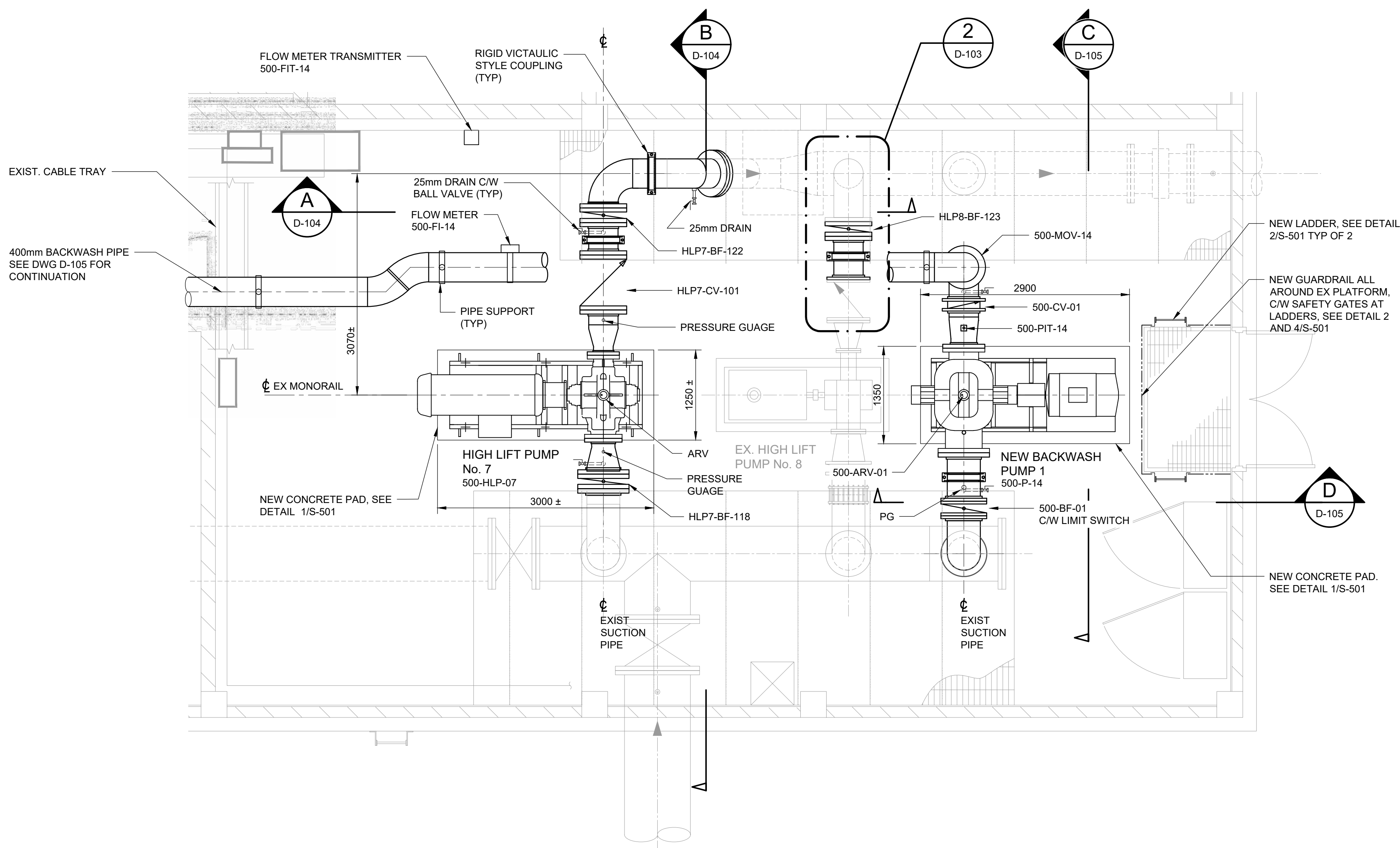
DRAFTER:	SCALE:
SKC	AS NOTED

DESIGNER:	DATE:
JZ	FEB 2025

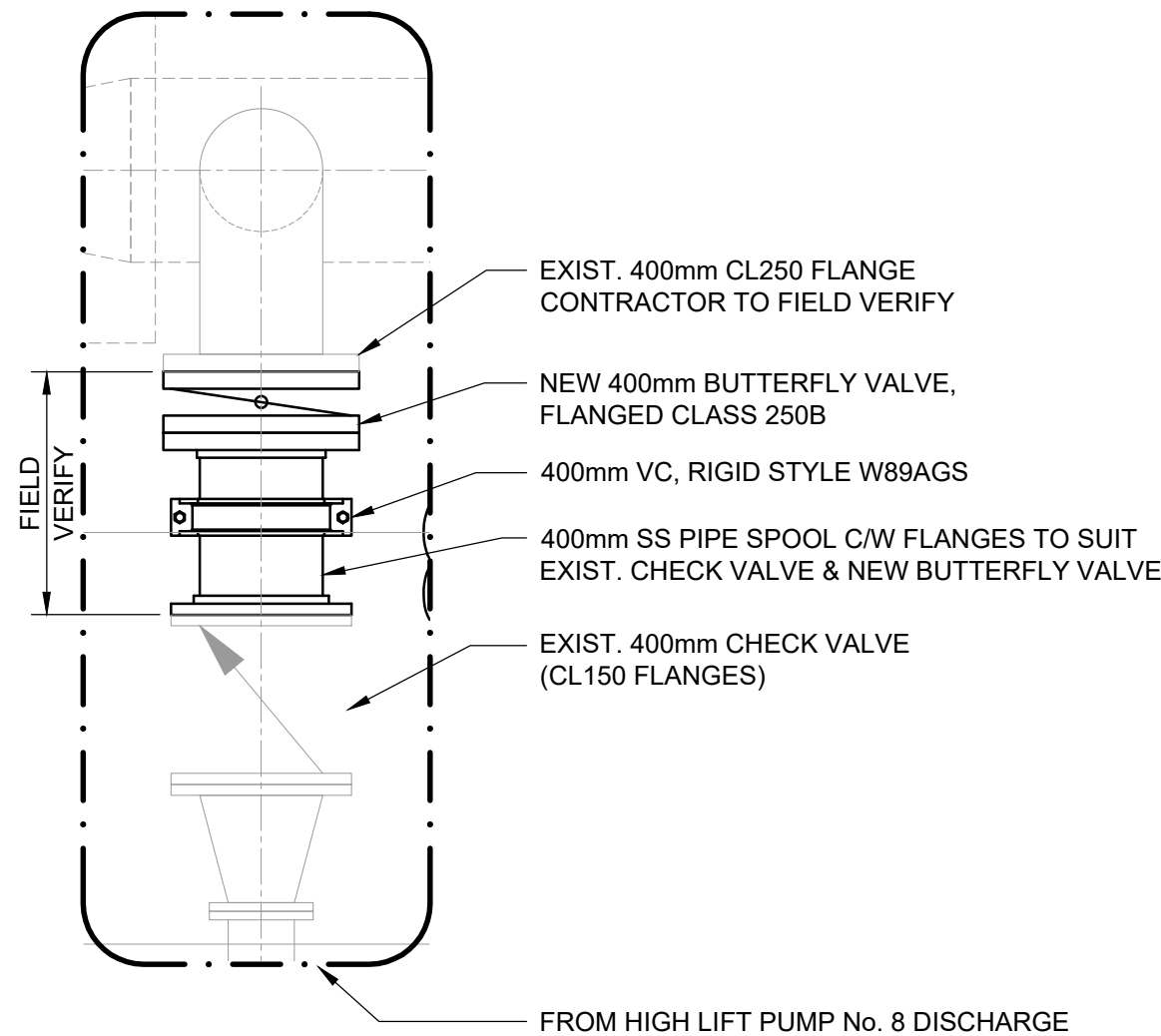
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GA	GA

PROJECT No:	DRAWING No:
T001960A	D-102

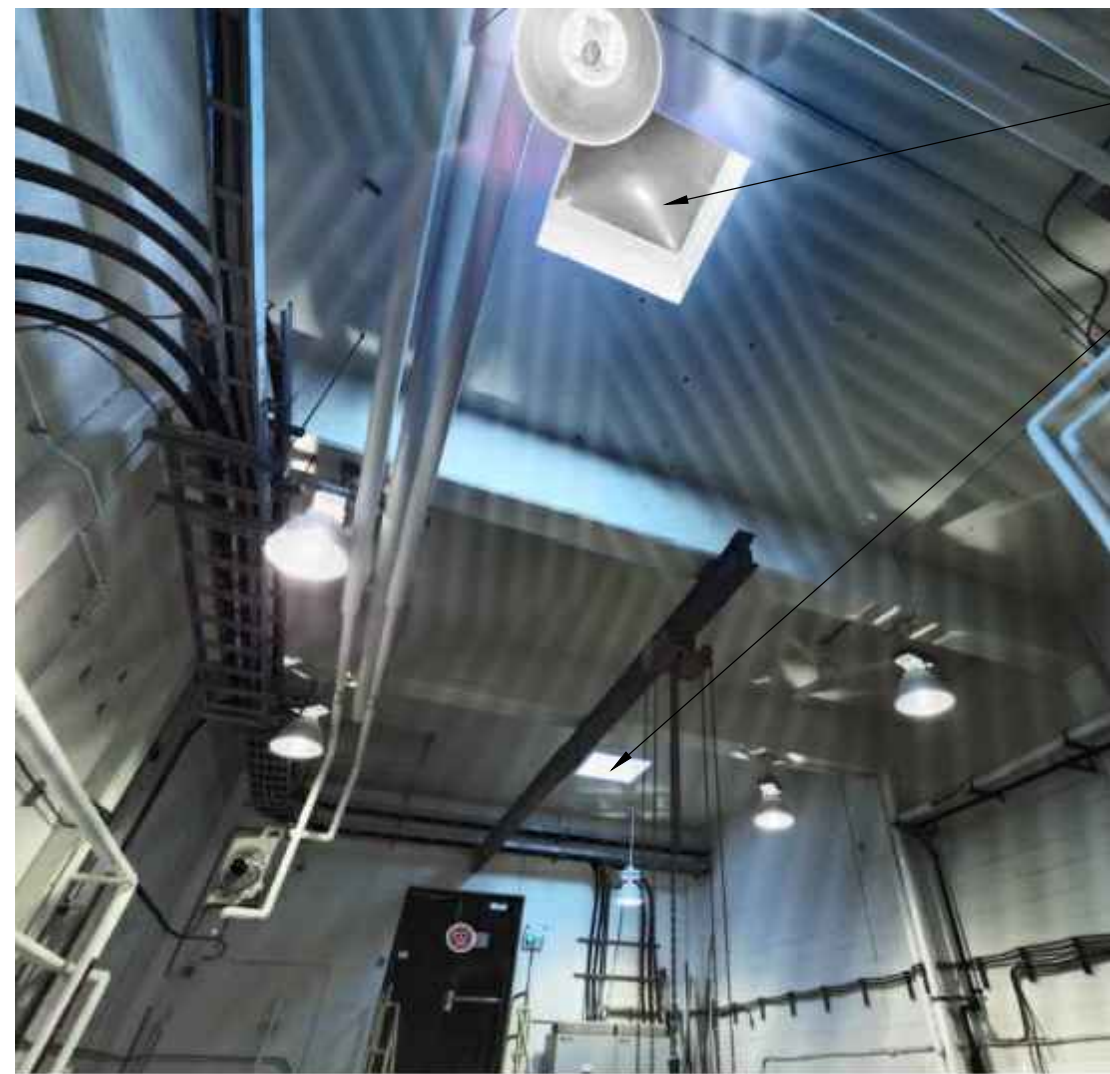
SHEET No:



1 PLAN - HIGH LIFT PUMP ROOM No. 2
D-101 SCALE: 1:40



2 DETAIL - HIGH LIFT PUMP 8 VALVE REPLACEMENT
D-102 SCALE: 1:25



3 EXISTING ROOF OPENING
D-103 SCALE: NTS

NOTES:

- THIS DRAWING IS ORIGINATED FROM "CITY OF TIMMINS, TIMMINS WATER FILTRATION PLAN CONTRACT No. 2003-W001" DRAWING P013 DATED JANUARY 2003.
- DRAWING BACKGROUND MAY NOT ACCURATELY REPRESENT ACTUAL EXISTING CONDITIONS. FIELD VERIFY EXISTING LAYOUT OF PIPING AND EQUIPMENT PRIOR TO CONSTRUCTION.
- CONTRACTOR TO FIELD VERIFY ALL DIMENSIONS AND CONFIRM BOLT PATTERN ON ALL FLANGES BEFORE CONSTRUCTION.
- TYPE, NUMBER, SIZE AND LOCATION OF ANCHOR BOLTS SHOULD BE DETERMINED BY THE PUMP SUPPLIER. CONTRACTOR IS RESPONSIBLE FOR AND STRUCTURAL WORK REQUIRED TO FACILITATE THE INSTALLATION OF NEW PUMP.
- STAINLESS STEEL FLANGES ON PIPE TO BE ASME/ANSI B16.5 CLASS 300 RF SLIP-ON UNLESS OTHERWISE SPECIFIED ON DRAWINGS.
- HIGH LIFT PUMP No. 7 PUMP LOCATION AND ELEVATION IS BASED ON THE CENTERLINE OF EXISTING 450mm SUCTION PIPE. PUMP IS TO BE ALIGNED WITH EX. HIGH LIFT PUMP 8, AND OVERHEAD HOIST BEAM.
- ALL NEW PIPE TO BE 316L SS SCH 10, ASTM A778/A774
- FINAL SIZE OF PUMP CONCRETE PADS TO BE COORDINATED WITH FINAL APPROVED PUMP SHOP DRAWINGS.
- CONTRACTOR IS RESPONSIBLE FOR MEANS AND METHODS TO INSTALL ALL COMPONENTS OF NEW PUMPS. APPROXIMATE DIMENSIONS AND LOCATIONS OF EXISTING ROOF OPENINGS HAVE BEEN SHOWN IN 3/D-103. REFER TO NOTE 19 ON DRAWING DD-101 FOR EXISTING MONORAIL/HOIST INFORMATION.

KEY PLAN:

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No.	Date	Issued For Tender	GA
0	MAR 2025	ISSUED FOR TENDER	GA

STAMPS:

DESIGNED BY: APPROVED BY:

CONSULTANT:

CLIENT:

PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:

PUMP ROOM No. 2
HIGH LIFT PUMP No. 7, 8 &
BACKWASH PUMP PLAN

DISCIPLINE:

PROCESS

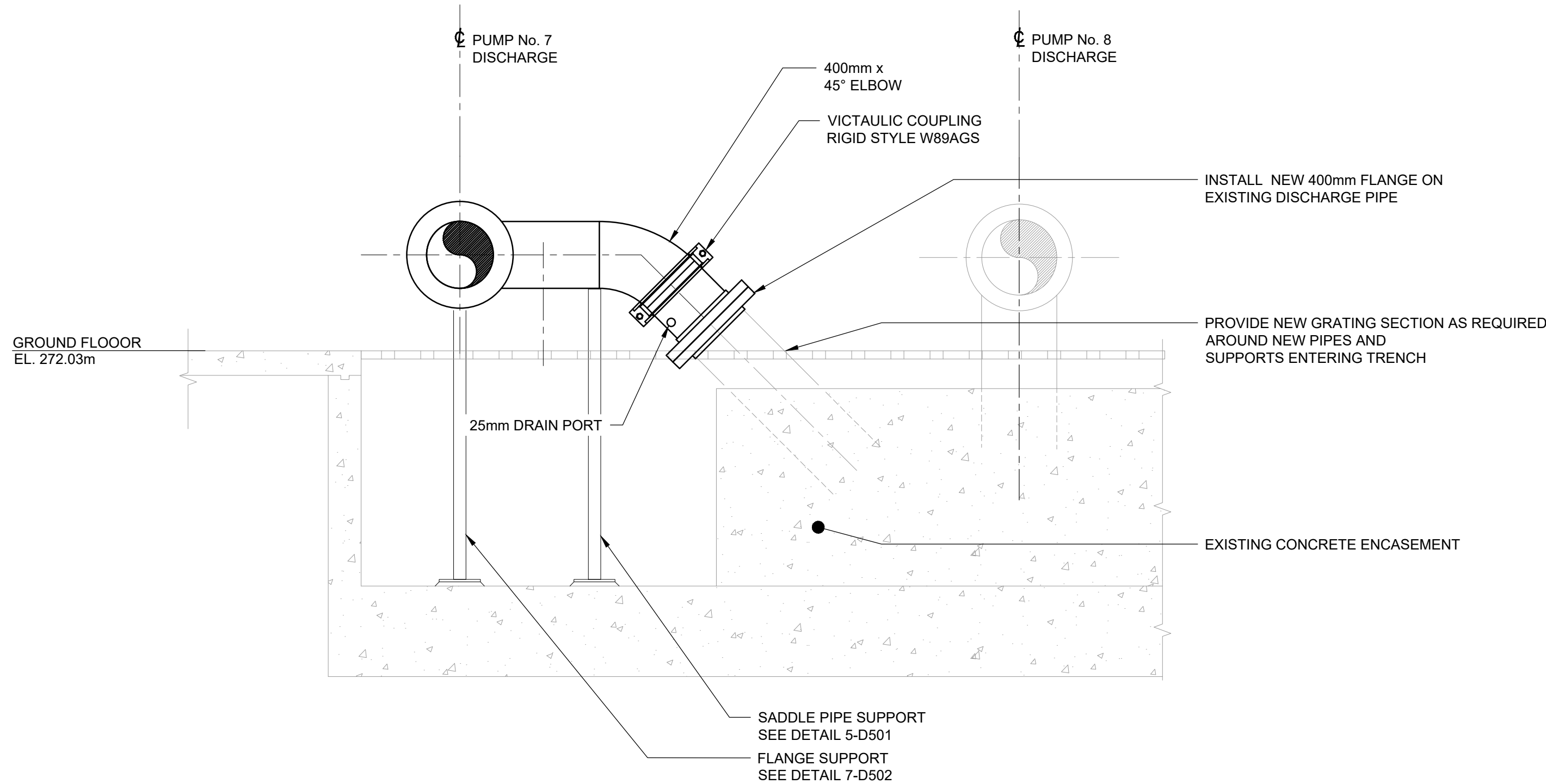
DRAFTER:	SCALE:
SKC	AS NOTED

DESIGNER:	DATE:
JZ	FEB 2025

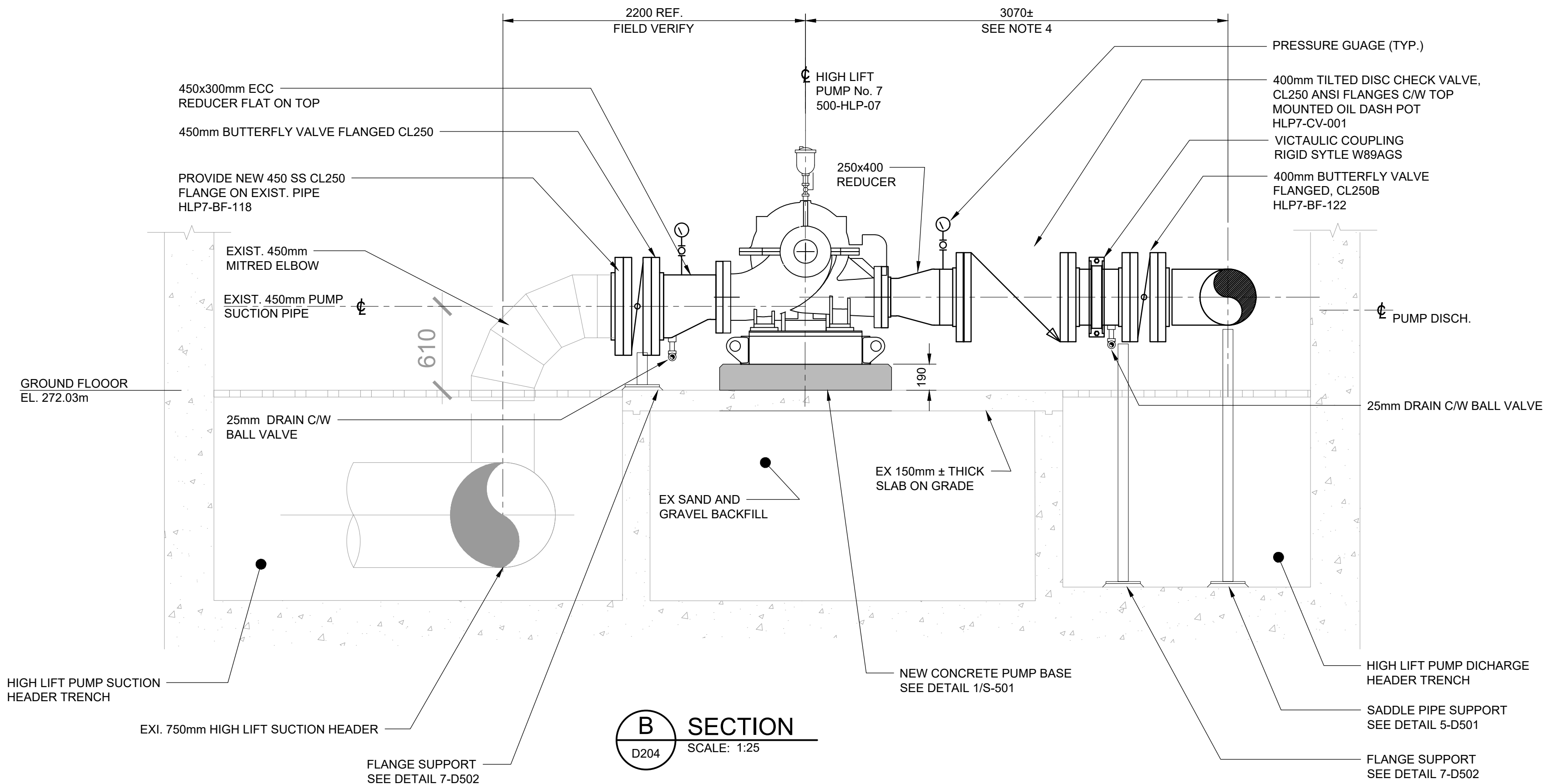
APPROVER:	CHECKER:
GA	GA

PROJECT No:	DRAWING No:
T001960A	D-103

SHEET No:



A SECTION - HIGH LIFT PUMP No. 7 DISCHARGE
D103 SCALE: 1:40



B SECTION
D204 SCALE: 1:25

KEY PLAN:

THIS DRAWING

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No.	Date	Description	By
0	MAR 2025	ISSUED FOR TENDER	GA

STAMPS:

DESIGNED BY: APPROVED BY:

CONSULTANT:

CLIENT:

PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:

HIGH LIFT PUMP No. 7 SECTIONS

DISCIPLINE:

PROCESS

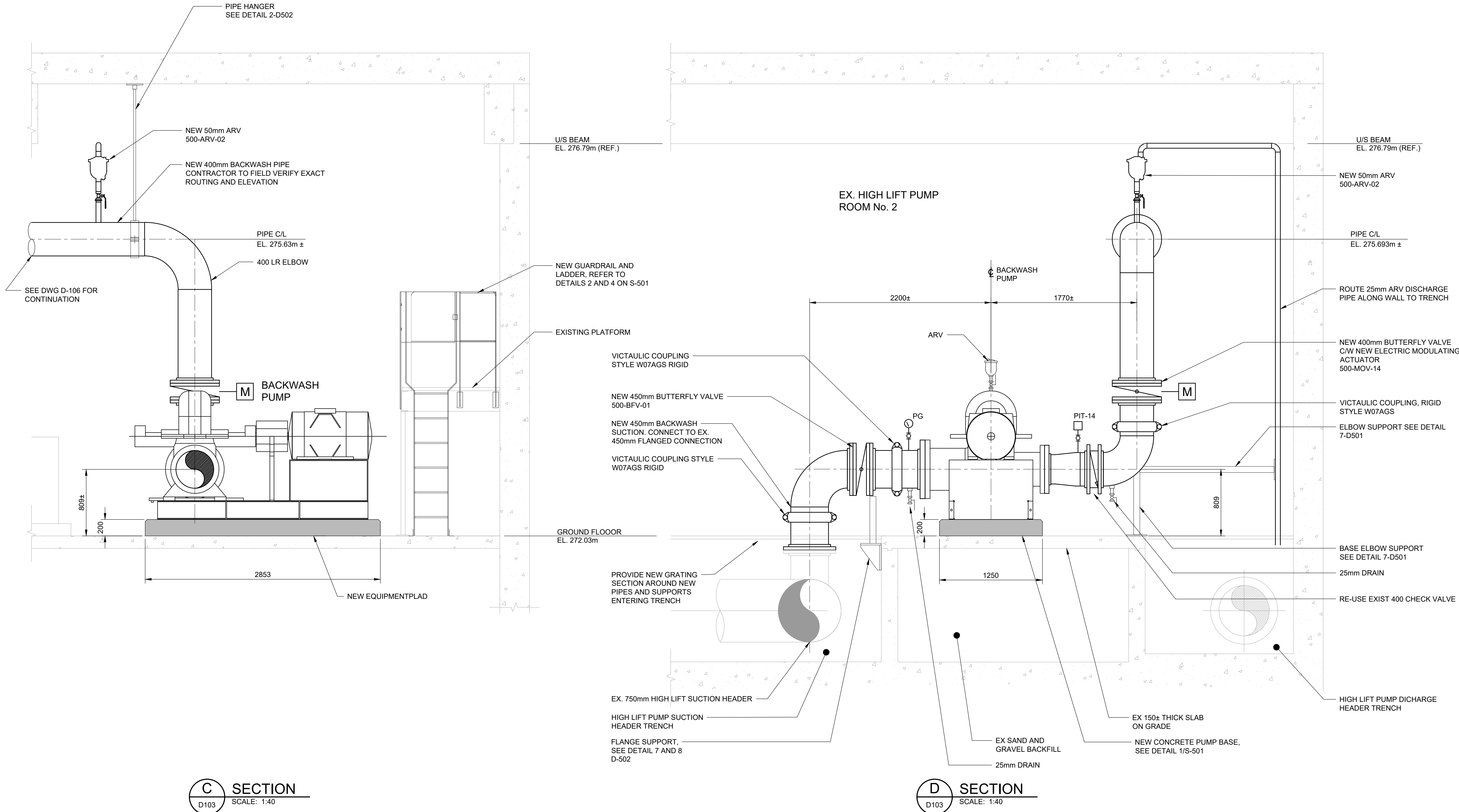
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SKC	AS NOTED

DESIGNER:	DATE:
JZ	FEB 2025

APPROVER:	CHECKER:
GA	GA

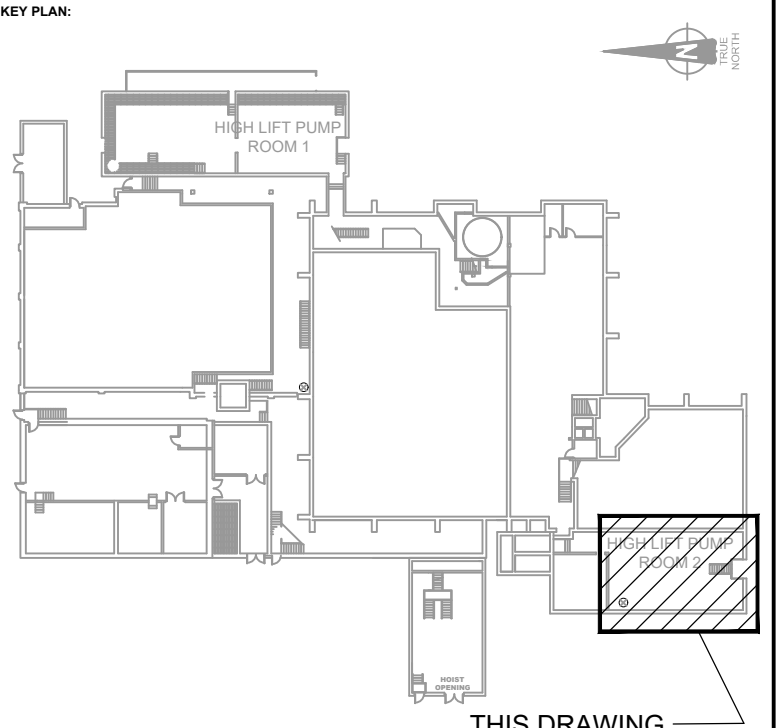
PROJECT No:	DRAWING No:
T001960A	D-104

SHEET No:



C SECTION
D103 SCALE: 1:40

D SECTION
D103 SCALE: 1:40



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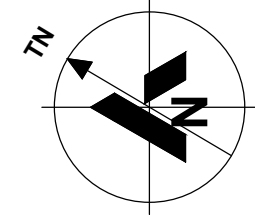
No.	0	MAR 2025	ISSUED FOR TENDER	GA
Date			Description	By



PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

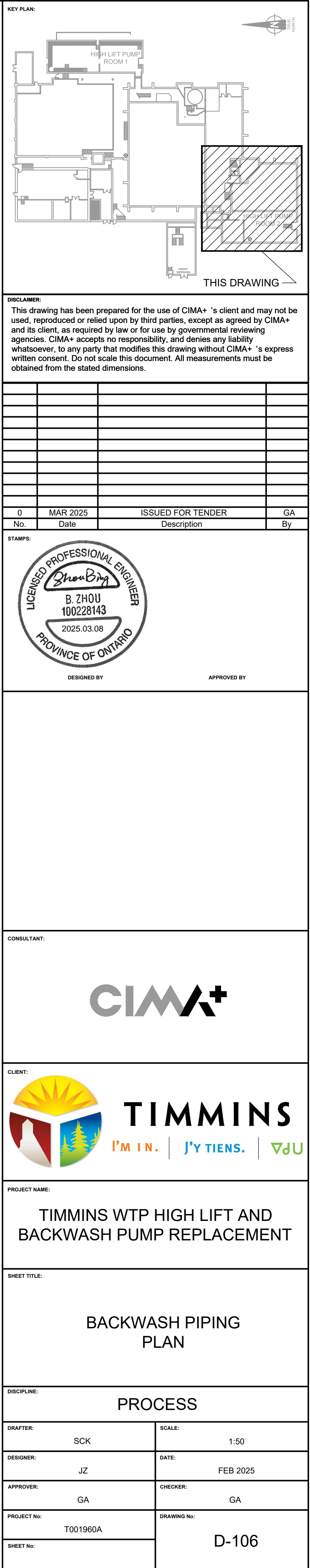
SHEET TITLE:
BACKWASH PUMP SECTIONS

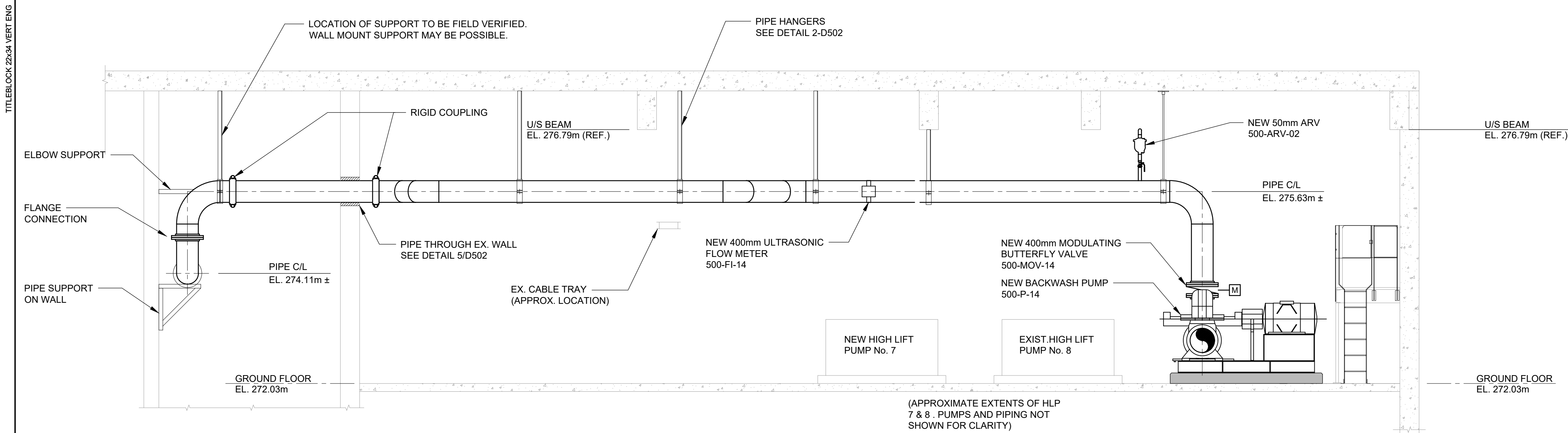
DISCIPLINE: PROCESS			
DRAFTER:	SCK	SCALE:	AS NOTED
DESIGNER:	JZ	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	GA
PROJECT No:	T001960A	DRAWING No:	D-105
SHEET No:			



1. THE DRAWING WAS ORIGINATED FROM "CITY OF TIMMINS, TIMMINS WATER FILTRATION PLANT CONTRACT NO. 2003 - W001" DRAWING P013 DATED JANUARY 2003.
2. DRAWING BACKGROUND MAY NOT ACCURATELY REPRESENT ACTUAL EXISTING CONDITIONS. FIELD VERIFY EXISTING LAYOUT OF PIPING AND EQUIPMENT PRIOR TO CONSTRUCTION.
3. PIPE WITHIN HIGH LIFT PUMP ROOM NO. 2 AND FILTER 1, 2 AND 3 PIPE GALLERY TO BE INSULATED AS SPECIFIED.
4. ELECTRICAL PANELS NOT SHOWN FOR CLARITY. REFER TO ELECTRICAL DRAWINGS.

3 PLAN - BACKWASH PIPING
D101 SCALE: 1:50

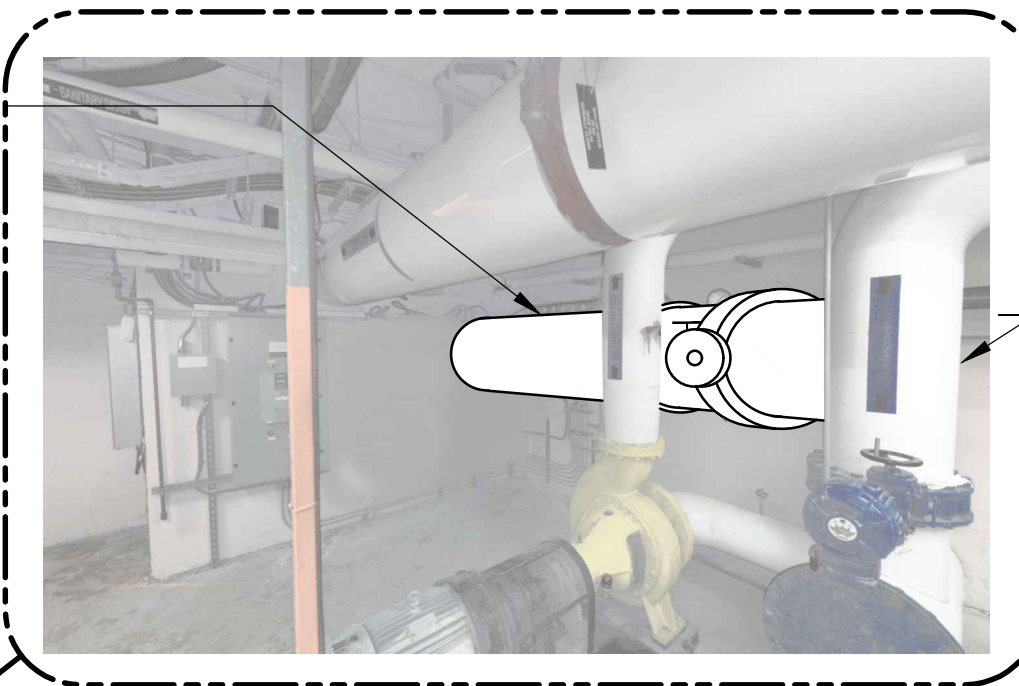




A SECTION
D-106 SCALE: 1:50

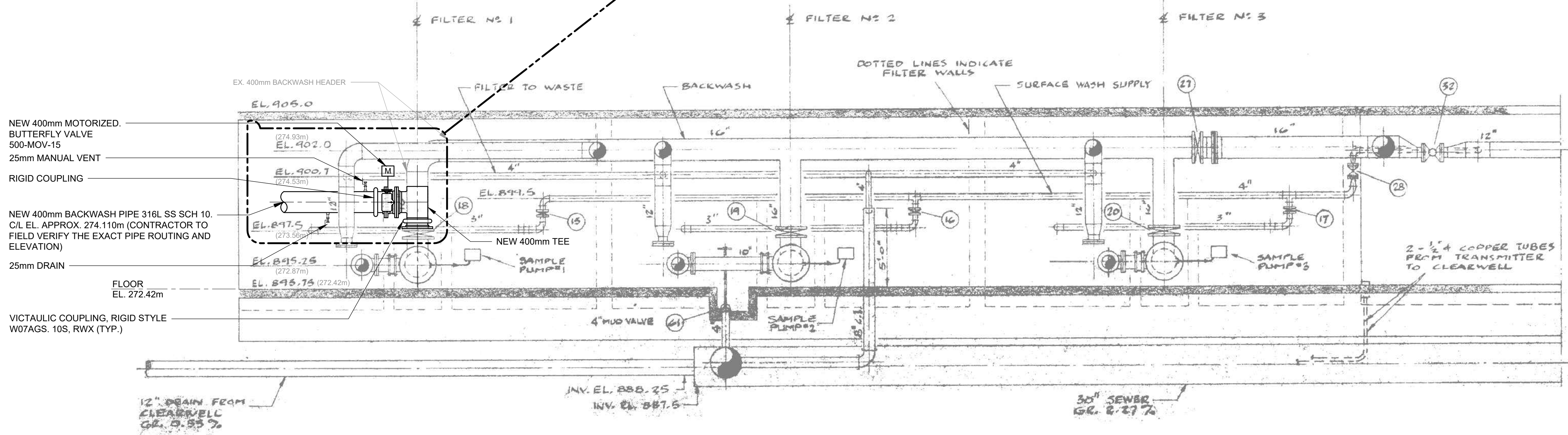
BACKWASH PUMP

NEW 400mm BACKWASH PIPE C/L EL. APPROX. 274.110m (CONTRACTOR TO FIELD VERIFY THE EXACT PIPE ROUTING AND ELEVATION)

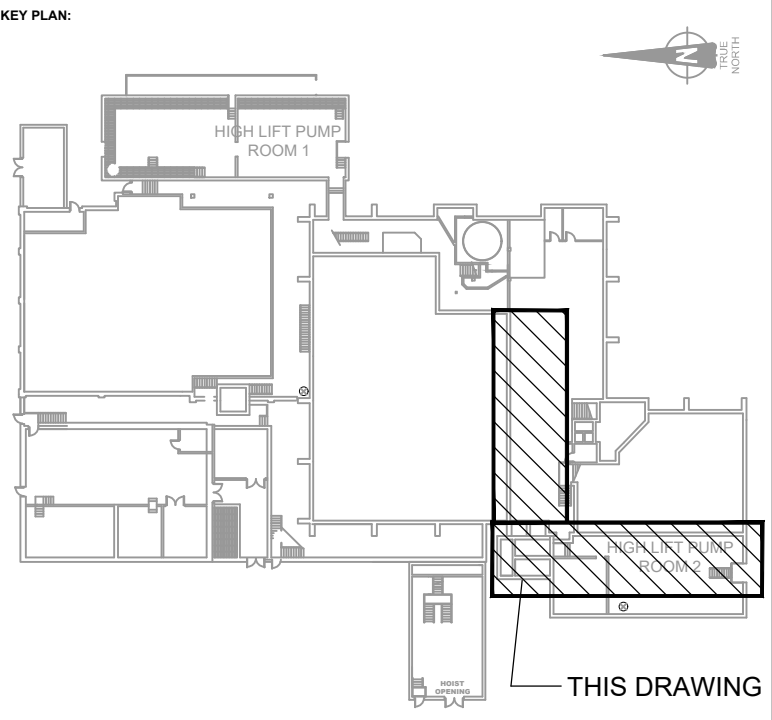


EX. 400mm BACKWASH HEADER

- NOTES:
- DRAWING BACKGROUNDS MAY NOT ACCURATELY REPRESENT ACTUAL EXISTING CONDITIONS. FIELD VERIFY EXISTING LAYOUT OF PIPING AND EQUIPMENT PRIOR TO CONSTRUCTION.

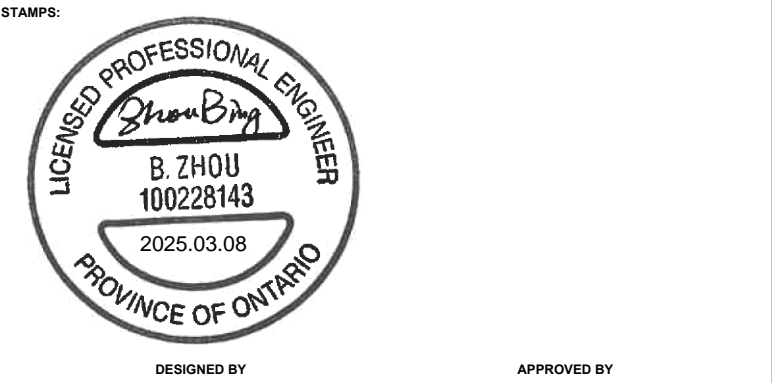


B SECTION
D-106 SCALE: 1:50



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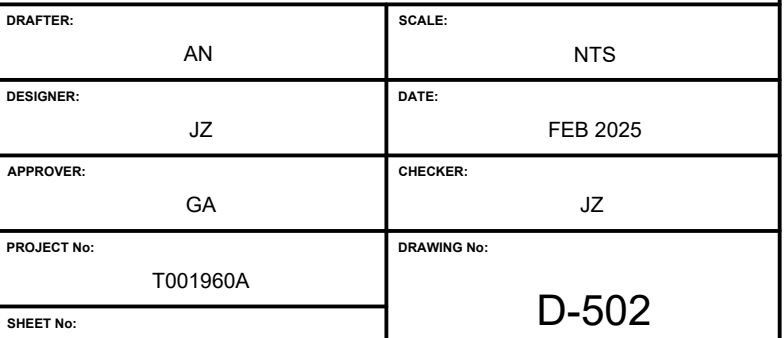
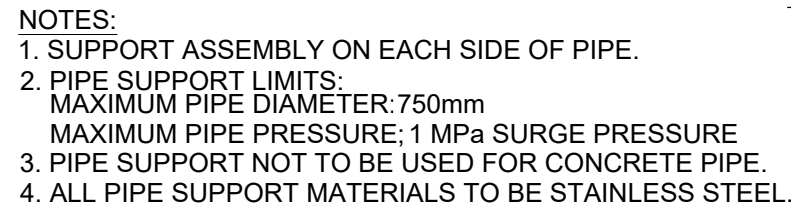
No.	Date	Description	By
0	MAR 2025	ISSUED FOR TENDER	GA

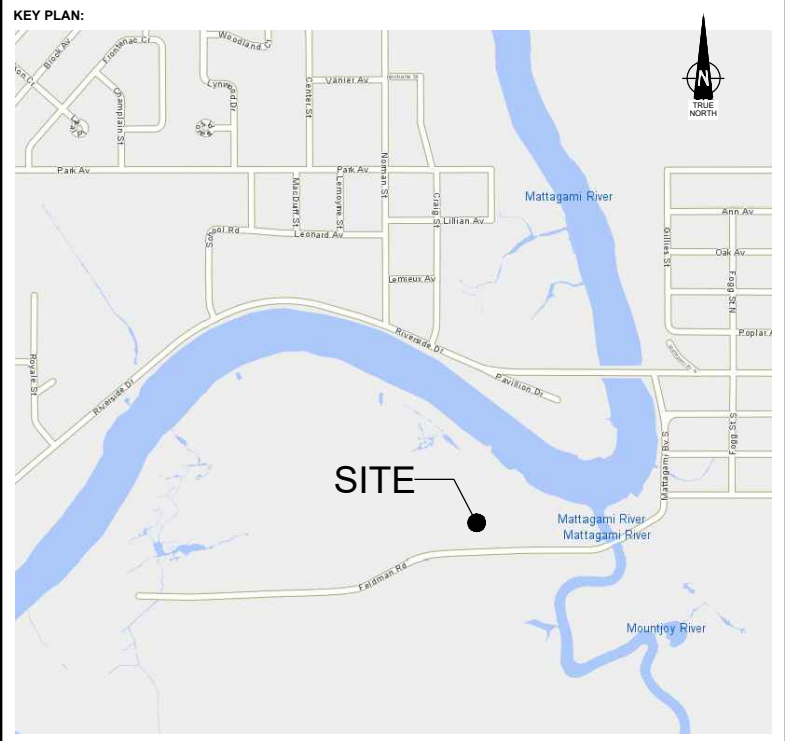


PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

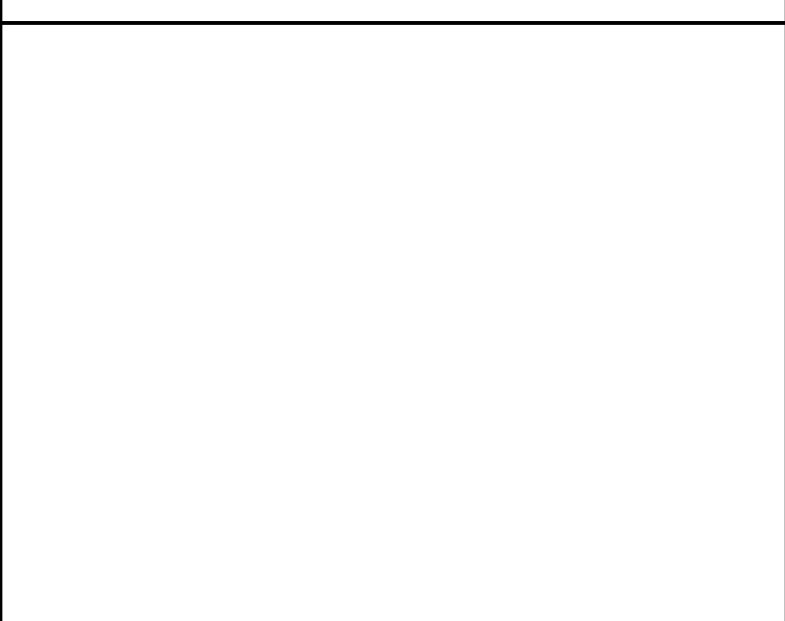
SHEET TITLE:
BACKWASH PIPING SECTIONS

PROCESS			
DRAFTER:	SKC	SCALE:	1:50
DESIGNER:	JZ	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	GA
PROJECT No:	T001960A	DRAWING No:	D-107
SHEET No:			





0	MAR 2025	ISSUED FOR TENDER	GA
No.	Date	Description	By



PROJECT NAME:

TIMMINS WTP HIGH LIFT AND
BACKWASH PUMP REPLACEMENT

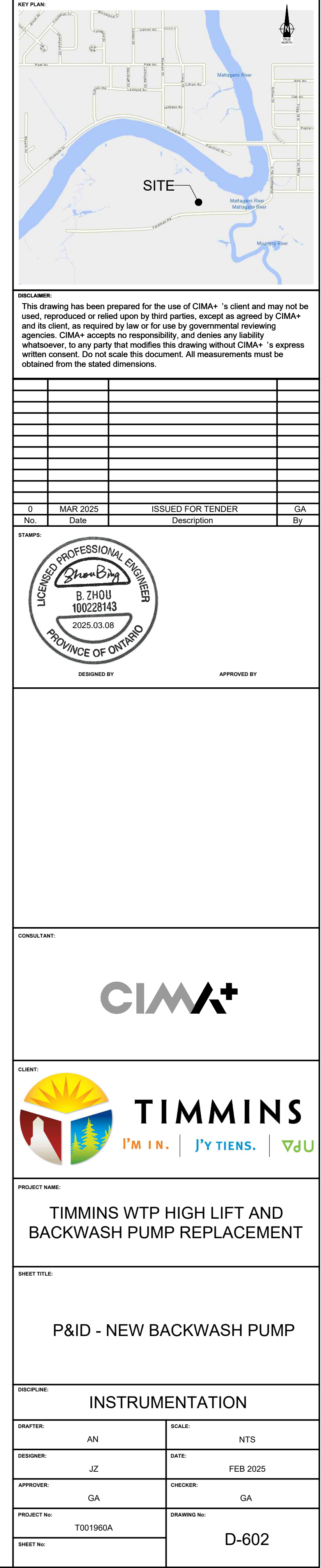
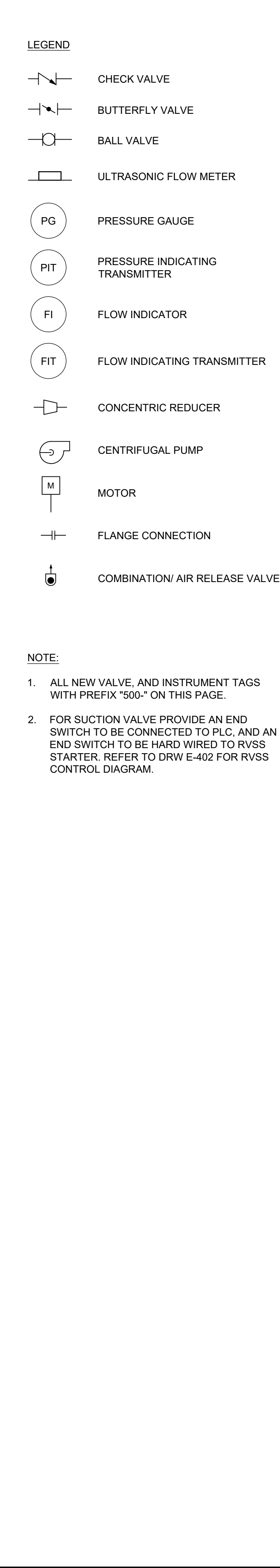
SHEET TITLE:

P&ID - NEW HIGH LIFT
PUMPS 6 AND 7

DISCIPLINE		PROCESS	
DRAWER: AN		SCALE: NTS	
DESIGNER: JZ		DATE: FEB 2025	
APPROVER: GA		CHECKER: GA	
PROJECT No: T001960A		DRAWING No: D-601	
SHEET No:			

NOTE:

DRAWING WAS ORIGINATED FROM "CITY OF TIMMINS WATER FILTRATION PLANT UPGRADES" PROJECT, CONTRACT NO. W-2007-014, FILE NO. 5900-113, DRAWING NAME "INSTRUMENTATION - PROCESS AND INSTRUMENTATION DIAGRAM - EXISTING HIGH LIFT PUMPS", DRAWING NUMBER "I-13", DATED APRIL 2007.



125 MIN

70 TO EDGE OF BASE PL.

38x38 CHAMFER TYP.

15M DIWL @ 300 ALL AROUND, MIN. 100 EMBED., HILTI HIT HY200 MAX. ADHESIVE SYSTEM FOR EXISTING SLABS

ANCHOR BOLTS & SLEEVES AS REQUIRED BY MANUFACTURER

15M @ 300 TOP, EW

BASEPLATE

38 MIN

38 MIN GROUT

ELECTRICAL EQUIPMENT PAD 100 UNO

FOR PUMP PADS REFER TO PLANS

ROUGHEN THE SURFACE OF THE CONCRETE, CLEAN & APPLY BONDING AGENT

NOTES:

- ANY APERTURES IN SLAB OR PAD, REQUIRED BY THE MANUFACTURER, TO BE COORDINATED WITH CONTRACTOR.
- FOR PLAN DIMENSIONS & LOCATION SEE PLAN. FINAL DIMENSIONS TO BE COORDINATED WITH EQUIPMENT.
- WHERE ANCHOR SLEEVES ARE USED, INCREASE MINIMUM EDGE DISTANCE AS REQUIRED BY MANUFACTURER TO PREVENT INTERRUPTION OF REBAR.

1

TYPICAL EQUIPMENT PAD DETAIL

SCALE: 1:20

NEW GUARDRAIL W/ SAFETY GATE AT LADDERS TO BE DESIGNED AND SUPPLIED BY VENDOR, SEE DETAIL 4/S-501

TOP ELEV.

EX PLATFORM

EX C250x23

300 MAX

MIN 10 x 64mm FLAT GALV STEEL PL

SAFETY-TREAD (NON-SLIP) LADDER RUNG MIN 40mm (1 5/8") GALV STEEL AS SUPPLIED BY AMICO-ISG OR APPROVED EQUAL

MIN 10mm THK GALV STEEL C/W 13ø SS HILTI HVA ANCHORS W/ DIELECTRIC WASHER OR ISOLATION COATING BETWEEN DISSIMILAR METALS

1800±

300

BOTTOM ELEV.

EX CONC SLAB

ELEVATION

2

LADDER & SAFETY GATE DETAIL

SCALE: 1:20

GRIND 20 CHAMFER @ BOTH EDGES

EXISTING CONCRETE

EXISTING REINFORCEMENT

NEW OPENING

CUT BACK EXISTING BAR 40 & FILL HOLE w/ NON-SHRINK, NON-FERROUS GROUT

REMOVED CONCRETE, CUT & REMOVE REBAR

GRIND SURFACE SMOOTH

3

OPENING AT EXISTING WALL & SLAB

SCALE: 1:20

535

1070

535

SEE CHART FOR POST AND RAIL SIZES

MAXIMUM SPACING OF POSTS = 1200 c/c

PROVIDE 125X6 CONT. KICK PLATE

EX PLATFORM

20 DRAIN HOLE

4 - 12ø S.S. BOLTS

EX CHANNEL

MATERIAL	APPLICATION	POST	RAIL
GALV. STEEL GRADE	GUARD (ON PLATFORM)	48ø SCH 40	48ø SCH 40

4

REMOVABLE HANDRAIL ON PLATFORM

SCALE: 1:10

STRUCTURAL NOTES:

GENERAL:

- READ STRUCTURAL DRAWINGS IN CONJUNCTION WITH THE REMAINDER OF THE CONTRACT DRAWINGS AND DOCUMENTS.
- VERIFY ALL DIMENSIONS ON THE STRUCTURAL DRAWINGS WITH THE REMAINDER OF THE CONTRACT DRAWINGS BEFORE CONSTRUCTION. ANY DISCREPANCIES OR ERRORS MUST BE REPORTED TO THE ENGINEER PRIOR TO STARTING THE WORK.
- DO NOT SCALE DRAWINGS.
- DESIGN LOADS INDICATED ARE UNFACTORED UNLESS NOTED OTHERWISE.
- STRUCTURAL DESIGN IS BASED ON THE LATEST EDITION OF THE NATIONAL AND ONTARIO BUILDING CODES.
- FEATURES OF CONSTRUCTION NOT FULLY SHOWN ARE OF THE SAME CHARACTERISTICS AS THOSE NOTED FOR SIMILAR CONDITIONS.

MATERIALS:

- THE DESIGN REQUIREMENTS FOR THE CONCRETE MIX DESIGN INDICATED SHALL CONFORM TO THE CHARACTERISTICS DESCRIBED IN THE PROJECT SPECIFICATIONS.
- MINIMUM 28 DAY COMPRESSIVE STRENGTH FOR STRUCTURAL CONCRETE IS 30MPa.
- ALL REINFORCING BAR SHALL BE GRADE 400MPa, DEFORMED, CAN/CSA-G30.18.
- ALUMINUM AND FRP CONSTRUCTION TO CONFORM TO THE REQUIREMENTS OF THE SPECIFICATIONS.
- ALL PIPE SUPPORTS TO BE 304 STAINLESS STEEL, UNLESS NOTED OTHERWISE.

CAST-IN-PLACE CONCRETE:

- DO CONCRETE WORK IN ACCORDANCE WITH THE LATEST VERSION OF THE APPLICABLE CODES AND STANDARDS AS REQUIRED BY THE PROJECT SPECIFICATION.
- FORMWORK AND TOLERANCES IN ACCORDANCE WITH THE LATEST VERSION OF THE APPLICABLE CODES AND STANDARDS AS REQUIRED BY THE PROJECT SPECIFICATIONS.
- SUBMIT REINFORCING DIAGRAMS BEFORE FABRICATION FOR REVIEW BY THE ENGINEER.
- REINFORCING IS TO BE GENERALLY DETAILED IN ACCORDANCE WITH RSIC, MANUAL OF STANDARD PRACTICE (LATEST EDITION). SPLICES SHALL CONFORM TO "TABLE OF CLASS 'B' TENSION LAPS AND STANDARD 90° HOOKS" PROVIDED ON THE DRAWINGS.
- THE CLEAR DISTANCE BETWEEN REINFORCING STEEL AND SURFACE OF CONCRETE SHALL 50mm.
- UNLESS INDICATED OTHERWISE, ALL DOWELS SHALL HAVE THE SAME SIZE AND SPACING AS THE REINFORCING STEEL TO WHICH THEY ARE SPLICED, AND SHALL HAVE A MINIMUM LAP L1.
- ALL REINFORCING STEEL PLACEMENT TO BE INSPECTED BY THE ENGINEER BEFORE PLACING THE CONCRETE.
- NO WELDING OF REINFORCING BARS SHALL BE PERMITTED, UNLESS APPROVAL IS OBTAINED FROM THE ENGINEER PRIOR TO CONSTRUCTION.
- ALL REINFORCING BARS SHALL BE SUPPORTED IN THE FORMS AND SPACED WITH STANDARD ACCESSORIES SO THAT THERE IS NO MOVEMENT DURING CONCRETE PLACEMENT.

BAR SIZE	STANDARD TENSION LAP SPLICE	TENSION LAP SPLICE FOR TOP BARS	STANDARD 90° HOOK
	L1	L2	L3
10M	400mm	500mm	180mm
15M	600mm	700mm	260mm
20M	700mm	900mm	310mm
25M	1100mm	1400mm	400mm
30M	1300mm	1700mm	510mm
35M	1500mm	2000mm	610mm

KEY PLAN:

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No.	Date	Description	By
0	FEB 2025	ISSUED FOR TENDER	GA

STAMPS:

DESIGNED BY

APPROVED BY

CONSULTANT:

CLIENT:

PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:

STRUCTURAL DETAILS

DISCIPLINE:

STRUCTURAL

DRAFTER:	SCALE:
LM	AS NOTED
DESIGNER:	DATE:
YC	FEB 2025
APPROVER:	CHECKER:
GA	JZ
PROJECT No:	DRAWING No:
T001960A	S-501
SHEET No:	

TITLE: 00001960A - WPD-00001960A
SINGLE LINE DIAGRAM LEGEND

	TRANSFORMER RATING AS SHOWN ON THE SINGLE LINE DIAGRAM Δ : DENOTES DELTA CONNECTION Y: DENOTES WYE CONNECTION WITH IMPEADANCE GROUND Y: DENOTES WYE CONNECTION WITH SOLID GROUND	50	INSTANTANEOUS OVER CURRENT RELAY DEVICE
		51	TIMED OVER CURRENT RELAY DEVICE
		63 G	TANK SUDDEN PRESSURE RELAY
	CURRENT XMR X: QUANTITY (IF SHOWN) Y: RATIO (IF SHOWN) IF NOT INDICATED, PROVIDE QUANTITY & RATIO TO SUIT PHASING, COORDINATION STUDY REQUIREMENTS AND EQUIPMENT	63 Q	LIQUID LEVEL RELAY
	ZERO SEQUENCE CURRENT XMR	86	LOCKOUT RELAY DEVICE
	STORED ENERGY CIRCUIT BREAKER DRAWOUT TYPE COMPLETE WITH INTEGRAL SOLID STATE 50/51, 50/51G OVERCURRENT PROTECTION	87	DIFFERENTIAL PROTECTIVE RELAY DEVICE
	STORED ENERGY CIRCUIT BREAKER (FIXED) COMPLETE WITH INTEGRAL SOLID STATE 50/51, 50/51G OVERCURRENT PROTECTION	V	VOLTAGE METER
	FUSE	A	AMMETER
	NON FUSED INTERRUPTER SWITCH	F	FREQUENCY METER
	FUSED INTERRUPTER LOAD BREAK SWITCH	PF	POWER FACTOR METER
	FUSED CONTACTOR	LSSC	LOAD SHARING & SPEED CONTROL
	CIRCUIT BREAKER C/W MAG. & THERM TRIP	AVR	AUTOMATIC VOLTAGE REGULATOR
	CONTACTOR & OVERLOAD	KW	KILOWATT METER
	CONTACTOR-XC BC: BYPASS CONT. CC: CAPACITOR CONT. IC: INLINE CONT.	KWT	KILOWATT TRANSDUCER BITRONICS MODEL POWERPLEX RTH C/W MODBUS PLUS COMMUNICATIONS
	HARMONIC LINE FILTER FOR VFD APPLICATIONS. MIRUS LINIATOR SIZED TO SUIT MOTOR HP	DM	DIGITAL METER PML 10N 7650 C/W 10 BASE-T COMM.
	FUSED POTENTIAL TRANSFORMER(S)	X	HEAVY DUTY SAFETY SWITCH NEMA 4X, SS, 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 LOCALLY MOUNTED
PFCC	POWER FACTOR CORRECTION CAPACITOR		
	CIRCUIT BREAKER MOULDED CASE, PROVIDE INTEGRAL SOLID STATE 50/51, 50/51G OVERCURRENT PROTECTION TO SUIT ALL 600VAC BREAKERS RATED ≥1000A V: DESIGNATION INDICATES THAT THE BREAKER IS REQUIRED TO HAVE VISIBLE VERIFICATION OF BREAKER CONTACTS TO CONFIRM "OPEN" AND "CLOSED" STATUS, PROVIDE CLEAR LEXSAN VIEWING WINDOW IN THE RESPECTIVE BREAKER, AND BREAKER ENCLOSURE TO SUIT ESA REQUIREMENTS	▽	46KV STRESS CONE COLD SHRINK - 3M TYPE
		▽	STRESS CONE/CABLE TERMINATION (PROVIDE ALUMA-FORM 31-AP MOUNTING BRACKET FOR POLE TERMINATIONS)
		— — —	ELECTRICAL CONTROL & STATUS SIGNALS
	SURGE ARRESTOR - STATION CLASS	LA	
	ELECTRICAL UNIT HEATER		
	THREE PHASE MOTOR		
	SINGLE PHASE MOTOR		
	3Ø SELECTOR SWITCH	FC	TRANSFORMER ONAF FAN CONTROLS ENCLOSURE RATED NEMA 4X NON METALLIC
	SYNC CHECK RELAY DEVICE	88	CABLE SCHEDULE TAG
	AUTOMATIC SYNCHRONIZER	M/U	UTILITY METERING
	REVERSE POWER RELAY DEVICE	TP	TEST POINT
	THERMAL OVERLOAD RELAY DEVICE	AT	AUTOMATIC TRANSFER CONTROLLER
	TIMED/INST GROUND OVER CURRENT RELAY	EPO	EMERGENCY POWER OFF BUTTON

	NORMALLY OPEN RELAY CONTACT
	NORMALLY CLOSED RELAY CONTACT
DP	DISTRIBUTION PANEL
MCC	MOTOR CONTROL CENTER
POWER LAYOUT LEGEND	
	HYDRO METER, NEMA 3 ENCLOSURE C/W/ LEXAN WINDOW FOR VIEWING & PROVISION FOR LOCKING WITH A PAD LOCK. SIZE TO SUIT.
	GROUND ROD, COPPER CLAD 19mm Ø x 3000 mm
	LINE VOLTAGE THERMOSTAT, TEMP RANGE - 5° TO 30°C DIFFERENTIAL 1.0°C, 1-SPDT SWITCH RATED 8.0A 120 V. HONEYWELL MODEL T651A (EXHAUST FAN)
	SOLID STATE VARIABLE SPEED CONTROL
	DAMPER MOTOR
	BELL TELEPHONE OUTLET
	DUPLEX RECEPTACLE, 15A - 120V U GROUND WP: DENOTES WEATHER PROOF GF: DENOTES GROUND FAULT PROTECTION
	CONCRETE ENCASED RIGID PVC DUCT
	DIRECTLY BURIED RIGID PVC DUCT
	OVERHEAD POWER LINE
XP	ANY DEVICE DENOTED "XP" IS RATED TO SUIT CLASS 1, DIV 1 ENVIRONMENTS
	TIME DELAY SWITCH - PENN MODEL AM12 SNAP ON: LIGHT ON IMMEDIATELY; FAN ON WITHIN 15 SEC. SNAP OFF: LIGHT OFF IMMEDIATELY; FAN REMAINS ON FOR 10 MINUTES; (ADJUSTBLE 0-10MIN)
	RJ-45 ETHERNET JACK
	STARTER- WALL MOUNTED
SDBC	SOFT DRAWN BARE COPPER
	HATCHING INDICATES EQUIPMENT TO BE REMOVED
HTC	HEAT TRACING CONTROLLER
CONTROL WIRING LEGEND	
PF	POWER FAIL RELAY
PC	PHOTO CELL RELAY
	PRIMARY FLOW ELEMENT
	FLOW INDICATOR TRANSMITTER
	PRIMARY LEVEL ELEMENT
	LEVEL INDICATOR TRANSMITTER
	PRIMARY TEMPERATURE ELEMENT
	TEMPERATURE INDICATOR CONTROLLER
	GAS SENSOR
	GAS MONITOR
	ISOLATOR LOOP

	NORMALLY CLOSE SPRING RETURN PUSH BUTTON
	NORMALLY OPEN SPRING RETURN PUSH BUTTON
	TWO POSITION SELECT SWITCH
	INDICATING/ALARM LIGHT PUSH TO TEST LED TYPE A: AMBER R: RED G: GREEN
	MOTION ELEMENT
	TIME DELAY RELAY
	120VAC, RATED 10A CONTROL RELAY
	3 POSITION SELECT SWITCH HAND/OFF/AUTO 'X' INDICATES CONTACT CLOSED POSITION FOR RESPECTIVE MODE
	SOLENOID VALVE
	LIMIT SWITCH
	FLOW SWITCH
	LEVEL SWITCH HIGH/LOW
	TEMPERATURE SWITCH
	PANEL HEATER
	ELAPSED TIME METER
	STARTER COOLING FAN
	EMERGENCY STOP PUSHBUTTON C/W MUSHROOM HEAD MANUAL RESET
	NORMALLY OPEN RELAY CONTACT
	NORMALLY CLOSED RELAY CONTACT
	CIRCUIT BREAKER
	COMBINATION SWITCHED FUSE BLOCK
	FUSE
L	LINE
N	NEUTRAL
G	GROUND
S	SHIELD
A	AMBER
L.O.S.	LOCK OFF STOP ALL LOCAL STOP P.B.'S ARE TO BE EQUIPED WITH A MECHANICAL INTERLOCK TO SUIT A PAD LOCK
	TERMINAL BLOCK (TYPICAL)
	ANALOG CABLE SHIELD
	GROUND
	DASHED BORDER INDICATES LIMITS OF ENCLOSURE, EQUIPMENT, DEVICES
	PRESSURE DIFFERENTIAL HIGH SWITCH
	NORMAL OPEN LIMIT SWITCH CLOSE ON CONTACT
	NORMAL CLOSED LIMIT SWITCH OPEN ON CONTACT
	TIME DELAY ENABLE CONTACT NORMALLY OPEN
	TIME DELAY ENABLE CONTACT NORMALLY CLOSE

- NOTES:
- ALL EQUIPMENT SHALL BE CONFIGURED FOR SIDE OR BOTTOM ENTRY, TOP ENTRY SHALL NOT BE PERMITTED.
 - TECK90 CABLE SHALL BE UTILIZED THROUGHOUT UNLESS NOTED OTHERWISE.
 - ALL NEW MCC'S AND ALL COMPONENTS WITHIN THE MCC SHALL HAVE A 65KA INTERRUPT RATING.
 - ALL SAFETY SWITCHES SHALL BE HEAVY DUTY, NEMA 4 RATED TO SUIT.
 - ALL POWER DISTRIBUTION CABLE INSTALLED UNDER THIS PROJECT SHALL BE COPPER.
 - 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.
 - REFERENCE P&ID DRAWING LEGEND FOR DETAILED DESCRIPTION OF THE INSTRUMENTATION AND FIELD DEVICE SYMBOLS.
 - ALL NEW POWER DISTRIBUTION CABLES SHALL BE CONTINUOUS FROM PRIMARY OVER CURRENT PROTECTION SUPPLY POINT TO THE LOAD APPLICATION TERMINATION. NO SPLICES ARE PERMITTED.
 - ALL WIRING AND MOTOR CIRCUIT PROTECTION MUST COMPLY WITH REQUIREMENTS OF THE ONTARIO ELECTRICAL SAFETY CODE - LATEST REVISION.
 - ALL ELECTRICAL EQUIPMENT & INSTALLATION TO BE INSPECTED BY THE ESA.
 - ALL ELECTRICAL EQUIPMENT MUST BE CSA. THE CONTRACTOR IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH ESA REVIEW AND INSPECTION.
 - ALL ELECTRICAL DISTRIBUTION AND OVER CURRENT PROTECTION DEVICES SHALL BE 100% RATED.
 - PROVIDE INTEGRAL GROUND FAULT PROTECTION IN ALL BREAKERS THAT ARE GREATER THAN OR EQUAL TO 1000 AMP RATING.
 - ALL 600V DISTRIBUTION EQUIPMENT INCLUDING ALL DISTRIBUTION COMPONENTS, BUS SYSTEMS AND OVER CURRENT PROTECTION SHALL BE RATED 65KA TO SUIT INTERRUPT CAPACITY UNLESS OTHERWISE SPECIFIED ON THE DRAWINGS.
 - THE CONTRACTOR IS REQUIRED TO SUPPLY AND INSTALL AS BUILD LAMINATED 'D' SIZE WALL MOUNTED ELECTRICAL SINGLE LINE DIAGRAMS IN THE ELECTRICAL ROOM.
 - COORDINATE WIRING TO EQUIPMENT AND DEVICES SUPPLIED BY DIV. 15 AS OUTLINED IN SPEC. SECTION 15900.
 - PROVIDE 120V AC POWER SUPPLY TO APPLICATION SPECIFIC CONTROLLERS ASSOCIATED WITH HVAC EQUIPMENT.
 - ALL ELECTRICAL EQUIPMENT TO BE PROVIDED WITH A FIELD DISCONNECT SWITCH LOCATED ADJACENT THE MOTOR LOAD OR EQUIPMENT ENCLOSURE.
 - DO NOT MIX 120V & 600V POWER CABLING.
 - LOCATE DISCONNECTS 1400mm AFFL IN AREA WITH CLEAR ACCESS AND NO OBSTRUCTION.
 - PROVIDE ALL REQUIRED FITTINGS, STRAIN RELIEF CONNECTORS & SUPPORT CLIPS TO INSTALL REQUIRED ELECTRICAL DISTRIBUTION.
 - SHOP DRAWINGS FOR ALL MATERIAL & EQUIPMENT MUST BE SUBMITTED FOR REVIEW PRIOR TO PROCEEDING WITH WORK.
 - PROVIDE FIRE TRANSITS FOR ALL CABLE TRAY AND DUCTS/CONDUITS TRANSITIONING THROUGH INTERIOR BUILDING WALLS.

KEY PLAN:

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0	MAR 2025	ISSUED FOR TENDER	GA
No.	Date	Description	By

STAMPS:

DESIGNED BY

APPROVED BY

CONSULTANT:

CLIENT:

PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

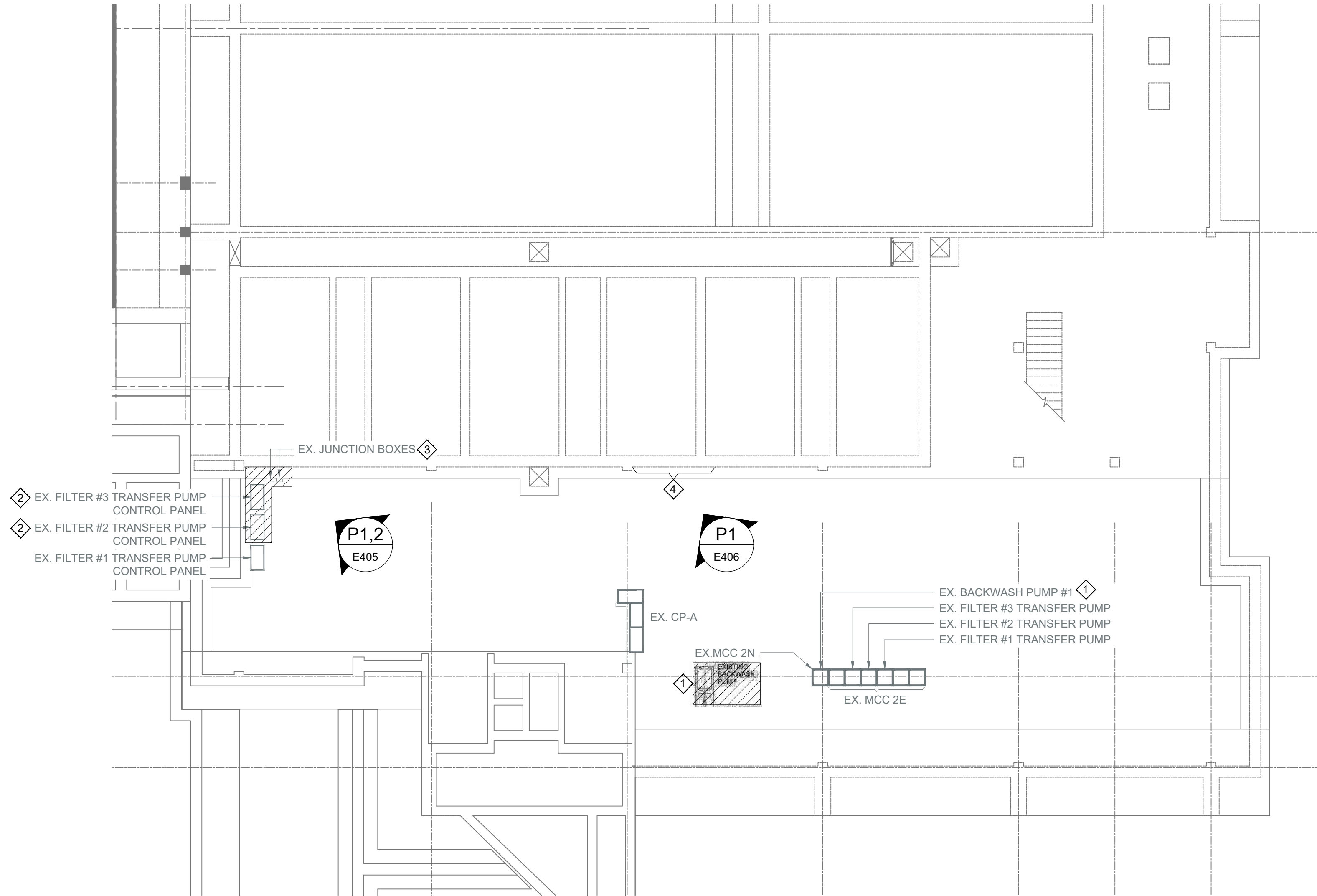
SHEET TITLE:

ELECTRICAL LEGEND & GENERAL NOTES

DISCIPLINE:

ELECTRICAL

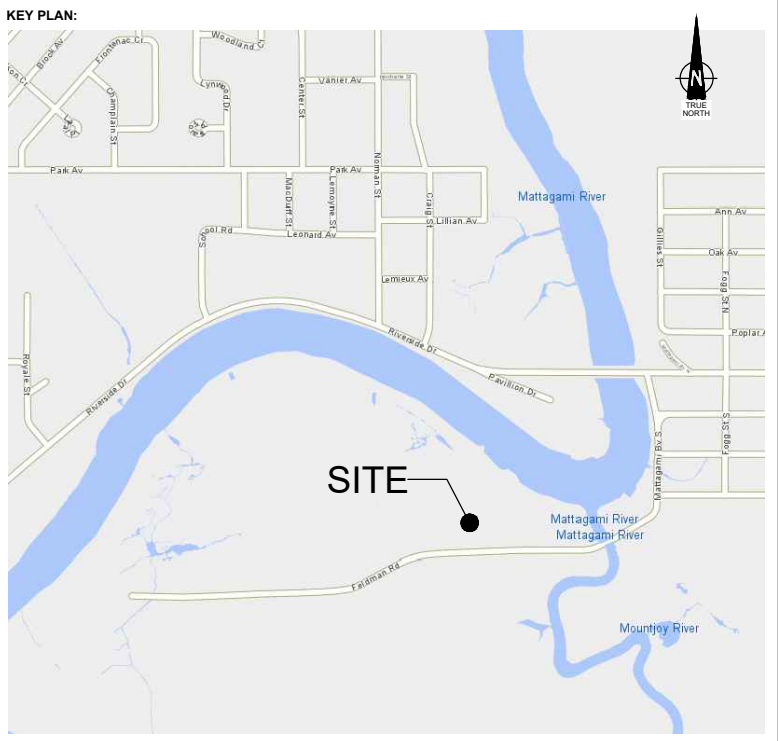
DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-001
SHEET No:			



1 FILTER 1, 2, 3 PIPE GALLERY PLAN POWER LAYOUT - REMOVALS
E101 SCALE: N.T.S.

- DRAWING NOTES:
- 1 EXISTING BACKWASH PUMP #1 TO BE REMOVED. DISCONNECT AND REMOVE REDUNDANT WIRING BACK TO SOURCE. LABEL DISCONNECT SWITCH IN MCC 2N AS SPARE. PROVIDE LAMACOID LABELLING TO MATCH EXISTING.
 - 2 RELOCATE EXISTING TRANSFER PUMP LOCAL CONTROL PANEL. PROVIDE NEW POWER WIRING FROM MCC 2E. EXTEND CONTROL WIRING TO THE NEW PUMP CONTROL PANEL LOCATION. REFER TO DRAWING E-201.
 - 3 RELOCATE EXISTING JUNCTION BOXES TO ALLOW INSTALLATION OF THE NEW PIPE. REFER TO DRAWING E-201.
 - 4 PREPARE THE SPACE ON WALL FOR FILTER TRANSFER PUMP CONTROL PANELS RELOCATION. REFER TO DRAWING 1/E405.

- GENERAL NOTES:
- 1. EXISTING STEPS AND PLATFORMS, MECHANICAL, PROCESS EQUIPMENT AND PIPING IS NOT SHOWN FOR CLARITY. CONTRACTOR IS TO REVIEW AND CONFIRM EXISTING SITE CONDITIONS.



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STAMPS:

DESIGNED BY

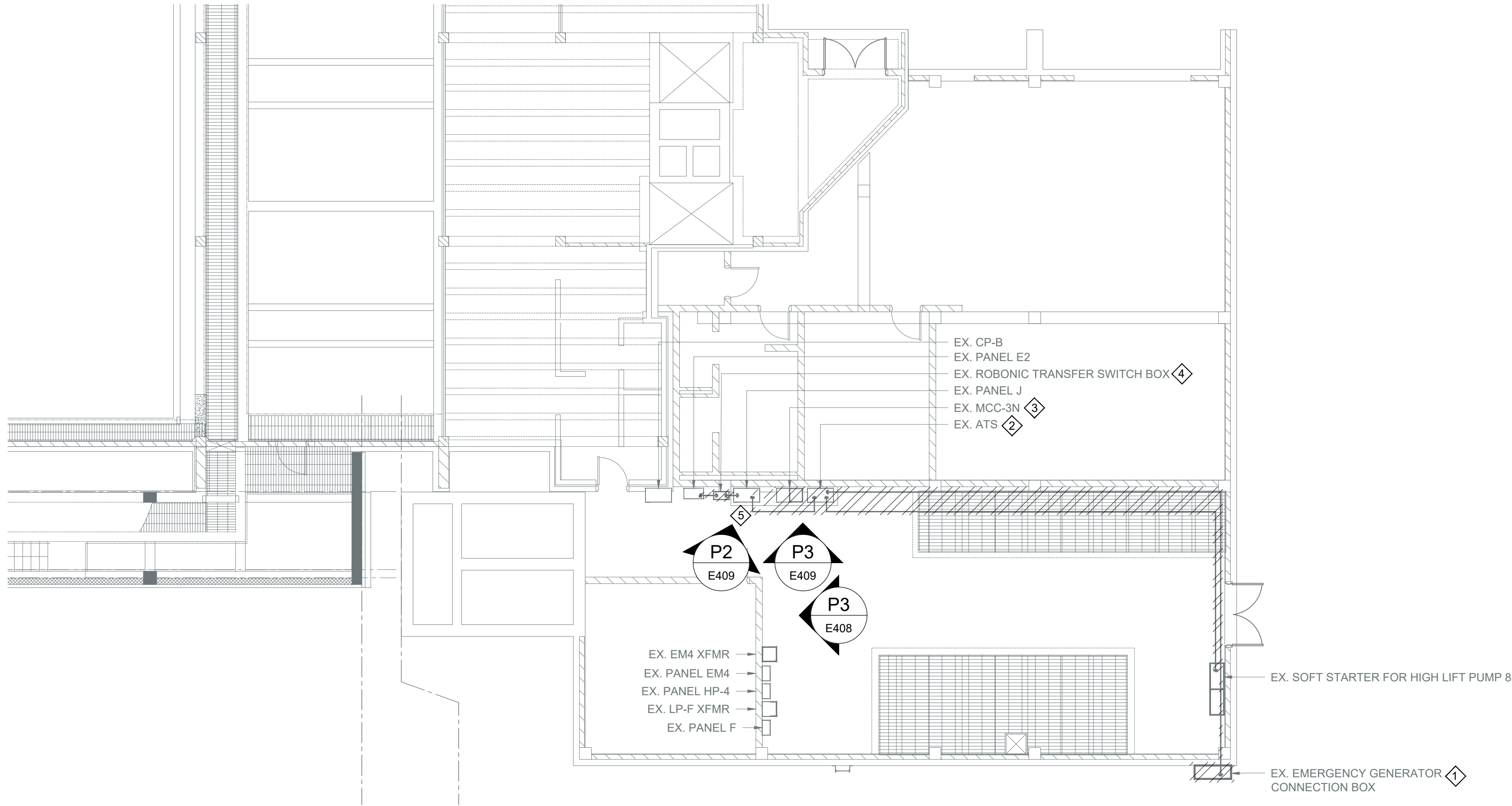
APPROVED BY



PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:
FILTER 1, 2, 3 PIPE GALLERY PLAN POWER LAYOUT - REMOVALS

DISCIPLINE: ELECTRICAL			
DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-101
SHEET No:			



1

E102

PUMP ROOM #2 PLAN POWER LAYOUT - REMOVALS

SCALE: 1:100

- DRAWING NOTES:**
- 1 REMOVE THE OUTDOOR GENERATOR CONNECTION BOX AND ASSOCIATED WIRING. REPAIR THE WALL TO CLOSE THE EXISTING PENETRATION.
 - 2 REMOVE ATS ALONG WITH ALL ASSOCIATED WIRING. REMOVE EXISTING WIRING FROM PANEL 'J' AND TO HLP-8 SOFT STARTER.
 - 3 REMOVE MCC-3N ALONG WITH ALL ASSOCIATED WIRING. REMOVE ALL 600V CIRCUITS FED FROM MCC-3N. REFEED 120V CIRCUITS FROM PANEL 'LP-G' BUILT INTO MCC-3N. REFER TO SINGLE LINE DIGRAM AND PANEL SCHEDULE.
 - 4 EXISTING ROBONIC TRANSFER SWITCH BOX IS SERVING AS A PULL BOX CONTAINING FEEDER WIRING FROM PANEL J TO PANEL E2. REMOVE THE BOX AND REINSTALL THE WIRING THROUGH A NEW 103MM CONDUIT.
 - 5 EXISTING HOUSEKEEPING PAD TO REMAIN.

- GENERAL NOTES:**
1. EXISTING STEPS AND PLATFORMS, MECHANICAL, PROCESS EQUIPMENT AND PIPING IS NOT SHOWN FOR CLARITY. CONTRACTOR IS TO REVIEW AND CONFIRM EXISTING SITE CONDITIONS.

KEY PLAN:

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0	MAR 2025	ISSUED FOR TENDER	GA
No.	Date	Description	By

STAMPS:

DESIGNED BY:APPROVED BY:

CONSULTANT:

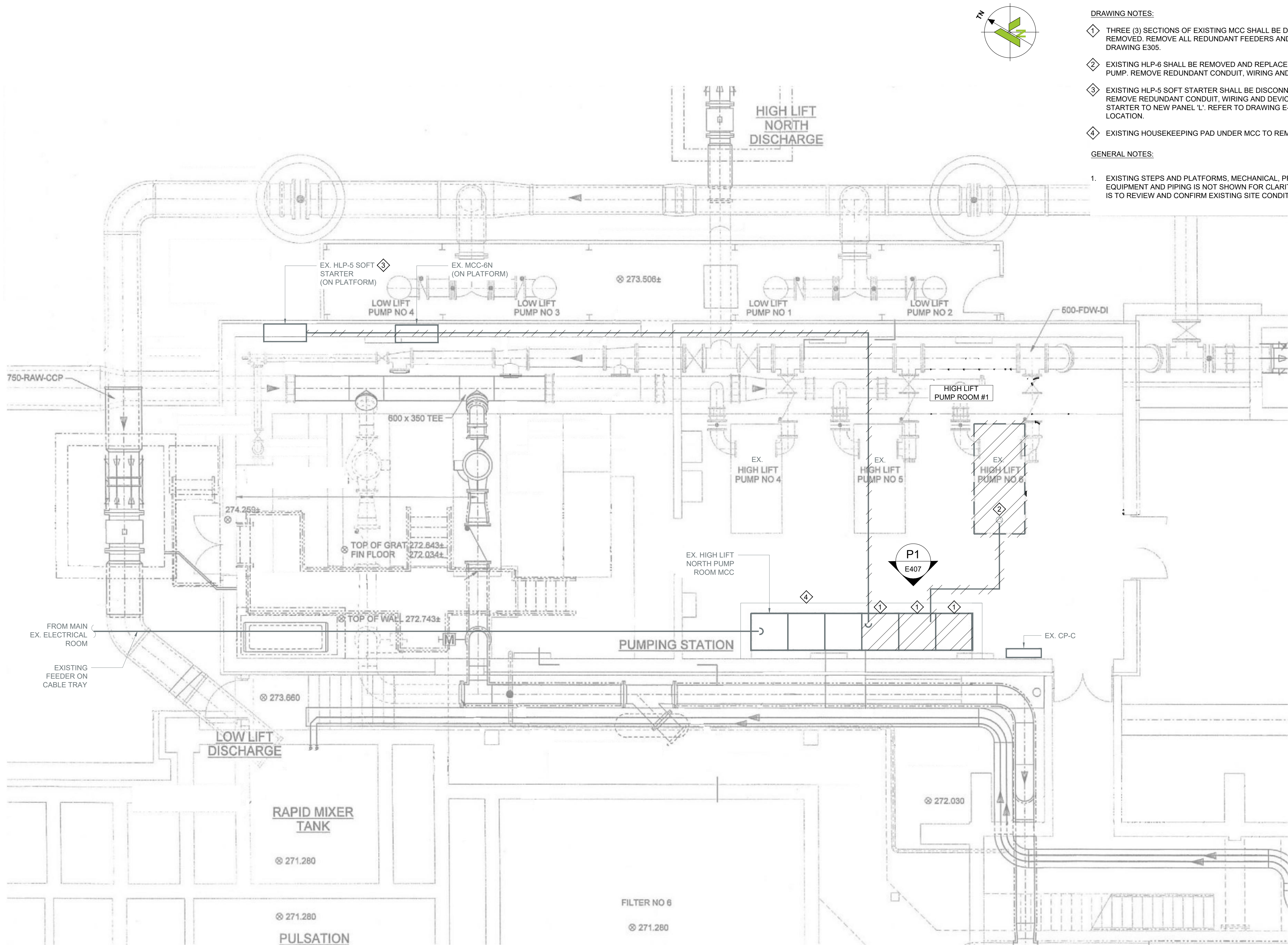
CLIENT:

PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:

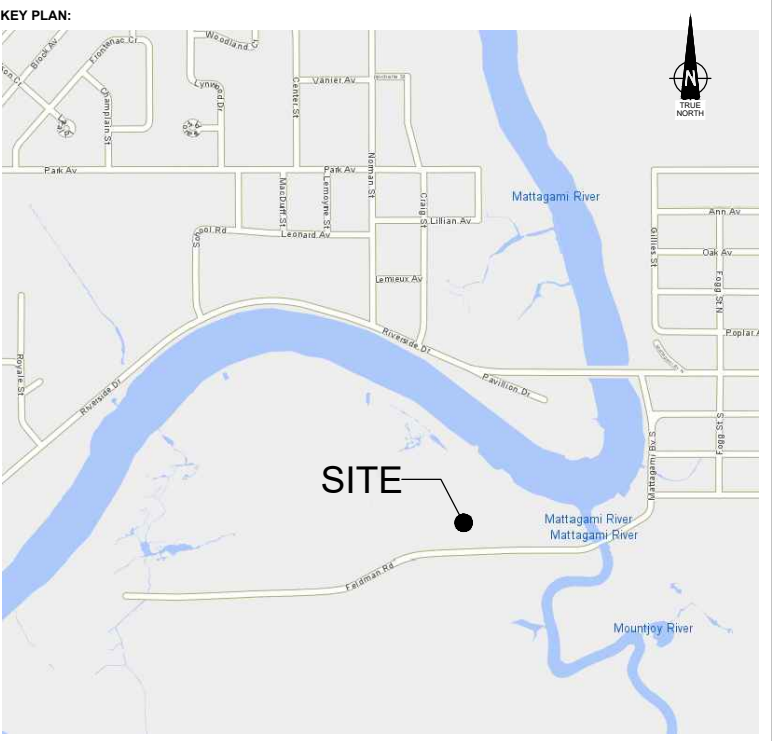
PUMP ROOM #2 PLAN
POWER LAYOUT -
REMOVALS

DISCIPLINE: ELECTRICAL			
DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-102
SHEET No:			



- DRAWING NOTES:**
- THREE (3) SECTIONS OF EXISTING MCC SHALL BE DISCONNECTED AND REMOVED. REMOVE ALL REDUNDANT FEEDERS AND DEVICES. REFER TO DRAWING E305.
 - EXISTING HLP-6 SHALL BE REMOVED AND REPLACED WITH A NEW 500HP PUMP. REMOVE REDUNDANT CONDUIT, WIRING AND DEVICES.
 - EXISTING HLP-5 SOFT STARTER SHALL BE DISCONNECTED FROM THE MCC, REMOVE REDUNDANT CONDUIT, WIRING AND DEVICES. RECONNECT THE STARTER TO NEW PANEL 'L'. REFER TO DRAWING E-203 FOR PANEL 'L' LOCATION.
 - EXISTING HOUSEKEEPING PAD UNDER MCC TO REMAIN.

- GENERAL NOTES:**
- EXISTING STEPS AND PLATFORMS, MECHANICAL, PROCESS EQUIPMENT AND PIPING IS NOT SHOWN FOR CLARITY, CONTRACTOR IS TO REVIEW AND CONFIRM EXISTING SITE CONDITIONS.



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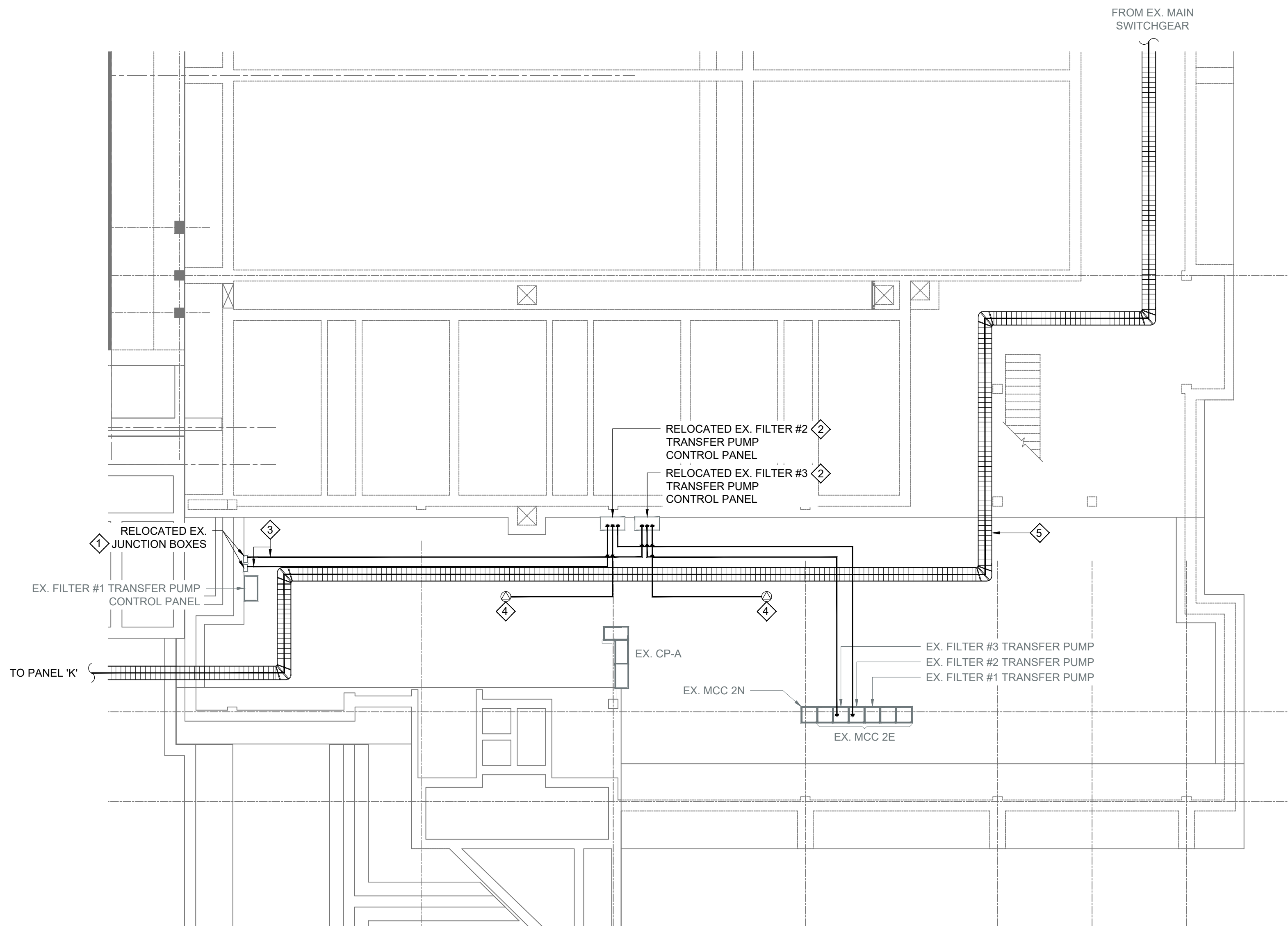
0	MAR 2025	ISSUED FOR TENDER	GA
No.	Date	Description	By



PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:
PUMP ROOM #1 POWER LAYOUT - REMOVALS

DISCIPLINE: ELECTRICAL			
DRAFTER: RW	SCALE: NTS		
DESIGNER: DC	DATE: FEB 2025		
APPROVER: GA	CHECKER: TGB		
PROJECT No: T001960A	DRAWING No:		
SHEET No:		E-103	



1 FILTER 1, 2, 3 PIPE GALLERY PLAN POWER LAYOUT - NEW WORK
E201 SCALE: 1:100

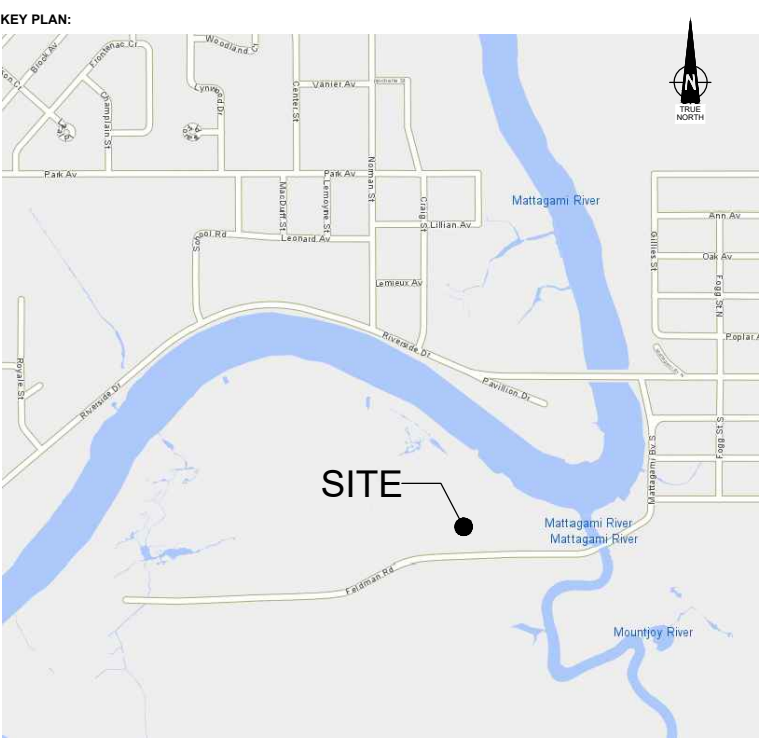
DRAWING NOTES:

- 1 EXISTING RELOCATED JUNCTION BOXES MOUNTED ON UNISTRUT CHANNEL SUPPORT STRUCTURE ON WEST WALL. REARRANGE / CUT BACK EXISTING CABLEING AS REQUIRED. THE NEW LOCATION TO BE APPROVED BY PLANT STAFF.
- 2 EXISTING TRANSFER PUMP LOCAL CONTROL PANEL IN RELOCATED POSITION. PROVIDE NEW UNISTRUT CHANNELS ON THE WALL TO INSTALL THE TRANSFER PUMP CONTROL PANELS. PROVIDE NEW POWER CONNECTION FROM MCC 2E. PROVIDE NEW POWER CONNECTION TO THE PUMP. FIELD VERIFY THE AVAILABLE SPACE IS ADEQUATE. RELOCATE EXISTING CONDUITS/RECEPTACLES TO FREE UP SPACE AS REQUIRED. REFER TO DRAWING E406.
- 3 PROVIDE CONTROLS WIRING (ARMORED INSTRUMENT CONTROL CABLE) FROM THE RELOCATED JUNCTION BOX TO THE RELOCATED PUMP CONTROL PANELS. THIS WIRING IS TO REPLACE EXISTING WIRING INSTALLED BETWEEN THE JUNCTION BOX AND THE PUMP CONTROL PANELS.
- 4 TERMINATE NEW POWER CABLE AT EXISTING FILTER TRANSFER PUMP.
- 5 PROVIDE NEW 18" LADDER TYPE CABLE TRAY SUPPORTED FROM CEILING SLAB. INSTALL NEW SINGLE CONDUCTOR CABLES ON THE CABLE TRAY TO MAINTAIN 100% CABLE DIAMETER SPACING TO ALLOW FREE AIR CABLE AMPACITY PER TABLE 1 OF OESC. PROVIDE NON-FERROUS MATERIAL PLATE AND CABLE GLANDS WHERE SINGLE CONDUCTOR CABLES ENTER METAL ENCLOSURES, COMPLY WITH OESC RULE 4-008 AND BULLETIN 12-7-12.

GENERAL NOTES:

1. EXISTING STEPS AND PLATFORMS, MECHANICAL, PROCESS EQUIPMENT AND PIPING IS NOT SHOWN FOR CLARITY, CONTRACTOR IS TO REVIEW AND CONFIRM EXISTING SITE CONDITIONS.

KEY PLAN:



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STAMPS



APPROVED BY _____

CONSULTANT:



CLIENT:



PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

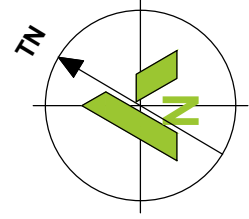
SHEET TITLE:

FILTER 1, 2, 3 PIPE
GALLERY PLAN POWER
LAYOUT - NEW WORK

DISCIPLINE:

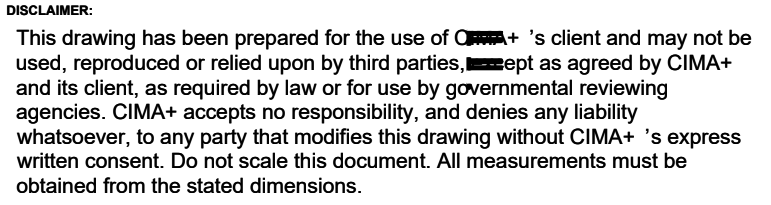
ELECTRICAL

DRAFTER:	RW	SCALE:	1:100
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-201
SHEET No:			



- 1 INSTALL VFD CABINET ON FORMER AT'S CONCRETE PAD, EXTEND HOUSEKEEPING PAD AS REQUIRED.
- 2 INSTALL PANEL 'LP-G' ON WALL AND TRANSFORMER ABOVE ON UNISTRUT CHANNEL STRUCTURE. REFER TO DETAIL 3/E401. TRANSFER CIRCUITS FROM EXISTING PANEL LP-G IN MCC-3N TO THE NEW PANEL 'LP-G'. REFER TO PANEL SCHEDULE ON DRAWING 4/E404.
- 3 PROVIDE A NEW FEEDER TO EXISTING HLP 8 SOFT STARTER. PROVIDE NEW 18" LADDER TYPE CABLE TRAY. REFER TO SINGLE LINE DIAGRAM.
- 4 PROVIDE A NEW CONCRETE HOUSEKEEPING PAD FOR THE NEW EQUIPMENT. REFER TO DETAILS ON STRUCTURAL DRAWINGS.
- 5 REFER TO DETAILS 5 & 6/E401 FOR CONNECTION DETAILS
- 6 EXTEND EXISTING HOUSEKEEPING PAD AS REQUIRED TO SUIT NEW EQUIPMENT (VFD CABINET FOR HLP-7, PANEL LP-G AND TRANSFORMER).

1. EXISTING STEPS AND PLATFORMS, MECHANICAL, PROCESS EQUIPMENT AND PIPING IS NOT SHOWN FOR CLARITY, CONTRACTOR IS TO REVIEW AND CONFIRM EXISTING SITE CONDITIONS.

[illegible]

2025-03-21
D. CHILOV
100946543
PROVINCE OF ONTARIO
DESIGNED BY

APPROVED BY

CONSULTANT:



PROJECT NAME:

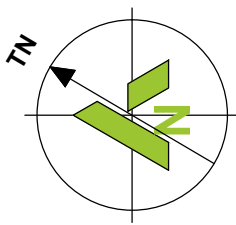
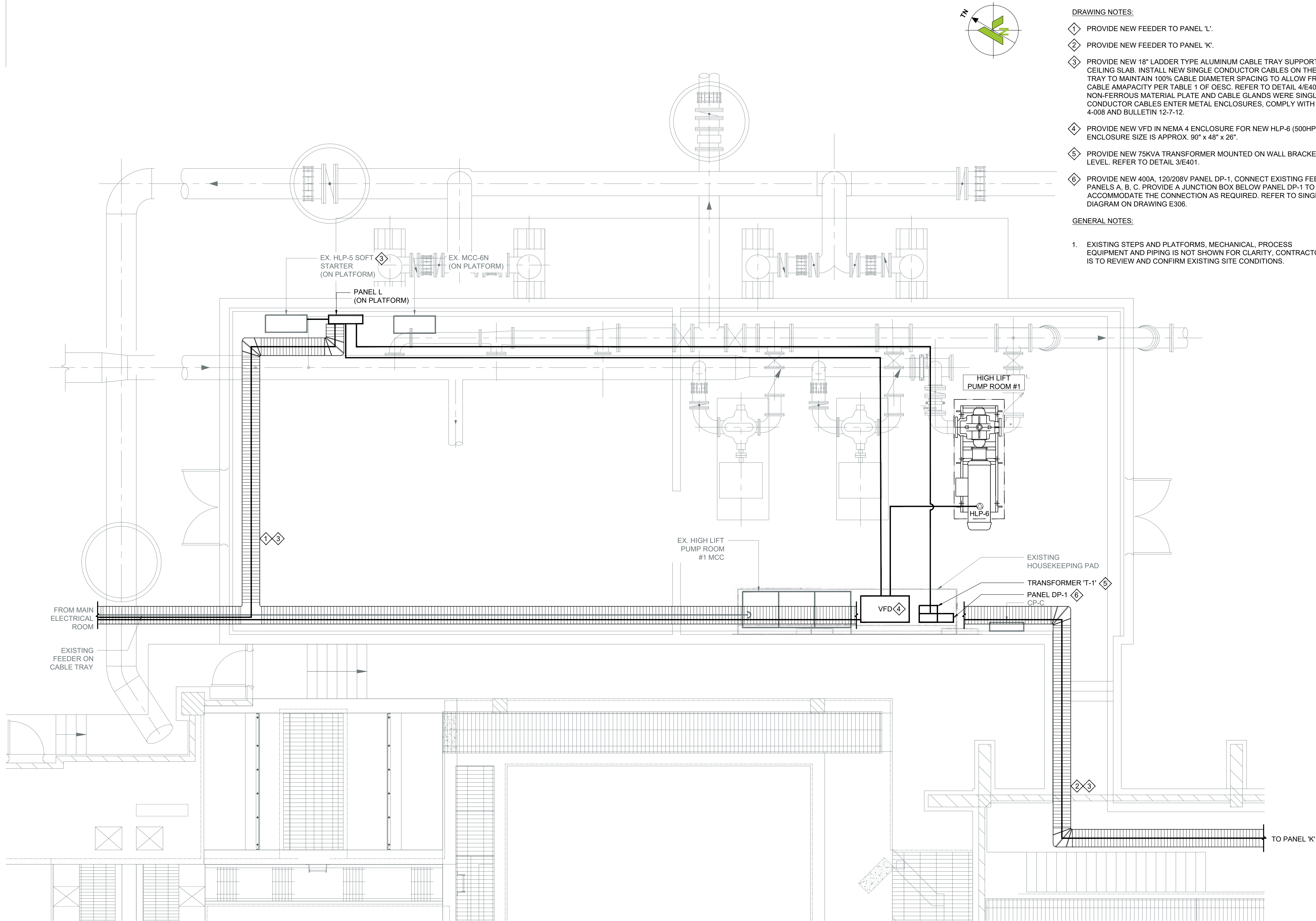
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:

POWER DISTRIBUTION
PUMP ROOM #2 PLAN -
NEW WORK

DISCIPLINE:

DRAWER:		SCALE:
	RW	1:100
DESIGNER:		DATE:
	DC	FEB 2025
APPROVER:		CHECKER:
	GA	TGB
PROJECT No:		DRAWING No:
T001960A		
SHEET No:		E-202

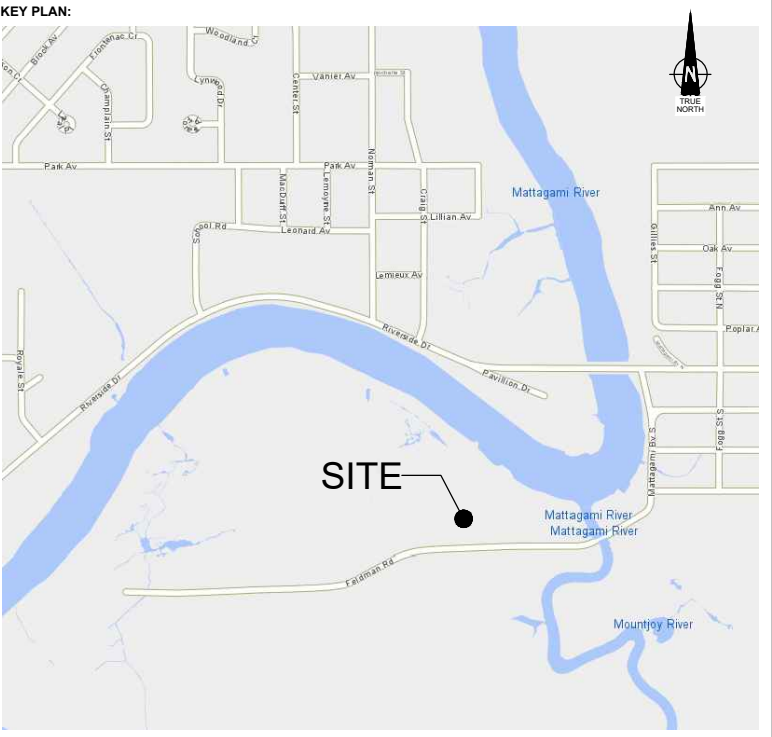


DRAWING NOTES:

1. PROVIDE NEW FEEDER TO PANEL 'L'.
2. PROVIDE NEW FEEDER TO PANEL 'K'.
3. PROVIDE NEW 18" LADDER TYPE ALUMINUM CABLE TRAY SUPPORTED FROM CEILING SLAB. INSTALL NEW SINGLE CONDUCTOR CABLES ON THE CABLE TRAY TO MAINTAIN 100% CABLE DIAMETER SPACING TO ALLOW FREE AIR CABLE AMAPACITY PER TABLE 1 OF OESC. REFER TO DETAIL 4/E401 PROVIDE NON-FERROUS MATERIAL PLATE AND CABLE GLANDS WERE SINGLE CONDUCTOR CABLES ENTER METAL ENCLOSURES, COMPLY WITH OESC RULE 4-008 AND BULLETIN 12-7-12.
4. PROVIDE NEW VFD IN NEMA 4 ENCLOSURE FOR NEW HLP-6 (500HP). ENCLOSURE SIZE IS APPROX. 90" x 48" x 26".
5. PROVIDE NEW 75KVA TRANSFORMER MOUNTED ON WALL BRACKETS AT HIGH LEVEL. REFER TO DETAIL 3/E401.
6. PROVIDE NEW 400A, 120/208V PANEL DP-1, CONNECT EXISTING FEEDERS TO PANELS A, B, C. PROVIDE A JUNCTION BOX BELOW PANEL DP-1 TO ACCOMMODATE THE CONNECTION AS REQUIRED. REFER TO SINGLE LINE DIAGRAM ON DRAWING E306.

GENERAL NOTES:

1. EXISTING STEPS AND PLATFORMS. MECHANICAL, PROCESS EQUIPMENT AND PIPING IS NOT SHOWN FOR CLARITY, CONTRACTOR IS TO REVIEW AND CONFIRM EXISTING SITE CONDITIONS.



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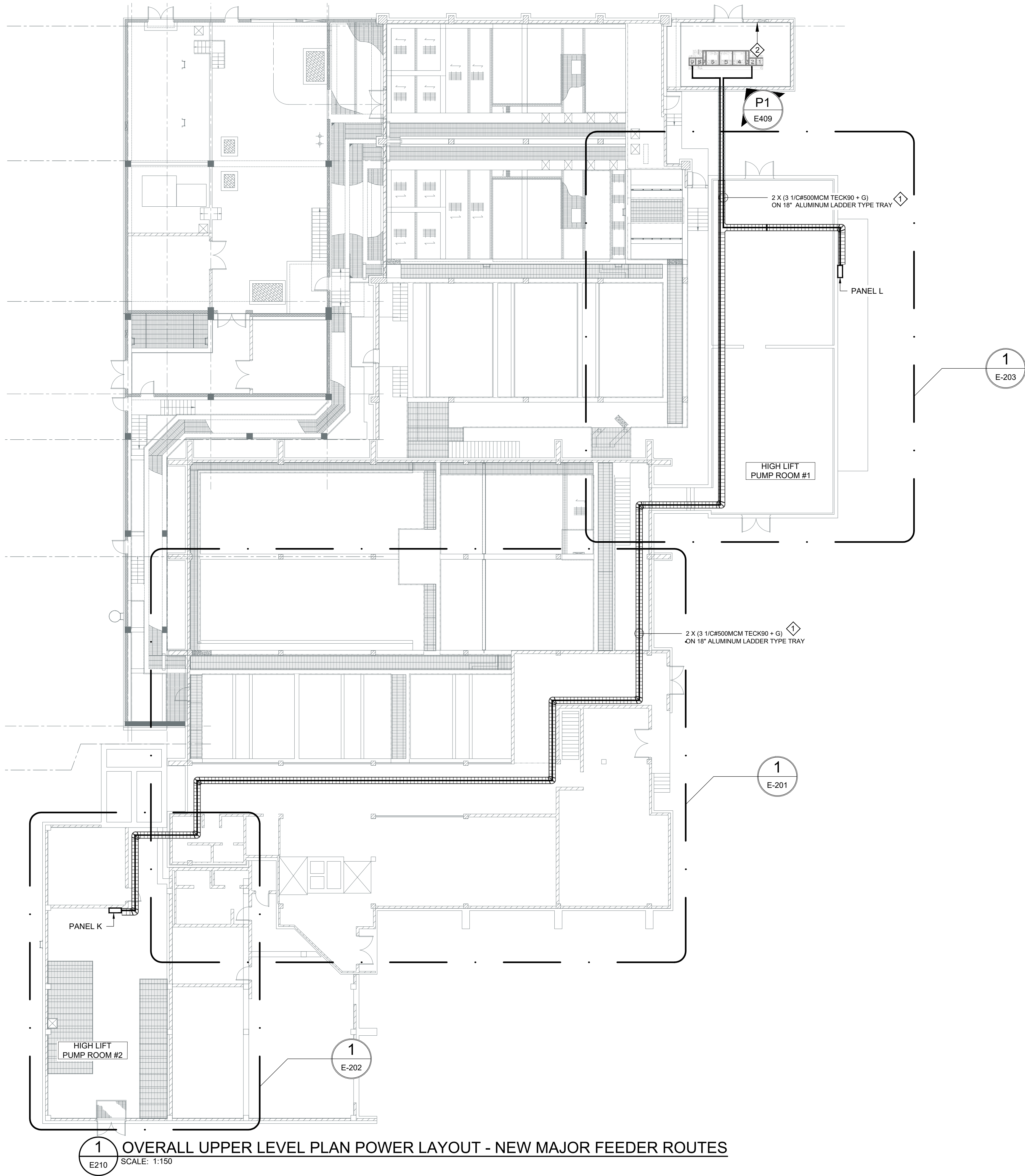
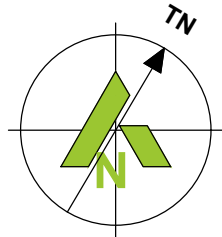
0	MAR 2025	ISSUED FOR TENDER	GA
No.	Date	Description	By



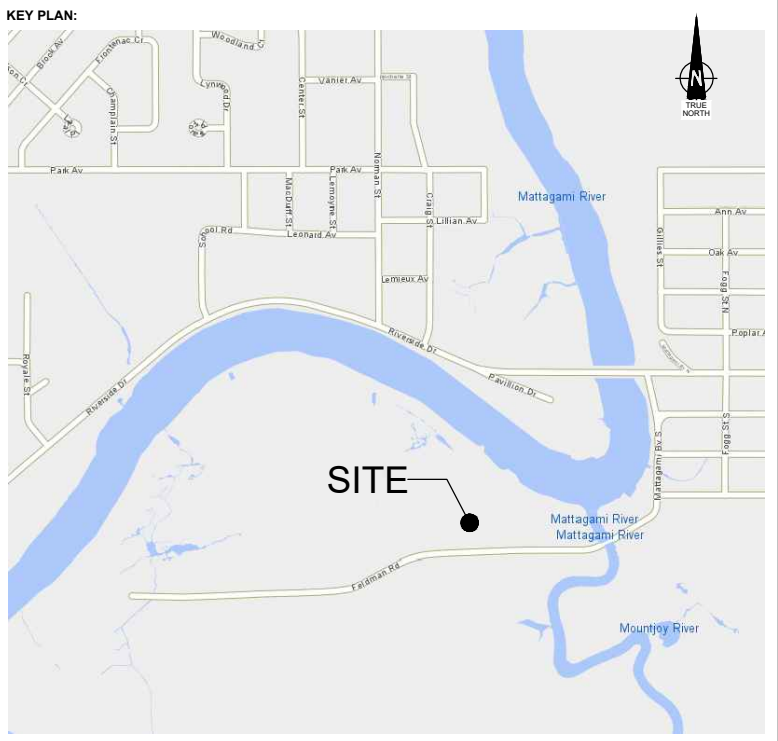
PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:
PUMP ROOM #1 POWER LAYOUT - NEW WORK

DISCIPLINE: ELECTRICAL			
DRAFTER:	RW	SCALE:	1:50
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-203
SHEET No:			



- DRAWING NOTES:
- 1 THE SINGLE CONDUCTOR CABLES SHALL BE INSTALLED TO MAINTAIN FREE AIR AMPACITY RATING. REFER TO TYPICAL DETAIL 4/E401.
 - 2 PROVIDE UPDATED SINGLE LINE DIAGRAM FULL SIZE DRAWING IN FRAME. THE DRAWING SHALL BE POSTED IN ELECTRICAL ROOM.



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No.	Date	Description	By

STAMPS:

DESIGNED BY

APPROVED BY



CONSULTANT:

CLIENT:

PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:
OVERALL UPPER LEVEL PLAN
POWER LAYOUT -
NEW MAJOR FEEDERS
ROUTES

DISCIPLINE: ELECTRICAL			
DRAFTER:	RW	SCALE:	1:150
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-210
SHEET No:			

1 PROVIDE A NEW BREAKER TO THE EXISTING SWITCHGEAR AS NOTED, THE INTERRUPTING CAPACITY SHALL BE 65 KA MINIMUM.

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No.	Date	Description	By

2025-03-21
D. CHILOV
100946543
PROVINCE OF ONTARIO

DESIGNED BY

APPROVED BY



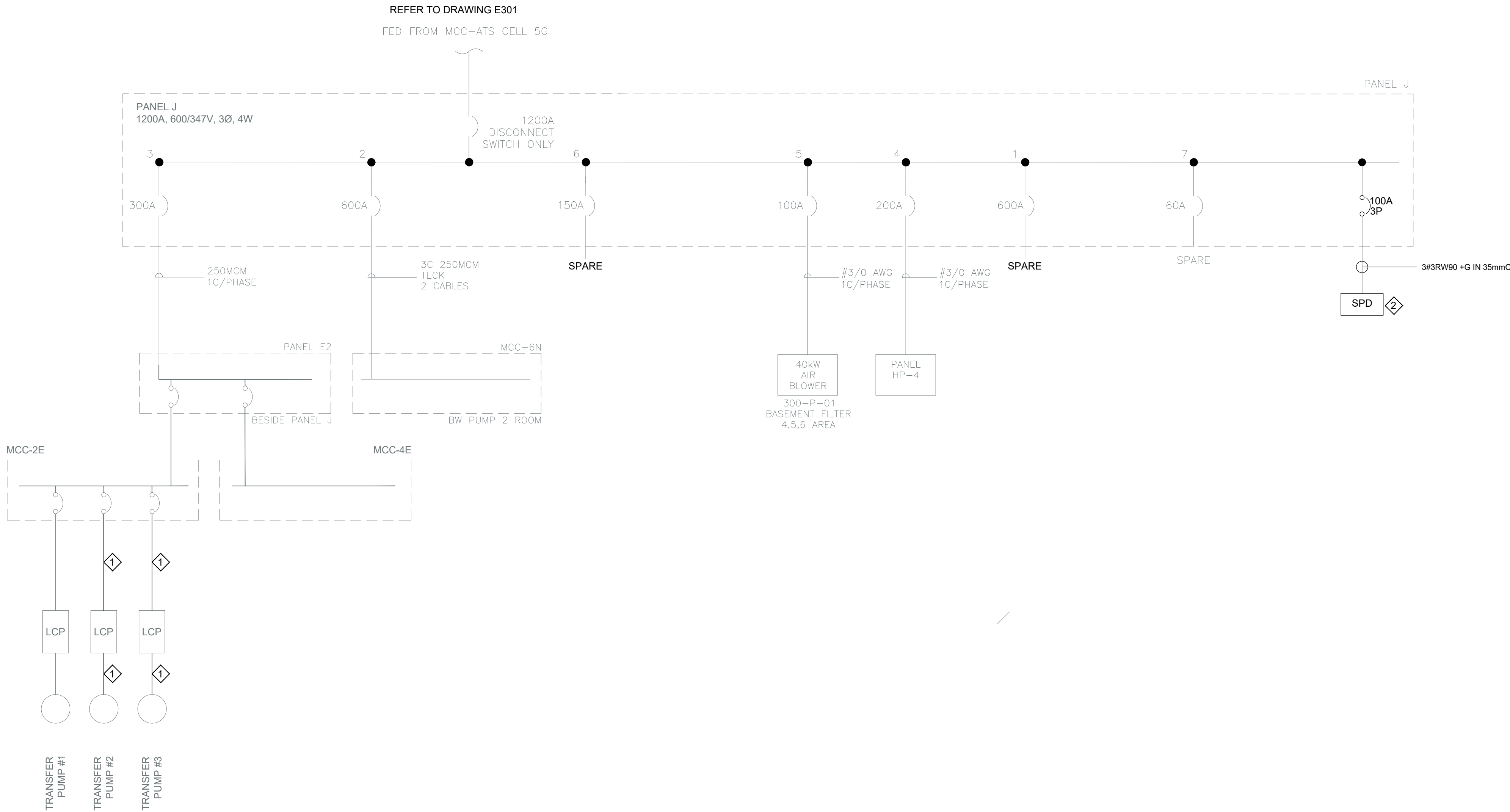
TIMMINS
I'M IN. | J'Y TIENS. | ∇dU

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

EXISTING MAIN PLANT SINGLE LINE DIAGRAM

ELECTRICAL

DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-301
SHEET No:			

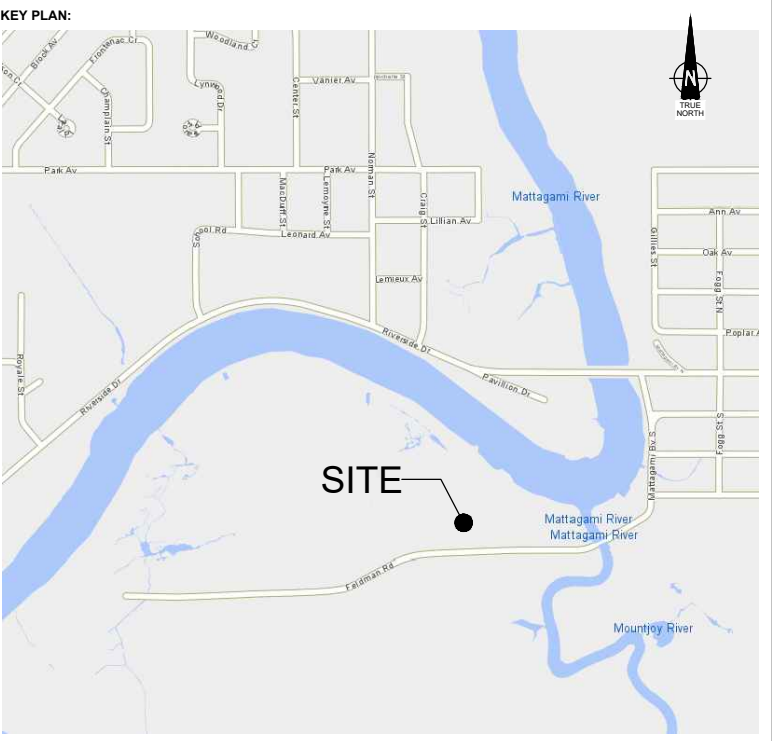


DRAWING NOTES:

1. RELOCATE EXISTING LOCAL CONTROL PANELS FOR FILTER TRANSFER PUMP. PROVIDE NEW CABLES TO THE RELOCATED EQUIPMENT TO MATCH EXISTING. REFER TO DRAWING E-201 FOR PANEL LOCATIONS.
2. SERVICE TRACK ST240 MODEL # TK-ST240-600NN-L.

GENERAL NOTES:

1. ALL NEW PANELS SHALL HAVE NEMA 4 ENCLOSURE AND BE CONFIGURED FOR SIDE OR BOTTOM CABLE ENTRY.



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No.	Date	Description	By
0	MAR 2025	ISSUED FOR TENDER	GA



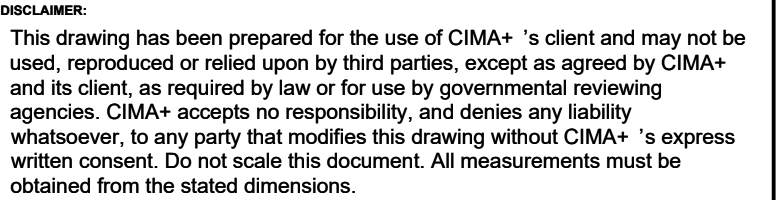
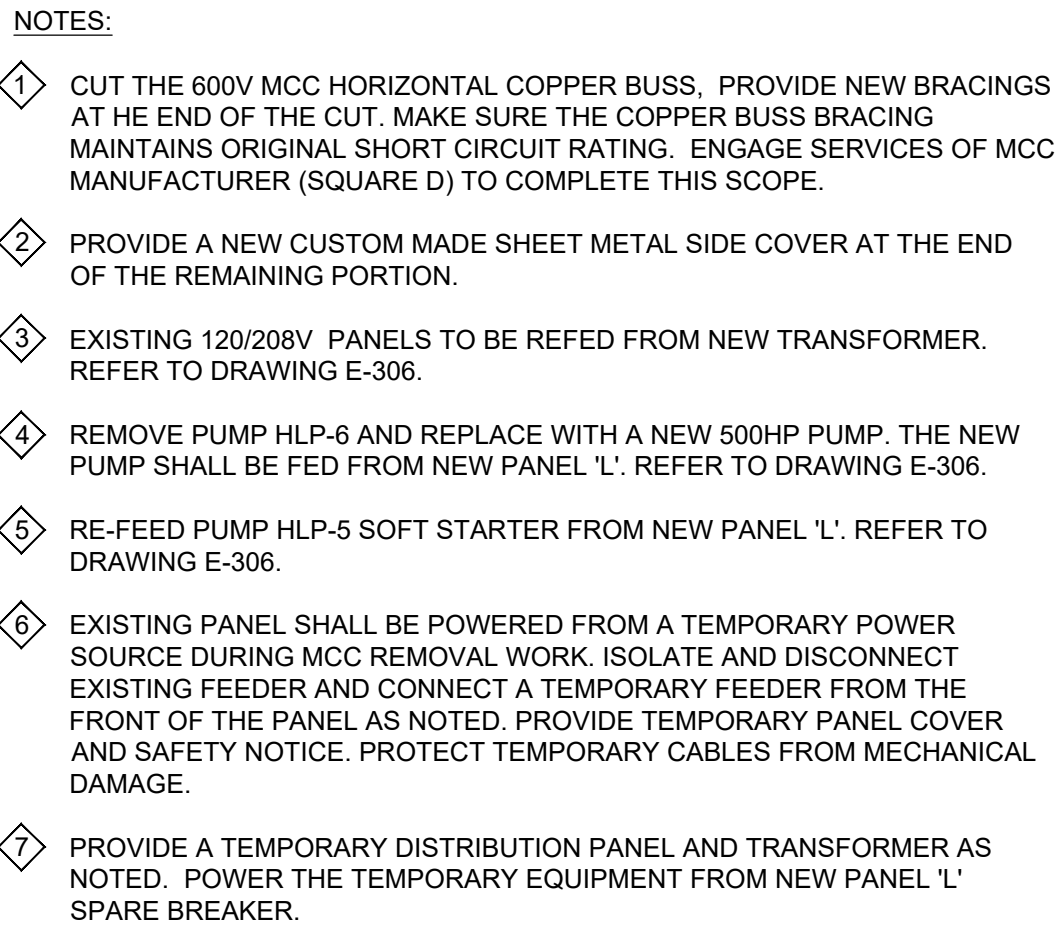
PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

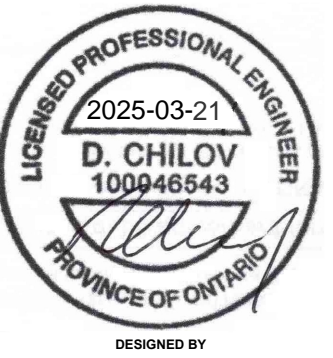
SHEET TITLE:

PANEL J
SINGLE LINE DIAGRAM
NEW WORK

DISCIPLINE:			
ELECTRICAL			
DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-303
SHEET No:			



0	MAR 2025	ISSUED FOR TENDER		GA
No.	Date	Description		By



CONSULTANT:



TIMMINS
MIN. | J'Y TIENS. | ∇d

PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

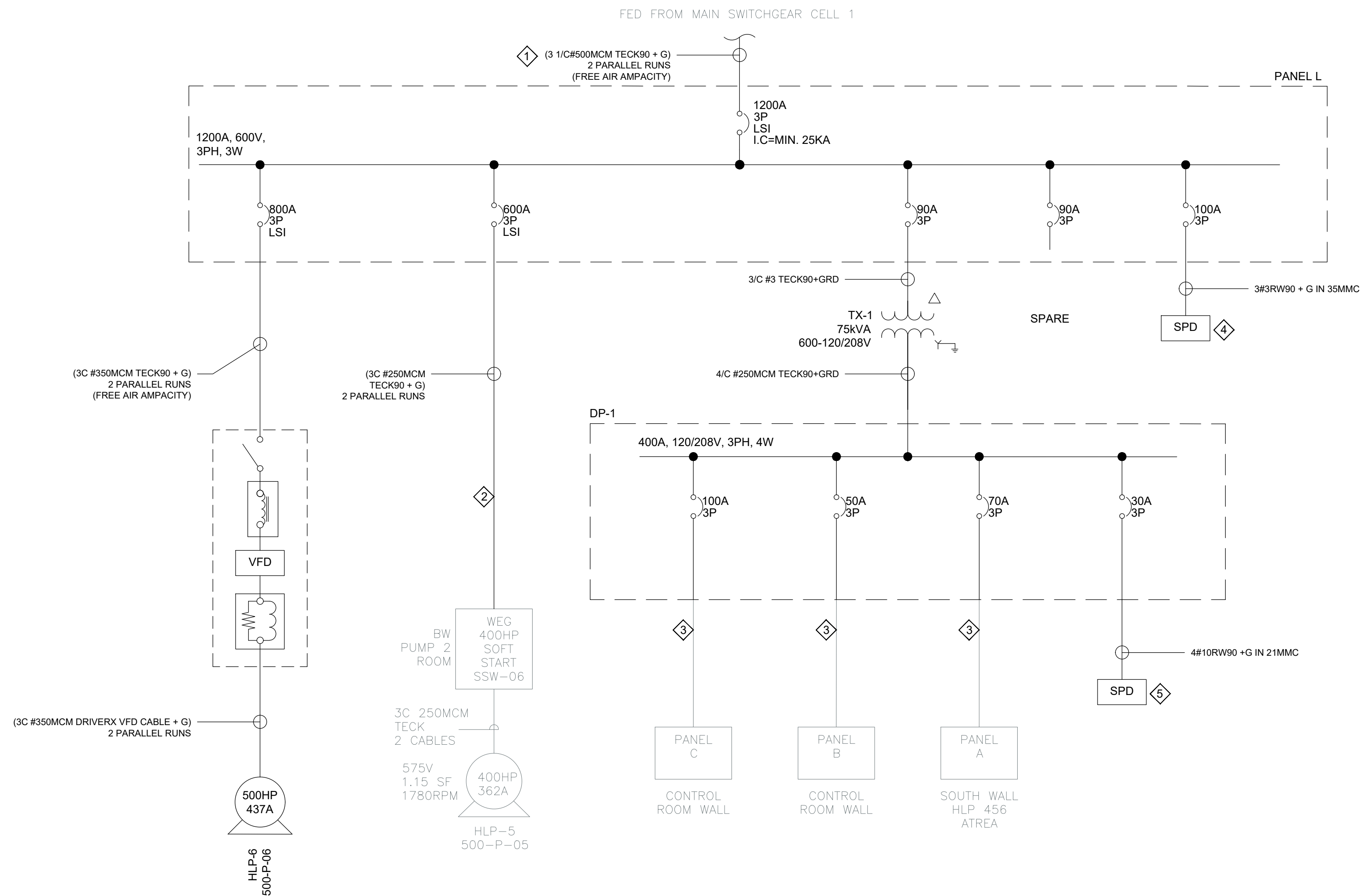
SHEET TITLE:

HIGH LIFT NORTH PUMP ROOM MCC SINGLE LINE DIAGRAM - REMOVALS

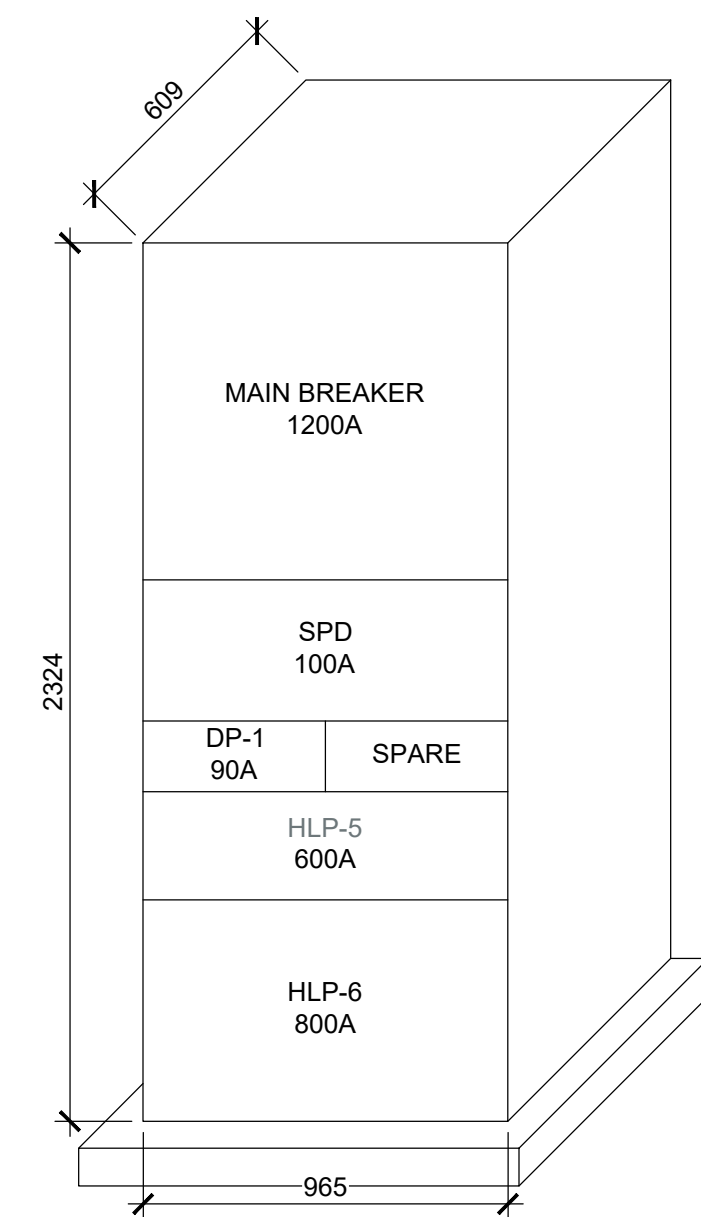
DISCIPLINE:

ELECTRICAL

DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-305
SHEET No:			



1 E306 PANEL L SINGLE LINE DIAGRAM - NEW WORK SCALE: N.T.S.



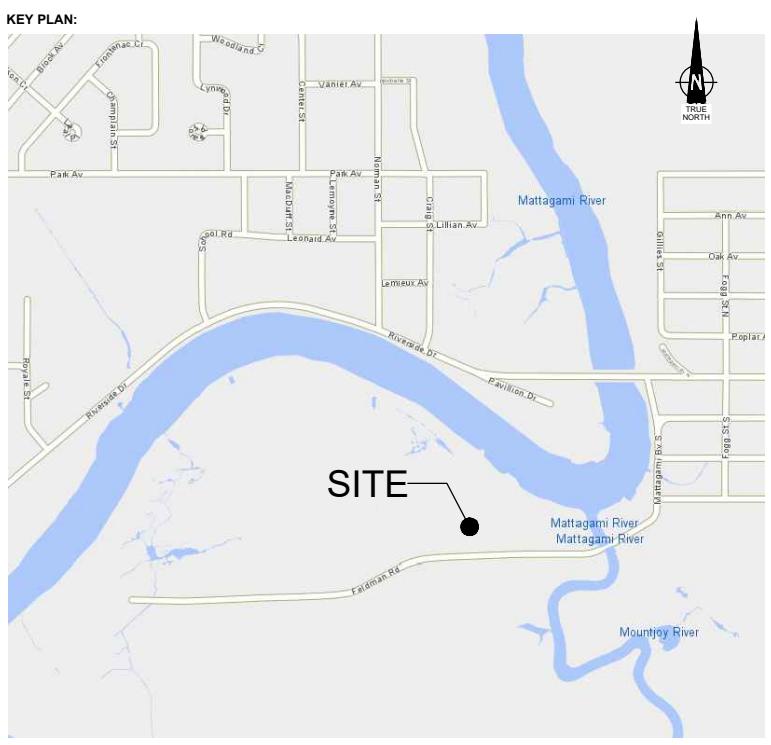
2 PANEL 'L' - ELEVATION
E306 SCALE: N.T.S.

DRAWING NOTES:

- 1 INSTALL NEW SINGLE CONDUCTOR CABLES ON NEW 18" CABLE TRAY TO MAINTAIN AT LEAST 100% CABLE DIAMETER SPACING. PROVIDE NON-FERROUS MATERIAL PLATE AND CABLE GLANDS WHERE SINGLE CONDUCTOR CABLES ENTER METAL ENCLOSURES. COMPLY WITH OESC RULE 4-008 AND BULLETIN 12-7-12. REFER TO DETAIL 4/E401
- 2 PROVIDE NEW POWER CONNECTION TO EXISTING HLP-5 SOFT STARTER AS NOTED.
- 3 RE-FEED EXISTING 120/208V PANELS FROM NEW SOURCE AS NOTED. REUSE EXISTING CABLES IN UNDERFLOOR CONDUITS TO THE 120/208V PANELS. CONDUCT INSULATION RESISTANCE TESTING OF THE CABLES AND SUBMIT RESULTS FOR REVIEW. PROVIDE A TEMPORARY POWER CONNECTION TO PANELS A, B, C TO SUPPORT THESE LOADS DURING MCC PARTIAL REMOVAL AND NEW TRANSFORMER AND DP-1 INSTALLATION.
- 4 SERVICE TRACK ST240 MODEL # TK-ST240-600N-L.
- 5 SERVICE TRACK ST240 MODEL # TK-ST080-3Y208-FL.

GENERAL NOTES:

1. ALL NEW PANELS SHALL HAVE NEMA 4 ENCLOSURE AND BE CONFIGURED FOR SIDE OR BOTTOM CABLE ENTRY.



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STAMPS:



APPROVED BY

CONSULTANT:



PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

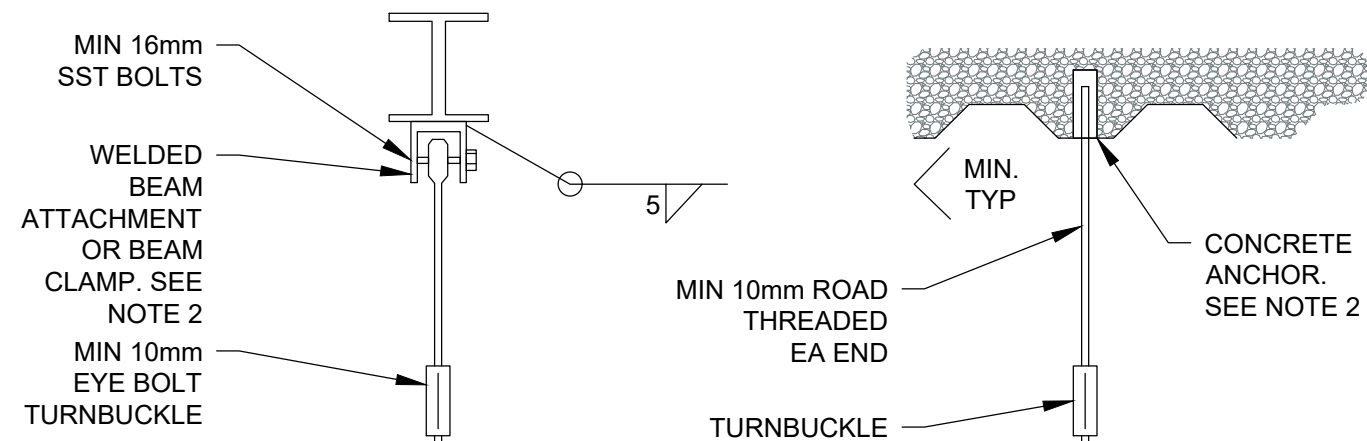
SHEET TITLE:

PANEL L
SINGLE LINE DIAGRAM -
NEW WORK

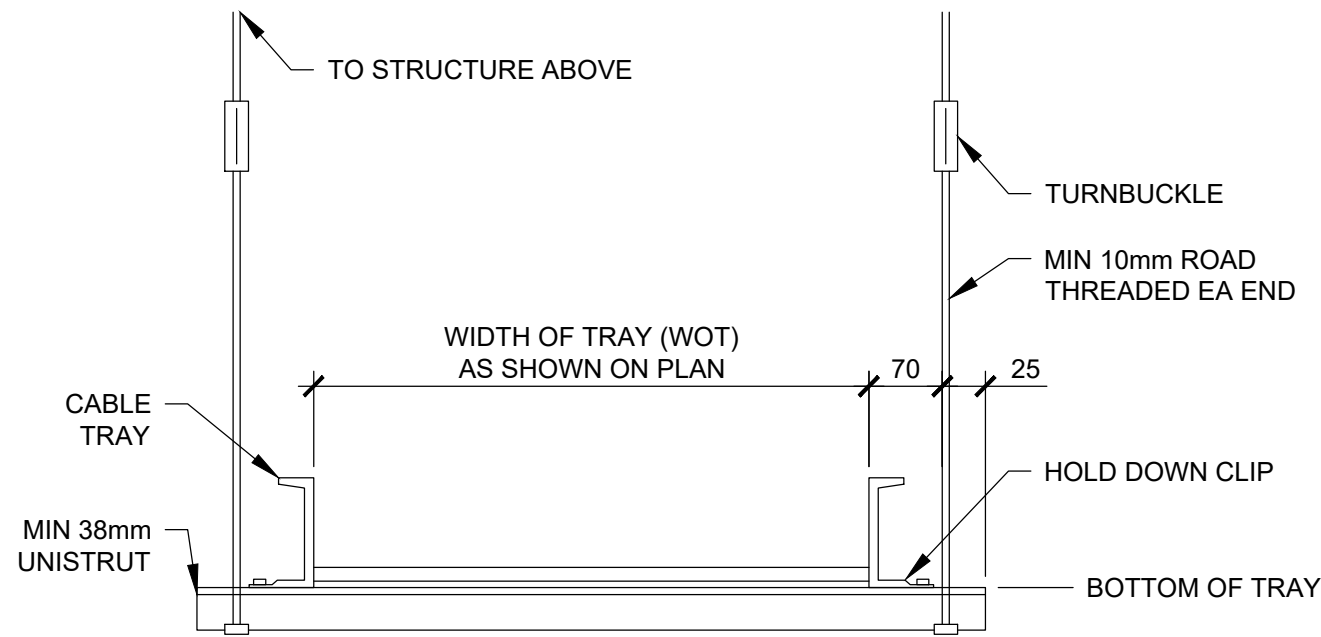
DISCIPLINE:

ELECTRICAL

DRAWER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-306
SHEET No:			



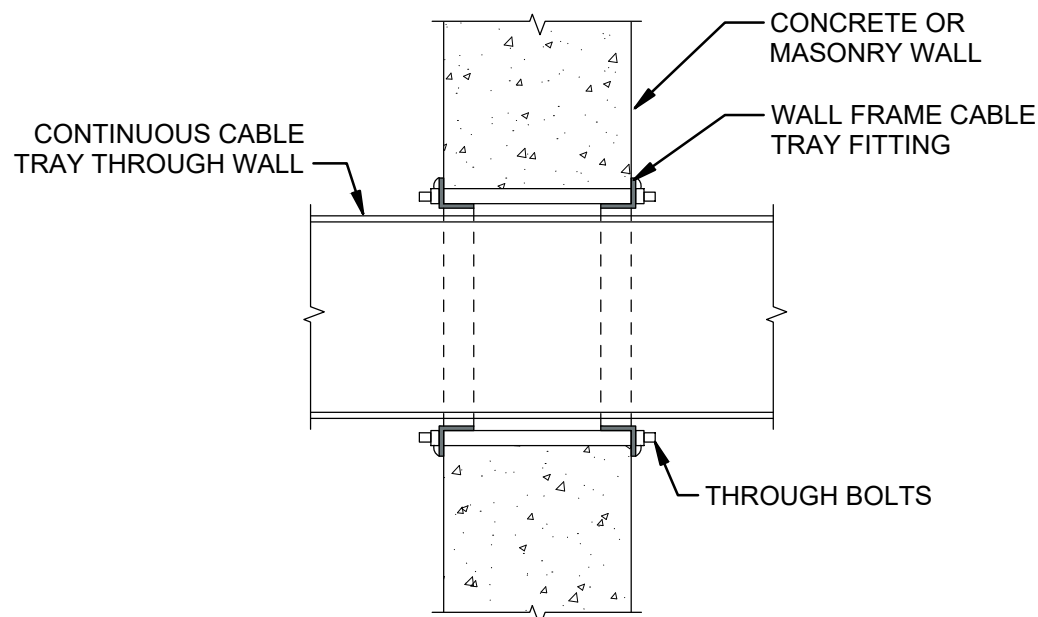
BEAM SUPPORT CONNECTION CONCRETE SLAB CONNECTION



NOTES:

- ALL CABLE TRAY SUPPORT MATERIAL SHALL BE FABRICATED FROM HOT DIP GALVANIZED STEEL. REPAIR ALL DAMAGED COATING AS PER SPECIFICATIONS.
- DETERMINE SPAN AND TYPE OF SUPPORTS. LOCATE SUPPORTS AND SIZE SUPPORT RODS, CONNECTIONS AND BRACES PER MANUFACTURER RECOMMENDATIONS AND SEISMIC REQUIREMENTS.
- USE STAINLESS STEEL HARDWARE IN WET OR CORROSIVE AREAS.

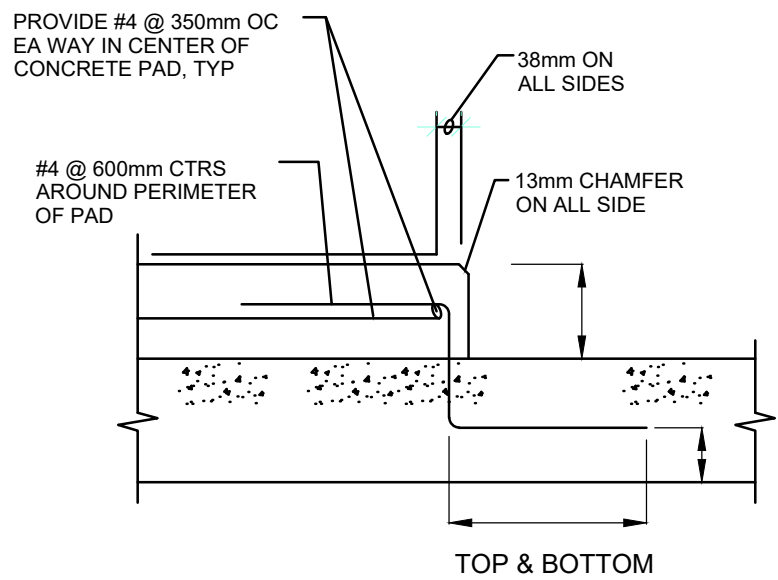
1 CABLE TRAY SUPPORT DETAIL SCALE: N.T.S.



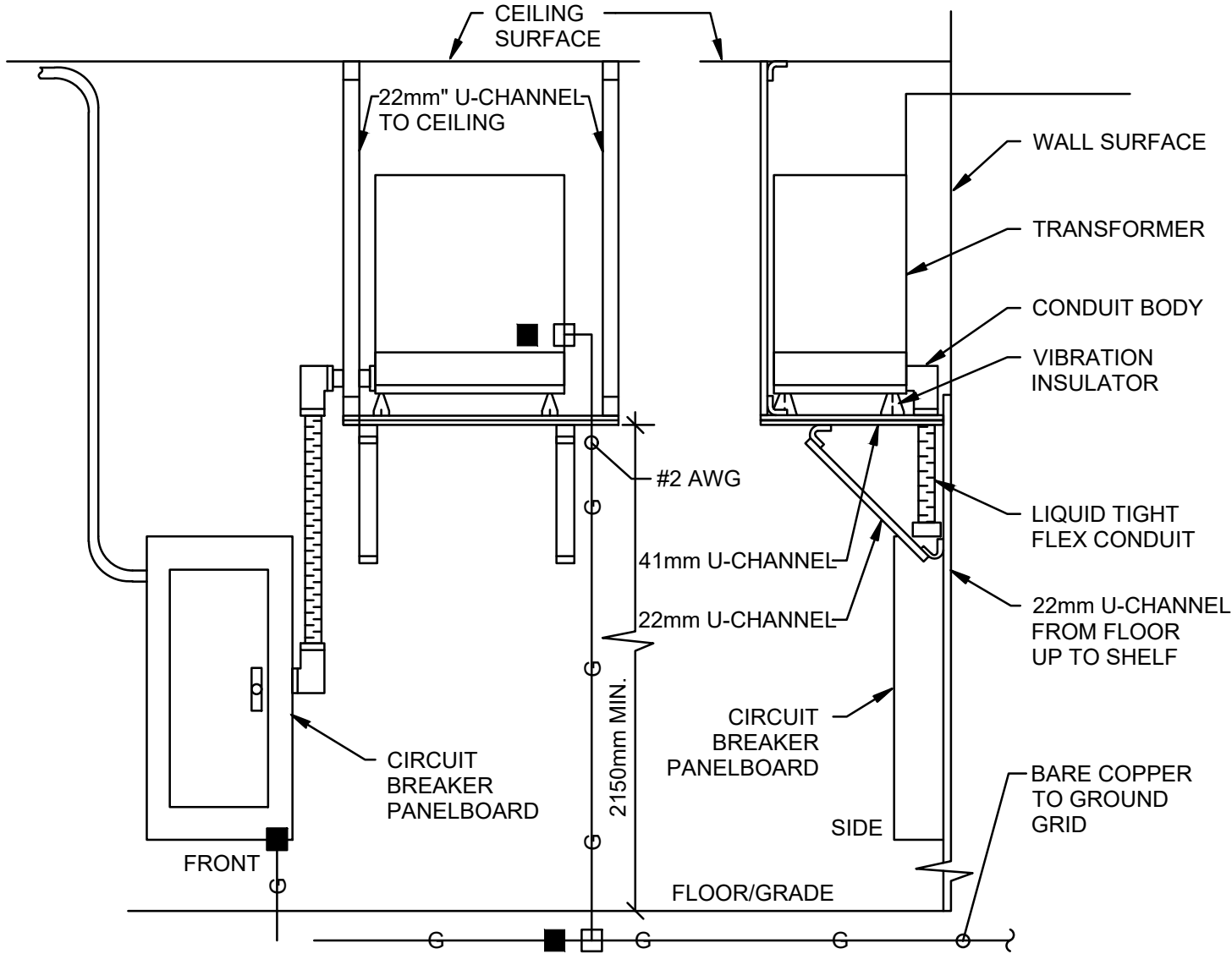
NOTES:

- SEAL OPENING IN AND AROUND CABLE TRAY WITH ULC CERTIFIED FIRE STOP KBS-SEALBAGS OR EQUAL

2 CABLE TRAY PENETRATION DETAIL SCALE: N.T.S.



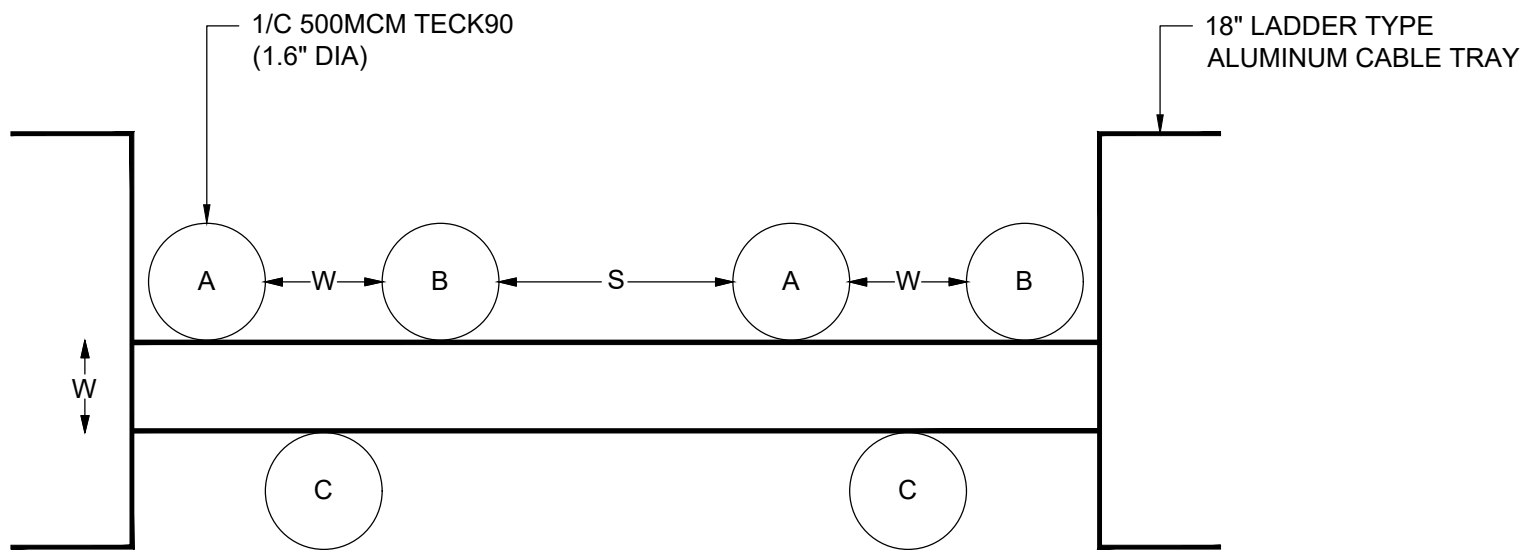
7 CONCRETE PAD SECTION SCALE: N.T.S.



NOTES:

- PROVIDE 30° CLEAR WORK SPACE FOR PANEL
- FRAMING CHANNEL AND HARDWARE SHALL BE PER SPECIFICATIONS
- REFER TO SINGLE LINE DIAGRAM FOR CONDUIT AND CONDUCTOR SIZES

3 TRANSFORMER AND PANELBOARD WALL MOUNT DETAILS SCALE: N.T.S.

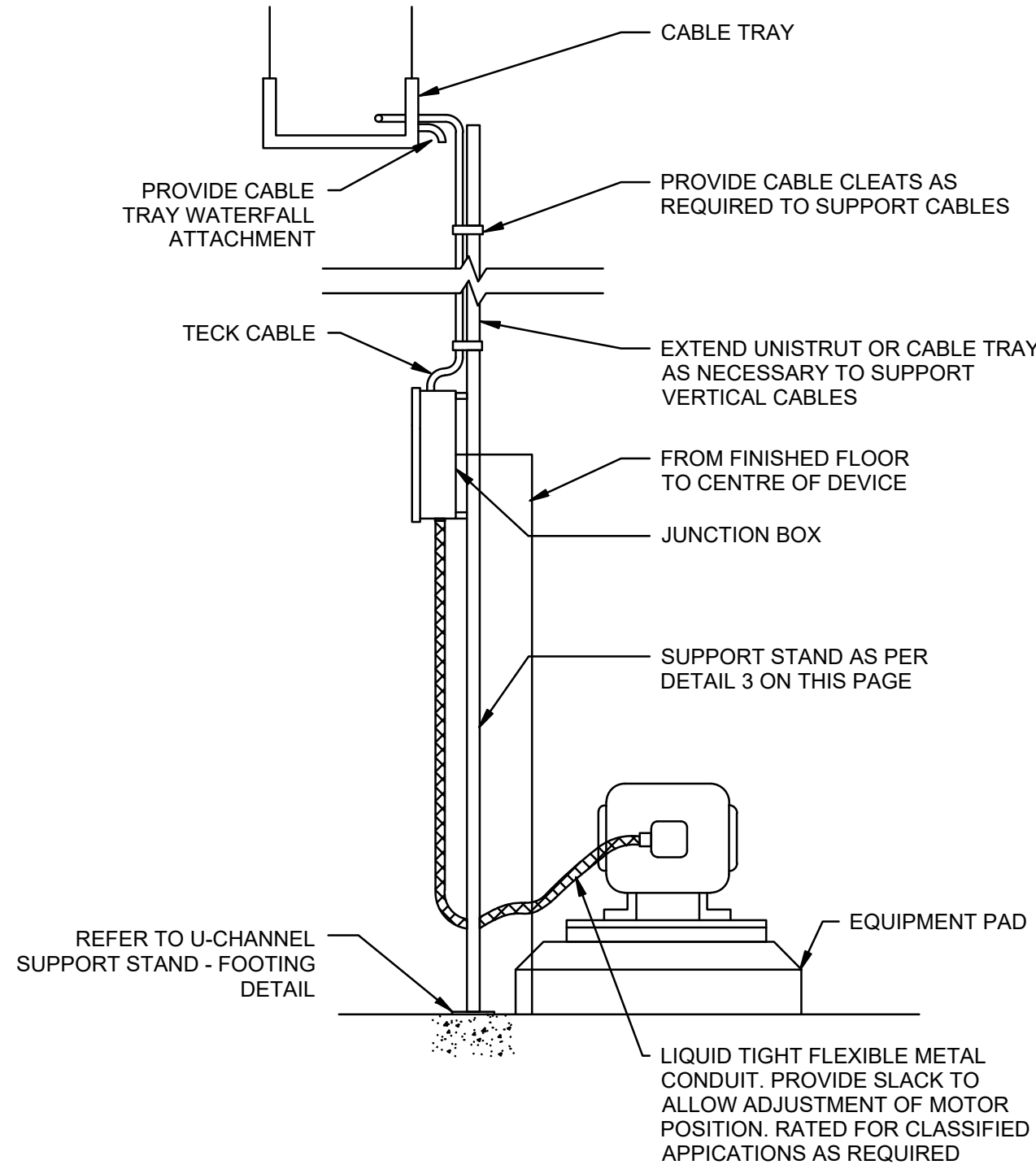


W = 1 CABLE DIAMETER
S = 2 CABLE DIAMETERS

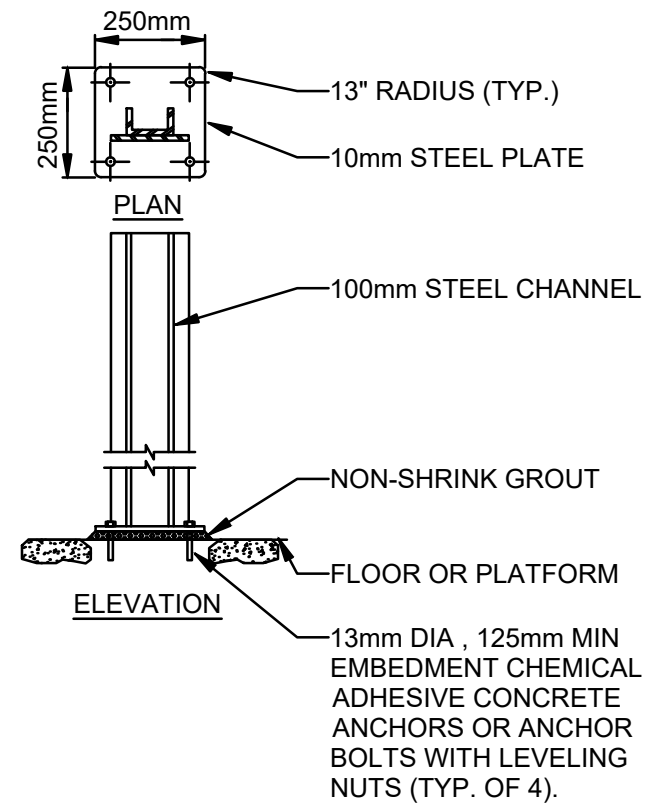
NOTES:

- SINGLE CONDUCTOR CABLES INSTALLED IN PARALLEL SHALL BE INSTALLED TO COMPLY WITH RULE 12-108.
- ALL ONE CONDUCTOR CABLES SHALL BE ATTACHED TO CABLE TRAY WITH CABLE CLAMPS MADE OF NON FERROUS MATERIAL TO PREVENT EDDY CURRENTS INDUCTION.
- WHERE ONE CONDUCTOR CABLES PENETRATE THROUGH CONCRETE WALL ALL THREE PHASE CONDUCTORS SHALL BE ROUTED THROUGH ONE OPENING. DO NOT INSTALL CABLES THROUGH SEPARATE OPENINGS SEPARATED BY REBARS TO AVOID EDDY CURRENTS INDUCTION IN THE REBARS. PROVIDE WALL SCANNING AND CORING PLAN FOR ENGINEERS REVIEW AHEAD OF TIME.

4 TYPICAL CABLE TRAY DETAIL SCALE: N.T.S.



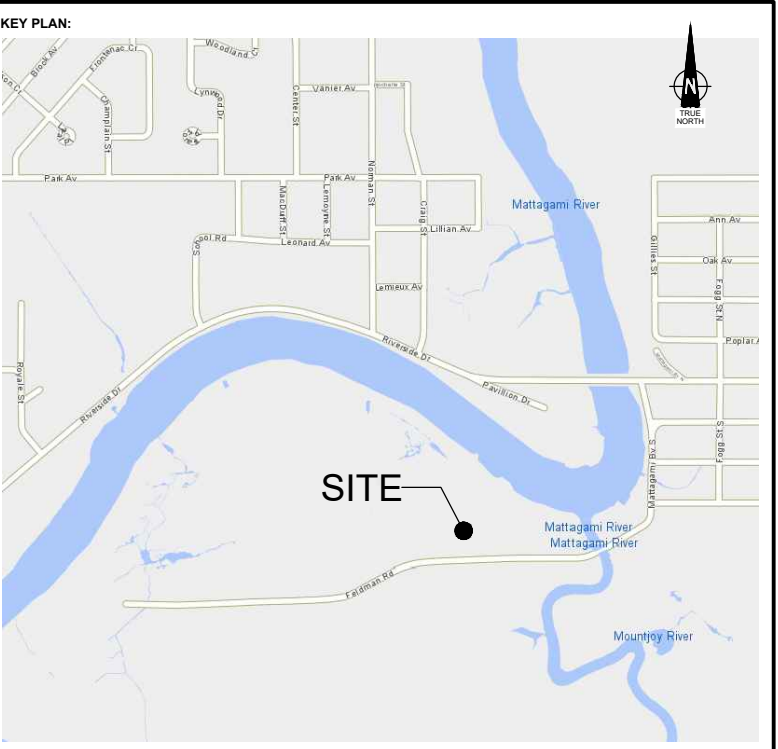
5 CABLE TRAY FEED FROM ABOVE DETAIL SCALE: N.T.S.



NOTES:

- HOT-DIP GALVANIZE ASSEMBLY AFTER FABRICATION.
- USE GALVANIZED MOUNTING HARDWARE. USE WASHERS AND SPLIT-LOCK WASHERS UNDER ALL NUTS AND BOLTS.
- PROVIDE TYPE 316 STAINLESS STEEL FASTENING HARDWARE. SIZE AND CONFIGURATION AS INDICATED. EXTEND UNISTRUT ASSEMBLY VERTICALLY AS NECESSARY TO ACCOMMODATE RACEWAYS DESCENDING FROM OVERHEAD.
- PROVIDE ISOLATION GASKETS IN BETWEEN DISSIMILAR METALS.
- SUPPORTS TO BE DESIGNED BY VENDOR AND STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN ONTARIO.

6 U-CHANNEL SUPPORT - BASE PLATE CONNECTION SCALE: N.T.S.



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No.	Date	Issued For Tender	GA
0	MAR 2025	ISSUED FOR TENDER	GA

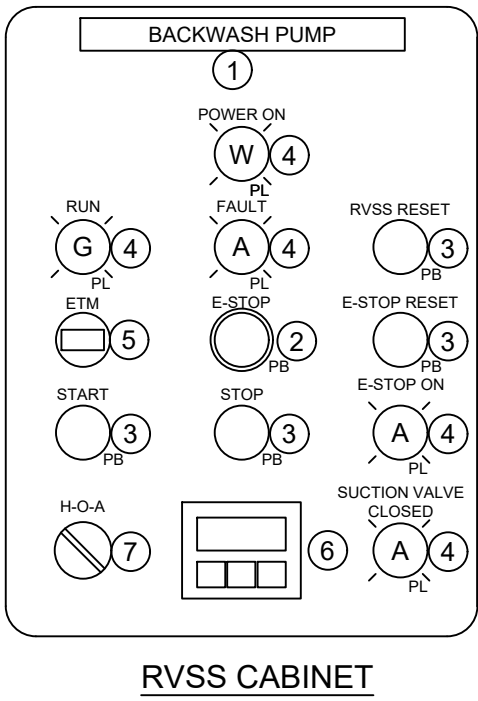


PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

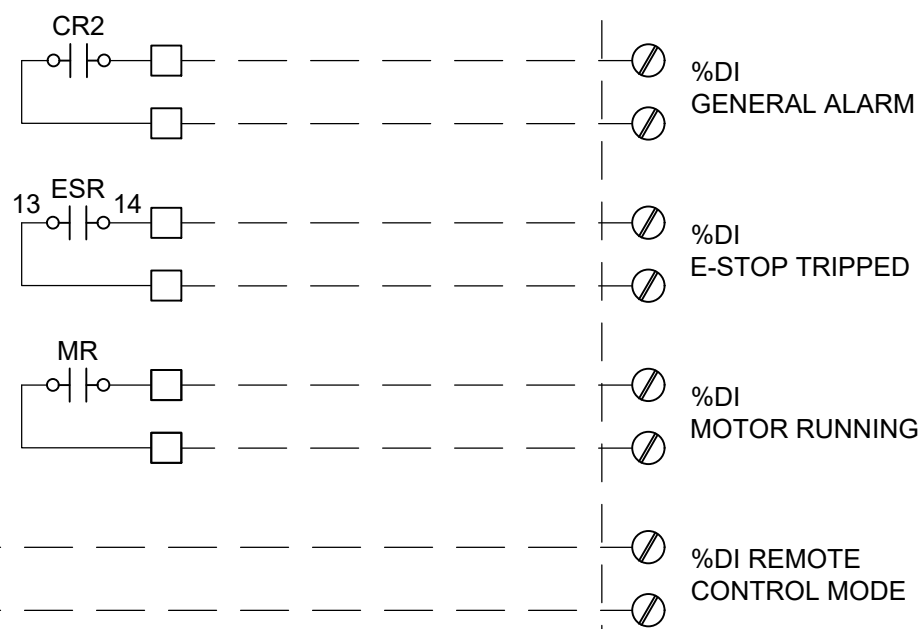
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ELECTRICAL DETAILS

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DESIGNER: DC	DATE: FEB 2025
APPROVER: GA	CHECKER: TGB
PROJECT No: T001960A	DRAWING No: E-401

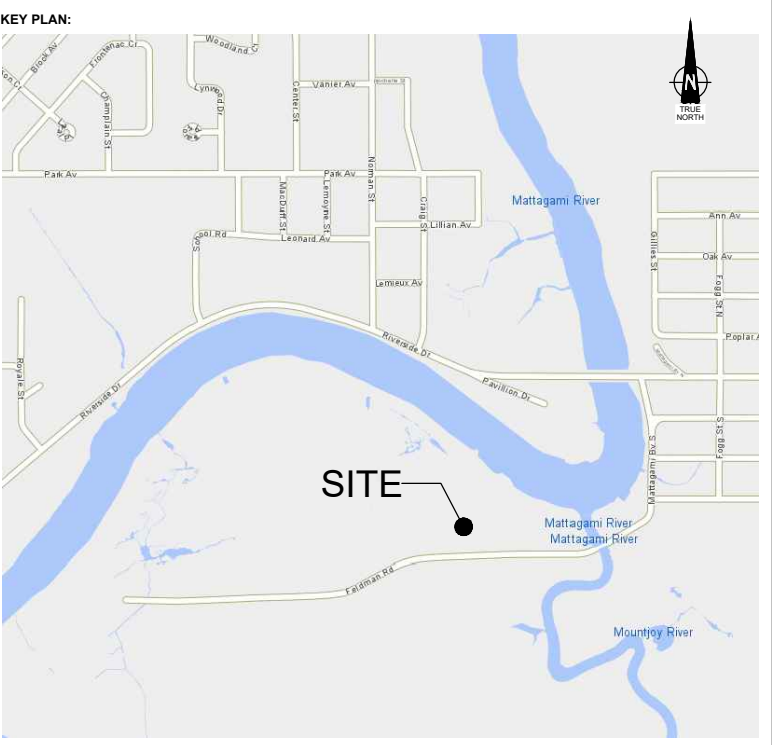
CP-B



ITEM	DESCRIPTION	QTY.
1	NAME PLATE	1
2	PUSH-TWIST RELEASE MUSHROOM HEAD E-STOP BUTTON C/W YELLOW IEC RING	1
3	MOMENTARY PUSH BUTTON, 30mm	4
4	LED PILOT LIGHT, 30mm	5
5	ELAPSED TIME METER	1
6	RVSS DISPLAY KEYPAD	1
7	3 POSITION SELECTOR SWITCH, 30mm	1



	DEVICE TERMINAL
	TERMINAL BLOCK IN LOCAL CONTROL PANEL (LCP)
	TERMINAL BLOCK IN RVSS CABINET
	TERMINAL BLOCK IN PLC



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0	MAR 2025	ISSUED FOR TENDER	GA
No.	Date	Description	By

STAMPS:



CONSULTANT:



CLIENT:



PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:

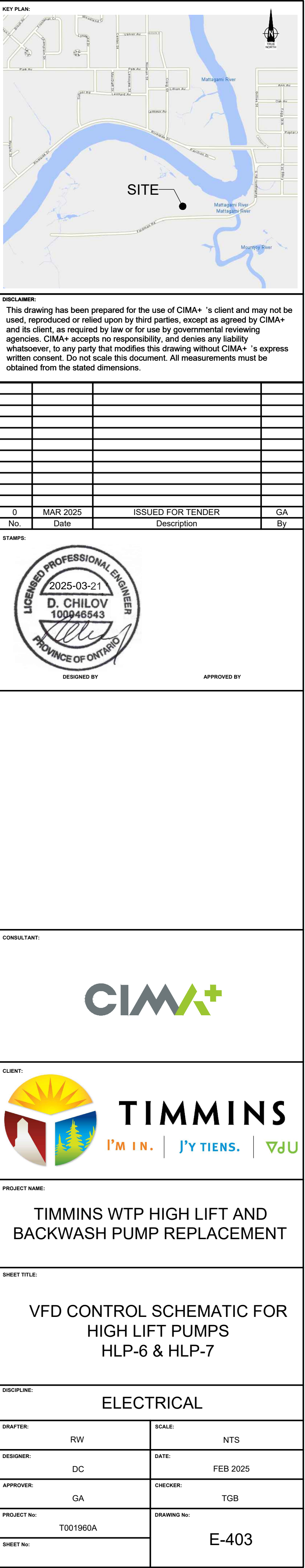
SOFT STARTER CONTROL SCHEMATIC FOR BACKWASH PUMP 500-P-14

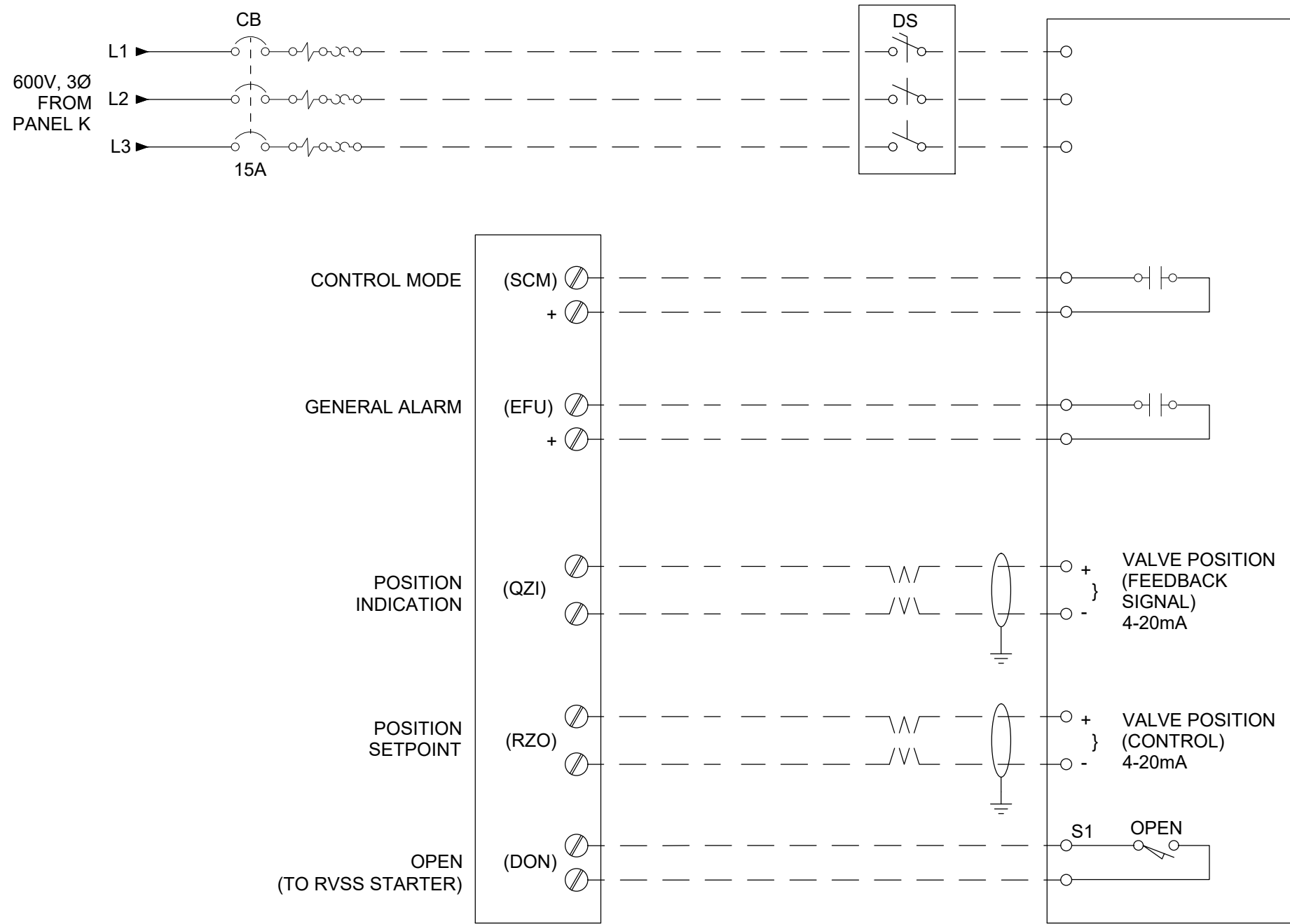
DISCIPLINE:

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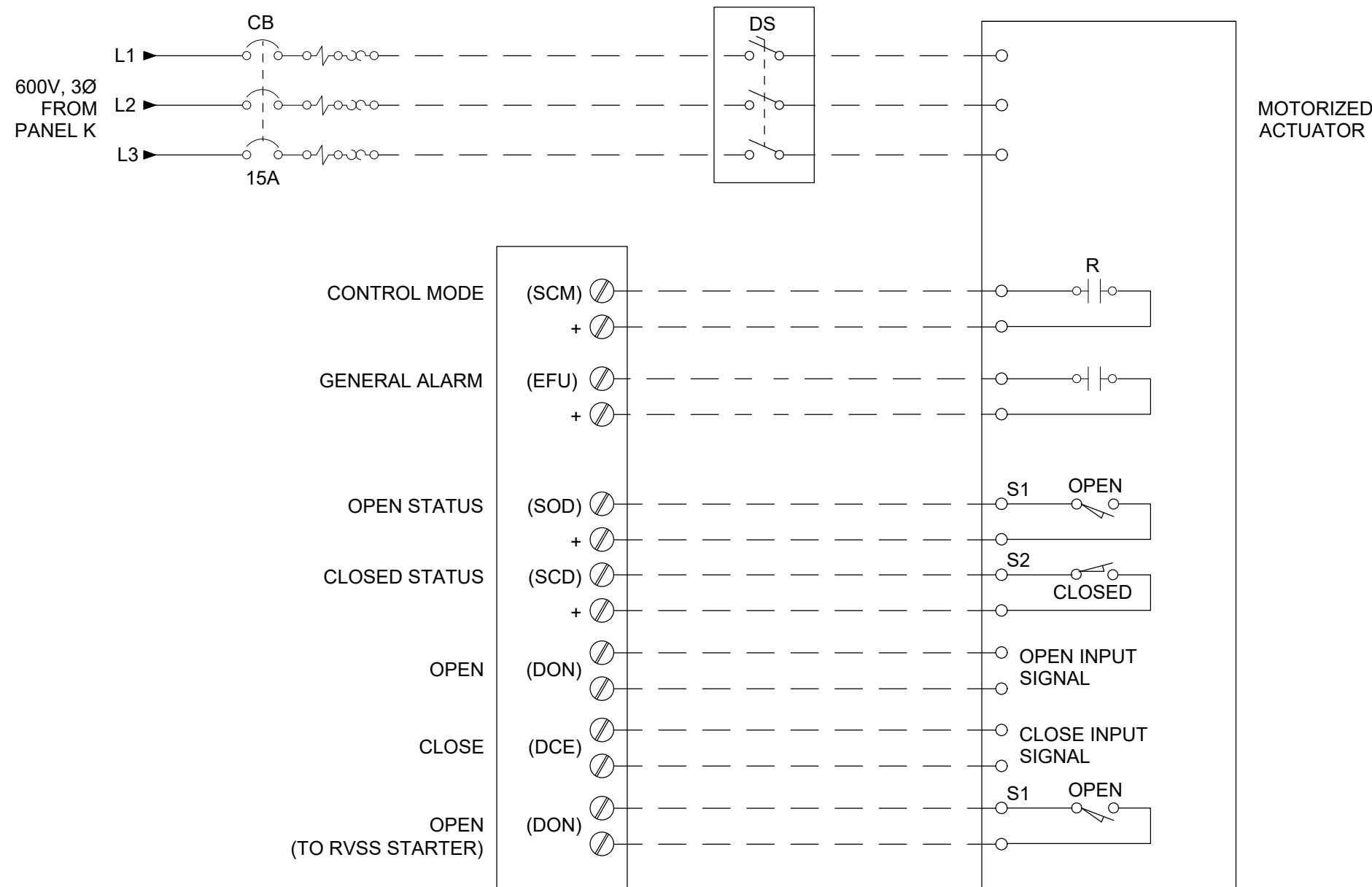
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DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-402
SHEET No:			

CP-B/CP-C





1 MODULATING ACTUATOR WIRING DIAGRAM
SCALE: N.T.S.
TYPICAL FOR MOV-14



2 MOTORIZED (ON/OFF) ACTUATOR WIRING DIAGRAM
SCALE: N.T.S.
TYPICAL FOR MOV-15

LIGHTING PANEL (LP-G)													
VOLTS: 208/120V			LOCATION: -						BUSSING: 225A				
PHASES: 3			FEEDER: TRANSFORMER						MAIN BKR: -				
WIRES: 4									MOUNTING: SURFACE				
									NO. CIR: 42				
DESCRIPTION			CCT	BKR	P	A	B	C	P	BKR	CCT	DESCRIPTION	
PUMP ROOM FAN #F-13			1	15 A	1	●			1	15 A	2	SANITARY SUMP PUMP ALARM	
LIME ROOM FAN #F-14			3	15 A	1		●		1	15 A	4	RECEPT. GARAGE OFFICE	
SHOP FAN #F-16			5	15 A	1			●	1	15 A	6	RECEPT. GARAGE OFFICE	
RECEPT. GARAGE OFFICE			7	15 A	1	●			1	15 A	8	RECEPT. GARAGE OFFICE	
RECEPT. GARAGE OFFICE			9	15 A	1		●		2	15 A	10	RECEPT. OUTSIDE SHOP	
RECEPT. BASEMENT NORTH WALL			11	15 A	1			●			12	RECEPT. ABOVE SHOP BENCH	
RECEPT. BASEMENT NORTH WALL			13	15 A	1	●			2	15 A	14	RECEPT. PLANNER OFFICE	
RECEPT. BASEMENT NORTH WALL			15	15 A	1		●				16		
RECEPT. BASEMENT NORTH WALL			17	15 A	1			●	2	15 A	18	PLANNER OFFICE BASEBOARD HEATER	
SPACE			19		1	●					20		
SPACE			21		1		●				22	SPACE	
SPACE			23		1			●			24	SPACE	

NOTES:

1. EXISTING PANEL SHALL BE REMOVED AS PART OF MCC-3N. TRANSFER ALL ACTIVE CIRCUITS TO NEW PANEL LP-G.

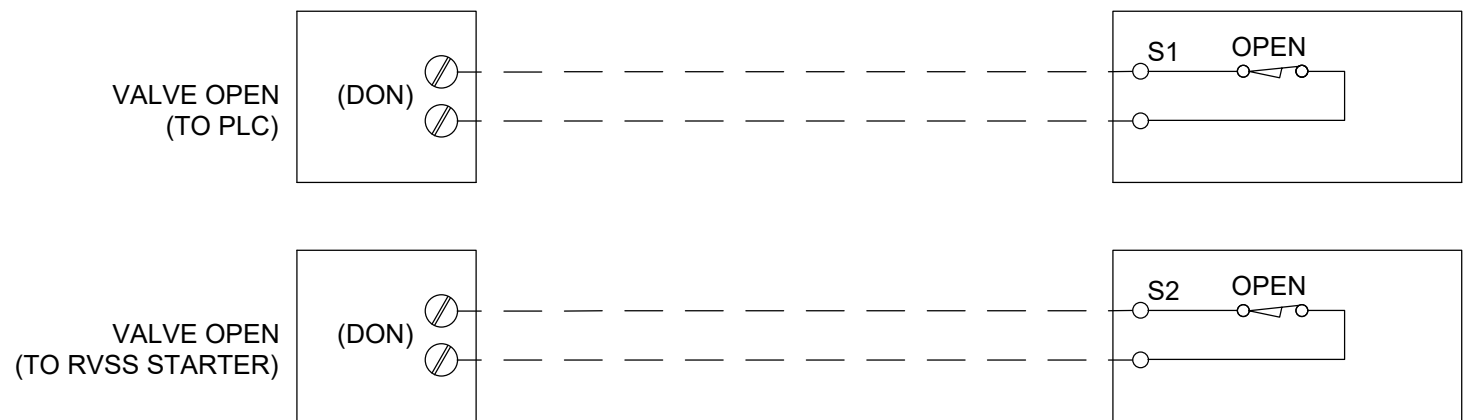
3 EXISTING PANEL LP-G
SCALE: N.T.S.

LIGHTING PANEL (LP-G)											
VOLTS: 208/120V			LOCATION: -						BUSSING: 225A		
PHASES: 3			FEEDER: TRANSFORMER						MAIN BKR: -		
WIRES: 4									MOUNTING: SURFACE		
									NO. CIR: 42		
DESCRIPTION		CCT	BKR	P	A	B	C	P	BKR	CCT	DESCRIPTION
PUMP ROOM FAN #F-13		1	15 A	1	●			1	15 A	2	SANITARY SUMP PUMP ALARM
LIME ROOM FAN #F-14		3	15 A	1		●		1	15 A	4	RECEPT. GARAGE OFFICE
SHOP FAN #F-16		5	15 A	1			●	1	15 A	6	RECEPT. GARAGE OFFICE
RECEPT. GARAGE OFFICE		7	15 A	1	●			1	15 A	8	RECEPT. GARAGE OFFICE
RECEPT. GARAGE OFFICE		9	15 A	1		●				10	RECEPT. OUTSIDE SHOP
RECEPT. BASEMENT NORTH WALL		11	15 A	1			●	2	15 A	12	RECEPT. ABOVE SHOP BENCH
RECEPT. BASEMENT NORTH WALL		13	15 A	1	●			2	15 A	14	RECEPT. PLANNER OFFICE
RECEPT. BASEMENT NORTH WALL		15	15 A	1		●				16	
RECEPT. BASEMENT NORTH WALL		17	15 A	1			●	2	15 A	18	PLANNER OFFICE BASEBOARD HEATER
FLOW TRANSMITTER		19	15 A	1	●					20	
SPD		21				●			15 A	22	SPARE
		23	30 A	3			●		15 A	24	SPARE
		25			●				15 A	26	SPARE
PRESSURE TRANSMITTER		27	15 A	1		●				28	SPACE
SPACE		29					●			30	SPACE
SPACE		31			●					32	SPACE
SPACE		33				●				34	SPACE
SPACE		35					●			36	SPACE
SPACE		37			●					38	SPACE
SPACE		39				●				40	SPACE
SPACE		41					●			42	SPACE

NOTES:

1. EXISTING CIRCUIT TRANSFERRED FROM DEMOLISHED PANEL LP-G
2. SERVICE TRACK ST240 MODEL # TK-ST080-3Y208-FL.

4 NEW PANEL LP-G
SCALE: N.T.S.



5 BFV-01 WIRING DIAGRAM
SCALE: N.T.S.

KEY PLAN:

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No.	0	MAR 2025	ISSUED FOR TENDER	GA
Date			Description	By

STAMPS:

DESIGNED BY

APPROVED BY

CONSULTANT:

CLIENT:

PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:

ACTUATOR WIRING DIAGRAMS & PANEL SCHEDULES

DISCIPLINE:

ELECTRICAL

DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-404
SHEET No:			



P1 EXISTING FILTER TRANSFER PUMP 2 & FILTER TRANSFER PUMP 3
E101 SCALE: N.T.S.



GENERAL NOTES:

1. RELOCATE EXISTING WALL MOUNTED CONTROL PANELS, EXTEND CONTROL AND POWER WIRING WIRING AS REQUIRED. REFER TO DRAWINGS E101 AND E201.

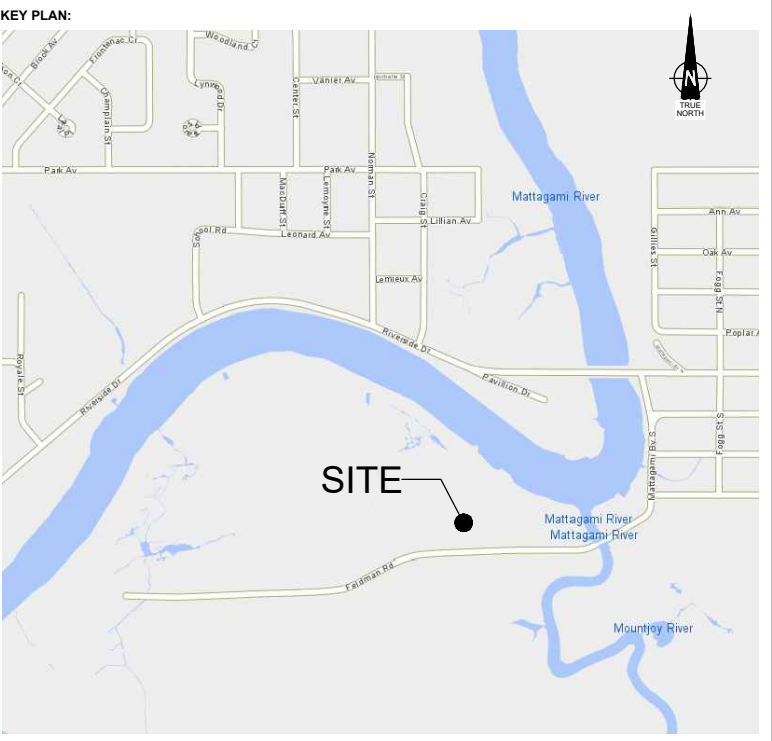


P2 EXISTING JUNCTION BOX IGB AND JUNCTION BOX 13-210-P2
E101 SCALE: N.T.S.



GENERAL NOTES:

1. RELOCATE EXISTING WALL MOUNTED JUNCTION BOXES AND MOUNT ON NEW UNISTRUT CHANNEL STRUCTURE IN FRONT OF NEW WATER PIPE. CUT BACK CONTROL WIRING WIRING AS REQUIRED. REFER TO DRAWINGS E101 AND E201.

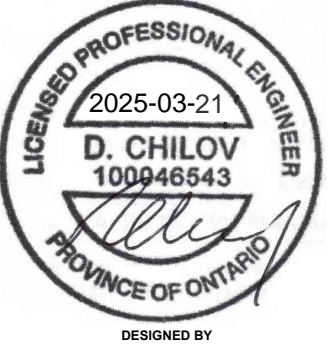


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[illegible]

STAMPS:



APPROVED BY _____

CONSULTANT:



CLIENT:



PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:

ELECTRICAL DETAILS

SHEET 1

DISCIPLINE:

ELECTRICAL

DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-405
SHEET No:			

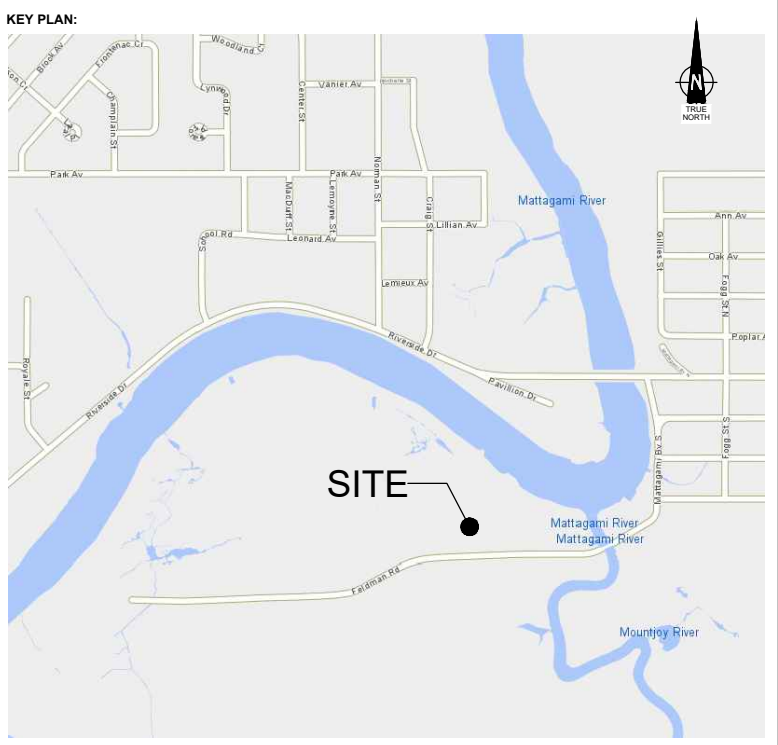


P1 FILTERS 1, 2, 3 PIPE GALLERY ROOM - WALL ELEVATION DETAIL
E101 SCALE: N.T.S.

NOTES:

◇ RELOCATE EXISTING WALL MOUNTED RECEPTACLE AND CONDUITS TO PREPARE SPACE FOR TWO (2) FILTER TRANSFER PUMP CONTROL PANELS MOUNTING. REFER TO DRAWINGS E101 AND E201.

◇ SPACE DESIGNATED FOR FILTER TRANSFER PUMP CONTROL PANELS RELOCATION



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No.	Date	Description	By

STAMPS:



DESIGNED BY

APPROVED BY

CONSULTANT:



CLIENT:



PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

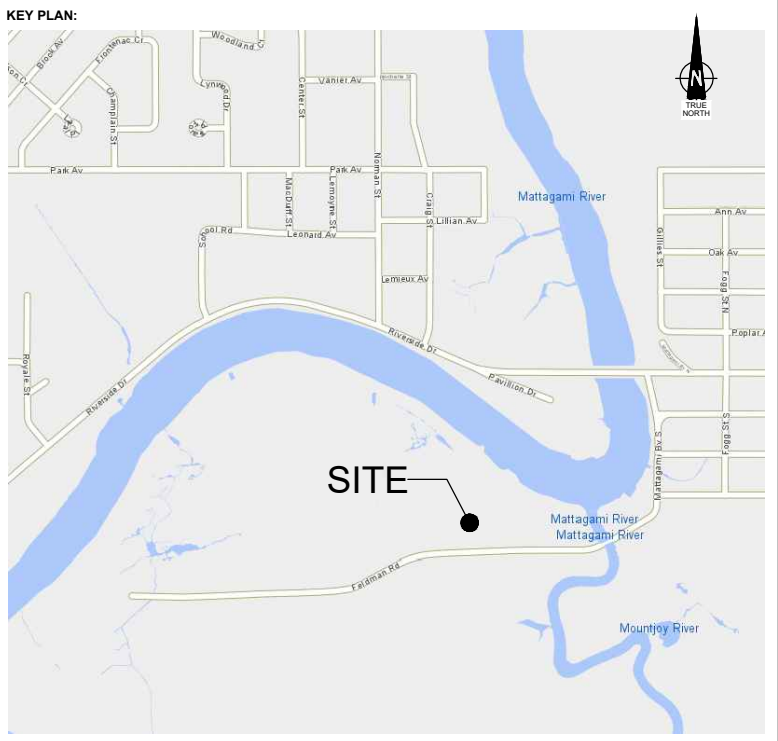
SHEET TITLE:
ELECTRICAL DETAILS
SHEET 2

DISCIPLINE: ELECTRICAL			
DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-406
SHEET No:			



NOTES:

- 1 DISCONNECT AND PULL OUT BONDING CONDUCTOR. RE-ENTER THROUGH HLP#4 SECTION AND RECONNECT TO GROUND BUSS IN THE MCC.
- 2 DISCONNECT CONTROL WIRING FROM ALL CONTOL DEVICES INSIDE MCC AND PULL THE CABLES OUT AND TERMINATE THE WIRING IN THE NEW JUNCTION BOX ABOVE THE MCC. RE-ENTER WIRING RELATED TO HLP#4 MONITORING INTO HLP#4 SECTION AND RECONNECT TO EXISTING CTS AND CONTROL COMPONENTS. REFER TO DRAWING E203 FOR ADDITIONAL INSTRUCTIONS.



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No.	Date	Description	By



CONSULTANT:



PROJECT NAME:
TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:
ELECTRICAL DETAILS
SHEET 3

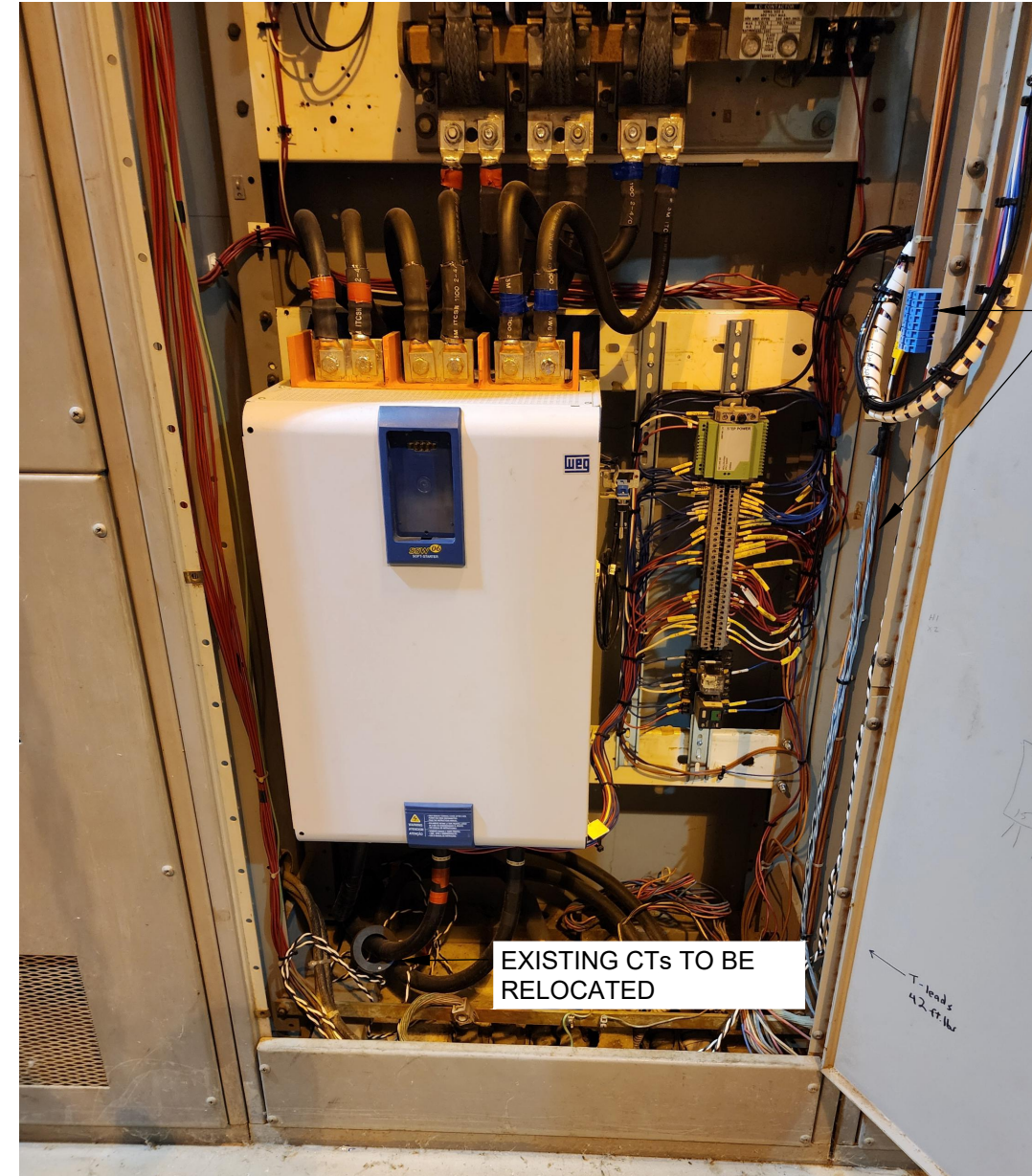
DISCIPLINE:
ELECTRICAL

DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-407
SHEET No:			

P1 HIGH LIFT PUMP ROOM #1 MCC DETAIL
E103 SCALE: N.T.S.



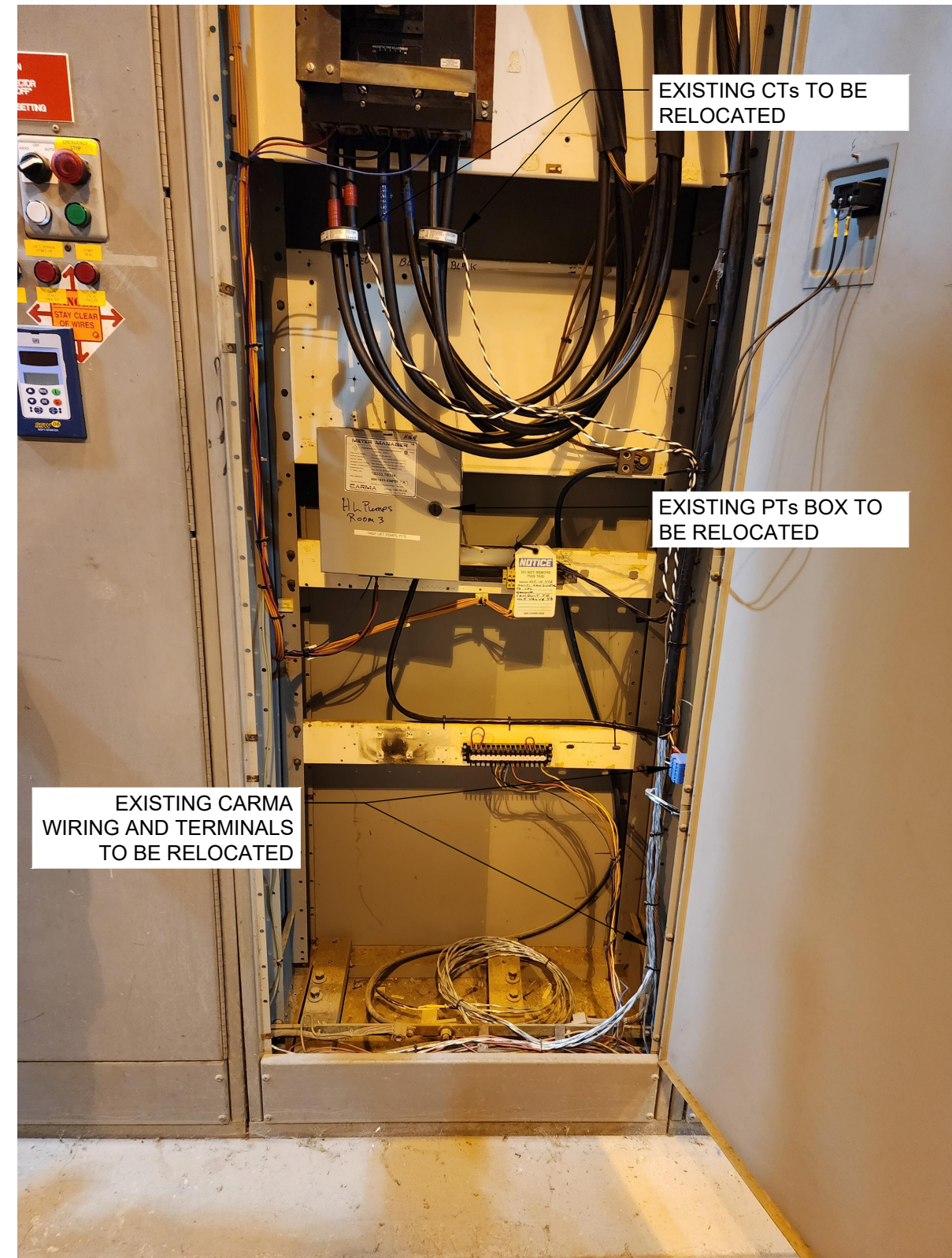
P1 EXISTING CARMA EQUIPMENT (EAST WALL)
E408 SCALE: N.T.S.



P2 EXISTING MCC HLP-6 STARTER SECTION
 E408 SCALE: N.T.S.



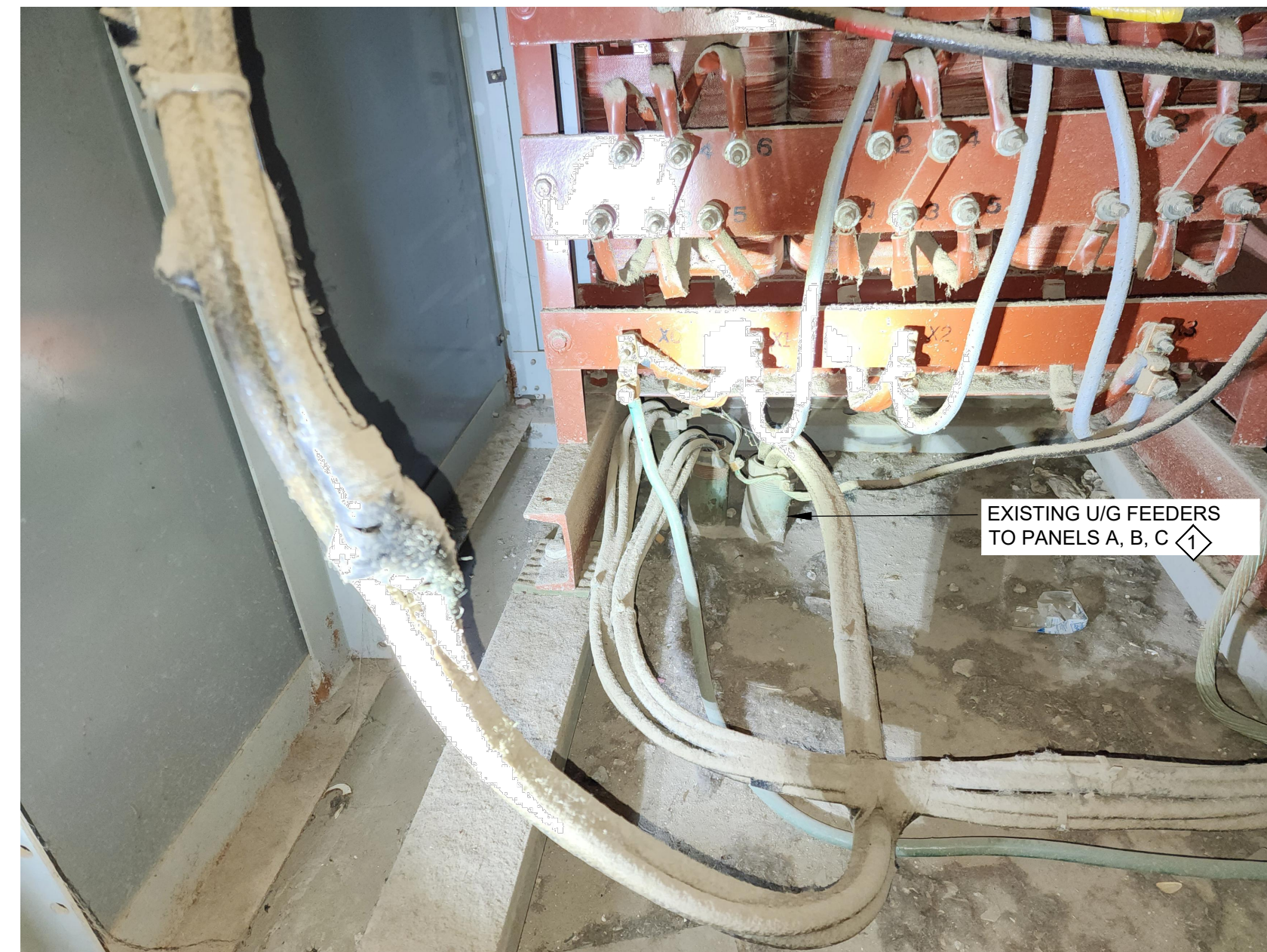
P3 PUMP ROOM #2 DETAIL (PANEL K LOCATION)
E408 SCALE: N.T.S.



P4 EXISTING MCC HLP-5 BREAKER SECTION
E408 SCALE: N.T.S.



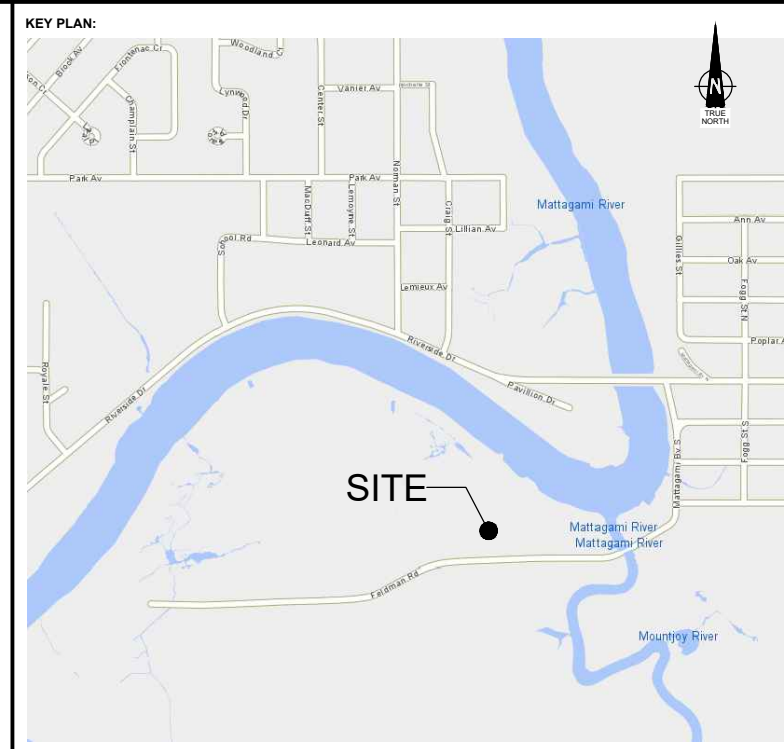
P5 EXISTING PTs BOX DETAIL IN HLP-5
E408 SCALE: N.T.S.



P6 EXISTING PANEL DTT-1 & TRANSF. SECTION OF THE MCC
E408 SCALE: N.T.S.

NOTES:

- 1 REUSE EXISTING UNDERGROUND FEEDERS, PROVIDE NEW RIGID PVC CONDUIT TO CONNECT TO NEW PANEL DP-1. REFER TO DRAWING E305 FOR ADDITIONAL INFORMATION.



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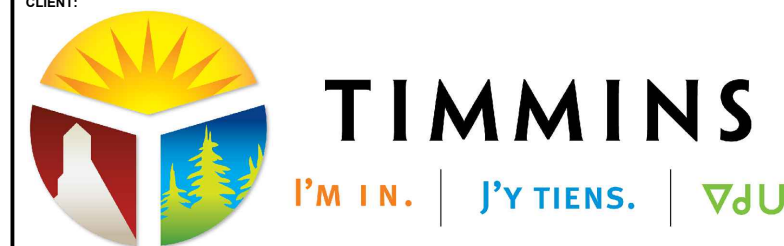
0	MAR 2025	ISSUED FOR TENDER	GA
No.	Date	Description	By



CONSULTANT:



CLIENT:



PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

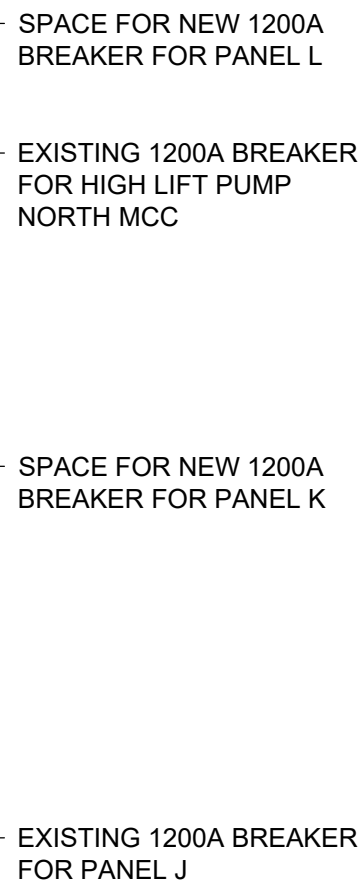
SHEET TITLE:

ELECTRICAL DETAILS
SHEET 4

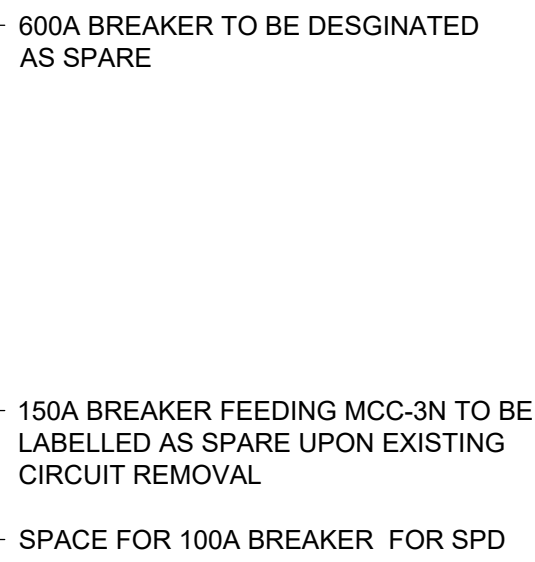
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ELECTRICAL

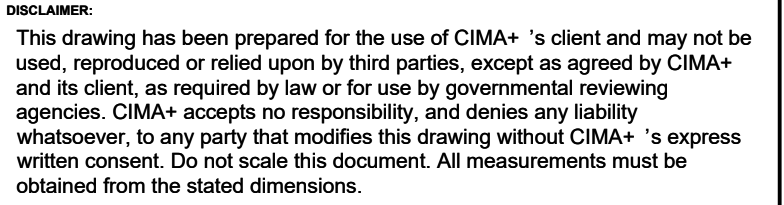
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DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-408
SHEET No:			



P3 EXISTING MCC-3N AND ATS
E101 SCALE: N.T.S.



P2 EXISTING PANEL J DETAIL
E101 SCALE: N.T.S.



0	MAR 2025	ISSUED FOR TENDER		GA
No.	Date	Description		By

STAMPS:



APPROVED BY

CONSULTANT:



CLIENT:



PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

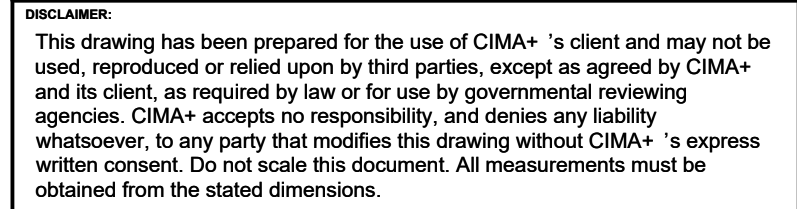
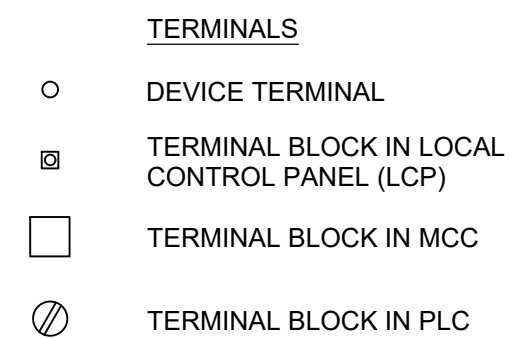
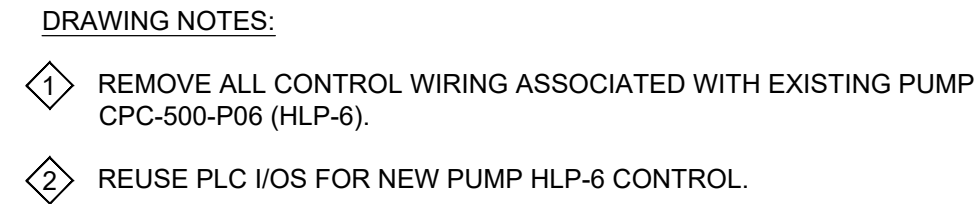
SHEET TITLE:

ELECTRICAL DETAILS
SHEET 5

DISCIPLINE:

ELECTRICAL

DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	FEB 2025
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	E-409
SHEET No:			



STAMPS:

2025-03-21

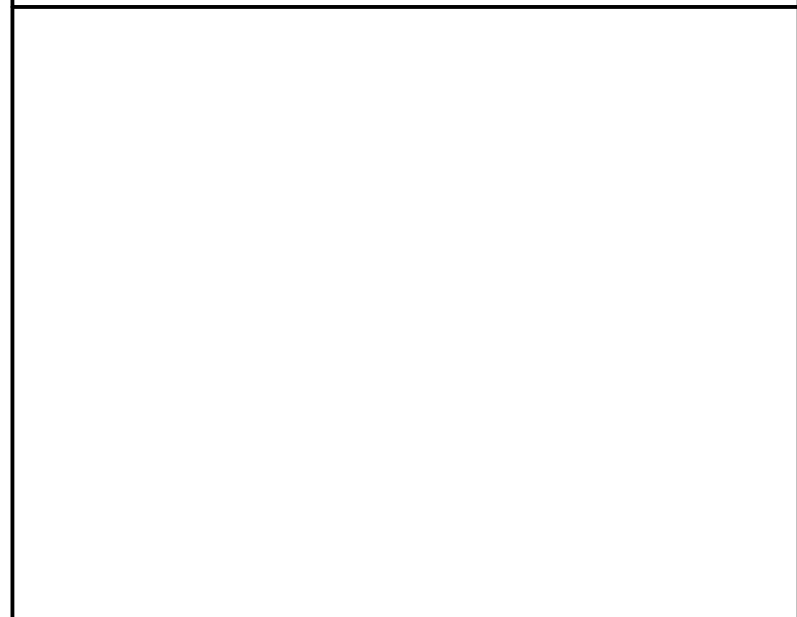
D. CHILOV

100946543

PROVINCE OF ONTARIO

DESIGNED BY

APPROVED BY



CONSULTANT: _____



PROJECT NAME:

TIMMINS WTP HIGH LIFT AND
BACKWASH PUMP REPLACEMENT

SHEET TITLE:

CP-C: INPUTS/OUTPUTS -
REMOVALS

DISCIPLINE: INSTRUMENTATION

DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	I-101
SHEET No:			

TITLEBLOCK 22x34 VERT ENG

TTLB-V02010-21 - HFD-V020301-15

FIELD - HIGH LIFT PUMP-7
PUMP ROOM - 2

I/O PANEL B

FISCHER ROSEMOUNT DELTA-V DCS
I/O MODULE

500-HLP-07
(VFD-HLP7)

SPEED
SETPOINT

11
12

VFD-HLP7-4
VFD-HLP7-5

HLP7-SP+
HLP7-SP-

TS2-FU33
TS2-34

YELLOW
BLACK

500-HLP-07 SPEED CONTROL
TB1-1
TB2-2
RACK
CD
CH

SPEED
FEEDBACK

CM
A1

VFD-HLP7-6
VFD-HLP7-7

HLP7-SD+
HLP7-SD-

TS2-FU23
TS2-24

RED
BLACK

500-HLP-07 SPEED INDICATION
TB1-7
TB2-8
RACK
CD
CH

FAULT

R-C2
N-01

VFD-HLP7-1
VFD-HLP7-2

VFD-HLP7-1

TB1-FU2
TB1-N

RUN
INDICATION

RC-1
N-01

VFD-HLP7-3

HLP7-FAULT

A1 TS1 13
A2 R33 14

YELLOW
WHITE

500-HLP-07 FAULT
TB1-1
TB2-PSC
RACK
CD
CH

HLP7
E-STOP

RC-1
N-01

VFD-HLP7-3

HLP7-RUN

A1 TS1 13
A2 R34 14

BLACK
WHITE

500-HLP-07 RUN
TB1-2
TB2-PSC
RACK
CD
CH

HLP7
NOT IN AUTO

RC-1
N-01

VFD-HLP7-3

HLP7-ESTOP

A1 TS1 13
A2 R34 14

BLACK
WHITE

500-HLP-07 E-STOP ACTIVE
TB1-2
TB2-PSC
RACK
CD
CH

START/STOP

+24
D1

VFD-HLP7-8
VFD-HLP7-9

HLP7-NOT IN AUTO

A1 TS1 13
A2 R34 14

BLACK
WHITE

500-HLP-07 NOT IN AUTO
TB1-2
TB2-PSC
RACK
CD
CH

HLP7-ST+
HLP7-ST-

13 TS1 A1
14 R1 A2

YELLOW
WHITE

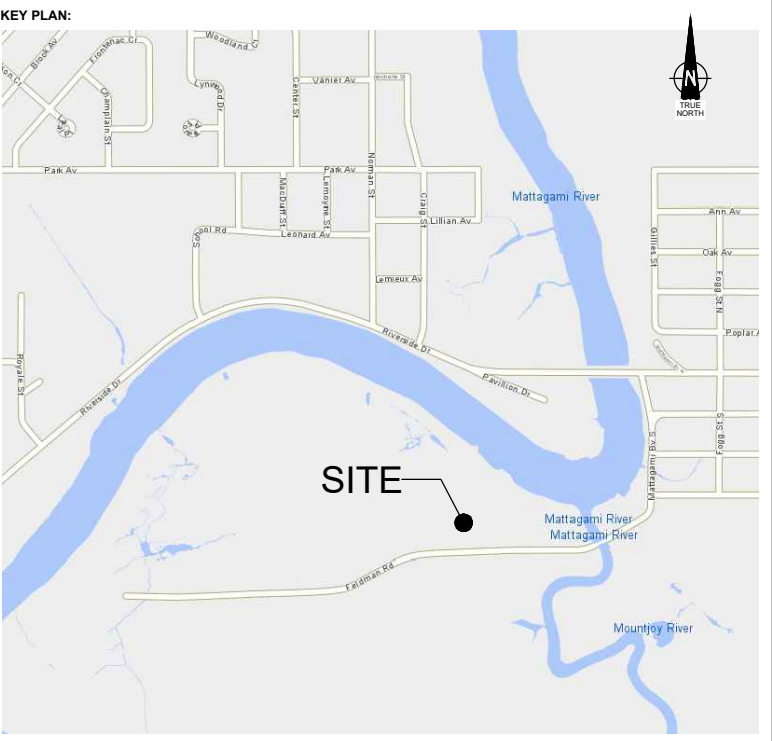
500-HLP-07 START/STOP COMMAND
TB1-1
TB2-PSC
RACK
CD
CH

NEUTRAL BUS

PRINT DATE: MARCH 2024
PATH: C:\cma-c13\projects\T001960A - Timmins WTP Backwash Upgrade (City of Timmins)\300 - DESIGN\310 - Draw\CAD Sheets\T001960A-112.dwg

1 HIGH LIFT PUMP CPC-500-P07 - NEW WORK.
1112 SCALE: N.T.S.

- TERMINALS
- DEVICE TERMINAL
 - ▣ TERMINAL BLOCK IN LOCAL CONTROL PANEL (LCP)
 - TERMINAL BLOCK IN MCC
 - ⊗ TERMINAL BLOCK IN PLC



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No.	Date	Description	By



PROJECT NAME:
TIMMINS WTP HIGH LIFT AND
BACKWASH PUMP REPLACEMENT

SHEET TITLE:
CP-B: INPUTS/OUTPUTS -
NEW WORK - SHEET 2

INSTRUMENTATION			
DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	I-112
SHEET No:			

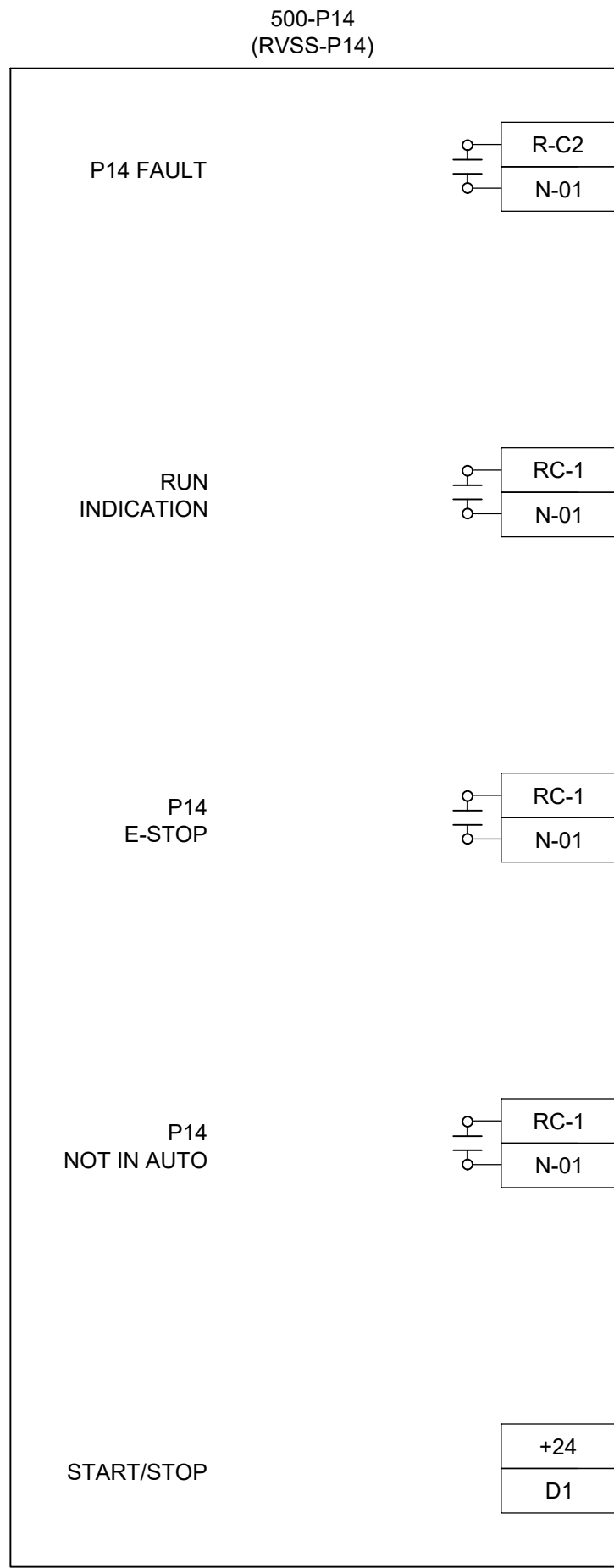
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TTLB-V002010-21 - INFO-V002301-15

FIELD - BACKWASH PUMP 500-P-14
PUMP ROOM - 2

I/O PANEL B

FISCHER ROSEMOUNT DELTA-V DCS
I/O MODULE

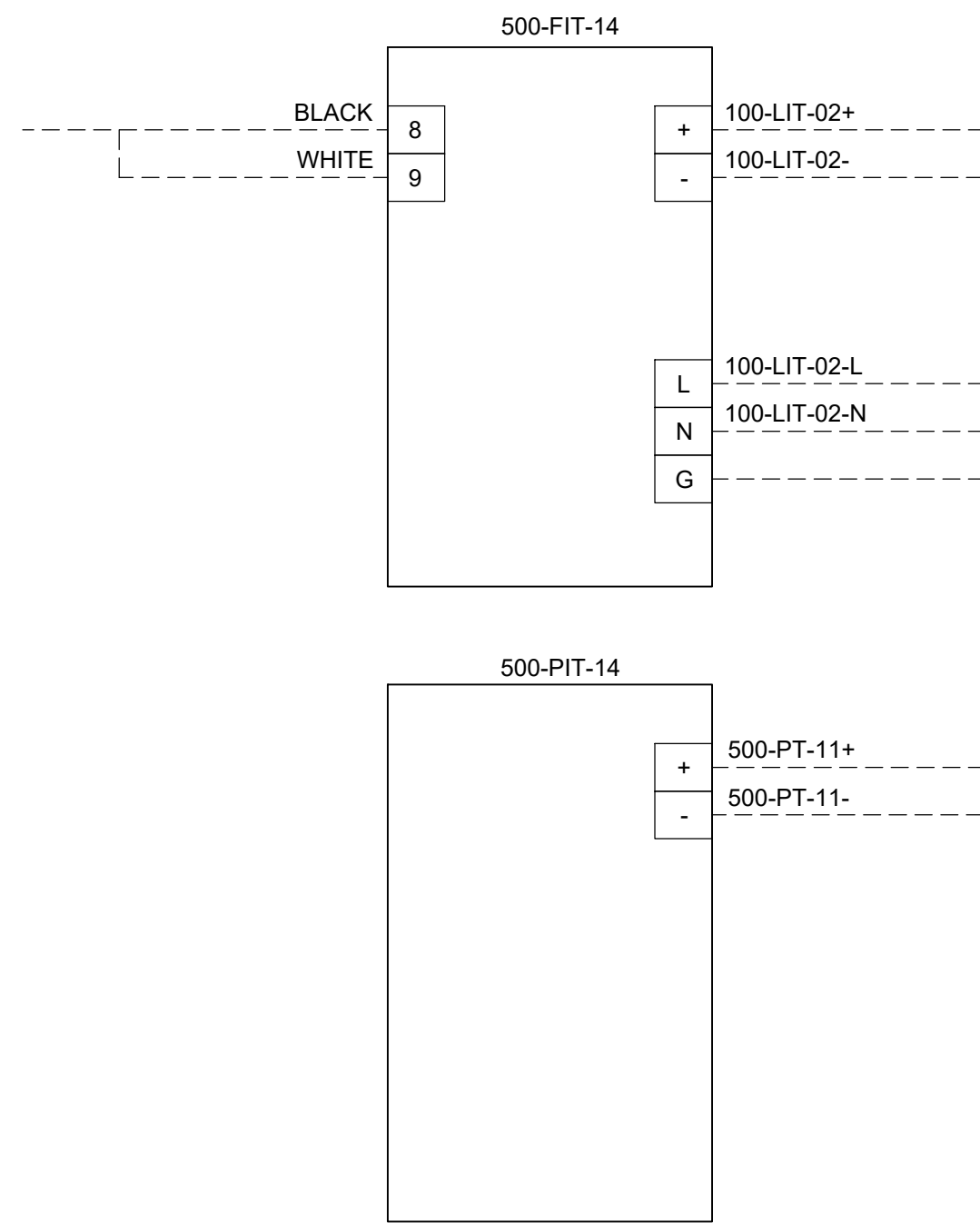
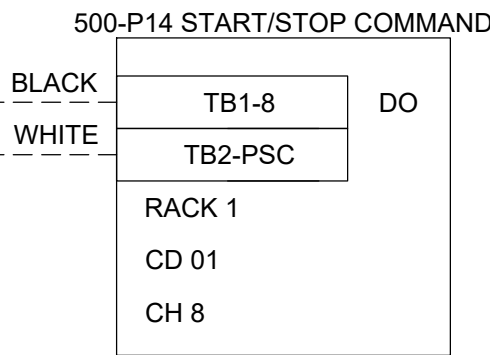
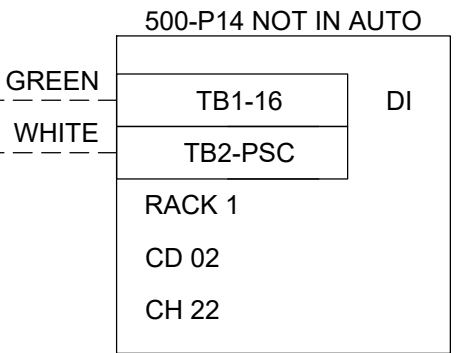
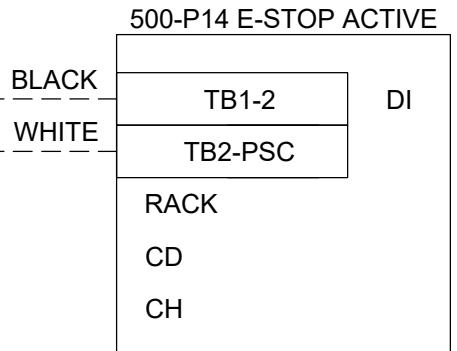
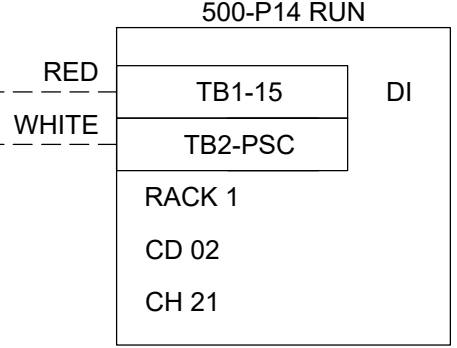
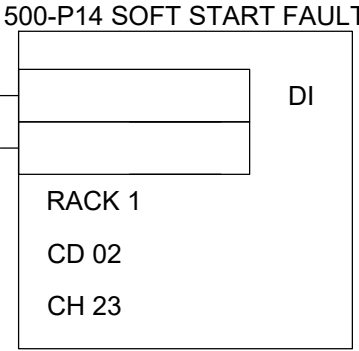
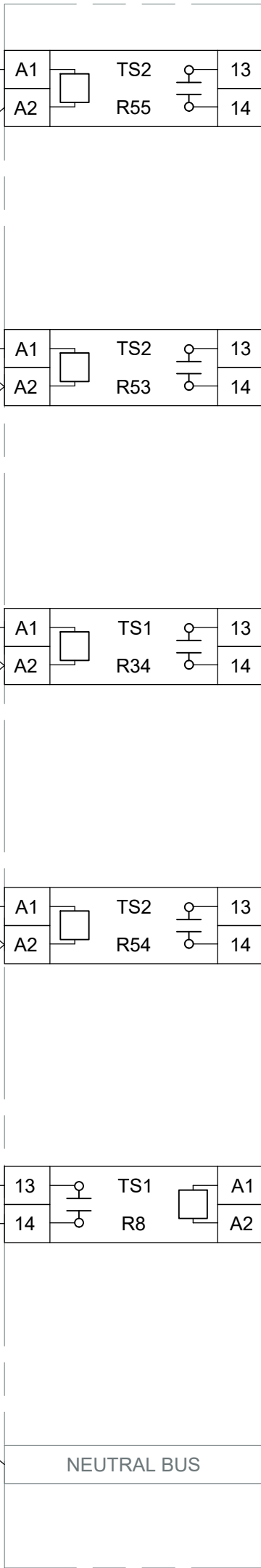


500-P14 PWR

500-P14 RDY

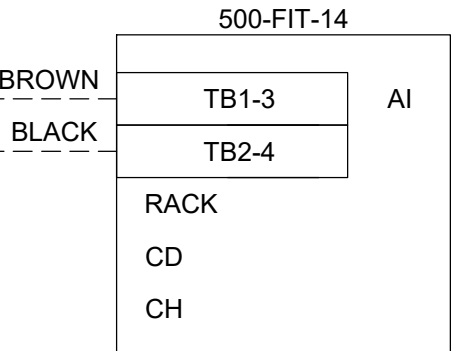
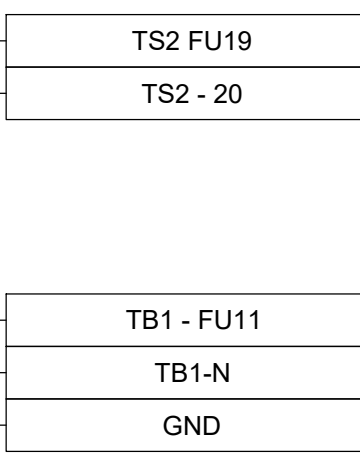
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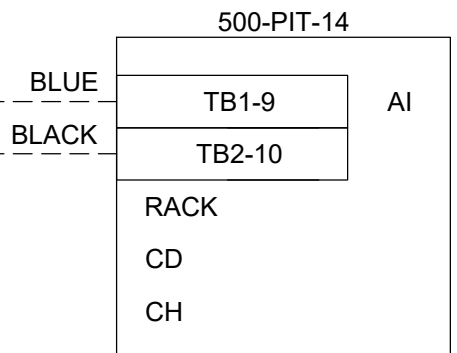
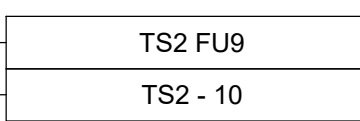
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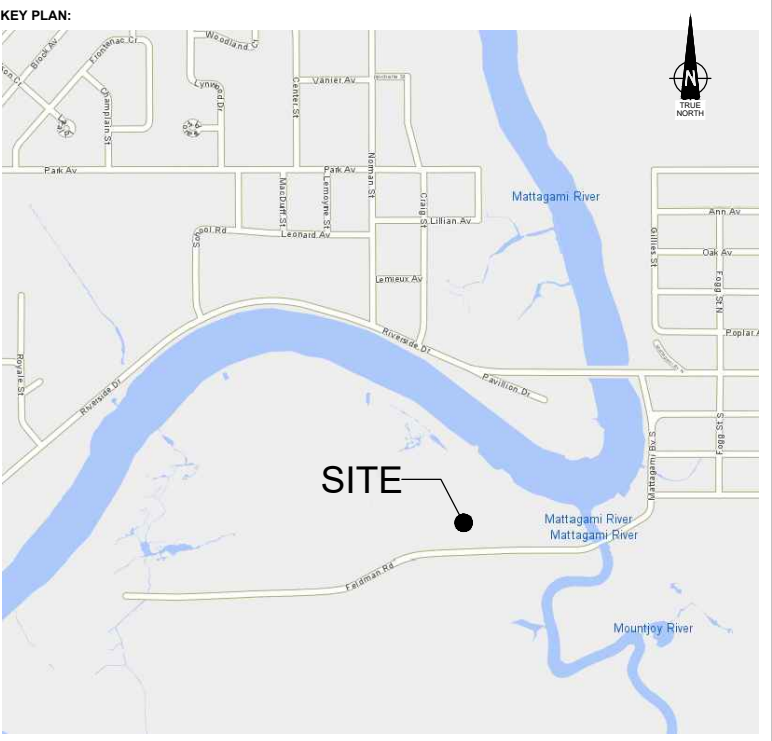
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500-PT-11-



TERMINALS

- DEVICE TERMINAL
- ☑ TERMINAL BLOCK IN LOCAL CONTROL PANEL (LCP)
- TERMINAL BLOCK IN MCC
- ⊗ TERMINAL BLOCK IN PLC



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0	MAR 2025	ISSUED FOR TENDER	GA
No.	Date	Description	By



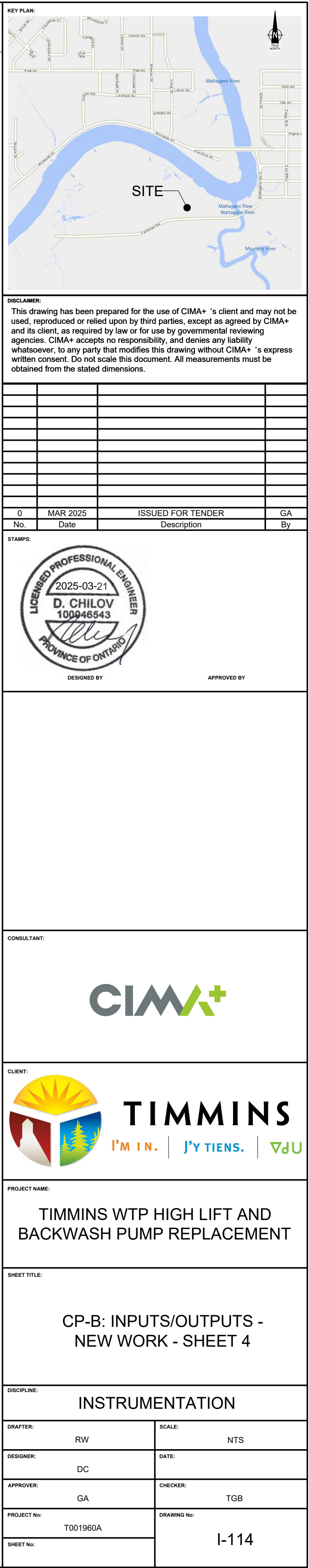
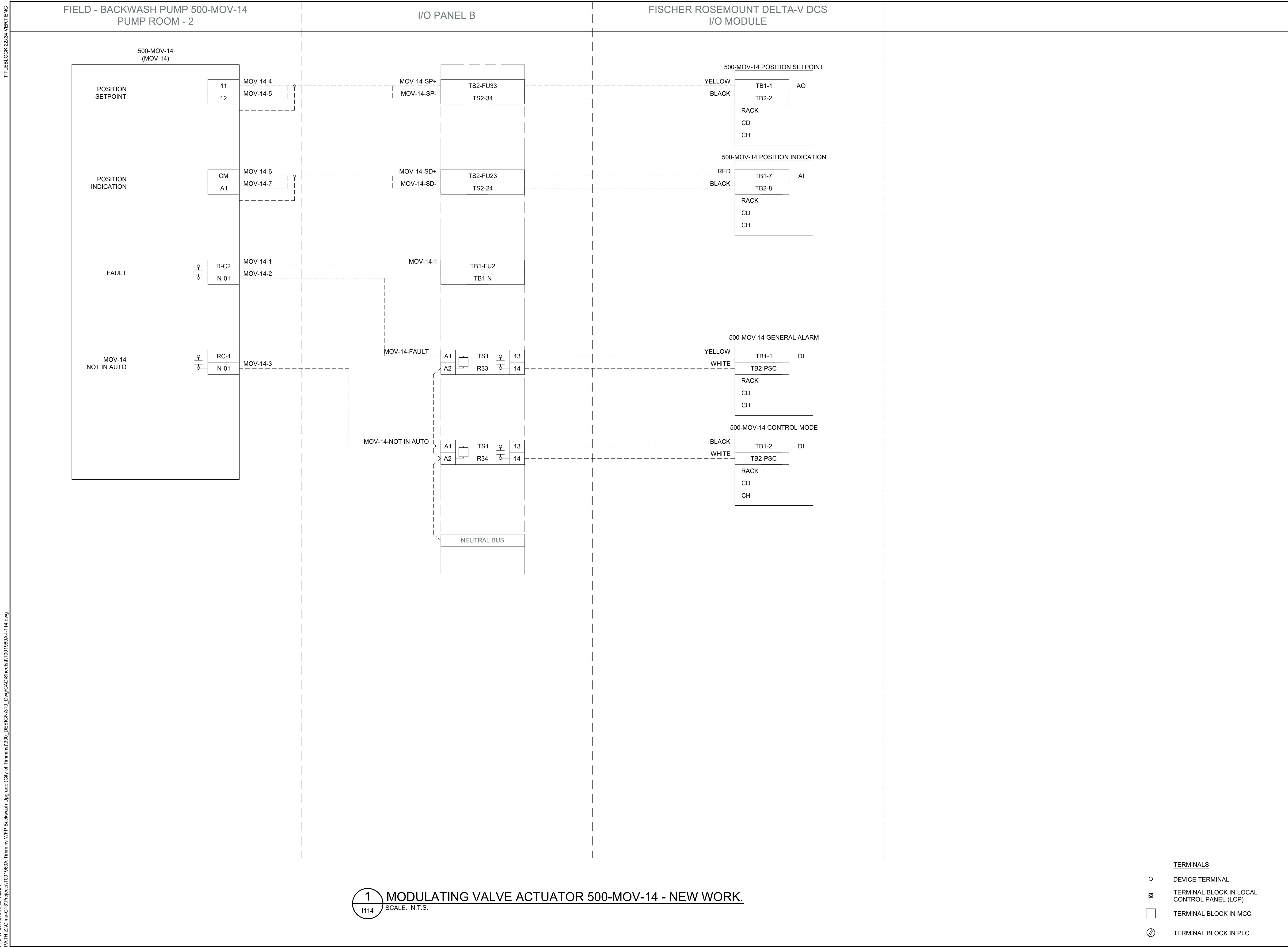
PROJECT NAME:

TIMMINS WTP HIGH LIFT AND BACKWASH PUMP REPLACEMENT

SHEET TITLE:

CP-B: INPUTS/OUTPUTS - NEW WORK - SHEET 3

INSTRUMENTATION			
DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	I-113
SHEET No:			



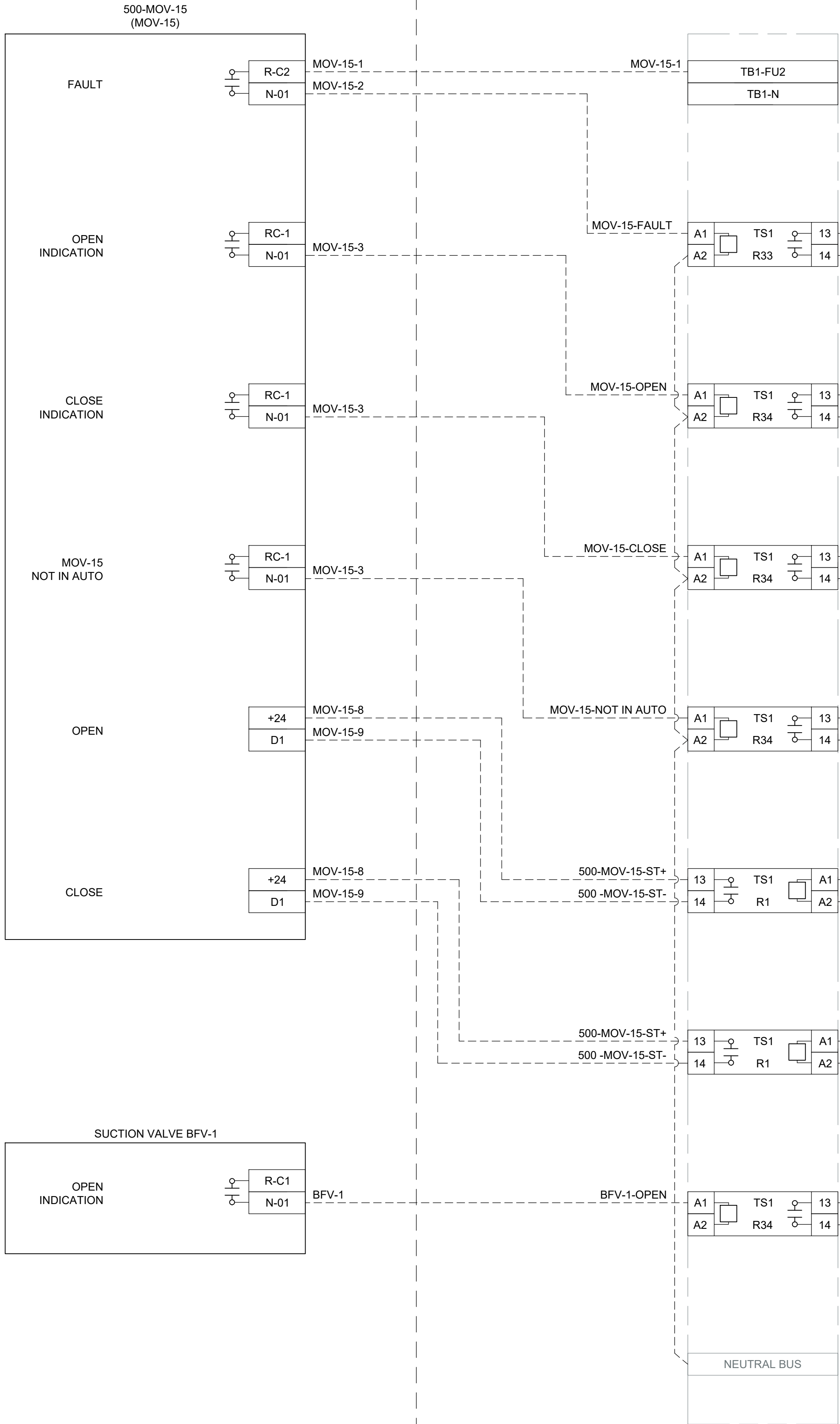
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TTLB-v02010-21 - WFO-v020301-15

FIELD - BACKWASH PUMP 500-MOV-15 AND BFV-1
PUMP ROOM - 2

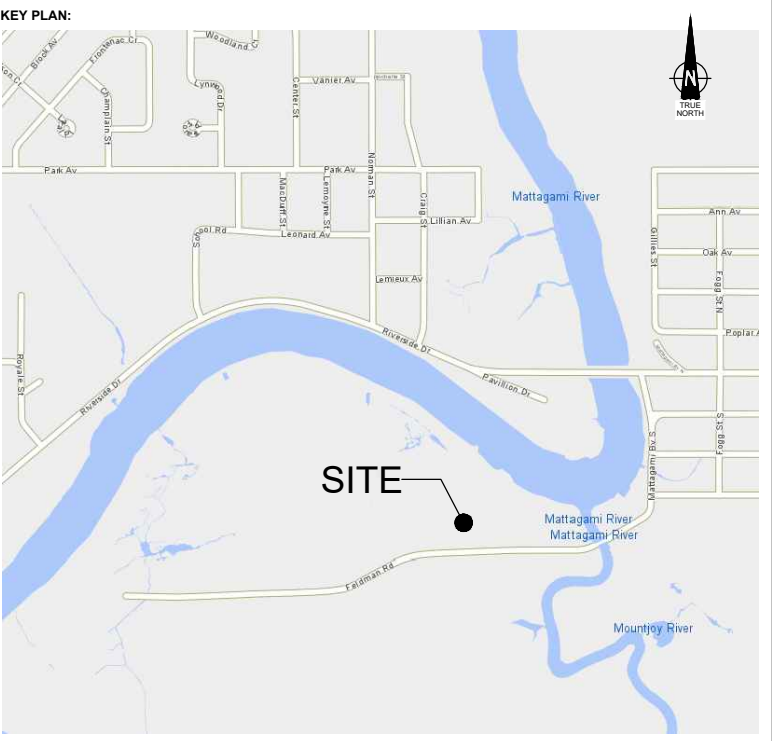
I/O PANEL B

FISCHER ROSEMOUNT DELTA-V DCS
I/O MODULE



1 115 **MOTORIZED VALVE ACTUATOR 500-MOV-15 - NEW WORK.**
SCALE: N.T.S.

- TERMINALS**
- DEVICE TERMINAL
 - ▣ TERMINAL BLOCK IN LOCAL CONTROL PANEL (LCP)
 - TERMINAL BLOCK IN MCC
 - ⊗ TERMINAL BLOCK IN PLC



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0	MAR 2025	ISSUED FOR TENDER	GA
No.	Date	Description	By



PROJECT NAME:
TIMMINS WTP HIGH LIFT AND
BACKWASH PUMP REPLACEMENT

SHEET TITLE:

CP-B: INPUTS/OUTPUTS -
NEW WORK - SHEET 5

INSTRUMENTATION			
DRAFTER:	RW	SCALE:	NTS
DESIGNER:	DC	DATE:	
APPROVER:	GA	CHECKER:	TGB
PROJECT No:	T001960A	DRAWING No:	I-115
SHEET No:			



**APPENDIX 1C - CITY OF TIMMINS CCDC SUPPLEMENTARY CONDITIONS AND
DIVISION 1**

City of Timmins CCDC Supplementary Conditions1

AGREEMENT BETWEEN OWNER AND CONTRACTOR

The Standard Construction Document for CCDC 2 Stipulated Price Contract, 2020 English version, consisting of the Agreement Between *Owner* and *Contractor*, Definitions, and General Conditions of the Stipulated Price Contract, Parts 1 to 13 inclusive, governing same is hereby made part of these *Contract Documents*, with the following amendments, additions and modifications. Where these amendments, additions, and modifications specifically reference a change to the Agreement, Definitions, or General Conditions, these amendments, additions and modifications shall govern.

1. AMENDMENTS TO AGREEMENT

ARTICLE A-3 – CONTRACT DOCUMENTS

.1 In paragraph 3.1 of Article A-3 add the following words to the end:

- “These Supplementary Conditions
- Special Conditions, if any
- Drawings
- Specifications
- Addendum”

ARTICLE A-5 – PAYMENT

.1 In paragraph 5.1.1 of Article A-5 add the following words to the end:

“or, where there is no *Payment Certifier*, jointly by the *Owner* and *Contractor*”

.2 Delete paragraph 5.2 in its entirety and replace with the following:

“Interest will be paid by the City on any amount that is not paid when it is due to be paid under Part I.1 of the Construction Act, commencing the date that the payment was due, at the prejudgment interest rate determined under subsection 127 (2) of the Courts of Justice Act. In no other circumstance will interest accrue on any amount due by the City to the Contractor, save and except if the payment of the same is mandatory pursuant to the Construction Act.”

ARTICLE A-6 – RECEIPT AND ADDRESSES FOR NOTICES IN WRITING

.1 In Delete paragraph 6.5 of Article A-6 in its entirety and replace it with the following:

“6.5 Contact information for a party may be changed by *Notice in Writing* to the other party setting out the new contact information in accordance with this Article.”

ARTICLE A-9 – CONFIDENTIALITY, FREEDOM OF INFORMATION AND PUBLICITY

.1 Add new Article A-9 – Confidentiality, Freedom of Information and Publicity:

“9.1 Without limiting the generality of the sections of the *Contract* relating to compliance with all applicable laws and statutes, the *Contractor* acknowledges that the *Owner* is governed by the *Municipal Freedom of Information and Protection of Privacy Act*, R.S.O. 1990 c. M.56 (“MFIPPA”) and the *Contractor* covenants to comply with this Act and to protect the

privacy of residents in keeping with this Act, as agent of the *Owner* for the purpose of this section.

- 9.2 The *Contractor* shall not at any time before, during or after the completion of the *Contract*, divulge any confidential information communicated to or acquired by the *Contractor* or disclosed by the *Owner* in the course of carrying out *Work* provided for herein. No such information shall be used by the *Contractor* before, during or after the completion of the *Contract* on any project without the prior written consent of the *Owner*. For the purpose of this *Contract*, "confidential information" means any information that is not in the public domain.
- 9.3 In accordance MFIPPA or other applicable privacy legislation, the *Contractor* agrees that any personal information it has provided as a proponent or bidder in the course of submitted a proposal or tender has been collected under the authority of the *Municipal Act*, 2001, S.O. 2001 c. 25 and has been properly used in the proposal or tender evaluation process and is now properly used for the purpose of this *Contract*. All correspondence, documentation and other information, including the proposal or tender, provided to the *Owner* or its employees, agents or representatives by the *Contractor*, as a proponent or bidder or now, or in the future in connection with, or arising out of, the proposal or tender process or this *Contract*, is or shall become property of the *Owner* and a record of the *Owner*. Such records and the *Contract Documents* are subject to the provisions of MFIPPA and the *Owner's* obligations under this or other privacy legislation and may be released pursuant to such Acts. The *Contractor's* name at a minimum will be made public on request. In addition, certain contractual information must be disclosed publicly by the *Owner* and accordingly may become part of the public record. All correspondence, documentation and information provided to the *Owner* may be produced for the purpose of evaluating the *Contractor's* or proponent's proposal or bid, or for purposes of this *Contract*.
- 9.4 All correspondence, documentation and information provided by the *Owner* to any bidder or *Contractor* in connection with or arising out of any tender, request for proposal, or *Contract* or the acceptance of any of the aforesaid remains the property of the *Owner* and must not be used for any purpose other than as related to the tender or proposal or in the fulfilment of any purpose other than as related to the tender or proposal or this *Contract* must be maintained at all times by the *Contractor*. Where any proprietary or confidential information belonging to or in the care of the *Owner* is disclosed to the *Contractor*, the *Contractor* shall:
- safeguard all information provided by the *Owner* at the request of the *Owner*;
 - maintain in strict confidence and not reproduce or disclose any such information to any person except as required by law or as expressly permitted in advance and in writing by the *Owner*;
 - return forthwith upon demand all such information as may be in documentary form or recorded electronically; and,
 - not use any such information for any purpose other than the purpose for which it was provided by the *Owner* or by any other person at the request of the *Owner*.
- 9.5 Any publicity or press releases with respect to this *Contract* shall be within the sole discretion and control of the *Owner*. The *Contractor* shall obtain prior approval from the *Owner* before making any information public with regard to this *Contract* at any time, during or after the term of the *Contract*."

2. AMENDMENTS TO DEFINITIONS

- .1 Add the following definition: Act
“*Act* means the Construction Act (Ontario) as amended.”
- .2 Delete in its entirety the Consultant definition and replace with the following:
“The *Consultant* is the person or entity engaged or appointed by the Owner and identified as such in the *Contract*. The *Consultant* is the Architect or the Engineer licensed to practice in the province or territory of the *Place of the Work*. The *Consultant* can also be an appointed representative of the Owner.”
- .3 Add the following definition: OHSA
“*OHSA* means the Occupational Health and Safety Act (Ontario)”
- .4 Add the following definition: Proper Invoice
“*Proper Invoice* means a “proper invoice” as defined in the *Construction Act* (Ontario) and will include the following at a minimum:
 - .1 a breakdown of the invoice amount by trade or division as required by the specifications,
 - .2 an updated schedule in a form and level of detail acceptable to the Owner showing the percentage complete on each task,
 - .3 Worker’s Compensation Board clearances showing current coverage,
 - .4 a Statutory Declaration in the form of CCDC 9A for every invoice after the first invoice,
 - .5 the *Owner’s* and *Contractor’s* full legal names,
 - .6 the Purchase Order number and Project number applicable to the *Work*,
 - .7 the aggregate amount of holdbacks retained by the *Owner* under the *Contract* including the amount retained under the *Proper Invoice* and separately the amount of the holdbacks retained under and applicable to the *Proper Invoice*.”
- .5 Add the following definition: Submittals
“*Submittals* are documents or items required by the *Contract Documents* to be provided by the *Contractor*, which include, but are not limited to:
- *Shop Drawings*, samples, models, mock ups to indicate details or characteristics, before the portion of the *Work* that they represent can be incorporated into the *Work*,
and
- As-built drawings and manuals to provide instructions to the operation and maintenance of the *Work*.”
- .6 Add the following definition: WSIB
“*WSIB* means the Workplace Safety and Insurance Board.”

3. SUPPLEMENTARY CONDITIONS

PART 1 GENERAL PROVISIONS

GC 1.1 CONTRACT DOCUMENTS

- .1 Delete paragraphs 1.1.3 in their entirety and replace with the following:

- “1.1.3 The *Contractor* shall review the *Contract Documents* for the purpose of facilitating and co-ordination and execution of the *Work* by the *Contractor*. The *Contractor* shall report promptly to the *Consultant* any ambiguities, design issues or other matters requiring clarification made known to the *Contractor* or that the *Contractor* may discover from such a review.”
- .2 Delete paragraph 1.1.4 in its entirety and replace with the following:
- “1.1.4 The *Owner* makes no representations as to the accuracy of information provided to the Contractor, including without limitation, the *Contract Drawings* and specifications relating to the *Work*. The Contractor represents to, and warrants with, the *Owner*, that the *Contractor* has reviewed and familiarized itself with all of the *Contract Documents*, including without limitation *Contract Drawings*, and the Contractor is capable of performing the *Work* in accordance with the provisions of the *Contract*. If the *Contractor* finds discrepancies in or omissions from the *Contract Documents* or has any doubt as to the meaning or intent of any part thereof, the *Contractor* shall immediately notify the *Consultant*, who will provide written instructions or explanations. Neither the *Owner* nor the *Consultant* will be responsible for the oral information.”
- .3 Delete paragraphs 1.1.5 in their entirety and replace with the following:
- “1.1.5 If there is a conflict within the *Contract Documents*:
- .1 the order of the priority of the documents. From the highest to lowest, shall be:
- the *Agreement* between the *Owner* and the *Contractor*, with the latest version of the *Agreement*, amended by mutual agreement in writing executed by each party, taking precedence over any previous version of the *Agreement*;
 - Supplementary Conditions
 - the Definitions,
 - the General Conditions,
 - Division 01 of the *Specifications*
 - the *Drawings*
 - technical Specifications
 - material and finishing schedules.
- .2 *Drawings* of larger scale shall govern over those of smaller scale of the same date.
- .3 dimensions shown on *Drawings* shall govern over dimensions scaled from *Drawings*.
- .4 amended or later dated documents shall govern over earlier documents of the same type.
- .5 noted material and annotations shall govern over graphic indications.”
- .4 All Specifications, Drawings, models and copies furnished by the Consultant shall, upon delivery of same to the Owner, become the sole and absolute property of the Owner.

GC 1.4 ASSIGNMENT

- .1 Delete paragraphs 1.4.1 in its entirety and replace with the following:
- “The *Contractor* shall not assign the *Contract*, either in whole or in part, without the written consent of the *Owner*. For certainty, a change in control of the Contractor constitutes an assignment of the Contract for which written consent of the Owner in advance, is required.”

PART 2 ADMINISTRATION OF THE CONTRACT

GC 2.2 ROLE OF THE CONSULTANT

- .1 In paragraph 2.2.3 add the following to the end:
“Without limiting the foregoing, the *Consultant* may appoint one or more authorized representatives in writing who may fulfill the obligations of the *Consultant* under this *Contract*.”
- .2 In paragraph 2.2.6 delete the words “except with respect to GC5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER.”
- .3 In paragraph 2.2.8 add the words “, written statements” after the word “interpretations” in both the first and second sentences; and
- .4 In paragraph 2.2.13 add the words “which are provided” before the words “by the *Contractor*”.

GC 2.4 DEFECTIVE WORK

- .1 In paragraph 2.4.1:
 - i. Add after the words “shall promptly correct” the phrase “in a manner acceptable to the *Owner* and the *Consultant*”; and
 - ii. Add after the words “*Contract Documents*” the phrase “or work that the *Contractor* discovers to be defective, whether or not the defective work had been identified by the *Consultant*, and”.
- .2 Add new paragraph 2.4.4 as follows:
“2.4.4 The *Contractor* shall prioritize the correction of any defective work which, in the sole discretion of the *Owner*, adversely affects the day-to-day operation of the *Owner*, except as otherwise instructed in writing by the *Consultant* or the *Owner*.”

PART 3 EXECUTION OF THE WORK

GC 3.1 CONTROL OF THE WORK

- .1 Add new paragraph 3.1.3 as follows:
“3.1.3 Prior to commencing individual procurement, fabrication and construction activities, the *Contractor* shall verify, at the *Place of the Work*, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the *Work* and shall further carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where dimensions are not included or contradictions exist, or exact locations are not apparent, the *Contractor* shall immediately notify the *Consultant* in writing and obtain written instructions from the *Consultant* before proceeding with any part of the affected work.”

GC 3.2 CONSTRUCTION BY OWNER AND OTHER CONTRACTORS

- .1 Delete subparagraph 3.2.2.3 and 3.2.2.4 in their entirety.
- .2 Add new paragraph 3.2.7 as follows:

- “3.2.7 At the commencement of the *Work*, the *Contractor* shall prepare for the review and acceptance of the *Owner* and the *Consultant*, a schedule indicating the times, within the construction schedule referred to in GC 3.4, that items that are specified to be *Owner* purchased and *Contractor* installed or hooked up are required at the site to avoid delaying the progress of the *Work*.”

GC 3.4 CONSTRUCTION SCHEDULE

- .1 Add new paragraph 3.4.2 as follows:
- “3.4.2 If, at any time, it should appear to the *Owner* or the *Consultant* that the actual progress of the *Work* is behind schedule or is likely to become behind schedule, or if the *Contractor* has given notice of such to the *Owner* or the *Consultant* pursuant to subparagraph 3.4.1.3, the *Contractor* shall take appropriate steps to cause the actual progress of the *Work* to conform to the schedule or minimize the resulting delay and shall produce and present to the *Owner* and the *Consultant* a recovery plan demonstrating how the *Contractor* will achieve the recovery of the schedule. If the *Contractor* intends to apply for a change in the *Contract Price* in relation to a schedule recovery plan, then the *Contractor* shall proceed in accordance with General Condition 6.5 – DELAYS.

GC 3.5 SUPERVISION

- .1 In paragraph 3.5.1:
- i. Add after the words “competent representative” the phrase “Who shall be *Competent Person*, as the term is defined in the OHSA”
 - ii. Delete the last sentence and replace with the following:
“The *Contractor* shall not be entitled to change the *Competent Person* without the prior written authorization of the *Owner*, which shall not be unreasonably withheld.”
- .2 Add new paragraph 3.5.3 as follows:
- “3.5.3 The *Owner* may, at any time during the course of the *Work*, request the replacement of the appointed representative(s), where the grounds for the request involve conduct which jeopardizes the safety and security of the site or the *Owner's* operations. Immediately upon receipt of the request, the *Contractor* shall make arrangements to appoint an acceptable replacement.

GC 3.7 LABOUR AND PRODUCTS

- .1 Add the following to the end of paragraph 3.7.1:
- “The *Contractor* represents that it has sufficient skilled employees to replace, subject to the *Owner's* approval, acting reasonably, its designated supervisor and project manager in the event of death, incapacity, removal or resignation.”
- .2 Add the following to the end of paragraph 3.7.2:
- “The *Contractor* shall not change the source of supply of any *Product* without the written authorization of the *Consultant*.”
- .3 Delete paragraph 3.7.3 in its entity and replace with the following:

- “3.7.3 Unless otherwise specified in the *Contract Documents*, *Products* provided shall be new and as specified. The *Contractor* shall not provide substitutions for specified *Products* without the express written consent of the *Consultant* and the *Owner*.”
- .4 Add new paragraphs 3.7.4 as follows:
- “3.7.4 The *Owner* shall provide the *Contractor* in a timely manner with all relevant information (including storage, protection, and installation requirements) regarding *Products* to be supplied by the *Owner* or other contractors and, prior to delivery of any such *Products* to the *Place of the Work*, the *Owner* shall obtain the *Contractor’s* written approval of the delivery date and proposed storage, protection and installation requirements.
- .5 Add new paragraphs 3.7.5 as follows:
- 3.7.5 Once the *Contractor* has accepted delivery of *Products*, the *Contractor* shall be responsible for the safe storage and protection (including *Products* supplied by the *Owner* and other contractors to be installed under the Contract) to avoid dangerous conditions, including without limitation, contamination of the environment, and the to the *Products* or other persons or property. *Products* shall be stored in locations and at the *Place of the Work* to the satisfaction of the *Owner* and the *Consultant* as agreed and approved by the *Contractor* pursuant to paragraph 3.7.4.

GC 3.8 SHOP DRAWINGS

- .1 Add the words “AND OTHER SUBMITTALS” to the title of GC 3.8 after the words “SHOP DRAWINGS”.
- .2 In paragraphs 3.8.1, 3.8.2, 3.8.3, 3.8.3.2, 3.8.5, 3.8.6, and 3.8.7 Add the words “and *Submittals*” after the words “*Shop Drawings*”.
- .3 In paragraph 3.8.2 delete in its entirety and replace it with new paragraph as follows:
- “3.8.2 Prior to the first application for payment, the *Contractor* and the *Consultant* shall jointly prepare a schedule of the dates for submission and return of *Shop Drawings* and *Submittals* in an orderly sequence.”
- .4 In paragraph 3.8.7 delete the words “with reasonable promptness so as to cause no delay in the performance of the Work” and replace them with the words “within 10 *Working Days* or such longer period as may be reasonably required”.

GC 3.9 PERFORMANCE BY CONTRACTOR

- .1 Add new General Condition GC 3.9 as follows:
- “GC 3.9 PERFORMANCE BY CONTRACTOR**
- 3.9.1 In performing its services and obligations under the *Contract*, the *Contractor* shall exercise a standard of care, skill and diligence that would normally be provided by an experienced and prudent contractor supplying similar services and products for similar projects. The *Contractor* acknowledges and agrees that throughout the *Contract*, the *Contractor’s* obligations, duties and responsibilities shall be interpreted in accordance with this standard. The *Contractor* shall exercise the same standard of due care and

diligence in respect of any *Products*, personnel, or procedures which it may supply to the *Owner*.”

- 3.9.2 The *Contractor* further represents, covenants and warrants to the *Owner* that:
- .1 the personnel assigned to the *Project* are Competent Person, as the term is defined in the OHSA.
 - .2 It has a sufficient staff of qualified and competent personnel to replace its designated supervisor and project manager, subject to the *Owner's* approval, in the event of death, incapacity, removal or resignation.”

GC 3.10 CLEANUP

- .1 Add new General Condition GC 3.10 as follows:

“GC 3.10 CLEANUP

- 3.10.1 The *Contractor* shall maintain the *Work* in a safe and tidy condition and free from the accumulation of waste products and debris, other than that caused by the *Owner*, other contractors or their employees.
- 3.10.2 The *Owner* shall have the right to back charge cleaning to the *Contractor* if the cleaning is not completed within 24 hours of written notice to clean and the *Owner* shall have the right to back charge the cost of damage to the *Place of Work* caused by the *Contractor's*, *Subcontractor's* or *Supplier's* transportation in and out of the *Place of Work* if not repaired within 5 *Working Days* or written notice to repair or before final payment, whichever is earlier. An administration fee of 15% shall be added to the *Owner's cost* of performing or of having performed, cleaning pursuant to this Section 3.10.2.”

PART 4 ALLOWANCES

GC 4.1 CASH ALLOWANCES

- .1 In paragraph 4.1.4 add the following to the end:
“The maximum markup on any overrun, with any such overrun to be pre-approved by the *Owner in writing*, shall be 5%.”
- .2 Delete paragraph 4.1.7 in its entirety and replace it with the following:
“4.1.7 At the commencement of the *Work*, the *Contractor* shall prepare for the review and acceptance of the *Owner* and the *Consultant*, a schedule indicating the times within the construction schedule referred to in GC 3.4 that items called for under cash allowances are required to be delivered to the *Place of the Work* to avoid delaying the progress of the *Work*.”
- .2 Add new paragraph 4.1.8 as follows:
“4.1.8 The *Owner* reserves the right to have the *Contractor* call for competitive bids for portions of the *Work* to be paid for from cash allowances.”

GC 4.2 CONTINGENCY ALLOWANCE

- .1 In paragraph 4.2.4 add the following to the end:

“The maximum markup on any overrun, with any such overrun to be pre-approved by the *Owner* in writing, shall be 5%.”

PART 5 PAYMENT

GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

- .1 Delete all paragraphs of GC 5.1 in its entirety.

GC 5.2 APPLICATION FOR PAYMENT

- .1 Delete all paragraphs of GC 5.2 in its entirety and replace with the following:
- “5.2.1 A “*Proper Invoice*” (as that term is defined in the *Construction Act*) shall be delivered to the *Owner* and the *Consultant* by the first day of every month for the previous month’s work. Subject the terms of the Contract Documents, including the holdback provisions of the Contract Documents and the *Construction Act*, and subject to any notice of non-payment delivered by the City under the *Construction Act*, the *Owner* shall pay the amount approved and certified by the *Consultant* as payable under a *Proper Invoice* no later than 28 days after receiving the invoice from the *Contractor*.
- 5.2.2 The approved *Proper Invoice* delivered to the *Owner* shall be provided by email to: accounts.payable@timmins.ca and *Owner* Project Coordinator.
- 5.2.3 No less than 7 days prior to the delivery of a *Proper Invoice*, the *Contractor* shall submit to the *Owner* and the *Consultant* a draft of the payment certificate (in a form prescribed by the *Consultant*) and all necessary supporting documentation, a *WSIB* clearance certificate and a Statutory Declaration of Progress Payment Distribution for review and acceptance. Once *Owner* and the *Consultant* approve of the draft payment certificate, *Contractor* will submit *Proper Invoice* for submission of a duly completed payment certificate.
- 5.2.4 Notice of non-payment may be made by email to the *Contractor*. For greater clarity, this provision constitutes the consent of the *Contractor* to service of the notice of non-payment in this manner.
- 5.2.5 The *Contractor* shall, within 10 days of signing the *Contract*, and prior to the first claim for payment, if not requested in the Request For Tender, submit to the *Owner* a detailed breakdown (schedule of values) of the lump sum tender price for the purpose of establishing monthly expenses. The *Owner*, acting reasonably, reserves the right to modify costs allocated to the various breakdown items to prevent unbalancing.
- 5.2.6 Payment for mobilizing and setting up plant, temporary buildings and services, premiums and other disbursements, shall be prorated based on the value of the *Work* performed during a billable period.
- 5.2.7 Payment for bonds and insurance will be paid 100 percent on the first progress payment, provided that respective invoices are submitted as proof of payment.
- 5.2.8 Prior to the first progress draw, the *Contractor* shall submit a monthly projected payment schedule based on the detailed construction schedule for the duration of the *Contract*.”

GC 5.3 PAYMENT

- .1 Delete all paragraphs of GC 5.3 in its entirety and replace with the following:
“5.3.1 Payment submitted by the *Contractor* is to be process according to GC 5.2 – APPLICATIONS FOR PAYMENT.”

GC 5.5 FINAL PAYMENT

- .1 In paragraph 5.5.1 add the following to the end:
“The application for final payment shall meet the requirements of a *Proper Invoice*.”
- .2 In paragraph 5.5.3 add the following to the end:
“Subject to any *Payment Legislation*, when the *Consultant* finds the *Contractor*’s application for final payment to be not valid, the *Contractor* shall revise and resubmit the application when the *Contractor* has addressed the reasons given by the *Consultant*.”
- .3 In paragraph 5.5.4 delete the number “5” and replace them with the number “61”.
- .4 Add new paragraphs 5.5.5 as follows:
“5.5.5 Prior to submitting final payment application, the *Contractor* shall submit to the *Consultant* all:
 1. guarantees;
 2. warranties;
 3. certificates;
 4. testing and balancing reports;
 5. distributing system diagrams;
 6. spare parts;
 7. maintenance/operation manuals;
 8. training manuals;
 9. samples;
 10. reports and correspondence from authorities having jurisdiction in the *Place of the Work*;
 11. *Shop Drawings*, and marked up *Drawings*;
 12. completed as-built drawings in an electronic format acceptable to the *Consultant*;
 13. inspection certificatesand any other materials or documentation required to be submitted under the *Contract* or otherwise reasonably requested by the *Consultant*, together with written proof of acceptance to the *Owner* and the *Consultant*. The *Work* shall be deemed not to be complete until all of the aforementioned materials have been delivered, and the *Owner* may withhold payment in respect of the delivery of any documents in an amount determined by the *Consultant*.”

PART 6 CHANGES IN THE WORK

GC 6.1 OWNER’S RIGHT TO MAKE CHANGES

- .1 In paragraph 6.1.2 add the following at the end:
“All such changes require approval by a representative of the *Owner* with proper signing authority.”
- .2 Add new paragraph 6.1.3 as follows:

“6.1.3 When a change in the *Work* is proposed or required, the *Contractor* shall within 10 *Working Days* submit to the *Consultant* for review a claim for a change in *Contract Price* and/or *Contract Time*. Should 10 *Working Days* be insufficient to prepare the submission, the *Contractor* shall within 5 *Working Days*, advise the *Consultant* in writing of the proposed date of the submission of the claim.

GC 6.2 CHANGE ORDER

.1 Add, as a last sentence to the existing paragraph 6.2.1:

“The Contractor shall make every reasonable effort to minimize the cost to the *Owner* of *Work* to be performed pursuant to a *Change Order*, the impact of the *Change Order* on the *Work* schedule, and disruptions to the flow of work at the *Place of Work*.

.2 Add new paragraph 6.2.3 as follows:

- “6.2.3 Any agreement reached by the *Owner* with the *Contractor* on an adjustment of the *Contract Price*, on either a lump-sum or unit price basis shall be subject to the conditions contained in this section.
1. Where a change in the *Work* is performed by the *Contractor's* own forces, the negotiated lump sum price for change in the *Work*, or negotiated unit price(s) for each unit priced items shall be all-inclusive, except HST and mark-up as provided hereafter, and shall include, without limitation, all costs, charges, expenses and fees whatsoever required or related to perform such change, or such unit price item. The *Contractor* shall be allowed a mark-up to a maximum amount of 10% of the lump sum price. The *Contractor* shall provide a written quotation identifying each amount to be charged for transportation, labour, *Product*, *Construction Equipment* and services and all other costs for the performance of the *Work*. The HST, as applicable, shall be identified separately in a manner satisfactory to the *Owner*.
 2. Where a change in the *Work* is performed by a *Subcontractor's* forces, the *Subcontractor's* lump sum price for change in the *Work*, or unit price(s) for each unit priced item shall be inclusive, except HST and mark-up, as provided hereafter, and shall include all of its costs, charges, expenses and fees whatsoever required or related to perform such change or such unit price item. The *Contractor* shall provide a written quotation with back-up documentation from the *Subcontractor* identifying each amount to be charged for transportation, *Product*, *Construction Equipment* and services and all other costs for the performance of the *Work* and the total price charged by the *Subcontractor* to attend to the *Change Order* and all other changes to the *Work* resulting therefrom. The *Subcontractor* shall be allowed a mark-up to a maximum amount of 10% of the lump sum price, or aggregate of unit items and applicable unit price(s), for such change(s), net of taxes. The *Contractor* shall be allowed a mark-up of 5% on the total price charged by the *Subcontractor* to the *Contractor* for such change, net of taxes and *Subcontractor* mark-up. The HST, as applicable, shall be identified separately in a manner satisfactory to the *Owner*.
 3. Notwithstanding paragraphs 6.2.3.1 and 6.2.3.2, in the event that any of change in the *Work* contains items or parts that, in the opinion of the *Consultant*, are the same or equivalent to items for which the *Contractor* submitted unit prices in the tender submitted by the *Contractor*, then the prices in the tender shall be the prices paid by the *Owner* for the work or parts of the work in respect of any change in the *Work*.

4. Where a change in the *Work* is performed either by the *Contractor* or a *Subcontractor*, and requires *Construction Equipment*, reasonable rental charges for *Construction 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 *Work* must be agreed upon before commencing the *Work*.
5. The mark-ups provided for in paragraphs 6.2.3.1, 6.2.3.2 and 6.2.3.3 shall constitute the only compensation the *Contractor* shall be entitled to for any and all overhead, profit, incidental and administrative costs whatsoever related to the change, including but not limited to, costs related to superintendence and supervision, *Shop Drawing* production, estimating, site office and home office expenses, workers tools, temporary facilities and controls, and coordination of any and all *Work*-related activities.
6. No claim whatsoever for a change in the *Contract Time*, delay, prolongation charges, remobilization or otherwise shall be permitted with respect to a change, unless authorized by the *Consultant* and approved by the *Consultant* and set out in the *Change Order* or *Change Directive*, as the case may be, by the *Owner*.
7. No compensation for any change in the *Work* shall be allowed unless such change is first ordered in writing by the *Consultant* and authorized by the *Owner*."

GC 6.3 CHANGE DIRECTIVE

- .1 Delete paragraph 6.3.7.1 in its entirety and replace it with the following:
 - “.1 salaries, wages and benefits paid to personnel in the direct employ of the *Contractor*, applying the labour rates set out in the wages schedule in the *Contract Documents* or as otherwise agreed between the *Owner* and the *Contractor* for personnel,
 - (1) carrying out the *Work*, including necessary supervisory services;
 - (2) engaged in expediting the production or transportation of material or equipment, at shops or on the road; or
 - (3) engaged in the preparation of *Shop Drawings*, fabrication drawings, coordination drawings and Contract as-built drawings."
- .2 Delete paragraph 6.3.7.17 in its entirety.
- .3 In subparagraph 6.3.7.18 delete the word "and" from the end.
- .4 In subparagraph 6.3.7.19 delete the period from the end and replace it with "; and".
- .5 Add new subparagraph 6.3.7.20 as follows:

“.20 safety measures and requirements."
- .6 In paragraph 6.3.8 add the words "except for paragraph 6.3.14" after the word "*Contract*" in the first line.
- .7 Add new paragraph 6.3.14 as follows:

"6.3.14 For greater certainty, and without limitation, the cost of performing the *Work* attributable to the *Change Directive* does not include, and no payment shall be made for:

 - .1 head office salaries and benefits and all other overhead or general expenses, except only for wages, benefits, compensation, contributions, assessments, or taxes described in paragraph 6.3.7.1;

- .2 capital expenses and interest on capital;
- .3 general clean-up, except where the performance of the *Work* in the *Change Directive* causes specific additional and extraordinary clean-up requirements;
- .4 wages paid for project managers, superintendents, assistants, watch persons and administrative personnel, provided the *Change Directive* does not result in extension of *Contract Time*;
- .5 wages, salaries, rentals, or other expenses that exceed the rates that are standard in the locality of the *Place of the Work*, that are otherwise deemed unreasonable by the *Consultant*;
- .6 any costs or expenses attributable to the negligence, improper *Work*, deficiencies, or breaches of *Contract* by the *Contractor* or *Subcontractor*;
- .7 any cost of quality assurance, such as inspection and testing services, charges levied by authorities, and any legal fees unless any such costs or fees are pre-approved in writing by the *Owner*."

GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

- .1 Add new paragraph 6.4.5:
 - "6.4.5 The *Contractor* confirms that, prior to bidding on the *Project*, it carefully reviewed the *Place of the Work* and applied to that review the degree of care and skill described in paragraph 3.9.1, given the amount of time provided between the issue of the bid documents and the actual closing of bids, the degree of access provided to the *Contractor* prior to submission of bid, and the sufficiency and completeness of the information provided by the *Owner*. The *Contractor* is not entitled to compensation or to an extension of the *Contract Time* for conditions which could reasonably have been ascertained by the *Contractor* by such review undertaken in accordance with this paragraph 6.4.5."

GC 6.5 DELAYS

- .1 In paragraph 6.5.1 delete the period at the end of the paragraph, and add the following words, " , but excluding any consequential, indirect or special damages, loss of profits, loss of opportunity or loss of productivity resulting from such delay."
- .2 In paragraph 6.5.2 delete the period at the end of the paragraph, and add the following words, " , but excluding any consequential, indirect or special damages, loss of profits, loss of opportunity or loss of productivity resulting from such delay."
- .3 Add new paragraph 6.5.6 as follows:
 - "6.5.6 The *Owner* shall be reimbursed by the *Contractor* for costs incurred by the *Owner* as the result of any delay caused by the *Contractor*, including without limitation, its *Subcontractors*. Such costs for which the *Owner* shall be reimbursed, include, without limitation, all services required by the *Owner* from the *Consultant* as a result of such delay by the *Contractor* and, in particular, the cost of the *Consultant's* services during the period between the date of *Ready-for-Takeover* stated in Article A-1 (as may be extended) and any later, actual date of *Ready-for-Takeover* achieved by the *Contractor*. Failing reimbursement within twenty-eight (28) days of demand therefore by the *Owner*, the *Owner* may set off any such costs against any invoice payable to the *Contractor*."
- .4 Add new paragraph 6.5.7 as follows:
 - "6.5.7 The *Contractor* shall be responsible for the care, maintenance and protection of the *Work* in the event of any suspension of construction as a result of the delay described in

paragraph 6.5.1, 6.5.2 or 6.5.3. In the event of such suspension, the *Contractor* shall be reimbursed by the *Owner* for the reasonable costs incurred by the *Contractor* for such care, maintenance and protection, but excluding the costs of the *Contractor's* head office personnel. The *Contractor's* entitlement to costs pursuant to paragraph 6.5.7, if any, shall be in addition to amounts, if any, to which the *Contractor* is entitled pursuant to paragraphs 6.5.1, 6.5.2 or 6.5.3.”

.5 Add new paragraph 6.5.8 as follows:

“6.5.8 Without limiting the obligations of the *Contractor* described in GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS and GC 9.4 – CONSTRUCTION SAFETY, the *Owner* may, by *Notice in Writing*, direct the *Contractor* to stop the *Work* where the *Owner* determines that there is an imminent risk to the safety of the persons or property at the *Place of the Work*. In the event that the *Contractor* receives such notice, it shall immediately stop the *Work* and secure the *Project* site. The *Contractor* shall not be entitled to an extension of the *Contract Time* or to an increase in the *Contract Price* unless the resulting delay, if any, would entitle the *Contractor* to an extension of the *Contract Time* or the reimbursement of the *Contractor's* costs as provided in paragraphs 6.5.1, 6.5.2 or 6.5.3.”

.6 Add new paragraph 6.5.9 as follows:

“6.5.9 In addition to the amount set out in paragraph 6.5.6, the *Contractor* recognizes and agrees that the *Owner* will suffer a financial loss if the *Work* is not completed within the time prescribed by the *Contract*. The *Contractor* also recognizes the delays, expenses and difficulties involved in proving the actual loss suffered by the *Owner* if the *Work* is not completed on time. Accordingly, instead of requiring any such proof, the *Contractor* agrees that as liquidated damages for delay (but not as penalty) the *Contractor* shall pay the *Owner* an amount per day, as designated in the Special Conditions of Contract for each and every day's delay from the specified time for *Ready-for-Takeover* until the actual date of *Ready-for-Takeover*, and it is further expressly acknowledged and agreed by the *Contractor* that:

- (a) this amount is a reasonable estimate of the actual damages that will be incurred by the *Owner* due to any failure to attain *Ready-for Takeover* within the time required by this *Contract*;
- (b) the *Owner* may deduct the amount due under this section from any monies that may be due or payable to the *Contractor*, whether under the *Contract* or any other agreement; and,
- (c) the liquidated damages provided for in this section shall be without prejudice to any other remedy to which the *Owner* is entitled at law or in equity.”

.7 Add new paragraph 6.5.10 as follows:

“6.5.10 In the event that paragraph 6.5.9 is held by a court of competent jurisdiction to be invalid, unenforceable or void, or if no liquidated damages are designated in the *Special Conditions* of the *Contract*, the *Contractor* shall be held responsible for the payment of the *Owner's* actual costs associated with the delay in achieving *Ready-for-Takeover*. The *Owner's* costs will include, but are not limited to, the amounts relating to the items set out in paragraph 6.5.6 and all other costs directly or indirectly associated with the delay in the completion of the *Work* by the *Contractor*. The amounts payable pursuant to paragraph 6.5.10 are in addition to the amounts payable by the *Contractor* to the *Owner* pursuant to paragraph 6.5.6.”

GC 6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

- .1 In paragraph 6.6.5 add the words “as noted in paragraph 6.6.3” after the words “of the claim” and add the words “and the *Consultant*”, at the end of paragraph.

PART 7 DEFAULT NOTICE

GC 7.1 OWNER’S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR’S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT

- .1 In paragraph 7.1.2 add the following to the end:
“Failure by the *Owner* to provide such notice shortly after the default has occurred shall not constitute condonation of the default.”
- .2 In paragraph 7.1.5 add the following subparagraph:
“.5 change to *Contractor* for any damages the *Owner* may have sustained as a result of default.”

GC 7.2 CONTRACTOR’S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

- .1 Delete paragraph 7.2.1 in its entirety.
- .2 Delete Subparagraph 7.2.3.1 in its entirety.
- .3 Delete Subparagraph 7.2.3.4 in its entirety and replace with the following:
“.4 the *Owner* violates the requirements of the *Contract* to substantial degree.”
- .4 Delete paragraph 7.2.5 in its entirety and replace with the following:
“7.2.5 If the default cannot be corrected within the 5 *Working Days* specified in paragraph 7.2.4, the *Owner* shall be deemed to have cured the default if it:
 - .1 commences the correction of the default within the specified time;
 - .2 provides the *Contractor* with an acceptable schedule for such correction; and,
 - .3 completes the correction in accordance with such schedule.”
- .5 Add new paragraph 7.2.6 as follows:
“7.2.6 If the *Contractor* terminates the *Contract* under the conditions described in this GC 7.2, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of termination. The *Contractor* shall not be entitled to any other expenses or costs whatsoever, including without limitation, recoveries for special, indirect or consequential losses, loss of use or loss of profit.”

PART 8 DISPUTE RESOLUTION

GC 8.2 ADJUDICATION

- .1 In paragraph 8.2.1 delete the word “prescribed” and replace with the words “provided for”.

PART 9 PROTECTION OF PERSONS AND PROPERTY

GC 9.1 PROTECTION OF WORK AND PROPERTY

- .1 In subparagraph 9.1.1.1 delete in its entirety and replace it with the following:
 - “.1 errors or omissions in the *Contract Documents* which the *Contractor* could not have discovered applying the standard of care described in GC 3.14 STANDARD OF CARE.”
- .2 In subparagraph 9.1.1.2 add the word “negligent” at the beginning of the sentence.
- .3 Delete paragraph 9.1.2 in its entirety and replace it with the following:
 - “9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground utilities and structures indicated in the *Contract Documents*, or that are discoverable by applying to an inspection of the *Place of the Work* the degree of care and skill described in paragraph 3.9.1.”
- .4 Add new paragraphs 9.1.5 as follow:
 - “9.1.5 Without in any way limiting the *Contractor’s* obligations under this GC 9.1, should the *Contractor* or any *Subcontractor* or supplier cause loss or damage to trees or other plantings, whether owned by the *Owner* or third parties, the *Contractor* shall be liable for the replacement cost of the trees or the plantings damaged, including the cost of any arborist or other *Consultant*, and such costs may be deducted by the *Owner* from amounts otherwise owing to the *Contractor*.”
- .4 Add new paragraphs 9.1.6 as follow:
 - “9.1.6 The *Contractor* shall neither undertake to repair and/or replace any damage whatsoever to the *Work* of other *Contractors*, or to adjoining property, nor acknowledge the same was caused or occasioned by the *Contractor*, without first consulting the *Owner* and receiving written instructions as to the course of action to be followed from either the *Owner* or the *Consultant*. However, where there is danger to life or public safety, the *Contractor* shall take such emergency action as it deems necessary to remove the danger.”

GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

- .1 In paragraph 9.2.6 add the following words after the word “responsible”:

“or whether any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the *Owner* or others,”
- .2 In subparagraph 9.2.7.4 add the words “and the *Consultant*” after the word “*Contractor*”.
- .3 In paragraph 9.2.8 add the following words after the word “responsible”:

“or that any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the *Owner* or others,”

GC 9.4 CONSTRUCTION SAFETY

- .1 Delete paragraph 9.4.1 in its entirety and replace with the following:

“9.4.1 The *Contractor* shall be solely responsible for construction safety at the *Place of the Work* and for compliance with the rules, regulations and practices required by the applicable construction health and safety legislation and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the *Work*.”
- .2 Add new paragraph 9.4.6 as follow:

“9.4.6 Prior to the commencement of the *Work*, the *Contractor* shall submit to the *Owner*:

 - .1 a current WSIB clearance certificate;
 - .2 documentation of the *Contractor's* in-house safety-related programs;
 - .3 a copy of the Notice of Project filed with the Ministry of Labour naming itself as “constructor” under the *OHS*A; and,
 - .4 *Owner's Contractor* orientation certificate.”
- .3 Add new paragraph 9.4.7 as follow:

“9.4.7 The *Contractor* shall indemnify and save harmless the *Owner*, its agents, officers, directors, employees, consultants, successors and assigns from and against the consequences of any and all safety infractions committed by the *Contractor* or *Subcontractors* under the *OHS*A, including the payment of legal fees and disbursements on a full indemnity basis.”

PART 10 GOVERNING REGULATIONS

GC 10.1 TAXES AND DUTIES

- .1 In paragraph 10.1.1 add the following to the end:

“Any *Value Added Taxes* (including without limitation, Harmonized Sales Tax), where applicable, shall be listed as line items separate from the total *Contract Price*.”
- .2 Delete paragraph 10.1.2 in its entirety and replace with the following:

“There shall be no adjustment to the *Contract Price* on account of any tax, duty, tariff, fines, assessment, or similar levy of any governmental authority or otherwise, and the *Contractor* represents and warrants to the *Owner* that in submitting its bid, it has contemplated the possibility and impact of any such tax, duty, tariff, or similar levy, upon the *Contract Price*.”
- .3 Add new paragraph 10.1.3 as follow:

“10.1.3 Where the *Owner* is entitled to an exemption or a recovery of sales taxes, custom duties, excise taxes or *Value Added Taxes* applicable to the *Contract*, the *Contractor* shall, at the request of the *Owner* or the *Owner's* representative, assist with the application for any exemption, recovery or refund of all such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the *Owner*. The *Contractor* agrees to endorse over to the *Owner* any cheques received from the Federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph.”

- .4 Add new paragraph 10.1.4 as follow:
- “10.1.4 The *Contractor* shall maintain accurate records of *Construction Equipment*, *Product* and component costs reflecting the taxes, custom duties, excise taxes and *Value Added Taxes* paid.”
- .5 Add new paragraph 10.1.5 as follow:
- “10.1.5 Any refund of taxes, including, without limitation, any government sales tax, customs duty, excise tax or *Value Added Tax*, whether or not paid, which if found to be inapplicable or for which exemption may be obtained, is the sole and exclusive property of the *Owner*. The *Contractor* agrees to cooperate with the *Owner* and to obtain from all *Subcontractors* and *Suppliers* cooperation with the *Owner* in the application for any refund of any the same, which cooperation shall include but not be limited to, making or concurring in the making of an application for any such refund or exemption and providing to the *Owner* copies, or where required, originals of records, invoices, purchase orders and other documentation necessary to support such applications for exemptions or refunds. All such refunds shall either be paid to the *Owner*, or may be a credit to the *Owner* against the *Contract Price*, in the *Owner's* discretion. The *Contractor* agrees to enable, assist with and submit to any reasonable audit requested by the *Owner* with respect to the potential refunds under this paragraph.”

GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

- .1 In paragraph 10.2.4 add the following to the end:
- “The *Contractor* shall notify the Chief Building Official, of the readiness, substantial completion, and *Ready-for Takeover* stages of construction. The *Contractor* shall be present at each site inspection by an inspector under the Ontario Building Code.”
- .2 In paragraph 10.2.5 delete from the first line the word, “The” and replace with the words “Subject to paragraph 3.9.1, the”.
- .3 Delete paragraph 10.2.6 in its entirety and replace with the following:
- “10.2.6 If the *Contractor* fails to notify the *Owner* and the *Consultant* in writing, fails to obtain direction required in paragraph 10.2.5, or performs work that contravenes any laws, ordinances, guidelines, standards, permits, statutes, by-laws, rules, regulations, or codes, the *Contractor* shall be responsible for and shall correct the violations thereof, and shall bear the costs, expenses, and damages attributable to the failure to comply with the provisions of such laws, ordinances, guidelines, standards, permits, statutes, by-laws, rules, regulations, or codes and, notwithstanding any limitation described in Part 13, shall indemnify and hold harmless the *Owner* and the *Consultant* from and against any claims, demands, losses, costs, damages, actions, suits or proceeding resulting from failure or breach of law.”
- .4 Add new paragraph 10.2.8 as follow:
- “10.2.8 Without limiting the generality of any other provision in the *Contract Documents*, the *Contractor* shall cause all certificates to be furnished that are required or given by the appropriate governmental or quasi-governmental authorities as evidence that the *Work* as installed conforms with the laws and regulations of any authorities having jurisdiction over the *Place of the Work*, including, without limitation, certificates of compliance for the *Owner's* occupancy or partial occupancy. The certificates are to be final certificates giving complete clearance of the *Work*, in the event that such governmental or quasi-governmental authorities furnish such certificates.”

GC 10.3 PATENT FEES

- .1 In paragraph 10.3.1 add the word, “indemnify and” before the words, “hold the”, in the second line.
- .2 In paragraph 10.3.2 add the word, “by the *Owner*” before the words, “supplied to the *Contractor*”.

GC 10.4 WORKERS' COMPENSATION

- .1 Add new paragraph 10.4.2 as follow:
“10.4.2 The *Contractor* shall ensure that each *Subcontractor* complies with the workers' compensation legislation at the *Place of the Work* and that all *Subcontractors* purchase worker's compensation coverage, whether or not required to do so under the applicable legislation.”
- .2 Add new paragraph 10.4.3 as follow:
“10.4.3 Where a *Subcontractor* is not required to participate in the insurance plan provided for under the workers' compensation legislation, the *Contractor* shall require the *Subcontractor* to provide a sworn declaration of its exemption as a condition of the *Subcontractor's* admission to the *Place of Work*. When requested by the *Owner*, the *Contractor* shall require the *Subcontractor* to provide a letter of exemption under the workers' compensation legislation.”

PART 11 INSURANCE

GC 11.1 INSURANCE

- .1 In paragraph 11.1.1.2 add the following at the end:
“11.1.1.2 In addition, this policy shall include in the coverage non-owned automobiles.”
- .2 Delete paragraph 11.1.2 in its entirety and replace with the following:
“11.1.2 Each of the policies of insurance shall also contain a provision requiring not less than 30 days' written notice to each named insured prior to cancellation or any change that would reduce coverage. At least 10 calendar days prior to commencement of the *Work* and upon any renewal, amendment, or extension of all or any part of the insurance, the *Contractor* shall promptly provide the *Owner* with confirmation of coverage and, if required, a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements applicable to the *Work*.”
- .3 Add new paragraph 11.1.9 as follow:
“11.1.9 Insurance amounts:
 - .1 **General Liability insurance:** Reference in CCDC 41 dated (December 14, 2020) and the General Conditions of CCDC 2 (2020) to general liability insurance in the amount of Ten Million Dollars (\$10,000,000) per occurrence and Ten Million Dollars (\$10,000,000) aggregate with a deductible not exceeding Ten Thousand Dollars (\$10,000) for the purpose of this *Contract*.

- .2 **Automobile liability insurance:** Reference in CCDC 41 dated (December 14, 2020) and the General Conditions of CCDC 2 (2020) to automobile liability insurance in the amount of Ten Million Dollars (\$10,000,000) for the purpose of this *Contract*.
- .3 **Broad Form property insurance:** Reference in CCDC 41 dated (December 14, 2020) and the General Conditions of CCDC 2 (2020) shall have no less than the sum of 1.1 times of the *Contract Price* with a deductible not exceeding Ten Thousand Dollars (\$10,000) for the purpose of this *Contract*.
- .4 **Boiler and machinery insurance:** Reference in CCDC 41 dated (December 14, 2020) and the General Conditions of CCDC 2 (2020) shall have a limit of not less than the replacement value of the permanent or temporary boilers and pressure vessels, and other insurable objects forming part of the *Work* for the purpose of this *Contract*.
- .5 **Pollution liability insurance:** Reference in CCDC 41 dated (December 14, 2020) and the General Conditions of CCDC 2 (2020) to pollution liability insurance shall not be required for the purpose of this *Contract*.

PART 12 OWNER TAKEOVER

GC 12.1 READY-FOR-TAKEOVER

- .1 In paragraph 12.1.3 after the second occurrence of the term "*Ready-for-Takeover*" insert before the term "*Ready-for-Takeover*" the words "determination of".

GC 12.2 EARLY OCCUPANCY BY THE OWNER

- .1 In paragraph 12.2.4 delete the word "achieve" and replace it with the words "have achieved".

GC 12.3 WARRANTY

- .1 In paragraph 12.3.1 delete the word "one year" and replace with the word "two years".
- .2 In paragraph 12.3.2 delete the word "The" from the first line and replace it with the words "Subject to paragraph 3.9.1, the".
- .3 In paragraph 12.3.3 delete the word "one year" and replace with the word "two years".
- .4 In paragraph 12.3.4 delete the word "one year" and replace with the word "two years".
- .5 In paragraph 12.3.6 delete the word "one year" and replace with the word "two years".
- .6 Add new paragraph 12.3.7 as follow:
"12.3.7 Any *Product*, or equipment requiring excessive servicing during the warranty period (or free maintenance period, if applicable) shall be considered defective and the warranty (or free maintenance period) shall be deemed to take effect from the time that the defect has been corrected so as to cause excessive servicing to terminate."
- .7 Add new paragraph 12.3.8 as follow:
"12.3.8 Following *Substantial Performance of the Work*, and without limiting the *Contractor's* warranty under GC 12.3, the *Contractor* shall assign to the *Owner*, to the extent

assignable, the benefit of all warranties and guarantees relating to the *Work*. The assignment shall expressly reserve the rights of the *Contractor* to make any claims under such warranty and guarantees and such assignment shall in no way prejudice any rights of or benefits accruing to the *Contractor* pursuant to such warranties and guarantees.”

- .8 Add new paragraph 12.3.9 as follow:

“12.3.9 The provisions of GC 12.3 shall not deprive the *Owner* of any action, right or remedy otherwise available to the *Owner* for the *Contractor's* failure to fulfill its obligations or responsibilities under the *Contract* and shall not be construed as a waiver of claims in favour of the *Contractor* or as limitation on the time in which the *Owner* may pursue such other action, right to remedy. The warranties set out in the *Contract* are supplemental to and do not limit or preclude the application of any other conditions and warranties, express or implied, by law or trade usage.”

PART 13 INDEMNIFICATION AND WAIVER

GC 13.1 INDEMNIFICATION

- .1 Delete GC 13.1 INDEMNIFICATION in its entirety and replace with the following:

“13.1.1 The *Contractor*, both during and after the term of this *Contract*, shall at all times, and at its own cost, expense and risk, defend, indemnify and hold harmless the *Owner*, its elected officials, officers, employees, volunteers, agents, *Consultants*, and all respective heirs, administrators, executors, successors and assigns from any and all losses, damages (including, but not limited to, incidental, indirect, special and consequential damages, or any loss of use, revenue or profit by any person, organization or entity), fines, penalties and surcharges, liabilities (including, but not limited to, any and all liability for damage to property and injury to persons, including death), judgments, claims, demands, causes of action, contracts, suits, actions or other proceedings of any kind (including, but not limited to proceedings of a criminal, administrative or quasi criminal nature) and expenses (including, but not limited to, legal fees on a substantial indemnity basis), which the indemnified person or persons may suffer or incur, howsoever caused, arising out of or in consequence of or directly or indirectly attributable to the *Work* required to be performed by the *Contractor*, its agents, employees and sub-contractors on behalf of the *Owner*, provided such losses, damages, fines, penalties and surcharges, liabilities, judgments, claims, demands, causes of action, contracts, suits, actions or other proceedings of any kind and expenses as defined above are due or claimed to be due to the negligence, breach of *Contract*, and/or breach of law of the *Contractor*, its agents, employees or *Subcontractors*.”

GC 13.2 WAIVER OF CLAIMS

- .1 In paragraph 13.2.2.2. replace the words “395 calendar days” with the following words “120 calendars days”.
- .2 Delete paragraph 13.2.5 in its entirety.
- .3 In paragraph 13.2.8 delete the word “The *Party*” and replace with the word “The *Contractor*”.

PART 14 OTHER PROVISIONS

- .1 Add new General Condition GC 14.1 as follows:

“GC 14.1 OWNERSHIP OF MATERIAL

- 14.1.1 Unless otherwise specified, all materials existing at the *Place of the Work*, at the time of execution of the *Contract* shall remain the property of the *Owner*. All *Work* and *Products* delivered to the *Place of the Work* by the *Contractor* shall be the property of the *Owner*. The *Contractor* shall remove all surplus or rejected materials as its property when notified in writing to do so by the *Consultant*.”

END OF SUPPLEMENTARY CONDITIONS



APPENDIX 2 - IRREVOCABLE LETTER OF CREDIT FORMS

Agreement to Provide a Letter of Credit.....	1
Irrevocable Letter of Credit.....	2

AGREEMENT TO PROVIDE A LETTER OF CREDIT

Date: _____

The Corporation of the City of Timmins
220 Algonquin Boulevard East
TIMMINS (Ontario)
P4N 1B3

Dear Sir:

SUBJECT: Contract No. 223027 – Timmins WTP High Lift and Backwash Pump Replacement

In consideration of the Corporation of the City of Timmins, (hereinafter referred to as "the City"), accepting the attached tender of executing an agreement with * _____, (hereinafter referred to as "the Tenderer") for the _____ of _____ subject to the express condition that the City receive the Letter of Credit in accordance with the said tender, we the undersigned, hereby agree with the City to become bound to the City as surety for the tenderer in a Letter of Credit in an amount equal to **10% of The Total Contract Value** in the form bound in and in accordance with the said tender and we agree to furnish the City with the said Letter of Credit within the seven (7) days after notification of the acceptance of the said tender and from when the said agreement has been mailed to us for execution.

Yours truly,

Note: This agreement must be executed on behalf of the bank or surety company by its authorized officers under the company's corporate seal.

+enter name and address of bank or surety company here

*enter name of tenderer here

Amount: _____

Initial Expiry Date: _____

IRREVOCABLE LETTER OF CREDIT

**TO: THE CITY TREASURER
THE CORPORATION OF THE CITY OF TIMMINS**

ADDRESS: 220 Algonquin Blvd. East, Timmins, Ontario P4N 1B3

WE HEREBY AUTHORIZE YOU TO DRAW ON THE _____ (Name of Bank)
for the account of _____ (Name of Customer).

UP TO AN AGGREGATE AMOUNT OF _____ DOLLARS (\$ _____)
available on demand.

PURSUANT TO THE REQUEST OF our customer: _____, we the
_____ (Name of Bank) hereby establish and give you an
Irrevocable Letter of Credit in your favour in the above amount which may be drawn on by you at any time
and from time to time, upon written demand for payment made upon us by you, which demand we shall
honour without enquiring whether you have the right as between yourself and the said customer to make
such demand, and without recognizing any claim of our said customer, or objection by it to payment by us.

The **LETTER OF CREDIT** we understand relates to those Municipal Services and financial obligations set
out in an Agreement between the customer and the Municipality and referred to as
Contract No. 223027 – Timmins WTP High Lift and Backwash Pump Replacement.

The **AMOUNT** of this Letter of Credit may be reduced from time to time as advised by notice in writing to the
undersigned from time to time by **THE CORPORATION OF THE CITY OF TIMMINS.**

This **LETTER OF CREDIT** will continue in force for the duration of the Construction including the two (2)
years but shall be subject only to the conditions hereinafter set forth.

IT IS A CONDITION of this Letter of Credit that it shall be deemed to be automatically extended without
amendment from year to year from the present or any future expiration date hereof, unless at least thirty
days prior to the present or any future expiration date, we shall notify you in writing by registered mail, that
we elect not to consider this Letter of Credit to be renewable for any additional period.

DATED at _____, Ontario, this _____ day of _____, 20____.

COUNTERSIGNED BY:

(NAME OF BANK)

PER:



APPENDIX 3 - AGREEMENT TO BOND

Agreement to Bond Form	1
------------------------------	---

AGREEMENT TO BOND

TO: THE CORPORATION OF THE CITY OF TIMMINS (the "City")

AND TO: _____ (the "Contractor")

DATE: _____

We, the undersigned, being licensed under the *Insurance Act* to write surety and fidelity insurance, hereby agree to become bound as Surety for the above-named Contractor in a bond totaling fifty percent (50%) of the total Contract price (the "Performance Bond"), as set out in the Contractor's Tender for **Contract No. 223027, Timmins WTP High Lift and Backwash Pump Replacement** (the "Contract"), for the full and due performance of the works described in the Contract Documents, if the Contractor's Tender for the Contract is accepted by the Owner. In addition, we agree to bond as Surety for the payment of the cost of all labour and materials for an amount equal to fifty percent (50%) of the Contract price (the "Labour and Materials Bond").

We, the undersigned, further acknowledge and agree that:

- (i) the Performance Bond and the Labour and Materials Bond will be in the form prescribed by Ontario's *Construction Act*, RSO, c C30, and its applicable regulations;
- (ii) if the Contractor's Tender is accepted, we will execute the bonds within seven (7) days of notification of acceptance of the Contractor's Tender; and
- (iii) this agreement must be executed on behalf of the Surety by its authorized officers.

Signed, sealed and delivered as at the date first written above.

Name of Surety

Signature of Surety's Authorized Signatory

Position of above-named individual



APPENDIX 4 - CCDC2-2020 CONTRACT

CCDC2 -2020 Contract1

CCDC 2

Stipulated Price Contract

2 0 2 0

[Name of Project]

Apply a CCDC 2 copyright seal here. The application of the seal demonstrates the intention of the party proposing the use of this document that it be an accurate and unamended form of CCDC 2 – 2020 except to the extent that any alterations, additions or modifications are set forth in supplementary conditions.

CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE
CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE
CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE

CCDC 2 STIPULATED PRICE CONTRACT

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CCDC 2 is the product of a consensus-building process aimed at balancing the interests of all parties on the construction project. It reflects recommended industry practices. The CCDC and its constituent member organizations do not accept any responsibility or liability for loss or damage which may be suffered as a result of the use or interpretation of CCDC 2.

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AGREEMENT BETWEEN OWNER AND CONTRACTOR

For use when a stipulated price is the basis of payment.

This Agreement made on _____ day of _____ in the year _____
by and between the parties

hereinafter called the "Owner"
and

hereinafter called the "Contractor"

The Owner and the Contractor agree as follows:

ARTICLE A-1 THE WORK

The Contractor shall:

- 1.1 perform the *Work* required by the *Contract Documents* for (insert below the description or title of the Work)

located at (insert below the Place of the Work)

for which the Agreement has been signed by the parties, and for which (insert below the name of the Consultant)

is acting as and is hereinafter called the "Consultant" and

- 1.2 do and fulfill everything indicated by the *Contract Documents*, and
- 1.3 commence the *Work* by the _____ day of _____ in the year _____ and, subject to adjustment in *Contract*
Time as provided for in the *Contract Documents*, attain *Ready-for-Takeover*, by the _____ day of _____ in
the year _____.

ARTICLE A-2 AGREEMENTS AND AMENDMENTS

- 2.1 The *Contract* supersedes all prior negotiations, representations or agreements, either written or oral, relating in any manner to the *Work*, including the bid documents that are not expressly listed in Article A-3 of the Agreement – CONTRACT DOCUMENTS.
- 2.2 The *Contract* may be amended only as provided in the *Contract Documents*.

ARTICLE A-3 CONTRACT DOCUMENTS

3.1 The following are the *Contract Documents* referred to in Article A-1 of the Agreement – THE WORK:

- Agreement between *Owner* and *Contractor*
- Definitions
- General Conditions

*

* (Insert here, attaching additional pages if required, a list identifying all other Contract Documents e.g. supplementary conditions; Division 01 of the Specifications – GENERAL REQUIREMENTS; Project information that the Contractor may rely upon; technical Specifications, giving a list of contents with section numbers and titles, number of pages and date; material finishing schedules; Drawings, giving drawing number, title, date, revision date or mark; addenda, giving title, number, date; time schedule)

ARTICLE A-4 CONTRACT PRICE

4.1 The *Contract Price*, which excludes *Value Added Taxes*, is:

/100 dollars \$

4.2 *Value Added Taxes* (of _____ %) payable by the *Owner* to the *Contractor* are:

/100 dollars \$

4.3 Total amount payable by the *Owner* to the *Contractor* for the *Work* is:

/100 dollars \$

4.4 These amounts shall be subject to adjustments as provided in the *Contract Documents*.

4.5 All amounts are in Canadian funds.

ARTICLE A-5 PAYMENT

5.1 Subject to the provisions of the *Contract Documents* and *Payment Legislation*, and in accordance with legislation and statutory regulations respecting holdback percentages, the *Owner* shall:

- .1 make progress payments to the *Contractor* on account of the *Contract Price* when due in the amount certified by the *Consultant* unless otherwise prescribed by *Payment Legislation* together with such *Value Added Taxes* as may be applicable to such payments,
- .2 upon *Substantial Performance of the Work*, pay to the *Contractor* the unpaid balance of the holdback amount when due together with such *Value Added Taxes* as may be applicable to such payment, and
- .3 upon the issuance of the final certificate for payment, pay to the *Contractor* the unpaid balance of the *Contract Price* when due together with such *Value Added Taxes* as may be applicable to such payment.

5.2 Interest

- .1 Should either party fail to make payments as they become due under the terms of the *Contract* or in an award by adjudication, arbitration or court, interest at the following rates on such unpaid amounts shall also become due and payable until payment:
 - (1) 2% per annum above the prime rate for the first 60 days.
 - (2) 4% per annum above the prime rate after the first 60 days.Such interest shall be compounded on a monthly basis. The prime rate shall be the rate of interest quoted by
(Insert name of chartered lending institution whose prime rate is to be used)

for prime business loans as it may change from time to time.

- .2 Interest shall apply at the rate and in the manner prescribed by paragraph 5.2.1 of this Article on the settlement amount of any claim in dispute that is resolved either pursuant to Part 8 of the General Conditions – DISPUTE RESOLUTION or otherwise, from the date the amount would have been due and payable under the *Contract*, had it not been in dispute, until the date it is paid.

ARTICLE A-6 RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING

- 6.1 *Notices in Writing* will be addressed to the recipient at the address set out below.
- 6.2 The delivery of a *Notice in Writing* will be by hand, by courier, by prepaid first class mail, or by other form of electronic communication during the transmission of which no indication of failure of receipt is communicated to the sender.
- 6.3 A *Notice in Writing* delivered by one party in accordance with this *Contract* will be deemed to have been received by the other party on the date of delivery if delivered by hand or courier, or if sent by mail it will be deemed to have been received five calendar days after the date on which it was mailed, provided that if either such day is not a *Working Day*, then the *Notice in Writing* will be deemed to have been received on the *Working Day* next following such day.
- 6.4 A *Notice in Writing* sent by any form of electronic communication will be deemed to have been received on the date of its transmission provided that if such day is not a *Working Day* or if it is received after the end of normal business hours on the date of its transmission at the place of receipt, then it will be deemed to have been received at the opening of business at the place of receipt on the first *Working Day* next following the transmission thereof.
- 6.5 An address for a party may be changed by *Notice in Writing* to the other party setting out the new address in accordance with this Article.

Owner

*name of Owner**

address

email address

Contractor

*name of Contractor**

address

email address

Consultant

*name of Consultant**

address

email address

** If it is intended that a specific individual must receive the notice, that individual's name shall be indicated.*

ARTICLE A-7 LANGUAGE OF THE CONTRACT

- 7.1 When the *Contract Documents* are prepared in both the English and French languages, it is agreed that in the event of any apparent discrepancy between the English and French versions, the English / French # language shall prevail.
Complete this statement by striking out inapplicable term.
- 7.2 This Agreement is drawn in English at the request of the parties hereto. La présente convention est rédigée en anglais à la demande des parties.

ARTICLE A-8 SUCCESSION

- 8.1 The *Contract* shall enure to the benefit of and be binding upon the parties hereto, their respective heirs, legal representatives, successors, and assigns.

In witness whereof the parties hereto have executed this Agreement by the hands of their duly authorized representatives.

SIGNED AND DELIVERED

in the presence of:

WITNESS

OWNER

signature

name of person signing

name of Owner

signature

name and title of person signing

WITNESS

CONTRACTOR

signature

name of person signing

name of Contractor

signature

name and title of person signing

- N.B.** Where legal jurisdiction, local practice or Owner or Contractor requirement calls for:
- (a) proof of authority to execute this document, attach such proof of authority in the form of a certified copy of a resolution naming the representative(s) authorized to sign the Agreement for and on behalf of the corporation or partnership; or
 - (b) the affixing of a corporate seal, this Agreement should be properly sealed.

DEFINITIONS

The following Definitions shall apply to all *Contract Documents*.

Change Directive

A *Change Directive* is a written instruction prepared by the *Consultant* and signed by the *Owner* directing the *Contractor* to proceed with a change in the *Work* within the general scope of the *Contract Documents* prior to the *Owner* and the *Contractor* agreeing upon adjustments in the *Contract Price* and the *Contract Time*.

Change Order

A *Change Order* is a written amendment to the *Contract* prepared by the *Consultant* and signed by the *Owner* and the *Contractor* stating their agreement upon:

- a change in the *Work*;
- the method of adjustment or the amount of the adjustment in the *Contract Price*, if any; and
- the extent of the adjustment in the *Contract Time*, if any.

Construction Equipment

Construction Equipment means all machinery and equipment, either operated or not operated, that is required for preparing, fabricating, conveying, erecting, or otherwise performing the *Work* but is not incorporated into the *Work*.

Consultant

The *Consultant* is the person or entity engaged by the *Owner* and identified as such in the Agreement. The *Consultant* is the Architect, the Engineer or entity licensed to practise in the province or territory of the *Place of the Work*.

Contract

The *Contract* is the undertaking by the parties to perform their respective duties, responsibilities and obligations as prescribed in the *Contract Documents* and represents the entire agreement between the parties.

Contract Documents

The *Contract Documents* consist of those documents listed in Article A-3 of the Agreement – CONTRACT DOCUMENTS and amendments agreed upon between the parties.

Contract Price

The *Contract Price* is the amount stipulated in Article A-4 of the Agreement – CONTRACT PRICE.

Contract Time

The *Contract Time* is the time from commencement of the *Work* to the date of *Ready-for-Takeover* as stipulated in paragraph 1.3 of Article A-1 of the Agreement – THE WORK.

Contractor

The *Contractor* is the person or entity identified as such in the Agreement.

Drawings

The *Drawings* are the graphic and pictorial portions of the *Contract Documents*, wherever located and whenever issued, showing the design, location and dimensions of the *Work*, generally including plans, elevations, sections, details, and diagrams.

Notice in Writing

A *Notice in Writing*, where identified in the *Contract Documents*, is a written communication between the parties or between them and the *Consultant* that is transmitted in accordance with the provisions of Article A-6 of the Agreement – RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING.

Owner

The *Owner* is the person or entity identified as such in the Agreement.

Other Contractor

Other Contractor means a contractor, other than the *Contractor* or a *Subcontractor*, engaged by the *Owner* for the *Project*.

Payment Legislation

Payment Legislation means such legislation in effect at the *Place of the Work* which governs payment under construction contracts.

Place of the Work

The *Place of the Work* is the designated site or location of the *Work* identified in the *Contract Documents*.

Product

Product or Products means material, machinery, equipment, and fixtures forming part of the *Work*, but does not include *Construction Equipment*.

Project

The *Project* means the total construction contemplated of which the *Work* may be the whole or a part.

Ready-for-Takeover

Ready-for-Takeover shall have been attained when the conditions set out in paragraph 12.1.1 of GC 12.1 – READY-FOR-TAKEOVER have been met, as verified by the *Consultant* pursuant to paragraph 12.1.4.2 of GC 12.1 – READY-FOR-TAKEOVER.

Shop Drawings

Shop Drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures, *Product* data, and other data which the *Contractor* provides to illustrate details of portions of the *Work*.

Specifications

The *Specifications* are that portion of the *Contract Documents*, wherever located and whenever issued, consisting of the written requirements and standards for *Products*, systems, workmanship, quality, and the services necessary for the performance of the *Work*.

Subcontractor

A *Subcontractor* is a person or entity having a direct contract with the *Contractor* to perform a part or parts of the *Work* at the *Place of the Work*.

Substantial Performance of the Work

Substantial Performance of the Work is as defined in the lien legislation applicable to the *Place of the Work*.

Supplemental Instruction

A *Supplemental Instruction* is an instruction, not involving adjustment in the *Contract Price* or *Contract Time*, in the form of *Specifications*, *Drawings*, schedules, samples, models, or written instructions, consistent with the intent of the *Contract Documents*. It is to be issued by the *Consultant* to supplement the *Contract Documents* as required for the performance of the *Work*.

Supplier

A *Supplier* is a person or entity having a direct contract with the *Contractor* to supply *Products*.

Temporary Work

Temporary Work means temporary supports, structures, facilities, services, and other temporary items, excluding *Construction Equipment*, required for the execution of the *Work* but not incorporated into the *Work*.

Value Added Taxes

Value Added Taxes means such sum as shall be levied upon the *Contract Price* by the Federal or any Provincial or Territorial Government and is computed as a percentage of the *Contract Price* and includes the Goods and Services Tax, the Quebec Sales Tax, the Harmonized Sales Tax, and any similar tax, the collection and payment of which have been imposed on the *Contractor* by tax legislation.

Work

The *Work* means the total construction and related services required by the *Contract Documents*.

Working Day

Working Day means a day other than a Saturday, Sunday, statutory holiday, or statutory vacation day that is observed by the construction industry in the area of the *Place of the Work*.

GENERAL CONDITIONS

PART 1 GENERAL PROVISIONS

GC 1.1 CONTRACT DOCUMENTS

- 1.1.1 The intent of the *Contract Documents* is to include the labour, *Products* and services necessary for the performance of the *Work* by the *Contractor* in accordance with these documents. It is not intended, however, that the *Contractor* shall supply products or perform work not consistent with, not covered by, or not properly inferable from the *Contract Documents*.
- 1.1.2 The *Contract Documents* are complementary, and what is required by one shall be as binding as if required by all. Performance by the *Contractor* shall be required only to the extent consistent with the *Contract Documents*.
- 1.1.3 The *Contractor* shall review the *Contract Documents* for the purpose of facilitating co-ordination and execution of the *Work* by the *Contractor*.
- 1.1.4 The *Contractor* is not responsible for errors, omissions or inconsistencies in the *Contract Documents*. If there are perceived errors, omissions or inconsistencies discovered by or made known to the *Contractor*, the *Contractor* shall promptly report to the *Consultant* and shall not proceed with the work affected until the *Contractor* has received corrected or additional information from the *Consultant*.
- 1.1.5 If there is a conflict within the *Contract Documents*:
- .1 the order of priority of documents, from highest to lowest, shall be
 - the Agreement between *Owner* and *Contractor*,
 - the Definitions,
 - Supplementary Conditions,
 - the General Conditions,
 - Division 01 of the *Specifications*,
 - technical *Specifications*,
 - material and finishing schedules,
 - the *Drawings*.
 - .2 *Drawings* of larger scale shall govern over those of smaller scale of the same date.
 - .3 dimensions shown on *Drawings* shall govern over dimensions scaled from *Drawings*.
 - .4 amended or later dated documents shall govern over earlier documents of the same type.
 - .5 noted materials and annotations shall govern over graphic indications.
- 1.1.6 Nothing contained in the *Contract Documents* shall create any contractual relationship between:
- .1 the *Owner* and a *Subcontractor*, a *Supplier*, or their agent, employee, or other person performing any portion of the *Work*.
 - .2 the *Consultant* and the *Contractor*, a *Subcontractor*, a *Supplier*, or their agent, employee, or other person performing any portion of the *Work*.
- 1.1.7 Words and abbreviations which have well known technical or trade meanings are used in the *Contract Documents* in accordance with such recognized meanings.
- 1.1.8 References in the *Contract Documents* to the singular shall be considered to include the plural as the context requires.
- 1.1.9 Neither the organization of the *Specifications* nor the arrangement of *Drawings* shall control the *Contractor* in dividing the work among *Subcontractors* and *Suppliers*.
- 1.1.10 *Specifications*, *Drawings*, models, and copies thereof furnished by the *Consultant* are and shall remain the *Consultant's* property, with the exception of the signed *Contract* sets, which shall belong to each party to the *Contract*. All *Specifications*, *Drawings* and models furnished by the *Consultant* are to be used only with respect to the *Work* and are not to be used on other work. These *Specifications*, *Drawings* and models are not to be copied or altered in any manner without the written authorization of the *Consultant*.
- 1.1.11 Physical models furnished by the *Contractor* at the *Owner's* expense are the property of the *Owner*.

GC 1.2 LAW OF THE CONTRACT

- 1.2.1 The law of the *Place of the Work* shall govern the interpretation of the *Contract*.

GC 1.3 RIGHTS AND REMEDIES

- 1.3.1 Except as expressly provided in the *Contract Documents*, the duties and obligations imposed by the *Contract Documents* and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights, and remedies otherwise imposed or available by law.

- 1.3.2 No action or failure to act by the *Owner*, the *Consultant* or the *Contractor* shall constitute a waiver of any right or duty afforded any of them under the *Contract*, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

GC 1.4 ASSIGNMENT

- 1.4.1 Neither party to the *Contract* shall assign the *Contract* or a portion thereof without the written consent of the other, which consent shall not be unreasonably withheld.

PART 2 ADMINISTRATION OF THE CONTRACT

GC 2.1 AUTHORITY OF THE CONSULTANT

- 2.1.1 The *Consultant* will have authority to act on behalf of the *Owner* only to the extent provided in the *Contract Documents*, unless otherwise modified by written agreement as provided in paragraph 2.1.2.
- 2.1.2 The duties, responsibilities and limitations of authority of the *Consultant* as set forth in the *Contract Documents* shall be modified or extended only with the written consent of the *Owner*, the *Consultant* and the *Contractor*.

GC 2.2 ROLE OF THE CONSULTANT

- 2.2.1 The *Consultant* will provide administration of the *Contract* as described in the *Contract Documents*.
- 2.2.2 The *Consultant* will visit the *Place of the Work* at intervals appropriate to the progress of construction to become familiar with the progress and quality of the work and to determine if the *Work* is proceeding in general conformity with the *Contract Documents*.
- 2.2.3 If the *Owner* and the *Consultant* agree, the *Consultant* will provide at the *Place of the Work*, one or more project representatives to assist in carrying out the *Consultant's* responsibilities. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in writing to the *Contractor*.
- 2.2.4 Based on the *Consultant's* observations and evaluation of the *Contractor's* applications for payment, the *Consultant* will determine the amounts owing to the *Contractor* under the *Contract* and will issue certificates for payment as provided in Article A-5 of the Agreement – PAYMENT, GC 5.3 – PAYMENT and GC 5.5 – FINAL PAYMENT.
- 2.2.5 The *Consultant* will not be responsible for and will not have control, charge or supervision of construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs required in connection with the *Work* in accordance with the applicable construction safety legislation, other regulations or general construction practice. The *Consultant* will not be responsible for the *Contractor's* failure to perform the *Work* in accordance with the *Contract Documents*.
- 2.2.6 Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER, the *Consultant* will be, in the first instance, the interpreter of the requirements of the *Contract Documents*.
- 2.2.7 Matters in question relating to the performance of the *Work* or the interpretation of the *Contract Documents* shall be initially referred in writing to the *Consultant* by the party raising the question for interpretations and findings and copied to the other party.
- 2.2.8 Interpretations and findings of the *Consultant* shall be consistent with the intent of the *Contract Documents*. In making such interpretations and findings the *Consultant* will not show partiality to either the *Owner* or the *Contractor*.
- 2.2.9 The *Consultant's* interpretations and findings will be given in writing to the parties within a reasonable time.
- 2.2.10 With respect to claims for a change in *Contract Price*, the *Consultant* will make findings as set out in GC 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE.
- 2.2.11 The *Consultant* will have authority to reject work which in the *Consultant's* opinion does not conform to the requirements of the *Contract Documents*. Whenever the *Consultant* considers it necessary or advisable, the *Consultant* will have authority to require inspection or testing of work, whether or not such work is fabricated, installed or completed. However, neither the authority of the *Consultant* to act nor any decision either to exercise or not to exercise such authority shall give rise to any duty or responsibility of the *Consultant* to the *Contractor*, *Subcontractors*, *Suppliers*, or their agents, employees, or other persons performing any of the *Work*.
- 2.2.12 During the progress of the *Work* the *Consultant* will furnish *Supplemental Instructions* to the *Contractor* with reasonable promptness or in accordance with a schedule for such instructions agreed to by the *Consultant* and the *Contractor*.
- 2.2.13 The *Consultant* will review and take appropriate action upon *Shop Drawings*, samples and other submittals by the *Contractor*, in accordance with the *Contract Documents*.

- 2.2.14 The *Consultant* will prepare *Change Orders* and *Change Directives* as provided in GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.
- 2.2.15 The *Consultant* will conduct reviews of the *Work* to determine the date of *Substantial Performance of the Work* and verify that *Ready-for-Takeover* has been attained.
- 2.2.16 All certificates issued by the *Consultant* will be to the best of the *Consultant's* knowledge, information and belief. By issuing any certificate, the *Consultant* does not guarantee the *Work* is correct or complete.
- 2.2.17 The *Consultant* will receive and review written warranties and related documents required by the *Contract* and provided by the *Contractor* and will forward such warranties and documents to the *Owner* for the *Owner's* acceptance.
- 2.2.18 If the *Consultant's* engagement is terminated, the *Owner* shall immediately engage a *Consultant* against whom the *Contractor* makes no reasonable objection and whose duties and responsibilities under the *Contract Documents* will be that of the former *Consultant*.

GC 2.3 REVIEW AND INSPECTION OF THE WORK

- 2.3.1 The *Owner* and the *Consultant* shall have access to the *Work* at all times. The *Contractor* shall provide sufficient, safe and proper facilities at all times for the review of the *Work* by the *Consultant* and the inspection of the *Work* by authorized agencies. If parts of the *Work* are in preparation at locations other than the *Place of the Work*, the *Owner* and the *Consultant* shall be given access to such work whenever it is in progress.
- 2.3.2 If work is designated for tests, inspections or approvals in the *Contract Documents*, by the *Consultant's* instructions, or by the laws or ordinances of the *Place of the Work*, the *Contractor* shall give the *Consultant* reasonable notification of when the work will be ready for review and inspection. The *Contractor* shall arrange for and shall give the *Consultant* reasonable notification of the date and time of inspections by other authorities.
- 2.3.3 The *Contractor* shall furnish promptly to the *Consultant* two copies of certificates and inspection reports relating to the *Work*.
- 2.3.4 If the *Contractor* covers, or permits to be covered, work that has been designated for special tests, inspections or approvals before such special tests, inspections or approvals are made, given or completed, the *Contractor* shall, if so directed, uncover such work, have the inspections or tests satisfactorily completed, and make good covering work at the *Contractor's* expense.
- 2.3.5 The *Consultant* may order any portion or portions of the *Work* to be examined to confirm that such work is in accordance with the requirements of the *Contract Documents*. If the work is not in accordance with the requirements of the *Contract Documents*, the *Contractor* shall correct the work and pay the cost of examination and correction. If the work is in accordance with the requirements of the *Contract Documents*, the *Owner* shall pay the cost of examination and restoration.
- 2.3.6 The *Contractor* shall pay the cost of making any test or inspection, including the cost of samples required for such test or inspection, if such test or inspection is designated in the *Contract Documents* to be performed by the *Contractor* or is required by the laws or ordinances applicable to the *Place of the Work*.
- 2.3.7 The *Contractor* shall pay the cost of samples required for any test or inspection to be performed by others if such test or inspection is designated in the *Contract Documents*.

GC 2.4 DEFECTIVE WORK

- 2.4.1 The *Contractor* shall promptly correct defective work that has been rejected by the *Consultant* as failing to conform to the *Contract Documents* whether or not the defective work was incorporated in the *Work* or the defect is the result of poor workmanship, use of defective products or damage through carelessness or other act or omission of the *Contractor*.
- 2.4.2 The *Contractor* shall make good promptly *Other Contractors'* work destroyed or damaged by such corrections at the *Contractor's* expense.
- 2.4.3 If in the opinion of the *Consultant* it is not expedient to correct defective work or work not performed as provided in the *Contract Documents*, the *Owner* may deduct from the amount otherwise due to the *Contractor* the difference in value between the work as performed and that called for by the *Contract Documents*. If the *Owner* and the *Contractor* do not agree on the difference in value, they shall refer the matter to the *Consultant* for a finding.

PART 3 EXECUTION OF THE WORK

GC 3.1 CONTROL OF THE WORK

- 3.1.1 The *Contractor* shall have total control of the *Work* and shall effectively direct and supervise the *Work* so as to ensure conformity with the *Contract Documents*.

- 3.1.2 The *Contractor* shall be solely responsible for construction means, methods, techniques, sequences, and procedures and for co-ordinating the various parts of the *Work* under the *Contract*.

GC 3.2 CONSTRUCTION BY THE OWNER OR OTHER CONTRACTORS

- 3.2.1 The *Owner* reserves the right to award separate contracts in connection with other parts of the *Project* to *Other Contractors* and to perform work with own forces.
- 3.2.2 When separate contracts are awarded for other parts of the *Project*, or when work is performed by the *Owner's* own forces, the *Owner* shall:
- .1 provide for the co-ordination of the activities and work of *Other Contractors* and the *Owner's* own forces with the *Work* of the *Contract*;
 - .2 enter into separate contracts with *Other Contractors* under conditions of contract which are compatible with the conditions of the *Contract*;
 - .3 ensure that insurance coverage is provided to the same requirements as are called for in GC 11.1 – INSURANCE and co-ordinate such insurance with the insurance coverage of the *Contractor* as it affects the *Work*; and
 - .4 take all reasonable precautions to avoid labour disputes or other disputes on the *Project* arising from the work of *Other Contractors* or the *Owner's* own forces.
- 3.2.3 When separate contracts are awarded for other parts of the *Project*, or when work is performed by the *Owner's* own forces, the *Contractor* shall:
- .1 afford the *Owner* and *Other Contractors* reasonable opportunity to store their products and execute their work;
 - .2 co-ordinate and schedule the *Work* with the work of *Other Contractors* or the *Owner's* own forces that are identified in the *Contract Documents*;
 - .3 participate with *Other Contractors* and the *Owner* in reviewing their construction schedules when directed to do so; and
 - .4 report promptly to the *Consultant* in writing any apparent deficiencies in the work of *Other Contractors* or of the *Owner's* own forces, where such work affects the proper execution of any portion of the *Work*, prior to proceeding with that portion of the *Work*.
- 3.2.4 Where a change in the *Work* is required as a result of the co-ordination and integration of the work of *Other Contractors* or *Owner's* own forces with the *Work*, the changes shall be authorized and valued as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.
- 3.2.5 Disputes and other matters in question between the *Contractor* and *Other Contractors* shall be dealt with as provided in Part 8 of the General Conditions – DISPUTE RESOLUTION provided the *Other Contractors* have reciprocal obligations. The *Contractor* shall be deemed to have consented to arbitration of any dispute with any *Other Contractor* whose contract with the *Owner* contains a similar agreement to arbitrate. In the absence of *Other Contractors* having reciprocal obligations, disputes and other matters in question initiated by the *Contractor* against *Other Contractors* will be considered disputes and other matters in question between the *Contractor* and the *Owner*.
- 3.2.6 Should the *Owner*, the *Consultant*, *Other Contractors*, or anyone employed by them directly or indirectly be responsible for ill-timed work necessitating cutting or remedial work to be performed, the cost of such cutting or remedial work shall be valued as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

GC 3.3 TEMPORARY WORK

- 3.3.1 The *Contractor* shall have the sole responsibility for the design, erection, operation, maintenance, and removal of *Temporary Work* unless otherwise specified in the *Contract Documents*.
- 3.3.2 The *Contractor* shall engage and pay for registered professional engineering personnel skilled in the appropriate disciplines to perform those functions referred to in paragraph 3.3.1 where required by law or by the *Contract Documents* and in all cases where such *Temporary Work* is of such a nature that professional engineering skill is required to produce safe and satisfactory results.
- 3.3.3 Notwithstanding the provisions of GC 3.1 – CONTROL OF THE WORK, paragraphs 3.3.1 and 3.3.2 or provisions to the contrary elsewhere in the *Contract Documents* where such *Contract Documents* include designs for *Temporary Work* or specify a method of construction in whole or in part, such designs or methods of construction shall be considered to be part of the design of the *Work* and the *Contractor* shall not be held responsible for that part of the design or the specified method of construction. The *Contractor* shall, however, be responsible for the execution of such design or specified method of construction in the same manner as for the execution of the *Work*.

GC 3.4 CONSTRUCTION SCHEDULE

3.4.1 The *Contractor* shall:

- .1 prepare and submit to the *Owner* and the *Consultant* prior to the first application for payment, a construction schedule that indicates the timing of the major activities of the *Work* and provides sufficient detail of the critical events and their inter-relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time*;
- .2 monitor the progress of the *Work* relative to the construction schedule and update the schedule on a monthly basis or as stipulated by the *Contract Documents*; and
- .3 advise the *Consultant* of any revisions required to the schedule as the result of extensions of the *Contract Time* as provided in Part 6 of the General Conditions – CHANGES IN THE WORK.

GC 3.5 SUPERVISION

3.5.1 The *Contractor* shall provide all necessary supervision and appoint a competent representative who shall be in attendance at the *Place of the Work* while the *Work* is being performed. The appointed representative shall not be changed except for valid reason.

3.5.2 The appointed representative shall represent the *Contractor* at the *Place of the Work*. Information and instructions provided by the *Consultant* to the *Contractor's* appointed representative shall be deemed to have been received by the *Contractor*, except with respect to Article A-6 of the Agreement – RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING.

GC 3.6 SUBCONTRACTORS AND SUPPLIERS

3.6.1 The *Contractor* shall preserve and protect the rights of the parties under the *Contract* with respect to work to be performed under subcontract, and shall:

- .1 enter into contracts or written agreements with *Subcontractors* and *Suppliers* to require them to perform their work as provided in the *Contract Documents*;
- .2 incorporate the applicable terms and conditions of the *Contract Documents* into all contracts or written agreements with *Subcontractors* and *Suppliers*; and
- .3 be as fully responsible to the *Owner* for acts and omissions of *Subcontractors*, *Suppliers* and any persons directly or indirectly employed by them as for acts and omissions of persons directly employed by the *Contractor*.

3.6.2 The *Contractor* shall indicate in writing, if requested by the *Owner*, those *Subcontractors* or *Suppliers* whose bids have been received by the *Contractor* which the *Contractor* would be prepared to accept for the performance of a portion of the *Work*. Should the *Owner* not object before signing the *Contract*, the *Contractor* shall employ those *Subcontractors* or *Suppliers* so identified by the *Contractor* in writing for the performance of that portion of the *Work* to which their bid applies.

3.6.3 The *Owner* may, for reasonable cause, at any time before the *Owner* has signed the *Contract*, object to the use of a proposed *Subcontractor* or *Supplier* and require the *Contractor* to employ one of the other subcontract bidders.

3.6.4 If the *Owner* requires the *Contractor* to change a proposed *Subcontractor* or *Supplier*, the *Contract Price* and *Contract Time* shall be adjusted by the difference occasioned by such required change.

3.6.5 The *Contractor* shall not be required to employ as a *Subcontractor* or *Supplier*, a person or firm to which the *Contractor* may reasonably object.

3.6.6 The *Owner*, through the *Consultant*, may provide to a *Subcontractor* or *Supplier* information as to the percentage of the *Subcontractor's* or *Supplier's* work which has been certified for payment.

GC 3.7 LABOUR AND PRODUCTS

3.7.1 The *Contractor* shall maintain good order and discipline among the *Contractor's* employees engaged on the *Work* and employ only workers that are skilled in the tasks assigned.

3.7.2 The *Contractor* shall provide and pay for labour, *Products*, tools, *Construction Equipment*, water, heat, light, power, transportation, and other facilities and services necessary for the performance of the *Work* in accordance with the *Contract*.

3.7.3 Unless otherwise specified in the *Contract Documents*, *Products* provided shall be new. *Products* which are not specified shall be of a quality consistent with those specified and their use acceptable to the *Consultant*.

GC 3.8 SHOP DRAWINGS

3.8.1 The *Contractor* shall provide *Shop Drawings* as required in the *Contract Documents*.

3.8.2 The *Contractor* shall provide *Shop Drawings* to the *Consultant* to review in accordance with an agreed schedule, or in the absence of an agreed schedule, in orderly sequence and sufficiently in advance so as to cause no delay in the *Work* or in the work of *Other Contractors* or the *Owner's* own forces.

- 3.8.3 The *Contractor* shall review all *Shop Drawings* before providing them to the *Consultant*. The *Contractor* represents by this review that:
- .1 the *Contractor* has determined and verified all applicable field measurements, field construction conditions, *Product* requirements, catalogue numbers and similar data, or will do so, and
 - .2 the *Contractor* has checked and co-ordinated each *Shop Drawing* with the requirements of the *Work* and of the *Contract Documents*.
- 3.8.4 The *Consultant's* review is for conformity to the design concept and for general arrangement only.
- 3.8.5 At the time of providing *Shop Drawings*, the *Contractor* shall expressly advise the *Consultant* in writing of any deviations in a *Shop Drawing* from the requirements of the *Contract Documents*. The *Consultant* shall indicate the acceptance or rejection of such deviation expressly in writing.
- 3.8.6 The *Consultant's* review shall not relieve the *Contractor* of responsibility for errors or omissions in the *Shop Drawings* or for meeting all requirements of the *Contract Documents*.
- 3.8.7 The *Consultant* will review and return *Shop Drawings* in accordance with the schedule agreed upon, or, in the absence of such schedule, with reasonable promptness so as to cause no delay in the performance of the *Work*.

PART 4 ALLOWANCES

GC 4.1 CASH ALLOWANCES

- 4.1.1 The *Contract Price* includes the cash allowances, if any, stated in the *Contract Documents*. The scope of the *Work* or costs included in such cash allowances shall be as described in the *Contract Documents*.
- 4.1.2 The *Contract Price*, and not the cash allowances, includes the *Contractor's* overhead and profit in connection with such cash allowances.
- 4.1.3 Expenditures under cash allowances shall be authorized by the *Owner* through the *Consultant*.
- 4.1.4 Where the actual cost of the *Work* under any cash allowance exceeds the amount of the allowance, any unexpended amounts from other cash allowances shall be reallocated, at the *Consultant's* direction, to cover the shortfall, and, in that case, there shall be no additional amount added to the *Contract Price* for overhead and profit. Only where the actual cost of the *Work* under all cash allowances exceeds the total amount of all cash allowances shall the *Contractor* be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess only, as set out in the *Contract Documents*.
- 4.1.5 The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the *Contract Price* by *Change Order* without any adjustment for the *Contractor's* overhead and profit on such amount.
- 4.1.6 The value of the *Work* performed under a cash allowance is eligible to be included in progress payments.
- 4.1.7 The *Contractor* and the *Consultant* shall jointly prepare a schedule that shows when the items called for under cash allowances must be ordered to avoid delaying the progress of the *Work*.

GC 4.2 CONTINGENCY ALLOWANCE

- 4.2.1 The *Contract Price* includes the contingency allowance, if any, stated in the *Contract Documents*.
- 4.2.2 The contingency allowance includes the *Contractor's* overhead and profit in connection with such contingency allowance.
- 4.2.3 Expenditures under the contingency allowance shall be authorized and valued as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.
- 4.2.4 The *Contract Price* shall be adjusted by *Change Order* to provide for any difference between the expenditures authorized under paragraph 4.2.3 and the contingency allowance.

PART 5 PAYMENT

GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

- 5.1.1 The *Owner* shall, at the request of the *Contractor*, before signing the *Contract*, and promptly from time to time thereafter, furnish to the *Contractor* reasonable evidence that financial arrangements have been made to fulfill the *Owner's* obligations under the *Contract*.
- 5.1.2 The *Owner* shall give the *Contractor Notice in Writing* of any material change in the *Owner's* financial arrangements to fulfill the *Owner's* obligations under the *Contract* during the performance of the *Contract*.

GC 5.2 APPLICATIONS FOR PAYMENT

- 5.2.1 Applications for payment on account as provided in Article A-5 of the Agreement – PAYMENT shall be submitted monthly to the *Owner* and the *Consultant* simultaneously as the *Work* progresses.
- 5.2.2 Applications for payment shall be dated the last day of each payment period, which is the last day of the month or an alternative day of the month agreed in writing by the parties.
- 5.2.3 The amount claimed shall be for the value, proportionate to the amount of the *Contract*, of *Work* performed and *Products* delivered to the *Place of the Work* as of the last day of the payment period.
- 5.2.4 The *Contractor* shall submit to the *Consultant*, at least 15 calendar days before the first application for payment, a schedule of values for the parts of the *Work*, aggregating the total amount of the *Contract Price*, so as to facilitate evaluation of applications for payment.
- 5.2.5 The schedule of values shall be made out in such form as specified in the *Contract* and supported by such evidence as the *Consultant* may reasonably require.
- 5.2.6 Applications for payment shall be based on the schedule of values accepted by the *Consultant* and shall comply with the provisions of *Payment Legislation*.
- 5.2.7 Each application for payment shall include evidence of compliance with workers' compensation legislation at the *Place of the Work* and after the first payment, a declaration by the *Contractor* as to the distribution made of the amounts previously received using document CCDC 9A 'Statutory Declaration'.
- 5.2.8 Applications for payment for *Products* delivered to the *Place of the Work* but not yet incorporated into the *Work* shall be supported by such evidence as the *Consultant* may reasonably require to establish the value and delivery of the *Products*.

GC 5.3 PAYMENT

- 5.3.1 After receipt by the *Consultant* and the *Owner* of an application for payment submitted by the *Contractor* in accordance with GC 5.2 – APPLICATIONS FOR PAYMENT:
 - .1 The *Consultant* will issue to the *Owner* and copy to the *Contractor*, no later than 10 calendar days after the receipt of the application for payment, a certificate for payment in the amount applied for, or in such other amount as the *Consultant* determines to be properly due. If the *Consultant* certifies a different amount, or rejects the application or part thereof, the *Owner* shall promptly issue a written notice to the *Contractor* giving reasons for the revision or rejection, such written notice to be in compliance with *Payment Legislation*.
 - .2 The *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement – PAYMENT on or before 28 calendar days after the receipt by the *Owner* and the *Consultant* of the application for payment, and in any event, in compliance with *Payment Legislation*.

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK

- 5.4.1 The *Consultant* will review the *Work* to certify or verify the validity of the application for *Substantial Performance of the Work* and will promptly, and in any event, no later than 20 calendar days after receipt of the *Contractors* application:
 - .1 advise the *Contractor* in writing that the *Work* or the designated portion of the *Work* is not substantially performed and give reasons why, or
 - .2 state the date of *Substantial Performance of the Work* or a designated portion of the *Work* in a certificate and issue a copy of that certificate to each of the *Owner* and the *Contractor*.
- 5.4.2 Where the holdback amount required by the applicable lien legislation has not been placed in a separate lien holdback account, the *Owner* shall, no later than 10 calendar days prior to the expiry of the holdback period stipulated in the lien legislation applicable to the *Place of the Work*, place the holdback amount in a bank account in the joint names of the *Owner* and the *Contractor*.
- 5.4.3 Subject to the requirements of any *Payment Legislation*, all holdback amount prescribed by the applicable lien legislation for the *Work* shall become due and payable to the *Contractor* no later than 10 *Working Days* following the expiration of the holdback period stipulated in the lien legislation applicable to the *Place of the Work*.
- 5.4.4 The *Contractor* shall submit an application for payment of the lien holdback amount in accordance with GC 5.3 – PAYMENT.
- 5.4.5 Where legislation permits progressive release of the holdback for a portion of the *Work* and the *Consultant* has certified or verified that the part of the *Work* has been performed prior to *Substantial Performance of the Work*, the *Owner* hereby agrees to release, and shall release, such portion to the *Contractor* in accordance with such legislation.

- 5.4.6 Notwithstanding any progressive release of the holdback, the *Contractor* shall ensure that such parts of the *Work* are protected pending the issuance of a final certificate for payment and be responsible for the correction of defects or work not performed regardless of whether or not such was apparent when the holdback was released.

GC 5.5 FINAL PAYMENT

- 5.5.1 When the *Contractor* considers that the *Work* is completed, the *Contractor* shall submit an application for final payment.
- 5.5.2 The *Consultant* will, no later than 10 calendar days after the receipt of an application from the *Contractor* for final payment, review the *Work* to verify the validity of the application and when the *Consultant* finds the *Contractor's* application for final payment valid, the *Consultant* will promptly issue a final certificate for payment to the *Owner*, with a copy to the *Contractor*.
- 5.5.3 If the *Consultant* rejects the application or part thereof, the *Owner* will promptly issue a written notice to the *Contractor* giving reasons for the revision or rejection, such written notice to be in compliance with *Payment Legislation*.
- 5.5.4 Subject to the provision of paragraph 10.4.1 of GC 10.4 – WORKERS' COMPENSATION, and any legislation applicable to the *Place of the Work*, the *Owner* shall, no later than 5 calendar days after the issuance of a final certificate for payment, pay the *Contractor* as provided in Article A-5 of the Agreement – PAYMENT and in any event, in compliance with *Payment Legislation*.

GC 5.6 DEFERRED WORK

- 5.6.1 If because of climatic or other conditions reasonably beyond the control of the *Contractor*, or if the *Owner* and the *Contractor* agree that, there are items of work that must be deferred, payment in full for that portion of the *Work* which has been performed as certified by the *Consultant* shall not be withheld or delayed by the *Owner* on account thereof, but the *Owner* may withhold, until the remaining portion of the *Work* is finished, only such an amount that the *Consultant* determines is sufficient and reasonable to cover the cost of performing such deferred *Work*.

GC 5.7 NON-CONFORMING WORK

- 5.7.1 No payment by the *Owner* under the *Contract* nor partial or entire use or occupancy of the *Work* by the *Owner* shall constitute an acceptance of any portion of the *Work* or *Products* which are not in accordance with the requirements of the *Contract Documents*.

PART 6 CHANGES IN THE WORK

GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

- 6.1.1 The *Owner*, through the *Consultant*, without invalidating the *Contract*, may make:
- .1 changes in the *Work* consisting of additions, deletions or other revisions to the *Work* by *Change Order* or *Change Directive*, and
 - .2 changes to the *Contract Time* for the *Work*, or any part thereof, by *Change Order*.
- 6.1.2 The *Contractor* shall not perform a change in the *Work* without a *Change Order* or a *Change Directive*.

GC 6.2 CHANGE ORDER

- 6.2.1 When a change in the *Work* is proposed or required, the *Consultant* will provide the *Contractor* with a written description of the proposed change in the *Work*. The *Contractor* shall promptly present to the *Consultant*, in a form that can be reasonably evaluated, a method of adjustment or an amount of adjustment for the *Contract Price*, if any, and the adjustment in the *Contract Time*, if any, for the proposed change in the *Work*.
- 6.2.2 When the *Owner* and the *Contractor* agree to the adjustments in the *Contract Price* and *Contract Time* or to the method to be used to determine the adjustments, such agreement shall be effective immediately and shall be recorded in a *Change Order*. The value of the work performed as the result of a *Change Order* shall be included in the applications for progress payment.

GC 6.3 CHANGE DIRECTIVE

- 6.3.1 If the *Owner* requires the *Contractor* to proceed with a change in the *Work* prior to the *Owner* and the *Contractor* agreeing upon the corresponding adjustment in *Contract Price* and *Contract Time*, the *Owner*, through the *Consultant*, shall issue a *Change Directive*.
- 6.3.2 A *Change Directive* shall only be used to direct a change in the *Work* which is within the general scope of the *Contract Documents*.
- 6.3.3 A *Change Directive* shall not be used to direct a change in the *Contract Time* only.

- 6.3.4 Upon receipt of a *Change Directive*, the *Contractor* shall proceed promptly with the change in the *Work*.
- 6.3.5 For the purpose of valuing *Change Directives*, changes in the *Work* that are not substitutions or otherwise related to each other shall not be grouped together in the same *Change Directive*.
- 6.3.6 The adjustment in the *Contract Price* for a change carried out by way of a *Change Directive* shall be determined on the basis of the cost of the *Contractor's* actual expenditures and savings attributable to the *Change Directive*, valued in accordance with paragraph 6.3.7 and as follows:
- .1 If the change results in a net increase in the *Contractor's* cost, the *Contract Price* shall be increased by the amount of the net increase in the *Contractor's* cost, plus the *Contractor's* percentage fee on such net increase.
 - .2 If the change results in a net decrease in the *Contractor's* cost, the *Contract Price* shall be decreased by the amount of the net decrease in the *Contractor's* cost, without adjustment for the *Contractor's* percentage fee.
 - .3 The *Contractor's* fee shall be as specified in the *Contract Documents* or as otherwise agreed by the parties.
- 6.3.7 The cost of performing the work attributable to the *Change Directive* shall be limited to the actual cost of the following in as much as it contributes directly to the implementation of the *Change Directive*:

Labour

- .1 rates that are listed in the schedule or as agreed by the *Owner* and the *Contractor* including wages, benefits, compensation, contributions, assessments, or taxes incurred for such items as employment insurance, provincial or territorial health insurance, workers' compensation, and Canada or Quebec Pension Plan for:
 - (1) trade labour in the direct employ of the *Contractor*;
 - (2) the *Contractor's* personnel when stationed at the field office;
 - (3) the *Contractor's* personnel engaged at shops or on the road, in expediting the production or transportation of materials or equipment; and
 - (4) the *Contractor's* office personnel engaged in a technical capacity, or other personnel identified in Article A-3 of the Agreement – CONTRACT DOCUMENTS for the time spent in the performance of the *Work*;

Products, Construction Equipment and Temporary Work

- .2 cost of all *Products* including cost of transportation thereof;
- .3 in the absence of agreed rates, cost less salvage value of *Construction Equipment*, *Temporary Work* and tools, exclusive of hand tools under \$1,000 owned by the *Contractor*;
- .4 rental cost of *Construction Equipment*, *Temporary Work* and tools, exclusive of hand tools under \$1,000;
- .5 cost of all equipment and services required for the *Contractor's* field office;

Subcontract

- .6 subcontract amounts of Subcontractor with pricing mechanism approved by the *Owner*;

Others

- .7 travel and subsistence expenses of the *Contractor's* personnel described in paragraph 6.3.7.1;
- .8 deposits lost provided that they are not caused by negligent acts or omissions of the *Contractor*;
- .9 cost of quality assurance such as independent inspection and testing services;
- .10 charges levied by authorities having jurisdiction at the *Place of the Work*;
- .11 royalties, patent license fees, and damages for infringement of patents and cost of defending suits therefor subject always to the *Contractor's* obligations to indemnify the *Owner* as provided in paragraph 10.3.1 of GC 10.3 – PATENT FEES;
- .12 premium for all contract securities and insurance for which the *Contractor* is required, by the *Contract Documents*, to provide, maintain and pay in relation to the performance of the *Work*;
- .13 losses and expenses sustained by the *Contractor* for matters which are the subject of insurance under the policies prescribed in GC 11.1 – INSURANCE when such losses and expenses are not recoverable because the amounts are in excess of collectible amounts or within the deductible amounts;
- .14 taxes and duties, other than *Value Added Taxes*, income, capital, or property taxes, relating to the *Work* for which the *Contractor* is liable;
- .15 charges for voice and data communications, courier services, expressage, transmittal and reproduction of documents, and petty cash items;
- .16 cost for removal and disposal of waste products and debris;
- .17 legal costs, incurred by the *Contractor*, in relation to the performance of the *Work* provided that they are not:
 - (1) relating to a dispute between the *Owner* and the *Contractor* unless such costs are part of a settlement or awarded by arbitration or court,
 - (2) the result of the negligent acts or omissions of the *Contractor*, or
 - (3) the result of a breach of this *Contract* by the *Contractor*;
- .18 cost of auditing when requested by the *Owner*; and
- .19 cost of *Project* specific information technology in accordance with the method determined by the parties.

- 6.3.8 Notwithstanding any other provisions contained in the General Conditions of the *Contract*, it is the intention of the parties that the cost of any item under any cost element referred to in paragraph 6.3.7 shall cover and include any and all costs or liabilities attributable to the *Change Directive* other than those which are the result of or occasioned by any failure on the part of the *Contractor* to exercise reasonable care and diligence in the *Contractor's* attention to the *Work*. Any cost due to failure on the part of the *Contractor* to exercise reasonable care and diligence in the *Contractor's* performance of the *Work* attributable to the *Change Directive* shall be borne by the *Contractor*.
- 6.3.9 The *Contractor* shall keep full and detailed accounts and records necessary for the documentation of the cost of performing the *Work* attributable to the *Change Directive* and shall provide the *Consultant* with copies thereof.
- 6.3.10 For the purpose of valuing *Change Directives*, the *Owner* shall be afforded reasonable access to all of the *Contractor's* pertinent documents related to the cost of performing the *Work* attributable to the *Change Directive*.
- 6.3.11 Pending determination of the final amount of a *Change Directive*, the undisputed value of the *Work* performed as the result of a *Change Directive* is eligible to be included in progress payments.
- 6.3.12 If the *Owner* and the *Contractor* do not agree on the proposed adjustment in the *Contract Time* attributable to the change in the *Work*, or the method of determining it, the adjustment shall be referred to the *Consultant* for a finding.
- 6.3.13 When the *Owner* and the *Contractor* reach agreement on the adjustment to the *Contract Price* and to the *Contract Time*, this agreement shall be recorded in a *Change Order*.

GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

- 6.4.1 If the *Owner* or the *Contractor* discover conditions at the *Place of the Work* which are:
- .1 subsurface or otherwise concealed physical conditions which existed before the commencement of the *Work* and differ materially from those indicated in the *Contract Documents*; or
 - .2 physical conditions, other than conditions due to weather, that are of a nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the *Contract Documents*,
- then the observing party shall give *Notice in Writing* to the other party of such conditions before they are disturbed and in no event later than 5 *Working Days* after first observance of the conditions.
- 6.4.2 The *Consultant* will promptly investigate such conditions and make a finding. If the finding is that the conditions differ materially and this would cause an increase or decrease in the *Contractor's* cost or time to perform the *Work*, the *Owner*, through the *Consultant*, shall issue appropriate instructions for a change in the *Work* as provided in GC 6.2 – CHANGE ORDER or GC 6.3 – CHANGE DIRECTIVE.
- 6.4.3 If the *Consultant* finds that the conditions at the *Place of the Work* are not materially different or that no change in the *Contract Price* or the *Contract Time* is justified, the *Consultant* will promptly inform the *Owner* and the *Contractor* in writing.
- 6.4.4 If such concealed or unknown conditions relate to toxic and hazardous substances and materials, artifacts and fossils, or mould, the parties will be governed by the provisions of GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES, GC 9.3 – ARTIFACTS AND FOSSILS and GC 9.5 – MOULD.

GC 6.5 DELAYS

- 6.5.1 If the *Contractor* is delayed in the performance of the *Work* by the *Owner*, the *Consultant*, or anyone employed or engaged by them directly or indirectly, contrary to the provisions of the *Contract Documents*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The *Contractor* shall be reimbursed by the *Owner* for reasonable costs incurred by the *Contractor* as the result of such delay.
- 6.5.2 If the *Contractor* is delayed in the performance of the *Work* by a stop work order issued by a court or other public authority and providing that such order was not issued as the result of an act or fault of the *Contractor* or any person employed or engaged by the *Contractor* directly or indirectly, resulting in the failure of the *Contractor* to attain *Ready-for-Takeover* by the date stipulated in Article A-1 of the Agreement – THE WORK, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The *Contractor* shall be reimbursed by the *Owner* for reasonable costs incurred by the *Contractor* as the result of such delay.
- 6.5.3 If the *Contractor* is delayed in the performance of the *Work* by:
- .1 labour disputes, strikes, lock-outs (including lock-outs decreed or recommended for its members by a recognized contractors' association, of which the *Contractor* is a member or to which the *Contractor* is otherwise bound),
 - .2 fire, unusual delay by common carriers or unavoidable casualties,
 - .3 abnormally adverse weather conditions, or

- .4 any cause beyond the *Contractor's* control other than one resulting from a default or breach of *Contract* by the *Contractor*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The extension of time shall not be less than the time lost as the result of the event causing the delay, unless the *Contractor* agrees to a shorter extension. The *Contractor* shall not be entitled to payment for costs incurred by such delays unless such delays result from actions by the *Owner*, the *Consultant* or anyone employed or engaged by them directly or indirectly.

- 6.5.4 No extension shall be made for delay unless *Notice in Writing* of the cause of delay is given to the *Consultant* not later than 10 *Working Days* after the commencement of the delay. In the case of a continuing cause of delay only one *Notice in Writing* shall be necessary.
- 6.5.5 If no schedule is made under paragraph 2.2.12 of GC 2.2 – ROLE OF THE CONSULTANT, then no request for extension shall be made because of failure of the *Consultant* to furnish instructions until 10 *Working Days* after demand for such instructions has been made.

GC 6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

- 6.6.1 If the *Contractor* intends to make a claim for an increase to the *Contract Price*, or if the *Owner* intends to make a claim against the *Contractor* for a credit to the *Contract Price*, the party that intends to make the claim shall give timely *Notice in Writing* of intent to claim to the other party and to the *Consultant*.
- 6.6.2 Upon commencement of the event or series of events giving rise to a claim, the party intending to make the claim shall:
- .1 take all reasonable measures to mitigate any loss or expense which may be incurred as a result of such event or series of events, and
 - .2 keep such records as may be necessary to support the claim.
- 6.6.3 The party making the claim shall submit within a reasonable time to the *Consultant* a detailed account of the amount claimed and the grounds upon which the claim is based and the *Consultant* will make a finding upon such claim.
- 6.6.4 Where the event or series of events giving rise to the claim has a continuing effect, the detailed account submitted under paragraph 6.6.3 shall be considered to be an interim account and the party making the claim shall, at such intervals as the *Consultant* may reasonably require, submit further interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. The party making the claim shall submit a final account after the end of the effects resulting from the event or series of events.
- 6.6.5 The *Consultant's* findings, with respect to a claim made by either party, will be given by *Notice in Writing* to both parties within 30 *Working Days* after receipt of the claim by the *Consultant*, or within such other time period as may be agreed by the parties.
- 6.6.6 If such finding is not acceptable to either party, the claim shall be settled in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION.

PART 7 DEFAULT NOTICE

GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT

- 7.1.1 If the *Contractor* is adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the *Contractor's* insolvency, or if a receiver is appointed because of the *Contractor's* insolvency, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, terminate the *Contractor's* right to continue with the *Work*, by giving the *Contractor* or receiver or trustee in bankruptcy *Notice in Writing* to that effect.
- 7.1.2 If the *Contractor* neglects to perform the *Work* properly or otherwise fails to comply with the requirements of the *Contract* to a substantial degree and if the *Consultant* has given a written statement to the *Owner* and *Contractor* which provides the detail of such neglect to perform the *Work* properly or such failure to comply with the requirements of the *Contract* to a substantial degree, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, give the *Contractor Notice in Writing*, containing particulars of the default including references to applicable provisions of the *Contract*, that the *Contractor* is in default of the *Contractor's* contractual obligations and instruct the *Contractor* to correct the default in the 5 *Working Days* immediately following the receipt of such *Notice in Writing*.
- 7.1.3 If the default cannot be corrected in the 5 *Working Days* specified or in such other time period as may be subsequently agreed in writing by the parties, the *Contractor* shall be in compliance with the *Owner's* instructions if the *Contractor*:
- .1 commences the correction of the default within the specified time,
 - .2 provides the *Owner* with an acceptable schedule for such correction, and
 - .3 corrects the default in accordance with the *Contract* terms and with such schedule.

- 7.1.4 If the *Contractor* fails to correct the default in the time specified or in such other time period as may be subsequently agreed in writing by the parties, without prejudice to any other right or remedy the *Owner* may have, the *Owner* may by giving *Notice in Writing*:
- .1 correct such default and deduct the cost thereof from any payment then or thereafter due the *Contractor* for the *Work* provided the *Consultant* has certified such cost to the *Owner* and the *Contractor*, or
 - .2 terminate the *Contractor*'s right to continue with the *Work* in whole or in part or terminate the *Contract*.
- 7.1.5 If the *Owner* terminates the *Contractor*'s right to continue with the *Work* as provided in paragraphs 7.1.1 and 7.1.4, the *Owner* shall be entitled to:
- .1 take possession of the *Work* and *Products* at the *Place of the Work*; subject to the rights of third parties, utilize the *Construction Equipment* at the *Place of the Work*; finish the *Work* by whatever method the *Owner* may consider expedient, but without undue delay or expense,
 - .2 withhold further payment to the *Contractor* until a final certificate for payment is issued,
 - .3 charge the *Contractor* the amount by which the full cost of finishing the *Work* as certified by the *Consultant*, including compensation to the *Consultant* for the *Consultant*'s additional services and a reasonable allowance as determined by the *Consultant* to cover the cost of corrections to work performed by the *Contractor* that may be required under GC 12.3 – WARRANTY, exceeds the unpaid balance of the *Contract Price*; however, if such cost of finishing the *Work* is less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Contractor* the difference, and
 - .4 on expiry of the warranty period, charge the *Contractor* the amount by which the cost of corrections to the *Contractor*'s work under GC 12.3 – WARRANTY exceeds the allowance provided for such corrections, or if the cost of such corrections is less than the allowance, pay the *Contractor* the difference.
- 7.1.6 The *Contractor*'s obligation under the *Contract* as to quality, correction and warranty of the work performed by the *Contractor* up to the time of termination shall continue in force after such termination of the *Contract*.

GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

- 7.2.1 If the *Owner* is adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the *Owner*'s insolvency, or if a receiver is appointed because of the *Owner*'s insolvency, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, terminate the *Contract* by giving the *Owner* or receiver or trustee in bankruptcy *Notice in Writing* to that effect.
- 7.2.2 If the *Work* is suspended or otherwise delayed for a period of 20 *Working Days* or more under an order of a court or other public authority and providing that such order was not issued as the result of an act or fault of the *Contractor* or of anyone directly or indirectly employed or engaged by the *Contractor*, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, terminate the *Contract* by giving the *Owner* *Notice in Writing* to that effect.
- 7.2.3 The *Contractor* may give *Notice in Writing* to the *Owner*, with a copy to the *Consultant*, that the *Owner* is in default of the *Owner*'s contractual obligations if:
- .1 the *Owner* fails to furnish, when so requested by the *Contractor*, reasonable evidence that financial arrangements have been made to fulfill the *Owner*'s obligations under the *Contract*,
 - .2 the *Consultant* fails to issue a certificate as provided in Part 5 of the General Conditions – PAYMENT,
 - .3 the *Owner* fails to pay the *Contractor* when due the amounts certified by the *Consultant* or awarded by adjudication, arbitration or court, or
 - .4 the *Owner* fails to comply with the requirements of the *Contract* to a substantial degree and the *Consultant*, except for GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER, gives a written statement to the *Owner* and the *Contractor* that provides detail of such failure to comply with the requirements of the *Contract* to a substantial degree.
- 7.2.4 The *Contractor*'s *Notice in Writing* to the *Owner* provided under paragraph 7.2.3 shall advise that if the default is not corrected within 5 *Working Days* following the receipt of the *Notice in Writing*, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, suspend the *Work* or terminate the *Contract*.
- 7.2.5 If the *Contractor* terminates the *Contract* by giving a *Notice in Writing* to the *Owner* under the conditions set out above, the *Contractor* shall be entitled to be paid for all work performed including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the termination of the *Contract*.

PART 8 DISPUTE RESOLUTION

GC 8.1 AUTHORITY OF THE CONSULTANT

- 8.1.1 Differences between the parties to the *Contract* as to the interpretation, application or administration of the *Contract* or any failure to agree where agreement between the parties is called for, herein collectively called disputes, which are not resolved

in the first instance by findings of the *Consultant* as provided in GC 2.2 – ROLE OF THE CONSULTANT, shall be settled in accordance with the requirements of Part 8 of the General Conditions – DISPUTE RESOLUTION.

- 8.1.2 If a dispute arises under the *Contract* in respect of a matter in which the *Consultant* has no authority under the *Contract* to make a finding, the procedures set out in paragraph 8.1.3 and paragraphs 8.3.3 to 8.3.8 of GC 8.3 – NEGOTIATION, MEDIATION AND ARBITRATION, and in GC 8.4 – RETENTION OF RIGHTS apply to that dispute with the necessary changes to detail as may be required.
- 8.1.3 If a dispute is not resolved promptly, the *Consultant* will give such instructions as in the *Consultant's* 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 the party may have. If it is subsequently determined that such instructions were in error or at variance with the *Contract Documents*, the *Owner* shall pay the *Contractor* costs incurred by the *Contractor* in carrying out such instructions which the *Contractor* was required to do beyond what the *Contract Documents* correctly understood and interpreted would have required, including costs resulting from interruption of the *Work*.

GC 8.2 ADJUDICATION

- 8.2.1 Nothing in this *Contract* shall be deemed to affect the rights of the parties to resolve any dispute by adjudication as may be prescribed by applicable legislation.

GC 8.3 NEGOTIATION, MEDIATION AND ARBITRATION

- 8.3.1 In accordance with the rules for mediation as provided in CCDC 40 'Rules for Mediation and Arbitration of Construction Industry Disputes' in effect at the time of bid closing, the parties shall appoint a Project Mediator
- .1 within 20 *Working Days* after the *Contract* was awarded, or
 - .2 if the parties neglected to make an appointment within the 20 *Working Days*, within 10 *Working Days* after either party by *Notice in Writing* requests that the Project Mediator be appointed.
- 8.3.2 A party shall be conclusively deemed to have accepted a finding of the *Consultant* under GC 2.2 – ROLE OF THE CONSULTANT and to have expressly waived and released the other party from any claims in respect of the particular matter dealt with in that finding unless, within 15 *Working Days* after receipt of that finding, the party sends a *Notice in Writing* of dispute to the other party and to the *Consultant*, which contains the particulars of the matter in dispute and the relevant provisions of the *Contract Documents*. The responding party shall send a *Notice in Writing* of reply to the dispute within 10 *Working Days* after receipt of such *Notice in Writing* setting out particulars of this response and any relevant provisions of the *Contract Documents*.
- 8.3.3 The parties shall make all reasonable efforts to resolve their dispute by amicable negotiations and agree to provide, without prejudice, frank, candid, and timely disclosure of relevant facts, information and documents to facilitate these negotiations.
- 8.3.4 After a period of 10 *Working Days* following receipt of a responding party's *Notice in Writing* of reply under paragraph 8.3.2, the parties shall request the Project Mediator to assist the parties to reach agreement on any unresolved dispute. The mediated negotiations shall be conducted in accordance with the rules for mediation as provided in CCDC 40 in effect at the time of bid closing.
- 8.3.5 If the dispute has not been resolved at the mediation or within such further period as is agreed by the parties, the Project Mediator will terminate the mediated negotiations by giving *Notice in Writing* to the *Owner*, the *Contractor* and the *Consultant*.
- 8.3.6 By giving a *Notice in Writing* to the other party and the *Consultant*, not later than 10 *Working Days* after the date of termination of the mediated negotiations under paragraph 8.3.5, either party may refer the dispute to be finally resolved by arbitration under the rules of arbitration as provided in CCDC 40 in effect at the time of bid closing. The arbitration shall be conducted in the jurisdiction of the *Place of the Work*.
- 8.3.7 On expiration of the 10 *Working Days*, the arbitration agreement under paragraph 8.3.6 is not binding on the parties and, if a *Notice in Writing* is not given under paragraph 8.3.6 within the required time, the parties may refer the unresolved dispute to the courts or to any other form of dispute resolution, including arbitration, which they have agreed to use.
- 8.3.8 If neither party, by *Notice in Writing*, given within 10 *Working Days* of the date of *Notice in Writing* requesting arbitration in paragraph 8.3.6, requires that a dispute be arbitrated immediately, all disputes referred to arbitration as provided in paragraph 8.3.6 shall be:
- .1 held in abeyance until:
 - (1) *Ready-for-Takeover*,
 - (2) the *Contract* has been terminated, or
 - (3) the *Contractor* has abandoned the *Work*,whichever is earlier; and

- .2 consolidated into a single arbitration under the rules governing the arbitration under paragraph 8.3.6.

GC 8.4 RETENTION OF RIGHTS

- 8.4.1 It is agreed that no act by either party shall be construed as a renunciation or waiver of any rights or recourses, provided the party has given the *Notice in Writing* required under Part 8 of the General Conditions – DISPUTE RESOLUTION and has carried out the instructions as provided in paragraph 8.1.3 of GC 8.1 – AUTHORITY OF THE CONSULTANT.
- 8.4.2 Nothing in Part 8 of the General Conditions – DISPUTE RESOLUTION shall be construed in any way to limit a party from asserting any statutory right to a lien under applicable lien legislation of the jurisdiction of the *Place of the Work* and the assertion of such right by initiating judicial proceedings is not to be construed as a waiver of any right that party may have under paragraph 8.3.6 of GC 8.3 – NEGOTIATION, MEDIATION AND ARBITRATION to proceed by way of arbitration to adjudicate the merits of the claim upon which such a lien is based.

PART 9 PROTECTION OF PERSONS AND PROPERTY

GC 9.1 PROTECTION OF WORK AND PROPERTY

- 9.1.1 The *Contractor* shall protect the *Work*, the *Owner's* property and property adjacent to the *Place of the Work* from damage which may arise as the result of the *Contractor's* operations under the *Contract*, and shall be responsible for such damage, except damage which occurs as the result of:
- .1 errors or omissions in the *Contract Documents*; or
 - .2 acts or omissions by the *Owner*, the *Consultant*, *Other Contractors*, or their agents and employees.
- 9.1.2 Before commencing any work, the *Contractor* shall determine the location of all underground utilities and structures indicated in the *Contract Documents* or that are reasonably apparent in an inspection of the *Place of the Work*.
- 9.1.3 Should the *Contractor* in the performance of the *Contract* damage the *Work*, the *Owner's* property or property adjacent to the *Place of the Work*, the *Contractor* shall be responsible for making good such damage at the *Contractor's* expense.
- 9.1.4 Should damage occur to the *Work* or the *Owner's* property for which the *Contractor* is not responsible, as provided in paragraph 9.1.1, the *Contractor* shall make good such damage to the *Work* and, if the *Owner* so directs, to the *Owner's* property. The *Contract Price* and *Contract Time* shall be adjusted as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

- 9.2.1 For the purposes of applicable legislation related to toxic and hazardous substances, the *Owner* shall be deemed to have control and management of the *Place of the Work* with respect to existing conditions.
- 9.2.2 Prior to the *Contractor* commencing the *Work*, the *Owner* shall,
- .1 take all reasonable steps to determine whether any toxic or hazardous substances are present at the *Place of the Work*, and
 - .2 provide the *Consultant* and the *Contractor* with a written list of any such substances that are known to exist and their locations.
- 9.2.3 The *Owner* shall take all reasonable steps to ensure that no person's exposure to any toxic or hazardous substance exceeds the time weighted levels prescribed by applicable legislation at the *Place of the Work* and that no property is damaged or destroyed as a result of exposure to, or the presence of, toxic or hazardous substances which were at the *Place of the Work* prior to the *Contractor* commencing the *Work*.
- 9.2.4 Unless the *Contract* expressly provides otherwise, the *Owner* shall be responsible for taking all necessary steps, in accordance with applicable legislation in force at the *Place of the Work*, to dispose of, store or otherwise render harmless any toxic or hazardous substance which was present at the *Place of the Work* prior to the *Contractor* commencing the *Work*.
- 9.2.5 If the *Contractor*
- .1 encounters toxic or hazardous substances at the *Place of the Work*, or
 - .2 has reasonable grounds to believe that toxic or hazardous substances are present at the *Place of the Work*, which were not brought to the *Place of the Work* by the *Contractor* or anyone for whom the *Contractor* is responsible and which were not disclosed by the *Owner* or which were disclosed but have not been dealt with as required under paragraph 9.2.4, the *Contractor* shall
 - .3 take all reasonable steps, including stopping the *Work*, to ensure that no person's exposure to any toxic or hazardous substance exceeds any applicable time weighted levels prescribed by applicable legislation at the *Place of the Work*, and
 - .4 immediately report the circumstances to the *Consultant* and the *Owner* in writing.

- 9.2.6 If the *Owner* and the *Contractor* do not agree on the existence, significance of, or whether the toxic or hazardous substances were brought onto the *Place of the Work* by the *Contractor* or anyone for whom the *Contractor* is responsible, the *Owner* shall retain and pay for an independent qualified expert to investigate and determine such matters. The expert's report shall be delivered to the *Owner* and the *Contractor*.
- 9.2.7 If the *Owner* and the *Contractor* agree or if the expert referred to in paragraph 9.2.6 determines that the toxic or hazardous substances were not brought onto the place of the *Work* by the *Contractor* or anyone for whom the *Contractor* is responsible, the *Owner* shall promptly at the *Owner's* own expense:
- .1 take all steps as required under paragraph 9.2.4;
 - .2 reimburse the *Contractor* for the costs of all steps taken pursuant to paragraph 9.2.5;
 - .3 extend the *Contract Time* for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor* and the expert referred to in 9.2.6 and reimburse the *Contractor* for reasonable costs incurred as a result of the delay; and
 - .4 indemnify the *Contractor* as required by GC 13.1 – INDEMNIFICATION.
- 9.2.8 If the *Owner* and the *Contractor* agree or if the expert referred to in paragraph 9.2.6 determines that the toxic or hazardous substances were brought onto the place of the *Work* by the *Contractor* or anyone for whom the *Contractor* is responsible, the *Contractor* shall promptly at the *Contractor's* own expense:
- .1 take all necessary steps, in accordance with applicable legislation in force at the *Place of the Work*, to safely remove and dispose the toxic or hazardous substances;
 - .2 make good any damage to the *Work*, the *Owner's* property or property adjacent to the place of the *Work* as provided in paragraph 9.1.3 of GC 9.1 – PROTECTION OF WORK AND PROPERTY;
 - .3 reimburse the *Owner* for reasonable costs incurred under paragraph 9.2.6; and
 - .4 indemnify the *Owner* as required by GC 13.1 – INDEMNIFICATION.
- 9.2.9 If either party does not accept the expert's findings under paragraph 9.2.6, the disagreement shall be settled in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION. If such disagreement is not resolved promptly, the parties shall act immediately in accordance with the expert's determination and take the steps required by paragraph 9.2.7 or 9.2.8 it being understood that by so doing, neither party will jeopardize any claim that party may have to be reimbursed as provided by GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES.

GC 9.3 ARTIFACTS AND FOSSILS

- 9.3.1 Fossils, coins, articles of value or antiquity, structures and other remains or things of scientific or historic interest discovered at the *Place or Work* shall, as between the *Owner* and the *Contractor*, be deemed to be the absolute property of the *Owner*.
- 9.3.2 The *Contractor* shall take all reasonable precautions to prevent removal or damage to discoveries as identified in paragraph 9.3.1, and shall advise the *Consultant* upon discovery of such items.
- 9.3.3 The *Consultant* will investigate the impact on the *Work* of the discoveries identified in paragraph 9.3.1. If conditions are found that would cause an increase or decrease in the *Contractor's* cost or time to perform the *Work*, the *Owner*, through the *Consultant*, shall issue appropriate instructions for a change in the *Work* as provided in GC 6.2 – CHANGE ORDER or GC 6.3 – CHANGE DIRECTIVE.

GC 9.4 CONSTRUCTION SAFETY

- 9.4.1 The *Contractor* shall be responsible for establishing, initiating, maintaining, and supervising all health and safety precautions and programs in connection with the performance of the *Work* in accordance with the applicable health and safety legislation.
- 9.4.2 The *Owner* and the *Contractor* shall comply with all health and safety precautions and programs established at the *Place of the Work*.
- 9.4.3 The *Owner* and the *Contractor* shall comply with the rules, regulations and practices required by the applicable health and safety legislation.
- 9.4.4 The *Owner* shall cause the *Consultant*, *Other Contractors* and the *Owner's* own forces to comply with all health and safety precautions and programs established by the *Contractor* at the *Place of the Work*.
- 9.4.5 Nothing in this *Contract* shall affect the determination of liability under the applicable health and safety legislation.

GC 9.5 MOULD

- 9.5.1 If the *Contractor* or the *Owner* observes or reasonably suspects the presence of mould at the *Place of the Work*, the remediation of which is not expressly part of the *Work*,
- .1 the observing party shall promptly report the circumstances to the other party in writing,
 - .2 the *Contractor* shall promptly take all reasonable steps, including stopping the *Work* if necessary, to ensure that no person suffers injury, sickness or death and that no property is damaged as a result of exposure to or the presence of the mould, and

- .3 if the *Owner* and the *Contractor* do not agree on the existence, significance or cause of the mould or as to what steps need be taken to deal with it, the *Owner* shall retain and pay for an independent qualified expert to investigate and determine such matters. The expert's report shall be delivered to the *Owner* and the *Contractor*.
- 9.5.2 If the *Owner* and the *Contractor* agree, or if the expert referred to in paragraph 9.5.1.3 determines that the presence of mould was caused by the *Contractor*'s operations under the *Contract*, the *Contractor* shall promptly, at the *Contractor*'s own expense:
- .1 take all reasonable and necessary steps to safely remediate or dispose of the mould,
 - .2 make good any damage to the *Work*, the *Owner*'s property or property adjacent to the *Place of the Work* as provided in paragraph 9.1.3 of GC 9.1 – PROTECTION OF WORK AND PROPERTY,
 - .3 reimburse the *Owner* for reasonable costs incurred under paragraph 9.5.1.3, and
 - .4 indemnify the *Owner* as required by GC 13.1 – INDEMNIFICATION.
- 9.5.3 If the *Owner* and the *Contractor* agree, or if the expert referred to in paragraph 9.5.1.3 determines that the presence of mould was not caused by the *Contractor*'s operations under the *Contract*, the *Owner* shall promptly, at the *Owner*'s own expense:
- .1 take all reasonable and necessary steps to safely remediate or dispose of the mould,
 - .2 reimburse the *Contractor* for the cost of taking the steps under paragraph 9.5.1.2 and making good any damage to the *Work* as provided in paragraph 9.1.4 of GC 9.1 – PROTECTION OF WORK AND PROPERTY,
 - .3 extend the *Contract Time* for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor* and the expert referred to in paragraph 9.5.1.3 and reimburse the *Contractor* for reasonable costs incurred as a result of the delay, and
 - .4 indemnify the *Contractor* as required by GC 13.1 – INDEMNIFICATION.
- 9.5.4 If either party does not accept the expert's finding under paragraph 9.5.1.3, the disagreement shall be settled in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION. If such disagreement is not resolved promptly, the parties shall act immediately in accordance with the expert's determination and take the steps required by paragraphs 9.5.2 or 9.5.3, it being understood that by so doing neither party will jeopardize any claim the party may have to be reimbursed as provided by GC 9.5 – MOULD.

PART 10 GOVERNING REGULATIONS

GC 10.1 TAXES AND DUTIES

- 10.1.1 The *Contract Price* shall include all taxes and customs duties in effect at the time of the bid closing except for *Value Added Taxes* payable by the *Owner* to the *Contractor* as stipulated in Article A-4 of the Agreement – CONTRACT PRICE.
- 10.1.2 Any increase or decrease in costs to the *Contractor* due to changes in taxes and duties after the time of the bid closing shall increase or decrease the *Contract Price* accordingly.

GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

- 10.2.1 The laws of the *Place of the Work* shall govern the *Work*.
- 10.2.2 The *Owner* shall obtain and pay for development approvals, building permit, permanent easements, rights of servitude, and all other necessary approvals and permits, except for the permits and fees referred to in paragraph 10.2.3 or for which the *Contract Documents* specify as the responsibility of the *Contractor*.
- 10.2.3 The *Contractor* shall be responsible for the procurement of permits, licences, inspections, and certificates, which are necessary for the performance of the *Work* and customarily obtained by contractors in the jurisdiction of the *Place of the Work* after the issuance of the building permit. The *Contract Price* includes the cost of these permits, licences, inspections, and certificates, and their procurement.
- 10.2.4 The *Contractor* shall give the required notices and comply with the laws, ordinances, rules, regulations, or codes which are or become in force during the performance of the *Work* and which relate to the *Work*, to the preservation of the public health, and to construction safety.
- 10.2.5 The *Contractor* shall not be responsible for verifying that the *Contract Documents* are in compliance with the applicable laws, ordinances, rules, regulations, or codes relating to the *Work*. If the *Contract Documents* are at variance therewith, or if, subsequent to the time of bid closing, changes are made to the applicable laws, ordinances, rules, regulations, or codes which require modification to the *Contract Documents*, the *Contractor* shall advise the *Consultant* in writing requesting direction immediately upon such variance or change becoming known. The *Consultant* will issue the changes required to the *Contract Documents* as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

- 10.2.6 If the *Contractor* fails to advise the *Consultant* in writing; fails to obtain direction as required in paragraph 10.2.5; and performs work knowing it to be contrary to any laws, ordinances, rules, regulations, or codes; the *Contractor* shall be responsible for and shall correct the violations thereof; and shall bear the costs, expenses and damages attributable to the failure to comply with the provisions of such laws, ordinances, rules, regulations, or codes.
- 10.2.7 If, subsequent to the time of bid closing, changes are made to applicable laws, ordinances, rules, regulations, or codes of authorities having jurisdiction which affect the cost of the *Work*, either party may submit a claim in accordance with the requirements of GC 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE.

GC 10.3 PATENT FEES

- 10.3.1 The *Contractor* shall pay the royalties and patent licence fees required for the performance of the *Contract*. The *Contractor* shall hold the *Owner* harmless from and against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Contractor's* performance of the *Contract* which are attributable to an infringement or an alleged infringement of a patent of invention by the *Contractor* or anyone for whose acts the *Contractor* may be liable.
- 10.3.2 The *Owner* shall hold the *Contractor* harmless against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Contractor's* performance of the *Contract* which are attributable to an infringement or an alleged infringement of a patent of invention in executing anything for the purpose of the *Contract*, the physical model, plan or design of which was supplied to the *Contractor* as part of the *Contract*.

GC 10.4 WORKERS' COMPENSATION

- 10.4.1 Prior to commencing the *Work*, and again with the *Contractor's* applications for payment, the *Contractor* shall provide evidence of compliance with workers' compensation legislation at the *Place of the Work*.

PART 11 INSURANCE

GC 11.1 INSURANCE

- 11.1.1 Without restricting the generality of GC 13.1 – INDEMNIFICATION, the *Contractor* shall provide, maintain and pay for the following insurance coverages, the requirements of which are specified in CCDC 41 'CCDC Insurance Requirements' in effect at the time of bid closing except as hereinafter provided:
- .1 General liability insurance in the name of the *Contractor* and include, or in the case of a single, blanket policy, be endorsed to name, the *Owner* and the *Consultant* as insureds but only with respect to liability, other than legal liability arising out of their sole negligence, arising out of the operations of the *Contractor* with regard to the *Work*. General liability insurance shall be maintained from the date of commencement of the *Work* until one year from the date of *Ready-for-Takeover*. Liability coverage shall be provided for completed operations hazards from the date of *Ready-for-Takeover* on an ongoing basis for a period of 6 years following *Ready-for-Takeover*.
 - .2 Automobile Liability Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.
 - .3 Unmanned aerial vehicle aircraft, manned aircraft or watercraft Liability Insurance when owned or non-owned manned or unmanned aircraft or watercraft are used directly or indirectly in the performance of the *Work*.
 - .4 "Broad form" property insurance in the joint names of the *Contractor*, the *Owner* and the *Consultant*. The policy shall include as insureds all *Subcontractors*. The "Broad form" property insurance shall be provided from the date of commencement of the *Work* until the earliest of:
 - (1) 10 calendar days after the date of *Ready-for-Takeover*;
 - (2) on the commencement of use or occupancy of any part or section of the *Work* unless such use or occupancy is for construction purposes, habitational, office, banking, convenience store under 465 square metres in area, or parking purposes, or for the installation, testing and commissioning of equipment forming part of the *Work*; and
 - (3) when left unattended for more than 30 consecutive calendar days or when construction activity has ceased for more than 30 consecutive calendar days.
 - .5 Boiler and machinery insurance in the joint names of the *Contractor*, the *Owner* and the *Consultant*. The policy shall include as insureds all *Subcontractors*. The coverage shall be maintained continuously from commencement of use or operation of the boiler and machinery objects insured by the policy and until 10 calendar days after the date of *Ready-for-Takeover*.
 - .6 The "Broad form" property and boiler and machinery policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Contractor* as their respective interests may appear. In the event of loss or damage:
 - (1) the *Contractor* shall act on behalf of the *Owner* 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 be entitled to such reasonable extension of *Contract Time* relative to the extent of the loss or damage as the *Consultant* may recommend in consultation with the *Contractor*;

- (2) the *Contractor* shall be entitled to receive from the *Owner*, in addition to the amount due under the *Contract*, the amount which the *Owner's* interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds in accordance with the progress payment provisions. In addition the *Contractor* shall be entitled to receive from the payments made by the insurer the amount of the *Contractor's* interest in the restoration of the *Work*; and
- (3) to the *Work* arising from the work of the *Owner*, the *Owner's* own forces or *Other Contractors*, the *Owner* shall, in accordance with the *Owner's* obligations under the provisions relating to construction by the *Owner* or *Other Contractors*, pay the *Contractor* the cost of restoring the *Work* as the restoration of the *Work* proceeds and as in accordance with the progress payment provisions.

.7 Contractors' Equipment Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.

.8 Contractors' Pollution Liability Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.

11.1.2 Prior to commencement of the *Work* and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the *Contractor* shall promptly provide the *Owner* with confirmation of coverage and, if required, a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements applicable to the *Work*.

11.1.3 The parties shall pay their share of the deductible amounts in direct proportion to their responsibility in regards to any loss for which the above policies are required to pay, except where such amounts may be excluded by the terms of the *Contract*.

11.1.4 If the *Contractor* fails to provide or maintain insurance as required by the *Contract Documents*, then the *Owner* shall have the right to provide and maintain such insurance and give evidence to the *Contractor* and the *Consultant*. The *Contractor* shall pay the cost thereof to the *Owner* on demand or the *Owner* may deduct the cost from the amount which is due or may become due to the *Contractor*.

11.1.5 All required insurance policies shall be with insurers licensed to underwrite insurance in the jurisdiction of the *Place of the Work*.

11.1.6 If a revised version of CCDC 41 is published, which specifies reduced insurance requirements, the parties shall address such reduction, prior to the *Contractor's* insurance policy becoming due for renewal, and record any agreement in a *Change Order*.

11.1.7 If a revised version of CCDC 41 is published, which specifies increased insurance requirements, the *Owner* may request the increased coverage from the *Contractor* by way of a *Change Order*.

11.1.8 A *Change Directive* shall not be used to direct a change in the insurance requirements in response to the revision of CCDC 41.

PART 12 OWNER TAKEOVER

GC 12.1 READY-FOR-TAKEOVER

12.1.1 The prerequisites to attaining *Ready-for-Takeover* of the *Work* are limited to the following:

- .1 The *Consultant* has certified or verified the *Substantial Performance of the Work*.
- .2 Evidence of compliance with the requirements for occupancy or occupancy permit as prescribed by the authorities having jurisdiction.
- .3 Final cleaning and waste removal at the time of applying for *Ready-for-Takeover*, as required by the *Contract Documents*.
- .4 The delivery to the *Owner* of such operations and maintenance documents reasonably necessary for immediate operation and maintenance, as required by the *Contract Documents*.
- .5 Make available a copy of the as-built drawings completed to date on site.
- .6 Startup, testing required for immediate occupancy, as required by the *Contract Documents*.
- .7 Ability to secure access to the *Work* has been provided to the *Owner*, if required by the *Contract Documents*.
- .8 Demonstration and training, as required by the *Contract Documents*, is scheduled by the *Contractor* acting reasonably.

12.1.2 If any prerequisites set forth in paragraphs 12.1.1.3 to 12.1.1.6 must be deferred because of conditions reasonably beyond the control of the *Contractor*, or by agreement between the *Owner* and the *Contractor* to do so, *Ready-for-Takeover* shall not be delayed.

12.1.3 When the *Contractor* considers that the *Work* is *Ready-for-Takeover*, the *Contractor* shall deliver to the *Consultant* and to the *Owner* a comprehensive list of items to be completed or corrected, together with a written application for *Ready-for-Takeover* for review. Failure to include an item on the list does not alter the responsibility of the *Contractor* to complete the *Contract*.

12.1.4 The *Consultant* will review the *Work* to verify the validity of the application and will promptly, and in any event, no later than 10 calendar days after receipt of the *Contractor's* list and application:

- .1 advise the *Contractor* in writing that the *Work* is not *Ready-for-Takeover* and give reasons why, or
 - .2 confirm the date of *Ready-for-Takeover* in writing to each of the *Owner* and the *Contractor*.
- 12.1.5 Immediately following the confirmation of the date of *Ready-for-Takeover*, the *Contractor*, in consultation with the *Consultant*, shall establish a reasonable date for finishing the *Work*.
- 12.1.6 The provision of GC 12.1 – READY-FOR-TAKEOVER shall be subject to GC 12.2 – EARLY OCCUPANCY BY THE OWNER.

GC 12.2 EARLY OCCUPANCY BY THE OWNER

- 12.2.1 The *Owner* may take occupancy of a part or the entirety of the *Work* before *Ready-for-Takeover* has been attained only as agreed by the *Contractor* which agreement shall not be unreasonably withheld.
- 12.2.2 The *Owner* shall not occupy a part or the entirety of the *Work* without prior approval by authorities having jurisdiction.
- 12.2.3 If the *Owner* takes occupancy of a part of the *Work* before *Ready-for-Takeover* has been attained:
- .1 The part of the *Work* which is occupied shall be deemed to have been taken over by the *Owner* as from the date on which it is occupied.
 - .2 The *Contractor* shall cease to be liable for the care of such part as from this date, when responsibility shall pass to the *Owner*.
 - .3 The warranty period specified in paragraph 12.3.1 of GC 12.3 – WARRANTY for that part of the *Work* shall start from the date on which it is occupied.
- 12.2.4 If the *Owner* takes occupancy of the entirety of the *Work* before all the prerequisites are met as described in paragraph 12.1.1 of GC 12.1 – READY-FOR-TAKEOVER, the *Work* shall, subject to the requirements of the applicable lien legislation, be deemed to achieve *Ready-for-Takeover*. This shall not relieve the *Contractor*'s responsibility to complete the *Work* in a timely manner.

GC 12.3 WARRANTY

- 12.3.1 Except for extended warranties as described in paragraph 12.3.6, the warranty period under the *Contract* is one year from the date when *Ready-for-Takeover* has been attained.
- 12.3.2 The *Contractor* shall be responsible for the proper performance of the *Work* to the extent that the design and *Contract Documents* permit such performance.
- 12.3.3 The *Owner*, through the *Consultant*, shall promptly give the *Contractor Notice in Writing* of observed defects and deficiencies which occur during the one year warranty period.
- 12.3.4 Subject to paragraph 12.3.2, the *Contractor* shall correct promptly, at the *Contractor*'s expense, defects or deficiencies in the *Work* which appear prior to and during the one year warranty period.
- 12.3.5 The *Contractor* shall correct or pay for damage resulting from corrections made under the requirements of paragraph 12.3.4.
- 12.3.6 Any extended warranties required beyond the one year warranty period as described in paragraph 12.3.1, shall be as specified in the *Contract Documents*. Extended warranties shall be issued by the warrantor to the benefit of the *Owner*. The *Contractor*'s responsibility with respect to extended warranties shall be limited to obtaining any such extended warranties from the warrantor. The obligations under such extended warranties are solely the responsibilities of the warrantor.

PART 13 INDEMNIFICATION AND WAIVER

GC 13.1 INDEMNIFICATION

- 13.1.1 Without restricting the parties' obligation to indemnify respecting toxic and hazardous substances, patent fees and defect in title claims all as described in paragraphs 13.1.4 and 13.1.5, the *Owner* and the *Contractor* shall each indemnify and hold harmless the other from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings whether in respect to losses suffered by them or in respect to claims by third parties that arise out of, or are attributable in any respect to their involvement as parties to this *Contract*, provided such claims are:
- .1 caused by:
 - (1) the negligent acts or omissions of the party from whom indemnification is sought or anyone for whose negligent acts or omissions that party is liable, or
 - (2) a failure of the party to the *Contract* from whom indemnification is sought to fulfill its terms or conditions; and
 - .2 made by *Notice in Writing* within a period of 6 years from the *Ready-for-Takeover* date or within such shorter period as may be prescribed by any limitation statute of the Province or Territory of the *Place of the Work*.
- The parties expressly waive the right to indemnity for claims other than those provided for in this *Contract*.

- 13.1.2 The obligation of either party to indemnify as set forth in paragraph 13.1.1 shall be limited as follows:
- .1 In respect to losses suffered by the *Owner* and the *Contractor* for which insurance is to be provided by either party pursuant to GC 11.1 – INSURANCE, the minimum liability insurance limit for one occurrence, of the applicable insurance policy, as referred to in CCDC 41 in effect at the time of bid closing.
 - .2 In respect to losses suffered by the *Owner* and the *Contractor* for which insurance is not required to be provided by either party in accordance with GC 11.1 – INSURANCE, the greater of the *Contract Price* as recorded in Article A-4 – CONTRACT PRICE or \$2,000,000, but in no event shall the sum be greater than \$20,000,000.
 - .3 In respect to indemnification by a party against the other with respect to losses suffered by them, such obligation shall be restricted to direct loss and damage, and neither party shall have any liability to the other for indirect, consequential, punitive or exemplary damages.
 - .4 In respect to indemnification respecting claims by third parties, the obligation to indemnify is without limit.
- 13.1.3 The obligation of either party to indemnify the other as set forth in paragraphs 13.1.1 and 13.1.2 shall be inclusive of interest and all legal costs.
- 13.1.4 The *Owner* and the *Contractor* shall indemnify and hold harmless the other from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of their obligations described in GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES.
- 13.1.5 The *Owner* shall indemnify and hold harmless the *Contractor* from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings:
- .1 as described in paragraph 10.3.2 of GC 10.3 – PATENT FEES, and
 - .2 arising out of the *Contractor*'s performance of the *Contract* which are attributable to a lack of or defect in title or an alleged lack of or defect in title to the *Place of the Work*.
- 13.1.6 In respect to any claim for indemnity or to be held harmless by the *Owner* or the *Contractor*:
- .1 *Notice in Writing* of such claim shall be given within a reasonable time after the facts upon which such claim is based become known; and
 - .2 should any party be required as a result of its obligation to indemnify another to pay or satisfy a final order, judgment or award made against the party entitled by this contract to be indemnified, then the indemnifying party upon assuming all liability for any costs that might result shall have the right to appeal in the name of the party against whom such final order or judgment has been made until such rights of appeal have been exhausted.

GC 13.2 WAIVER OF CLAIMS

- 13.2.1 Subject to any lien legislation applicable to the *Place of the Work*, the *Contractor* waives and releases the *Owner* from all claims which the *Contractor* has or reasonably ought to have knowledge of that could be advanced by the *Contractor* against the *Owner* under the *Contract*, including, without limitation, those arising from negligence or breach of contract in respect to which the cause of action is based upon acts or omissions which occurred prior to or on the *Ready-for-Takeover* date, except as follows:
- .1 claims arising prior to or on the *Ready-for-Takeover* date for which *Notice in Writing* of claim has been received by the *Owner* from the *Contractor* no later than 5 calendar days before the expiry of the lien period provided by the lien legislation applicable at the *Place of the Work* or 20 calendar days following the *Ready-for-Takeover* date, whichever is later;
 - .2 indemnification for claims advanced against the *Contractor* by third parties for which a right of indemnification may be asserted by the *Contractor* against the *Owner* pursuant to the provisions of this *Contract*;
 - .3 claims respecting toxic and hazardous substances, patent fees and defect in title matters for which a right of indemnity could be asserted by the *Contractor* pursuant to the provisions of paragraphs 13.1.4 or 13.1.5 of GC 13.1 – INDEMNIFICATION; and
 - .4 claims resulting from acts or omissions which occur after the *Ready-for-Takeover* date.
- 13.2.2 The *Contractor* waives and releases the *Owner* from all claims resulting from acts or omissions which occurred after the *Ready-for-Takeover* date except for:
- .1 indemnification respecting third party claims, and claims respecting toxic and hazardous substances, patent fees and defect in title matters, all as referred in paragraphs 13.2.1.2 and 13.2.1.3; and
 - .2 claims for which *Notice in Writing* of claim has been received by the *Owner* from the *Contractor* within 395 calendar days following the *Ready-for-Takeover* date.
- 13.2.3 Subject to any lien legislation applicable to the *Place of the Work*, the *Owner* waives and releases the *Contractor* from all claims which the *Owner* has or reasonably ought to have knowledge of that could be advanced by the *Owner* against the *Contractor* under the *Contract*, including, without limitation, those arising from negligence or breach of contract in respect to which the cause of action is based upon acts or omissions which occurred prior to or on the *Ready-for-Takeover* date, except as follows:
- .1 claims arising prior to or on the *Ready-for-Takeover* date for which *Notice in Writing* of claim has been received by the *Contractor* from the *Owner* no later than 20 calendar days following the *Ready-for-Takeover* date;

- .2 indemnification for claims advanced against the *Owner* by third parties for which a right of indemnification may be asserted by the *Owner* against the *Contractor* pursuant to the provisions of this *Contract*;
 - .3 claims respecting toxic and hazardous substances for which a right of indemnity could be asserted by the *Owner* against the *Contractor* pursuant to the provisions of paragraph 13.1.4 of GC 13.1 – INDEMNIFICATION;
 - .4 damages arising from the *Contractor*'s actions which result in substantial defects or deficiencies in the *Work*. "Substantial defects or deficiencies" mean those defects or deficiencies in the *Work* which affect the *Work* to such an extent or in such a manner that a significant part or the whole of the *Work* is unfit for the purpose intended by the *Contract Documents*;
 - .5 claims arising pursuant to GC 12.3 – WARRANTY; and
 - .6 claims arising from acts or omissions which occur after the *Ready-for-Takeover* date.
- 13.2.4 Respecting claims arising upon substantial defects and deficiencies in the *Work*, as referenced in paragraph 13.2.3.4, and notwithstanding paragraph 13.2.3.5, the *Owner* waives and releases the *Contractor* from all claims except claims for which *Notice in Writing* of claim has been received by the *Contractor* from the *Owner* within a period of six years from the *Ready-for-Takeover* date, provided that any limitation statute of the Province or Territory of the *Place of the Work* permit such agreement. If the applicable limitation statute does not permit such agreement, the time within which any such claim may be brought shall be such shorter period as may be prescribed by any limitation statute of the Province or Territory of the *Place of the Work*.
- 13.2.5 The *Owner* waives and releases the *Contractor* from all claims arising from acts or omissions which occur after the *Ready-for-Takeover* date, except for:
- .1 indemnification for claims advanced against the *Owner* by third parties, as referenced in paragraph 13.2.3.2;
 - .2 claims respecting toxic and hazardous substances for which a right of indemnity could be asserted by the *Owner* against the *Contractor*, as referenced in paragraph 13.2.3.3;
 - .3 claims arising under GC 12.3 – WARRANTY; and
 - .4 claims for which *Notice in Writing* has been received by the *Contractor* from the *Owner* within 395 calendar days following the *Ready-for-Takeover* date.
- 13.2.6 "Notice in Writing of claim" as provided in GC 13.2 – WAIVER OF CLAIMS to preserve a claim or right of action which would otherwise, by the provisions of GC 13.2 – WAIVER OF CLAIMS, be deemed to be waived, must include the following:
- .1 a clear and unequivocal statement of an intention to claim;
 - .2 a statement as to the nature of the claim and the grounds upon which the claim is based; and
 - .3 a statement of the estimated quantum of the claim.
- 13.2.7 A claim for lien asserted under the lien legislation prevailing at the *Place of the Work* shall qualify as notice of claim for the purposes of this *Contract*.
- 13.2.8 The party giving the *Notice in Writing* of claim as provided in GC 13.2 – WAIVER OF CLAIMS shall submit within a reasonable time a detailed account of the amount claimed.
- 13.2.9 Where the event or series of events giving rise to a claim made under paragraphs 13.2.1 or 13.2.3 has a continuing effect, the detailed account submitted under paragraph 13.2.8 shall be considered to be an interim account and the party making the claim shall submit further interim accounts, at reasonable intervals, giving the accumulated amount of the claim and any further grounds upon which such claim is based. The party making the claim shall submit a final account after the end of the effects resulting from the event or series of events.
- 13.2.10 Nothing in GC 13.2 – WAIVER OF CLAIMS shall be deemed to affect the rights of the parties under any lien legislation or limitations legislation prevailing at the *Place of the Work*.

1155 - Timmins Water Filtration Plant High Lift & Backwash Pump Replacement Tender

Opening Date: December 31, 9999 11:59 PM

Closing Date: April 23, 2025 2:00 PM

Schedule of Prices

The Bidder hereby Bids and offers to enter into the Contract referred to and to supply and do all or any part of the Work which is set out or called for in this Bid, at the unit prices, and/or lump sums, hereinafter stated. HST is additional.

* Denotes a "MANDATORY" field

Do not enter \$0.00 dollars unless you are providing the line item at zero dollars to the City.

If the line item and/or table is "NON-MANDATORY" and you are not bidding on it, leave the table and/or line item blank.Do not enter a \$0.00 dollar value.

Pricing Table - Lump Sum

SCOPE OF WORK AS NOTED IN TENDER DOCUMENT(S)

Item Description	U.O.M.	Quantity	Price *	Total Price
FIXED FEE PRICE TO PERFORM ALL THE WORK REQUIRED IN THE SCOPE OF WORK AND CONTRACT DOCUMENTS (Exclusive of HST)	LS	1		
10% CONTINGENCY ALLOWANCE (Exclusive of HST)	CA	1		
Subtotal:				

Pricing Table - Unit Prices

Pricing shall exclude H.S.T.

Item Description	U.O.M.	Price *
CONCRETE	cu.m	
GRANULAR MATERIAL - GRANULAR 'A'	t	
GRANULAR MATERIAL - GRANULAR 'B' TYPE I	t	
GRANULAR MATERIAL - GRANULAR 'B' TYPE II	t	
SUPPLY & PLACE HOT MIX ASPHALT - SUPERPAVE 12.5	t	
EARTH EXCAVATION	cu.m	
REMOVALS - ASPHALT PAVEMENT	sq.m	
PROJECT MANAGER	/hr	
SITE SUPERVISOR	/hr	
CARPENTER	/hr	
LICENSED CARPENTER	/hr	
GENERAL LABOURER	/hr	
PAINTER	/hr	
DRYWALLER	/hr	
ROOFER	/hr	
LICENSED PIPE FITTER	/hr	
PIPE FITTER APPRENTICE	/hr	
LICENSED SHEET METAL FITTER	/hr	
SHEET METAL FITTER APPRENTICE	/hr	
LICENSED ELECTRICIAN	/hr	
ELECTRICIAN APPRENTICE	/hr	

Pricing Table - Add-In Price

The following are our Add-In prices for the work listed hereunder. Such Add-In Work and monetary amounts are NOT included in our Stipulated LumpSum Price. Prices listed shall exclude the H.S.T.

Item Description	U.O.M.	Quantity	Price	Total Price
Allowance for disinfection sampling and testing	LS	1	\$10,000.0000	\$ 10,000.0000

Bid Questions

What is your HST number?

Proposed Construction Plant/Equipment to be Utilized on this Contract

*Tenderer to select correct drop-down option representing availability of Plant/Equipment as follows:

A= Available or Under Tenderer’s Control
R= To be Rented
P= To be Purchased

Line Item	Description of Plant/Equipment	Present Location	Availability*	
1			Select A Value	*
2			Select A Value	*
3			Select A Value	
4			Select A Value	
5			Select A Value	
6			Select A Value	
7			Select A Value	
8			Select A Value	
9			Select A Value	
10			Select A Value	

Construction Schedule

Indicate the construction schedule below. Enter in the month and the year during which the work will be performed. Provide a description of the work that will be performed during that time period.

Line Item	Month	Year	Construction Activity	
1				*
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Contractor List of Ongoing Projects

We declare that we have the following experience in similar work, which we have successfully completed:

Line Item	Contract Start Date	Contract End Date	Owner	Value	
1					*
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Tenderer's Experience

We declare that we have the following experience in similar work, which we have successfully completed:

Line Item	Year	Description of Contract	For Whom Work Performed	Value	
1					*
2					*
3					*
4					
5					

Proposed Project Manager for this Project

Name	Title/Position	Years of Experience as a Project Manager	Years Employed as a Project Manager with this Company	Qualifications	
					*

Project Manager Project Experience

Line Item	Project Name & City	Project Description	Year Completed	Final Project Value	
1					*
2					*
3					
4					
5					
6					

Proposed Site Supervisor for this Project

Name	Title/Position	Years of Experience as a Site Supervisor	Years Employed as a Site Supervisor with this Company	Qualifications	
					*

Site Supervisor Project Experience

Line Item	Project Name & City	Project Description	Year Completed	Final Project Value	
1					*
2					*
3					
4					
5					
6					

All references stated shall be for the same or similar scope as the one described in this Bid.

For newly formed business entity including, corporations, partnerships and sole proprietors or a Contractor teaming arrangement you shall state below in the Client Column that you were not the "Contractor" for the named project and should state whose past experience on the named project is relevant to that reference.

References - Similar types of projects in the last 3 years

Line Item	Company Name	Contact Name	Contact Title	Contact Phone Number	Contact E-mail	Project Description
1						
2						
3						

Sub-Contractors

The Bidder shall state all Subcontractor(s) and type of Work proposed to be used for this project. Bidders shall not indicate "TBD" (To Be Determined) or "TBA" (To Be Announced) or similar wording and shall not indicate multiple choices of Subcontractor names for any Subcontractor category in their list of Subcontractors.

The Bidder shall state only one (1) subcontractor for each type of work

Bidder(s) shall upon request by the Owner produce a list of references for all or any proposed Subcontractors within three (3) business days.

List of Proposed Sub-Contractors

We acknowledge that failure to comply with the foregoing requirements may result in our tender being rejected as informal. We shall subcontract the following parts of the Work to the sub-contractor or supplier listed for such part. We agree not to make changes in the following list without the written consent of the Contract Administrator and the Owner. In our opinion the sub-contractors named hereunder are reliable and competent to perform that part of the Work for which each is listed; however, we agree that the Owner may make changes pursuant to Section 2.17 Owner's Right to Approve or Reject Subcontractors for the Capital project.

Line Item	Part of Work	Sub-Contractor/Supplier	Address	
1				*
2				*
3				*
4				*
5				*
6				*
7				*
8				*
9				*

Documents

It is your responsibility to make sure the uploaded file(s) is/are not defective or corrupted and are able to be opened and viewed by the Owner. If the attached file(s) cannot be opened or viewed, your Bid Call Document may be rejected.

- Letter of Credit * (mandatory)
 - Agreement to Bond (optional)
 - Cost Breakdown (optional)
 - Additional Document (optional)
-
- Digital Bid Bond in the amount of \$50,000 * (mandatory)

Form of Tender

The Bidder hereby acknowledges and agrees:

1. Submission of Bid

I/We, the undersigned Bidder, having examined the locality and site of work as well as all the Contract Documents, hereby tenders and offers to furnish all material, labour, service, equipment, scaffolding and all the incidentals, and to render all services and pay all applicable Value Added Taxes and all other charges as specified and/or as necessary for performance and completion of the above referred to Project, all in full accordance with Contract Documents provided to the Bidder by the City (receipt of which is hereby acknowledged) for the Total Contract Price as provided in this Bid.

2. Total Contract Price

I/We confirm all prices provided in the Bid as in Canadian Dollars and do not include Value Added Taxes. Any tax payable is for the account of the City and is in addition to the Total Contract Price.

3. Addenda

I/We have made any necessary inquiries with respect to Addenda issued by the City and have ensured that we have received, examined and provided for all Addenda to the Request for Tenders in this Bid.

4. Contract

It is understood and agreed by me/us that a binding Contract shall come into being upon acceptance of the Bid by the City. The documents listed in the List of Contract Documents for this Tender shall constitute the contract, subject to such modifications as may be agreed to in writing between the parties.

5. Electronic Funds Transfer

I/We acknowledge and agree to provide the City with the information required for the City to make payment by EFT.

6. Occupational Health and Safety

I/We understand and agree that the Work must be conducted in a safe manner. Accordingly, I/we confirm that I/we and all subcontractors used on the Work for the City of Timmins will comply with all applicable laws of Canada, the Province of Ontario and the City of Timmins, including but not limited to the Occupational Health and Safety Act, and all applicable regulations thereunder. Further, without limiting any of the foregoing, I/we confirm that I/we have both a written occupational health and safety policy and program to implement that policy, and that all of our employees, subcontractors and any other persons performing the Work are appropriately trained, licensed and certified, as required to perform the Work.

7. Execution

If this Bid is accepted by the City and the Request for Tenders is awarded to me/us, I/we agree to provide and pay for the proof of insurance, WSIB clearance certificate, performance of contract security and a labour and material payment bond as required by the Contract Documents, my/our health and safety manual and any other document identified in the award letter as being required by the City prior to it being able to issue a purchase order, and to execute the Contract for Works if applicable, in quadruplicate, all within 10 Business Days after the City has issued its award letter or within such longer time period as the City may specify.

8. Bid Security

The bid security, if applicable, has been submitted through the Bidding System as specified in the Request for Tenders.

In the event of default or failure on my/our part to execute the Contract as required above and to provide the necessary Performance of Contract Bond and Proof of Insurance, I/we agree that the City may at its discretion accept the next lowest compliant Bid, advertise for new Tenders, or carry out the Works in any manner deemed in the best interests of the City. In such a case, I/we shall pay the City the difference between the Total Contract Price as provided in this Bid and any greater sum that the City may be obligated to pay be reason of that default or failure, including the cost of any advertisement for new Tenders.

I/We shall indemnify and save the City, its elected officials, officers and employees harmless from and against all loss and damage, costs, charges and expenses that they may suffer by reason of such default or failure on the Bidder's part. The City shall be entitled to call upon the bid bond certified cheque or letter of credit as the case may be for such difference or in respect of the indemnity, and the surety or issuer shall forthwith pay that difference. Despite any limitations set forth in the bid bond, certified cheque or letter of credit, I/we shall be and remain responsible to pay to the City the difference and all loss costs, charges and expenses as aforesaid without any such limitation or restriction.

9. Additional Work

I/We agree that if this Bid is accepted, I/we shall execute whatever additional or extra work may be required, in accordance with the General Conditions.

10. Time Open for Acceptance

I/We agree and confirm that this Bid is irrevocable and is to continue open to acceptance by the City for the time period specified in this Request for Tenders after the date and times set for closing of Bids. The City may at any time within the open for acceptance period accept this Bid whether or not any other Bid has previously been accepted, upon notice of acceptance in writing to me/us personally delivered or mailed to me/us by ordinary prepaid mail to the address provided in this Bid submission and any notice so mailed shall be deemed to have been received on the date of mailing thereof and any notice so delivered shall be deemed to have been received on the date the notice is so delivered.

11. No Collusion / Conflict of Interest

I/We hereby declare that no person, firm or corporation other than me/us has any interest in the Bid or in the proposed Contract(s) for which this Bid is made. I/We further declare that this Bid is made without any connection to, comparison of figures, arrangements with or knowledge of, any other corporation, firm or persons making a Bid for the same work and is in all respects fair and without fraud or collusion.

I/We declare that no member of the City of Timmins, and no officer, employee or agent of the City of Timmins has or will have an interest indirectly or directly as a contracting party, partner, shareholder, surety or otherwise in the performance of the Contract(s), or in the supply, work or business to which they relate or in any portion of the profits thereof, or in any of the monies to be derived there from.

12. Interpretation

I/We confirm that we have received no oral information, instruction or advice from any officer, employee, agent or consultant of the City which changes the content of the Request for Tenders and all Addenda thereto.

I/We acknowledge and agree that we have not assumed that any information concerning our operations, business or personnel or any other information required to be provided by us when submitting our Bid is known to the City, regardless of whether such information may be actually previously known to the City or not. Further, we acknowledge and agree that all information to be provided by us is to be complete and full and in such detail as required.

13. Accessibility for Ontarians with Disabilities Act, 2005

I/We confirm that I/we and all subcontractors used on the Work for the City of Timmins will comply with all applicable accessibility laws, regulations and by-laws of Canada, the Province of Ontario and the City of Timmins, including but not limited to the Ontarians with Disabilities Act, 2001 (ODA), the Accessibility for Ontarians with Disabilities Act, 2005 (AODA), Ontario Regulation 429/07 (Accessibility Standards for Customer Service) and Ontario Regulation 191/11 (Integrated Accessibility Standards), throughout the term of the Contract.

14. Compliance with the City of Timmins By-laws

I/We declare that I/we are in compliance with all municipal by-laws as they pertain to the City of Timmins in respect of the operation of my/our business and in respect of the Work described in the Request for Tenders. I/We understand and agree that if this statement is untrue or incorrect, the City of Timmins shall be entitled at its sole discretion to reject this Bid, or if such untruth or incorrectness comes to light after this Bid is accepted, to terminate or refuse to enter into, as applicable, any Contract and to pursue any other legal recourse the City deems appropriate, and that such untruth or incorrectness shall be a default under the Contract.

15. Procurement Policy

In submitting a Bid in response to the Tender, I/we agree and acknowledge that I/we have read and will be bound by the terms and conditions of the City's Procurement Policy. I/We understand that the City's Procurement Policy can be viewed on the following website at:
<https://timmins.hosted.civiclive.com/common/pages/DisplayFile.aspx?itemId=15458609>

☐ I/WE agree to be bound by the terms and conditions and have authority to submit this bid on behalf of the Bidder.

Except with the prior express written consent of the City, **prior to submitting this Bid**, vendors are required to notify the City in writing, of any potential conflict of interest that may arise prior to the award of any contract and fully disclose any details thereof. Failure on the part of a vendor to declare a conflict of interest to the City and to obtain the City's prior express written consent to waive the conflict of interest shall result in the vendor being ineligible to Bid and shall for a basis for rejection of a Bid submitted to the City.

Do you have a potential conflict of interest?

☒ Yes ☐ No

The Bidder acknowledges and agrees that the addendum/addenda below form part of the Bid Document.

Please check the box in the column "**I have reviewed this addendum**" below to acknowledge each of the addenda.

File Name	I have reviewed the below addendum and attachments (if applicable)	Pages
There have not been any addenda issued for this bid.		

