REGIONAL DISTRICT OF NANAIMO

REQUEST FOR QUALIFICATIONS

RFQ # 19-007

CONSTRUCTION OF THE BOWSER VILLAGE CENTRE WASTEWATER PROJECT

February 8, 2019

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PART 1 INTENT

The intent of this Request for Qualification (RFQ) is to seek statements of qualifications (Responses) from parties (the " Respondents") interested in construction of the Bowser Village Centre Wastewater Project.

More specifically, the intent of this RFQ is to short-list up to five (5) Respondents with a minimum bonding capacity of $15 million to potentially later participate in a construction tender or request for proposals process for a general Contract – Construction of the Bowser Village Wastewater Project (the "Project"). However, the RDN may short-list any number of Respondents.

While it is anticipated that this RFQ may lead to a Tender or Request for Proposal, the RDN has the sole discretion to determine its next steps in relation to the Project, which may include doing nothing, directly negotiating with any one or more of the Respondents, issuing a Tender or Request for Proposal to the short-listed Respondents, or pursuing a different selection process altogether.

For certainty, neither this RFQ process nor a Respondent's participation in it gives rise to any legal rights or obligations whatsoever in favour of either the RDN or any Respondent.

PART 2 SCOPE/BACKGROUND INFORMATION/PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

In March 2017, the Regional District of Nanaimo (RDN) was awarded a joint Federal and Provincial Clean Water & Wastewater Fund grant of up to $7.6 million to provide the Bowser Village Centre with sanitary sewer servicing to support the community's evolution into a "compact, complete community". The Project includes construction of a sewer collection system, wastewater treatment plant, effluent line and marine outfall for treated effluent.

The RDN has retained STANTEC and Great Pacific to complete detailed design work for the Project.

The work generally consists of the supply of all materials and construction of; a sewer collection system with both gravity and pumped connections and mains, a wastewater pump station, a sequencing batch reactor treatment plant, the effluent line and a marine outfall.

In order to meet the provincial and federal funding requirements the Project must be totally complete by March 31, 2020.

2.2 SCOPE OF THE WORK

1. The key components of the work are generally described as follows (not listed in any particular order):

    a. Supply and installation of the collection system including the following:

        i. approximately 225 meters of 200 mm PVC sewer

        ii. approximately 240 meters of 200 mm PVC and 100 mm HDPE in a common trench

        iii. approximately 600 meters of 2X 200 mm PVC and 100 mm HDPE in a common trench

        iv. approximately 1500 meters of 200 mm HDPE forcemain, including survey of the selected route to confirm the design

        v. 61 – 50 mm HDPE service connections

        vi. Supply of grinder pumps to property owners

        vii. Sewer lift station c/w kiosk and standby genset

    b. Construction of the 2850 meter 200 mm dia. HDPE marine outfall, and includes concrete weights and a diffuser, the works include a land section, intertidal section and a marine section.

    c. Supply and installation of a 400 M3/day wastewater treatment plant including:

        i. Tree removal, grubbing, and stump removal from the site and access road.

        ii. Excavation and concrete works

        iii. On and offsite utilities

        iv. Construction of the treatment plant

        v. Commissioning the treatment plant

    d. Development and implementation of comprehensive site-specific plans/programs such as safety and health, quality control, environmental protection, public impact mitigation, and pedestrian and vehicular traffic control.

    e. Coordination with utility companies and permitting authorities including but not limited to BC Hydro, Shaw, TELUS, MOTI, RDN Parks Recreation and Culture, Bowser Water Works, and Island Corridor Foundation, throughout the Project.

2. Drawings depicting the overall scope of work are attached in appendix “B”.

3. The general contractor ultimately selected by the RDN for the Project will be the Prime Contractor for the site (the proposed works) and will be solely responsible for the coordination of the health and safety activities at the worksite and development, implementation and maintenance of a safety program.

4. The general contractor ultimately selected by the RDN for the Project will be responsible for

ensuring the all appropriate permits and authorizations are is in place prior to starting that work. The following authorizations/permits have been applied for, however the permits/authorizations to proceed have not yet been received:

a. Occupant License to Cut (This allows for tree removal on the road allowance and the treatment plant site)
b. MOTI access permit
c. MOTI works within highway right of way
d. Fisheries Act Authorization
e. ICF works within railroad right of way
f. Bowser Waterworks connection to water system (application underway)
g. Permitting for the outfall (DFO and MOE)
h. RDN building permit
i. Municipal Wastewater Regulation, BC ministry of Environment and Climate Change

5. The general contractor ultimately selected by the RDN for the Project will be obligated to totally complete the Project by March 31, 2020. The work must be totally complete and all invoices submitted by March 31, 2020 to meet federal funding agency requirements.

6. The available budget for the construction contract portion of the Project is $8,900,000 excluding GST

PART 3 FORMAT OF RESPONSE

A clear and concise presentation of information is encouraged. No assumption should be made that the information regarding a Respondent is known to the RDN except as provided in its Response.

It is requested that each Response be arranged in the format described below. For evaluation purposes, the relevant weightings are identified at the beginning of each section.

Respondents are requested to be concise and limit their Response to approximately 20 single sided pages with a minimum 10 point font excluding appendices. Key information should be included in the main body of the Response.

The following information is requested to be included in the response:

Title page

i. Showing project name, closing date and time, Respondent name, address, telephone number, fax number, GST number, contact person and their e-mail address.

Letter of Introduction

i. One page, introducing the Respondent and signed by the person(s) authorized to sign on behalf of the Respondent to statements made in response to this RFQ.

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i. Include page numbers.

Section 1: Executive Summary

i) One or two page summary of the key features of the Response.

Section 2: Project Firm Qualifications & Specific Experience - 70 %

i. The type of work the Respondent specializes in, and the number of projects and value of work done by the company in last three (3) years.
ii. Where two or more entities collaborate to jointly submit a Response, information must be provided for each entity comprising the Respondent, including information regarding the structure of the joint venture, joint arrangement, partnership or other collaboration. Where the Respondent is a joint venture or consortium, the RDN will take into account in its evaluation of Responses the qualifications, experience and references of each constituent member of the joint venture or consortium. Joint ventures and consortia comprised of key entities that have successfully worked together in the recent past may be regarded as more favorable than those of otherwise equal credentials that have had no previous experience working with one another.
iii. List number of employees in company, number of branch offices, if any, and the number of employees in the office that will support this project.
iv. List relevant sub-consultants including environmental engineers, relevant sub-contractors including utility, marine, electrical instrumentation and mechanical contractors including their roles, expertise, experience, reference and past working relationship with the Respondent. The RDN recognizes that a sub-contractor named may not be able to remain part of the Respondent's team for the project. Therefore the Response should focus on the Respondent demonstrating a successful relationship between the Respondent and its named sub-contractors as substantiated by references.
v. Provide evidence in the form of a letter from an acceptable Surety indicating bonding capacity for a single construction project of $15 million or more (Bid Bond 10%, Labour and Materials Bond of 50% and Performance Bond of 50%). All evidence requested by this Section shall be issued by a company licensed to transact business in the Province of British Columbia. All required documentation must be originals; photocopies and facsimiles are not acceptable and may result in the rejection of the RFQ response.
vi. List up to five (5) projects within the last ten (10) years where the Respondent has successfully completed similar multi-disciplinary projects. Each project can demonstrate experience with multiple areas listed below. Include project name, project description, date and duration of project, value of project; note the specific staff that worked on the project, staff client reference contact including current contact name, telephone number and email address. Include any other relevant information to demonstrate successful completion of projects involving the following:

- Construction of sanitary sewer linear infrastructure and pump stations including HDPE piping in high traffic areas, demonstrating success in dealing with public impact and traffic management issues including liaising with local government staff and affected local residents and businesses.
- Construction of marine wastewater outfalls
- Construction and commissioning of sequencing batch reactor wastewater treatment plants.

vii. Demonstrate your corporate quality control program and your corporate quality control record as determined by three (3) references (complete with Name, phone number and email address) of prior successful Works of a similar nature to this Project. The RDN reserves the right to obtain its own references in this regard.

viii. Provide a description of the Respondent's corporate health and safety program.

ix. Provide a description of the Respondent's project performance, specifically demonstrated ability to meet project schedules, remain within budget, communicate effectively with the Engineer, subcontractors and the public, effective dispute resolution, document management and efficient project closeout.

Section 3: Project Organization, Staff Qualifications & Experience – 30%

I. Describe the proposed project organizational structure noting key personal and team relationships described

II. List the names of proposed key personnel for the Project including
   (a) Overall Project Manager
   (b) Treatment Plant Construction Manager
   (c) Marine Outfall Construction Manager
   (d) Civil Utilities Construction Manager
   (e) Superintendents

III. List the last three (3) projects similar in size, scope and nature to proposed Project, which they supervised including value of the projects

IV. List the relevant background and number of years of experience of the named personnel.

V. Include resumes as an appendix

Previous experience working with the RDN is not required and does not in any way confer an advantage; however, the RDN may take into account previous experience with a Respondent in the evaluation of Responses. The RDN may rely upon its records, references and recollection in this regard. The RDN may also obtain references other than those provided by the Respondent and may use these reference in determining greatest value. Responses will generally be evaluated on information contained therein. As such, Respondents should ensure that any information they wish to be evaluated in the context of this RFQ should be clearly expressed in their submission.

Response Submission

It is requested that four (4) copies of your Response be submitted, one (1) of which is clearly identified as the original Response; in addition, one (1) USB Key containing a digital copy of your Response is requested.

Responses should be received at the specific physical location referred to below **no later than the end of business day on the 25th of February, 2019** (the "Response Closing"):

Stantec Consulting Ltd
400 – 655 Tyee Road
Victoria, BC V9A 6X5
Attention Alan Ghanam P. Eng

The RDN may accept late responses.

Information to Respondents

The RDN's evaluation of the Responses and assessment of the qualifications shall be final. Where the RDN decides to move forward with a Tender or Request for Proposal process for the Project consequent on this RFQ process, the RDN may include a Respondent that was not previously short-listed in the event that a short-listed Respondent notifies the RDN they no longer intend to participate.

In submitting a Response to this RFQ, each Respondent is solely responsible for any and all costs and expenses incurred by it in preparing the Response, including any costs incurred by the Respondent after the Response Closing.

If the RDN, in the RDN's sole discretion, determines that a clarification, addition, deletion or revision of the RFQ Documents is required then the RDN may issue a written addendum. Notice of the issuance of a written addendum, and the issued written addendum, will be posted on BC Bid and the RDN website.
All Addenda issued by the RDN shall be incorporated into and become part of the Documents.

PART 4 EVALUATION OF RESPONSES

The RDN intends to evaluate the Responses received and to select Respondents who are deemed qualified at the sole discretion of the RDN to participate in the next phase of the process. As previously indicated, while the RDN intends to short-list up to five (5) Respondents, to the RDN may short-list a great number of Respondents.

Selection for advancement to the next stage, if any, does not does not give rise to any legal rights or obligations as between the RDN and a Respondent.

With respect to this evaluation process, the RDN, in its sole discretion, has the unfettered right to

proceed in any manner that it believes to be in its best interest, including without limitation:

- accept any Response;
- reject any Response;
- reject all Responses;
- reject a Response even if it is the only one received.

The RDN may request additional information and/or seek clarification from any Respondent, but is not obligated under any circumstance to do so, and may request information from one Respondent without any obligation to request the same of any other Respondent.

It is the RDN's intent to evaluate Responses as promptly as possible. Corporate staff may contact a Respondent if a clarification is required; otherwise, they are unable to provide any details concerning the evaluation until after the process has concluded.

The RDN will endeavor to post the list of Respondents on the BC Bid and the RDN website by 11:00 a.m. the business day following the Response Closing. Only the Respondents' names will be disclosed. All inquiries regarding the Responses will be referred to that site. Only the short-listed Respondents, if any, will be contacted at the conclusion of the process. Unsuccessful Respondents wishing to be debriefed are encouraged to contact the RDN within 30 days of the website posting. As only the short-listed Respondents, if any, will be contacted at the conclusion of this RFQ, the RDN wishes to thank all Respondents for their effort in responding to this opportunity.

PART 5 ENQUIRIES

Any requests for explanations, interpretations or clarifications made by Respondents should be submitted in writing to the RDN prior to the Response Closing. Any request for clarification or issues related to the RFQ must be transmitted to the Project Manager identified below.
All queries shall be made in writing to:

Stantec Consulting Ltd.
400-655 Tyee Road
Victoria, BC.
V9A 6X5
Attention Alan Ghanam P. Eng
Al.ghanam@stantec.com

Please Note: The above named (or designate) is the only valid contact for enquiries. No explanation, interpretation or clarification of the RFQ by any other person whatsoever shall bind the RDN in the interpretation of the RFQ.

PART 6 CONFLICT OF INTEREST

In submitting a Response, a Respondent declares that it has no pecuniary interest in the business of any third party that would cause a conflict of interest or be seen to cause a conflict of interest in carrying out the Project, if ultimately awarded to the Respondent. Should such an interest be acquired during the term of any construction contract ultimately awarded to the Respondent, the Respondent shall declare it immediately in writing to the RDN. If the Respondent does declare a conflict of interest the RDN may direct the Respondent to resolve the conflict of interest to the RDN's satisfaction.

Responses will not be evaluated if the Respondent's current or past corporate or other interests may, in the RDN's opinion, give rise to a conflict of interest in connection with this RFQ.

PART 7 SOLICITATION

The Respondent may not make any representations or solicitations to any director, officer or employee of the RDN with respect to the RFQ either before or after submission of the Response except as provided herein. If any director, officer, employee, agent sub-contractor, supplier or other representative of the Respondent communicates with any director, officer or employee of the RDN or any consultant engaged by the RDN in connection with this Request for Qualifications about this Request for Qualifications, the RDN may, regardless of the nature of the communication, reject the Response submitted by the Respondent.

PART 8 CONFIDENTIALITY AND SECURITY

It is the RDN's policy to maintain confidentiality with respect to all confidential information related to the Response, but the Corporation is subject to the *Freedom of Information and Protection of Privacy Act*. If the Respondent considers that any of its information is confidential, the Respondent shall identify that confidential information and advise the Corporation in its Response, however, confidentiality cannot be guaranteed.

Appendix A Geotechnical Reports

Geotechnical Report for Sanitary Pump Station No. 1

Bowser Village Centre Wastewater Project

November 5, 2018

Prepared for:

Regional District of Nanaimo
Wastewater Services
6300 Hammond Bay Road
Nanaimo, BC V9T 6N2

Prepared by:

Stantec Consulting Ltd.
500-4730 Kingsway
Burnaby, BC V5H 0C6

Project No.: 111700522

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1.0 INTRODUCTION

As requested by the Regional District of Nanaimo (RDN), Stantec Consulting Ltd. (Stantec) has carried out a geotechnical assessment to support design and construction of the proposed Sanitary Pump Station No.1 in Bowser, British Columbia. This sanitary pump station is planned as part of the RDN's Bowser Village Centre Wastewater Project.

The purpose of this geotechnical assessment was to characterize the soil and groundwater conditions near the proposed location of the new sanitary pump station and to provide geotechnical recommendations for design and construction of this structure. The scope of work for our geotechnical assessment consisted of the following:

- Review of available project drawings and published geological mapping for the project region.
- A geotechnical subsurface exploration program to characterize the soil and groundwater conditions.
- Laboratory testing of soil samples collected during our subsurface exploration program.
- Geotechnical engineering analyses.
- Preparation of this report.

Stantec has completed the geotechnical assessment for Sanitary Pump Station No. 1 in general accordance with our proposal (File p18_027, dated February 28, 2018).

1.1 PROJECT UNDERSTANDING

We understand that a new pump station is planned as part of the Bowser Village Centre Wastewater Project in Bowser, British Columbia. Based on the information provided via internal Stantec email and our experience on similar sanitary pump station projects, we understand the following:

- The pump station will be constructed on the south side of Island Highway W (Highway 19A), to the east of the intersection with Bowser Road.
  - The pump station will be constructed between the eastbound travel lane of the highway and the north property line of the residential property at 6880 Island Highway W.
  - The pump station's footprint will be approximately 25 m long (east-west) by 8.5 m wide (north-south), and the west end of the footprint roughly aligns with the west property line of 6880 Island Highway W.
  - An existing drainage ditch is present in the proposed location of the new pump station and might be infilled. Infilling would comprise filling the ditch to roughly match the existing grade of the south shoulder of Highway 19A.
  - Finished site grade is anticipated to be near the elevation of the existing road shoulder on the south side of Highway 19A.
- The pump station will include below-grade wet well and concrete valve chamber structures, at-grade genset and electrical kiosk structures, and associated underground piping.
  - The new structures will be arranged sequentially within the pump station footprint; however, the sequencing and spacing between the four structures is unknown.
  - The bottom of the wet well tank will be located approximately 4.5 m below the elevation of the existing road shoulder. The wet well will be less than 2 m in diameter, constructed of fibre-reinforced polymer (FRP), and have an anti-buoyancy concrete slab at its base.
  - The concrete valve chamber will be in the order of 2.5 m square (in plan) and founded within 2 m below finished grade.

- The genset and electrical kiosk will both be roughly 2.5 m by 1.25 m (in plan) and founded near finished grade on reinforced concrete slab foundations.

We understand that the new pump station will be designed as a post-disaster structure as prescribed in the 2012 British Columbia Building Code (BCBC, 2012), which adopted seismic provisions from the 2010 National Building Code of Canada (NBCC, 2010).

2.0 SITE DESCRIPTION AND GEOLOGY

The proposed Sanitary Pump Station No. 1 will be located between the eastbound travel lane of Island Highway W (Highway 19A) and the north property line of 6880 Island Highway W, near the intersection between Highway 19A and Bowser Road in Bowser, British Columbia. The pump station will extend approximately 25 m to the east of the west property line of 6880 Island Highway W. The site is located approximately 200 m west-southwest of the Salish Sea shoreline.

Stantec Drawing No. BC-C-123 (Sanitary Main Highway 19A STA 20+580 to 20+840, dated October 31, 2016) indicates that existing grade at the proposed pump station site is approximately EL. 19.5 m Geodetic. Based on site observations made at the time of our field investigation (Section 3.2) and review of 20 m contours on the RDN's online interactive map, RDNMap (Regional District of Nanaimo, 2018), the existing ground surface slopes down from the proposed pump station site to the Salish Sea shoreline at an average grade of approximately 15%, with localized areas as steep as approximately 20%.

A drainage ditch presently runs east-west through the middle of the proposed pump station site. The bottom of this ditch is approximately 0.75 m below the top of asphalt pavement along the south edge of Highway 19A. The sides of the ditch are grass-covered and roughly sloped at 1.5H:1V (horizontal to vertical). On the south side of the ditch, the slope is approximately 2 m high between the bottom of the ditch and an existing fence at the 6880 Island Highway W property.

A wooden, overhead utility pole was present near the crest of the south slope of the ditch and the west end of the proposed pump station footprint. The pole is approximately 9 m high.

Surficial geology information (Bednarski, 2015) indicates that existing subsurface conditions near the proposed pump station are likely to consist of a marine veneer over a till blanket. The marine veneer is anticipated to be less than 1 m thick and "variously comprise bouldery gravel, sand, silt, and clay". The underlying till blanket is anticipated to be more than 2 m thick and comprise diamicton with a sandy to clayey matrix (i.e., unsorted to poorly sorted soil particles, ranging in size from clay to boulders, contained within predominantly sandy to clayey soil).

3.0 GEOTECHNICAL EXPLORATION

3.1 PERMITS

Upon authorization to proceed, Stantec prepared and submitted information required by the British Columbia Ministry of Transportation and Infrastructure to carry out a geotechnical exploration within the Ministry right-of-way. Stantec, with the assistance of our sub-contracted traffic management firm, Island Traffic Group, completed and submitted forms H0020 (Provincial Public Highway Permit Application), H1080 (Work Notification/Lane Closure Request and Approval), and a *Drive BC Data Entry Information Request* to the Ministry the week of February 28, 2018.

The Ministry provided an approved H1080 form and a *Permit to Construct, Use, and Maintain Works within the Right-of-Way of a Provincial Public Highway* (Permit/File Number 2018-01110) on March 2, 2018.

3.2 FIELD WORK

Stantec advanced one geotechnical borehole (BH18-01) at the approximate location of the proposed new Sanitary Pump Station No. 1. Borehole BH18-01 was drilled at the transition between the existing hard and soft shoulders of Highway 19A, at approximate UTM coordinates 5476953 m N, 379149 m E (Zone 10 U).

The borehole was drilled using a rubber track mounted drill rig operated by Blue Max Drilling Inc. (Courtenay, British Columbia). The borehole was advanced using 140 mm diameter solid stem augers to approximately 6 m below existing grade. At the suggestion of the drillers, the borehole was terminated at this depth to avoid possible damage to the drilling equipment resulting from significant deflection of the drill rods. Drill rod deflection was suspected to be due to cobbles and boulders within the subsurface.

Dynamic Cone Penetration Tests (DCPTs) were carried out adjacent to the borehole to assess in-situ consistency or compactness of the existing soil layers. DCPT blow counts represent the number of blows required to advance a 60-degree apex cone at approximately 300 mm intervals into soil using a drop-hammer with a standardized drop height and weight of 760 mm and 63.5 kg, respectively. DCPT testing was carried out until practical equipment refusal (minimum 100 blows per 300 mm) on very dense soil at approximately 4.5 m depth. DCPT blow counts recorded in the field are shown on the Borehole Record for BH18-01 (**Appendix B**).

The field exploration was monitored by Stantec staff, who identified the sample locations, classified the soils in accordance with ASTM Standard D2488 (Visual Manual Procedure), kept a detailed borehole log, recorded DCPT blow counts, and observed and recorded pertinent site features. Representative soil samples from the borehole were collected, placed in moisture-tight containers, and transported to our soils laboratory.

3.3 LABORATORY TESTING

The objectives of the laboratory testing program were to aid in the classification of soil samples and to derive engineering design parameters of the soils. The tests consisted of visual classification (ASTM D2487 and D2488), water content measurement (ASTM D2216), and fines content measurement (ASTM D1140 Method A). The results of the laboratory soil testing are shown on the Borehole Record provided in **Appendix B**.

4.0 SUBSURFACE CONDITIONS

An approximately 90 mm thick layer of asphalt pavement was present at the location of borehole BH18-01 (at the transition from hard to soft shoulder). The asphalt was underlain by approximately 1.7 m of brown, silty sand with gravel. Based on visual observation, this soil layer has been classified as “fill” consisting of reworked native soils. DCPT blow counts infer that the silty sand with gravel layer was compact above approximately 0.9 m depth and dense to very dense below this depth. The measured moisture content of two samples of the reworked, silty sand with gravel fill was 15% and 11%.

Grey, clayey sand was encountered beneath the silty sand with gravel at approximately 1.8 m depth below top of existing pavement. The clayey sand contained less than 15% gravel by mass; however, occasional to frequent cobbles were encountered at approximately 3.4 m depth. DCPT blow count values indicate that the clayey sand was generally dense to very dense, though a layer of compact-to-dense clayey sand was encountered approximately between 4 m and 4.3 m depth. The clayey sand was moist, and the measured moisture content of two samples of this soil layer was 11%.

The clayey sand was underlain by a layer of grey, silty sand containing trace amounts of gravel. The silty sand layer was moist to wet and encountered between approximately 4.9 m depth and the termination depth of borehole BH18-01 (6 m). The silty sand was inferred to be very dense based on drilling resistance (i.e., based on difficulty advancing the solid-stem auger into the ground). The measured moisture content of one sample of the silty sand was approximately 21%.

Groundwater was observed in the open borehole at approximately 5 m depth.

5.0 SEISMIC DESIGN PARAMETERS

We understand that seismic design of the new pump station structures will be in accordance with the provisions of the current building code, BCBC (2012) with ground motions having a probability of exceedance of 2% in 50 years (i.e., 2,475-year return period earthquake).

Site-specific seismic design parameters were obtained from the interactive website maintained by the Geological Survey of Canada (Natural Resources Canada, 2016) in accordance with the provisions of NBCC 2010. The parameters from this website are in the form of 5% damped horizontal spectral response acceleration, $S_a(T)$ where T is the period in seconds. The $S_a(T)$ values are determined for very dense soil or soft bedrock, taken as the reference ground condition corresponding to Site Class "C".

The results of our subsurface exploration indicate that Site Class "C" should be considered for design. Table 1 provides the Peak Ground Acceleration (PGA) and $S_a(T)$ values for the 2,475-year return period and Site Class "C" conditions.

Table 1 Ground Motion Parameters (Site Class "C" Conditions and 5% Damping)— 2,475-Year Return Period

	PGA	Sa (0.2s)	Sa (0.5s)	Sa (1.0s)	Sa (2.0s)
NBCC 2010 (BCBC 2012)	0.344g	0.737g	0.532g	0.300g	0.162g
NBCC 2015 (BCBC 2018)*	0.366g	0.812g	0.778g	0.503g	0.320g
Note: 'g' is the acceleration due to gravity *An update to BCBC is expected in December 2018, which is likely to include the seismic design provisions of NBCC 2015.					

The existing subsurface soils at the subject site are not susceptible to liquefaction for the seismic event with a return period of 1 in 2,475 years.

6.0 RECOMMENDATIONS AND CONSTRUCTION CONSIDERATIONS

6.1 SITE PREPARATION

The subgrade soils exposed beneath the proposed pump station structures (wet well, valve chamber, electrical kiosk, and genset) should be reviewed by the Geotechnical Engineer prior to placement of any imported fill materials. Any loose or soft areas within the exposed subgrade will need to be sub-excavated to the discretion of the geotechnical engineer. The sub-excavated soils should be replaced with structural fill as described in Section 6.2.

Depending on the final layout of the pump station, the existing wooden utility pole might be located within or near the excavation for the below-grade wet well and valve chamber. The embedment depth of this pole is unknown; however, our experience with BC Hydro distribution line projects is that the typical embedment depth of these poles is 10% of the pole height plus 0.6 m (i.e., 1.5 m embedment for a 9-m high pole). Excavation for below-grade structures could undermine and negatively impact stability of this pole. If this pole is not relocated, we recommend that it is supported throughout construction to BC Hydro's satisfaction.

6.2 STRUCTURAL FILL

Structural fill should be well-graded 75 mm minus granular material with less than 5% fines content and should conform to the Master Municipal Construction Document (MMCD) Volume II, 2009 edition. Specific MMCD fill gradations have been recommended for frost protection (Section 6.5), underslab fill (Section 6.6), and to provide adequate drainage adjacent to below-grade structures (Section 6.7).

The fill should be placed in maximum 300 mm thick, loose lifts and compacted to 95% of the Modified Proctor Maximum Dry Density (MPMDD). We recommend that excavation backfill is placed simultaneously on all sides of the below-grade structures (i.e., the top of each lift of backfill should be relatively level at any time during the backfilling process).

The Contractor should provide laboratory sieve test results from the structural fill supplier prior to delivery to the Site. The laboratory sieve test should be completed in accordance with ASTM D422 and the results should be from tests completed within roughly one year of their intended use at the Site.

Review and testing of structural fill placement and compaction should be carried out by the Geotechnical Engineer.

6.3 EXCAVATIONS

All excavations should be carried out in accordance with Part 20 of the current WorkSafeBC regulations (WorkSafeBC 2013) and be safe for worker entry. Due to the height and inclination of the slope along the south side of the Site (approximately 2 m and 1.5H:1V, respectively), the maximum height of the vertical portion of any unsupported excavation permissible by WorkSafeBC is 0.6 m. Sloping and/or shoring is therefore required for temporary excavations greater than 0.6 m in depth.

The excavation depth should be measured from the base of the excavation to the higher of the top of the adjacent soil slope or existing grade at the adjacent residential property. Engineered excavation support will be necessary for all excavation depths greater than 6 m, in which case the Contractor's Geotechnical Engineer should design the temporary excavation supports based on the anticipated soil conditions, proposed excavation geometry and methodology, and proximity of the excavation to, and movement tolerance of, any adjacent utilities and structures including the overhead utility pole.

Excavated material should be stockpiled at a distance greater than the depth of the excavation, measured from the crest. Construction equipment should be kept a minimum of 2 m from the crest of all excavations.

The following sections provide recommendations for unsupported and supported temporary excavations less than 6 m deep (less than 6 m between the base of the excavation and the top of the adjacent soil slope).

6.3.1 Unsupported Excavations

Unsupported excavations greater than 0.6 m in depth and up to a maximum depth of 6 m should be configured with side slopes and/or benching no steeper than 1.5H:1V (horizontal to vertical). Along the south side of the pump station, sloping or benching at 1.5H:1V or flatter might require an encroachment agreement for the adjacent residential properties. The use of unsupported slopes for temporary excavations steeper than 1.5H:1V will require certification by a professional geotechnical engineer whom is recognized by the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC).

Excavation side slopes should be covered with polyethylene sheets secured to the ground with nails to protect the slope from precipitation and associated ground surface run-off. The slopes should be regularly reviewed by the geotechnical engineer for signs of instability. If groundwater seepage occurs through the sides of the excavation, the slopes may undergo sloughing, in which case additional maintenance and monitoring would be necessary. If localized instability is noted during excavation, or if wet conditions are encountered, the side slopes should be flattened as required to maintain safe working conditions.

The Contractor should inspect excavations regularly for signs of instability, and slopes should be flattened if required.

6.3.2 Supported Excavations

Temporary excavation support measures might be utilized to maintain excavation stability, allow for safe worker entry into excavations, and minimize excavation volumes and lateral extents. The upright portions of any temporary excavation support should be continuous to mitigate the granular fill soils passing through the supports.

Slumping of the excavation walls behind the temporary supports should be anticipated. This is particularly true for excavations adjacent to existing utility trenches, where the excavation sidewalls could partially consist of trench backfill material including granular and/or poor-quality fills from previous construction. We recommend that voids between the temporary excavation support and the excavation cut faces, when observed, be filled with imported granular soil or low-strength concrete (controlled density fill, CDF) to fill the void space and mitigate sloughing of the excavation walls/cut faces.

Design of the temporary shoring should be by the Contractor's engineer. Drawings showing shoring details should be provided to the Geotechnical Engineer for information and to the Owner's Engineer for record.

6.4 GROUNDWATER

At the time of the geotechnical site investigation, the groundwater level was observed approximately 5 m below top of asphalt along the hard shoulder of Highway 19A at the proposed location of Sanitary Pump Station No. 1. This observation suggests that groundwater will be approximately 0.5 m and 3 m below the proposed bottom of the wet well and valve chamber structures, respectively.

6.4.1 Temporary Dewatering

We anticipate that conventional construction sumps and pumps will be sufficient to maintain adequately dry conditions at the base of the excavations for the new wet well and valve chamber structures. The sumps should be positioned away from the footprints of these structures.

The excavations should be graded to direct water to flow to the sumps and to prevent ponding water on the foundation subgrade.

6.4.2 Buoyancy Forces

Hydrostatic pressure acting on the base of below grade structures will result in the potential for uplift forces. If a permanent drainage system is installed at the base of these structures, buoyancy forces can be estimated based on the groundwater levels observed during the geotechnical site investigation (approximately 5 m below existing grade, as shown on the Borehole Record for BH18-01). The below-grade structures should be designed assuming that they are empty.

Groundwater seepage and surface runoff infiltration could accumulate in the excavation backfill and underslab bedding layer given the permeability of these fill materials relative to the existing soils. If a permanent drainage system is not installed around the base of the below-grade structures, then these structures should also be designed to resist potential uplift pressures by assuming that they can become fully submerged (i.e., that groundwater could be present throughout the full height of excavation backfill). Further details on the permanent drainage system are provided in Section 6.7.

6.5 FOUNDATION DESIGN

Raft foundation or reinforced concrete slab-on-grade could be used to support the proposed wet well, valve chamber, electrical kiosk, and genset.

Foundations for the wet well (anti-buoyancy slab) and valve chamber structures should be underlain by at least 150 mm of compacted 19 mm clean clear crushed gravel (MMCD Section 31 05 17, Item 2.6–Coarse). Foundations for the electrical kiosk and genset should be underlain by non-frost-susceptible soil placed and compacted in accordance with Section 6.6.2. The exposed subgrade soils beneath the proposed pump station structures should be reviewed by the Geotechnical Engineer before placement of any structural fill and foundation bedding soils.

We recommend that uniform vertical subgrade modulus, k_{v1}, values of 20 MPa/m and 60 MPa/m be used for the design of the at-grade (electrical kiosk and genset) and below-grade (wet well and valve chamber) structures, respectively. Note that these uniform vertical subgrade moduli are based on tests on a 300 mm by 300 mm loaded

area. Interaction between the Geotechnical and Structural Engineers will be required during the design to further evaluate and confirm the above recommendation.

Post-construction settlement of the proposed below-grade wet well and valve chamber structures is estimated to be less than 25 mm.

Approximately 0.75 m of permanent site grading fill may be required to infill the existing ditch. Settlement of the ground due to this fill placement is estimated to be in the range of 10 to 25 mm. We recommend the proposed at-grade electrical kiosk and genset structures be designed for up to 25 mm of post-construction settlement.

We recommend minimum foundation embedment of 0.45 m to protect against frost for these unheated structures. Based on the assumptions in Section 1.1, concrete foundations for the proposed wet well and valve will be founded more than 0.45 m below finished grade. Foundations for these two structures therefore do not need to be protected against frost action.

We recommend that reinforced concrete slabs supporting exterior/at-grade equipment (electrical kiosk and genset) be founded a minimum 0.45 m below finished grade to protect against frost. If 0.45 m embedment depth is impractical, foundation slabs for these structures should be underlain by a layer of well-drained, non-frost-susceptible soil that extends below the foundation to at least 0.45 m below the final grade. Non-frost-susceptible soil includes pit run sand (MMCD Section 31 05 17, Item 2.4), clean 19 mm clear crushed gravel (MMCD Section 31 05 17, Item 2.6–Coarse), Type 1 Granular Pipe Bedding and Surround (MMCD Section 31 05 17, Item 2.7), and Crushed Granular Subbase.

If clear crushed gravel is used for the layer of non-frost-susceptible soil it should be separated from the surrounding soils by a layer of non-woven geotextile to prevent migration of finer particles. Geotextile is not required for the other types of non-frost-susceptible soil listed above. The clear crushed gravel should be compacted by the Contractor and reviewed by the Geotechnical Engineer. Other non-frost-susceptible soil should be compacted to at least 95% MPMDD.

The subgrade beneath the reinforced concrete slabs for the at-grade electrical kiosk and genset should be graded to direct water towards suitable drainage. Additional drainage measures, such as a French drain or collector pipe, should be installed to connect the layer of non-frost-susceptible fill to suitable drainage.

6.6 LATERAL EARTH PRESSURES

The buried FRP wet well and reinforced concrete walls of the below grade valve chamber should be designed to resist static lateral soil pressures and dynamic lateral pressures induced by the design seismic event. Table 2 provides the recommended soil design parameters for the structural design of the structures.

Table 2 Design Lateral Earth Pressure Parameters

Description	Value
Unit Weight of Structural Fill, γ	21 kN/m^3
Unit Weight of Water, γ_W	10 kN/m^3 (approx.)
Groundwater Level, D_W*	5 m
Coefficient of Lateral Earth Pressure At-Rest, K_o	 0.44
Base Sliding Coefficient, μ Cast-in-Place Concrete on Clear Crushed Gravel Bedding Layer	 0.55
Seismic Acceleration Coefficient, k_h (non-yielding walls)	0.344
Static + Dynamic Lateral Earth Pressure Coefficient, K_E (non-yielding walls)	0.56
Dynamic Lateral Earth Pressure Coefficient, ΔK_E (non-yielding walls)	0.12
**Groundwater level only if permanent drainage is installed per Section 6.8. Otherwise, assume groundwater could be present up to top of the below-grade structures.*	

6.6.1 Static Loading Conditions

Due to the relative rigidity of the cylindrical wet well and reinforced concrete valve chamber walls and the restraining influence provided by the excavation backfill and existing compact to very dense soils, we recommend that lateral earth pressure for static conditions be estimated assuming an "at rest" pressure distribution over the full height of the buried structure (where K_o is the “at rest” earth pressure coefficient). The “at rest” pressure distribution is triangular and can be calculated using the following equations:

- Above groundwater level: $p_o = \gamma * H * K_o$
- Below groundwater level: $p_o = \gamma * D_W * K_o + (\gamma - \gamma_W) * (H - D_W) * K_o$

Where, H = height from top of the wall/buried structure to underside of the footing/base.

Hydrostatic pressure should be included in the lateral pressure calculations using the equation, $p_W = \gamma_W * (H - D_W)$.

The south side of the FRP wet well and valve chamber (side adjacent to 6880 Island Highway W) should be designed to include a uniform surcharge pressure distribution resulting from reinstatement of the slope or possible construction of a retaining wall to account for the difference in final grade between the pump station site and adjacent residential property. The horizontal surcharge pressure, σ_{hs}, can be calculated using the equation, $\sigma_{hs} = \gamma * h * K_0$, where *h* is the final grade difference between the pump station site and residential property. The terms γ and K_0 are provided in Table 2.

The FRP wet well and valve chamber walls should also be designed to resist static lateral soil pressure from compacted backfill on all sides. The compaction force can be calculated using a uniform pressure of 12 kPa. The uniform compaction pressure will be applied from the ground surface to the point where the compaction pressure distribution intersects the “at rest” pressure distribution.

6.6.2 Seismic Loading Conditions

Lateral earth pressure for seismic loading conditions has been estimated based on the provisions of the 2014 Canadian Highway Bridge Design Code (CSA-S6-14), which indicates that seismic lateral earth pressures for non-yielding walls can be calculated using the Mononobe-Okabe (M-O) approach.

Non-yielding walls, which are restrained against lateral movement and will displace less than 25 mm, should be designed based on a seismic horizontal acceleration coefficient, k_h, that is equal to the full site-specific PGA (0.367g) when using the M-O approach. It is anticipated that the walls of the FRP wet well and valve chamber are relatively rigid such that the use of K_E for non-yielding walls is appropriate. The seismic vertical acceleration coefficient, k_v, is to be ignored using the M-O approach specified in CSA-S6-14.

The incremental dynamic pressure (with an inverted triangular distribution, zero pressure at the bottom of the wall and the maximum pressure at the ground surface) resulting from seismic loading is given by the equation:

$$\Delta p_E = \gamma * H * \Delta K_E$$

6.7 PERIMETER AND SITE DRAINAGE

A permanent drainage system should be installed around the base and sides of the below grade (buried) structures unless the walls of these structures are designed to resist hydrostatic water pressures (in addition to lateral earth pressures). If a permanent drainage system is not installed, the below grade structures should be designed for hydrostatic water pressures acting over the full height of the structure and assuming that the excavation backfill is saturated to the final ground surface. The remainder of this section pertains to the design of buried structures without inclusion of hydrostatic water pressures.

The drainage system should be designed to direct water by gravity flow into a permanent storm water drain or collector sump. The permanent drainage system should consist of a minimum 100 mm diameter slotted or perforated rigid wall pipe. The drainage pipe should be surrounded by a minimum of 150 mm of 25 mm clear crush gravel (MMCD, Section 31 05 17, Item 2.6), which is then encapsulated by a non-woven geotextile.

To reduce hydrostatic pressures that may build up in the backfill, it is recommended that retaining walls be backfilled with a minimum 300 mm wide zone of free draining, relatively well-graded backfill such as 25 mm minus crushed drain rock (e.g., MMCD Section 31 05 17, Item 2.6) and Type 1 Granular Pipe Surround (MMCD Section 31 05 17, Item 2.7). The free draining backfill should connect to the drainage pipe at the base of the below grade structures.

Excavation backfill placed beyond the zone of free-draining fill can consist of any structural fill meeting the requirements of Section 6.2. A layer of non-woven geotextile should be placed to separate the free-draining zone from the adjacent excavation backfill or native subgrade soils.

The free draining backfill zone should extend to within 450 mm of finished grade. In areas that are not covered by a hard surface, we recommend that a minimum 450 mm thick layer of relatively impermeable material (e.g., soil with greater than 15% fines content, bentonite, controlled density fill, etc.) be placed as a cap over the free draining backfill zone behind all below-grade walls to mitigate the infiltration of surface runoff and precipitation. The final ground surface should be graded to direct surface runoff away from all structures at the pump station site.

6.8 PERMANENT SOIL SLOPES AND RETAINING WALLS

It is envisaged that the existing, approximately 1.5H:1V soil slope along the south side of the pump station site will be partially to fully removed to permit construction of the pump station, and that construction of a permanent soil slope or retaining wall will be required to reinstate site grades. Currently, we provide the following general comments and recommendations to assist with conceptual site plans:

- The toe of the permanent slope or wall should be horizontally setback at least 0.5 m from the nearest point of the adjacent below-grade/buried pump station structures.
- An unsupported fill slope that is constructed using imported, well-graded granular fill soil can be sloped as steep as 2H:1V (horizontal to vertical).
- A reinforced soil slope (RSS) can be constructed as steep as 70 degrees from horizontal. The face of the RSS systems will be planted with vegetation.
- A retaining wall utilizing large, concrete blocks such as Lock Blocks can be constructed as steep as 1H:10V. The wall will be embedded at least 0.3 m below final grade and founded on at least 0.15 m of well-graded gravel. A gravity retaining wall would need to be backfilled with a zone of free-draining granular soil. A perforated drainage pipe, surrounded by 25 mm clear crush gravel and wrapped in filter fabric, would be required behind the base of the wall to drain groundwater towards a sump or storm sewer.
- A drainage ditch or swale will be required near the crest to prevent runoff from overtopping the permanent slope or wall.
- The fill behind the wall should be graded such that surface runoff is directed away from the wall.
- Geotechnical engineer should review the drawings and specifications.

Stantec can complete the geotechnical engineering design of the Lock Block walls if requested. The RSS walls consist of proprietary systems and will be designed by the supplier’s engineer using the design parameters given in this report.

6.9 GEOTECHNICAL FIELD REVIEW DURING CONSTRUCTION

A Geotechnical Engineer should be retained to provide geotechnical field reviews during the construction phase. Geotechnical field reviews should be carried out to verify that the subsurface conditions encountered are consistent with the design assumptions and to verify that the work is being carried out in accordance with the design recommendations.

Field review should include soils proposed for use as structural fill, placement and compaction of any sub-grade and bedding fill soils, foundation bearing surface, drainage provisions and site grading.

7.0 CLOSURE

This report was prepared for the exclusive use of the Regional District of Nanaimo and its agents for specific application to the Sanitary Pump Station No. 1 project. Any use of this report or the material contained herein by third parties, or for other than the intended purpose, should first be approved in writing by Stantec.

Use of this report is subject to the attached Statement of General Conditions. It is the responsibility of the Regional District of Nanaimo, who is identified as “the Client” within the Statement of General Conditions, and their agents to review the conditions and notify Stantec should any of them not be satisfied. Note that “Stantec” in the Statement of General Conditions specifically refers to Stantec Geotechnical Engineering in terms of this this multi-discipline Stantec project.

We trust that this report meets your present requirements. If you have any questions or require additional information, please do not hesitate to contact the undersigned.

Regards,

STANTEC CONSULTING LTD.

Reviewed by:

Adam McIntyre, M.Eng., P.Eng.
Associate, Geotechnical

Phone: (778) 331-0214
Fax: (604) 436-3752
Adam.McIntyre@stantec.com

(Uthaya) M. Uthayakumar, Ph.D., P.Eng.
Senior Principal, Geotechnical

Phone: (604) 678-3076
Fax: (604) 436-3752
Uthaya.Uthayakumar@stantec.com

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Appendix A STATEMENT OF GENERAL CONDITIONS

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the site-specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock, and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc.), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

Appendix B BOREHOLE RECORD

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor Quality*
25-50	*Poor Quality*
50-75	*Fair Quality*
75-90	*Good Quality*
90-100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.

Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Meta-morphic Bedrock | Sedi-mentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

measured in standpipe, piezometer, or well

inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

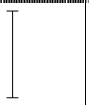
Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

BOREHOLE RECORD

BH18-01

CLIENT Regional District of Nanaimo
PROJECT Sanitary Pump Station No. 1
LOCATION Bowser, BC
DRILLING DATE 3/7/2018 DRILLING CO. Blue Max Drilling Inc.

DATUM Geodetic PROJECT No. 111700522
ELEVATION 20 m (approx.) NORTHING 5476953
DRILL RIG Mobile B47 Track EASTING 379149
DRILLING METHOD Solid Stem Auger

DEPTH (m)	SOIL TYPE	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)
0	AS	ASPHALT			
	FL	FILL: brown, silty sand with gravel	GS	1	15
1	FL	- fines at 1.2 m = 16% - inferred cobbles at 1.3 m	GS	2	11
2	SC	Dense to very dense, grey, clayey SAND (SC), moist - traces of gravel - fines at 2.1 m = 38%	GS	3	11
3	SC	- occasional to frequent cobbles at 3.4 m - fines at 3.4 m = 40%	GS	4	11
4					
▽5	SM	Very dense, grey, silty SAND (SM), moist to wet - traces of gravel - wet below 5 m - fines at 5.2 m = 26%	GS	5	21
6		End of BH18-01 at 6 m			

◇ Peak Minivane (kPa) ◆ Remoulded Minivane (kPa)
□ Insitu Shear Vane (kPa) ■ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✕ UU Triaxial (kPa) ▲ Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atteberg Limits

● Dynamic Cone Penetration Test, blows/0.3m

10 20 30 40 50 60 70 80 90

32 34 31 48 94 47 56 31 49 51 68 51 47 29 100

DEPTH (ft) 0 2 4 6 8 10 12 14 16 18 20

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: NG
Reviewed by: AM
Date: March 7, 2018

Stantec

BOWSER VILLAGE CENTRE

PUMP STATION SITES GEOTECHNICAL ASSESSMENT

Stantec

Project No: 151-64145-00
Date: August 2016

WSP Canada Inc.
1935 Bollinger Road
Nanaimo, BC
V9S 5W9

Phone: 250-753-1077
Fax: 250-753-1203
www.wspgroup.com

WSP

Project No: 151-64145-00

Date: 10 August 2016

WSP Canada Inc.
1935 Bollinger Road
Nanaimo, BC
V9S 5W9

Tel: 250-753-1077
Fax: 250-753-1203

www.wspgroup.com

Stantec
400 – 655 Tyee Road
Victoria, BC
V9A 6X5

Attention: Mr. Stan Spencer, M.A.Sc., P.Eng.
Principal

Project: Bowser Village Centre – Wastewater Pump Station Sites

Subject: Geotechnical Assessment

Dear Mr. Spencer,

As requested, WSP Canada Inc. has carried out a geotechnical assessment in support of the preliminary design of the three pump stations associated with the Bowser Village Centre development proposed by the Regional District of Nanaimo. This work was supplemental to a preliminary geotechnical assessment that was completed buy WSP for the overall wastewater system in February 2016.

We trust that the information provided in the following geotechnical assessment report meets the anticipated requirements of this phase of the project. If you have any comments or questions, or require further information, please contact the undersigned.

Yours truly,
WSP Canada Inc.

Tom Oxland, P.Eng.
Senior Geotechnical Engineer

1 INTRODUCTION

As requested, WSP Canada Inc. (WSP) has carried out a geotechnical assessment in support of preliminary design for the three pump stations associated with the Bowser Village Centre wastewater treatment and disposal system being proposed by the Regional District of Nanaimo (RDN).

The purpose and scope of work for the geotechnical assessment were presented in a written proposal dated 24 February 2016 (WSP file reference: 151-64145-00). Authorization to proceed with the work was received from Stantec on 25 March 2016.

The general locations for the proposed pump stations were provided to WSP by Stantec on 19 May 2016. Detailed location plans for each site were received on 1 June 2016.

The following presents the results of a subsurface investigation program that was carried out on 7 June 2016 and provides geotechnical discussion and recommendations relating to the preliminary design of the pumps stations. Attached to this report are figures indicating the location and published geology at the pump station sites along with an appendix of borehole logs and test results,

2 SITE DESCRIPTION

The Bowser Village Centre proposed by the RDN includes a wastewater collection, treatment, and disposal system that will require a series of pump stations situated within the relatively low elevation area along the ocean shoreline to pump wastewater to the proposed treatment plant site on the west side of the Island Highway (19A).

The area of the proposed Bowser Village Centre that contains the pump station sites is roughly triangular and extends from the ocean shoreline on the east to Sundry Road on the west. The pump station sites are situated in public right-of-**way's within** areas that are currently developed with single family residences.

The pump station sites are located as follows:

Pump Station #1 Bowser Road	near the toe of the former shoreline slope at Garrod Avenue (7 m elev.)
Pump Station #2 Midland Road	northern extent of public road (14 m elev.)
Pump Station #3 Thompson Clarke Road	south of the intersection with Maple Guard Drive (24 m elev.)

The approximate pump station site locations are shown on the Site Location Plan attached as Figure 1.

3 SUBSURFACE ASSESSMENT

A subsurface assessment that consisted of advancing a single borehole at each pump station site was carried out on 7 June 2016. The boreholes were advanced using a track-mounted auger drill rig operated by Blue Max Drilling from Courtenay. The boreholes were advanced to between depths of 3.5 and 7 m and to effective refusal within dense deposits.

Prior to drilling, WSP visited the sites with a private utility locates contractor (Kelly's 1st Call) from Nanaimo. The pump station site locations were located from the site plans provided by Stantec and the borehole locations were cleared from conflict with underground services and marked in the field with survey paint.

The boreholes were advanced using a hollow-stem auger and Standard Penetration Tests (SPT's) were carried out at approximately 1.5 m intervals. The samples obtained were returned to the WSP laboratory in Nanaimo for detailed visual identification and moisture content determination.

A standpipe piezometer was installed in Borehole BH16-01 – located adjacent to Bowser Road. This was the only borehole that encountered significant groundwater seepage.

None of the boreholes were located in areas of pavement. Following drilling, the boreholes were backfilled with the drill cuttings to ground surface.

4 SUBSURFACE CONDITIONS

The results of a background information review of available published mapping indicated that, in general, the area of the proposed village centre that contains the pump station sites is underlain by a veneer of granular marine deposits overlying glacial till soils. The ocean shoreline along the east edge of the proposed village area is underlain by recent marine intertidal and/or beach marine deposits that in turn rest on the older glacial till soils. Figure 2 indicates the local surficial geology in relation to the pump station sites.

As indicated above, Borehole BH16-01 was situated at a relatively low elevation and adjacent to the toe of the former shoreline slope at the eastern extent of Bowser Road. This borehole encountered approximately 6 m of fine or medium grained sand with varying amounts of silt and gravel. Between about 3 and 5 m depth, the SPT blow count data indicated that the sand was indicative of a 'very loose' to 'loose' consistency. After drilling (17 June), the groundwater table was measured at 4.6 m depth in this deposit. At 6.1 m depth, the sands were underlain by dense, well-graded, silty sand with gravel that was interpreted to be glacial till.

The remaining boreholes (BH16-02 and BH16-03) were located further inland and at relatively higher elevations. In these boreholes, the interpreted surface of the glacial till was within 2 m of the ground surface. Borehole BH16-03 was terminated due to effective auger penetration refusal at 3.5 m depth. Neither of these boreholes encountered significant groundwater seepage.

Descriptions of the soil conditions encountered in the boreholes, along with the results of the laboratory testing, are summarized in the appended Borehole Summary Logs.

5 DISCUSSION AND RECOMMENDATIONS

Based on the results of the subsurface assessment, the soil conditions encountered at the proposed pump station sites are generally consistent with those anticipated by the preliminary background information review and published surficial geology mapping. Each of the sites is underlain by natural dense glacial till soils at relatively shallow depths. The exception is Pump Station #1 – where the surface of the glacial till at the borehole location was about 6 m below ground surface.

5.1 PUMP STATION SITE NO. 1

The borehole in the proposed vicinity of the Pump Station No. 1 site was located on the east side of Bowser Road immediately across from its intersection with Garrod Road. The borehole was situated near the toe of the shoreline slope and slightly higher in elevation than the beach to the north. The shoreline slope in this area sloped up toward Park Avenue and the Island Highway to the south.

The borehole at this location (BH16-01) encountered about 6 m of varying, interlayered sand/silty sand overlying very dense silty sand (till). Observations made during drilling and a piezometer reading made ten days after drilling indicated that these sands were saturated below about 4.5 m depth. It is possible that a greater portion of the sands become saturated in the winter months when the watertable is expected to be higher.

The assessment is in support of preliminary design and structural details of the pump station at this location were not known to WSP at the time of preparation of this report. However, previous experience with similar installations have involved excavations of between 4 and 6 m depth to found the wet well.

Based on the soil conditions encountered in the borehole, there are a number of geotechnical concerns or constraints associated with the currently proposed Pump Station No. 1 site. These include:

- Structural loads from the pump station should be extended to bear on the glacial till surface at about 6 m below ground surface or potentially at a higher elevation on an engineered fill that bears on the glacial till. Depending on the depth of the proposed station, this could involve bulk excavation (see below) to expose the till. The installation of piers or piles through the upper sands to the till deposit could be an alternative approach provided that the foundation design can accommodate the seismic aspects of soil/structure interaction is an earthquake design event (see below).
- The pump station will need to be designed to resist hydrostatic uplift or buoyancy. The magnitude of forces will depend on the configuration of the structure relative to the watertable and will need to be reviewed during final design;
- The majority of the temporary excavation for construction of the pump station will take place in the loose, potentially saturated sands overlying the sand till. Given the location of adjacent private property and Bowser Road, it is unlikely that the excavation sidewalls could be graded back to a stable configuration for construction. As such, these conditions will require mechanical support in the form of shoring.

The temporary works will need to address construction excavation dewatering. The extent and methodology for excavation dewatering will depend on the system of shoring and the duration of the works. An important consideration in the long term foundation design will be protect the bearing surface from excessive heave and damage due to hydrostatic uplift. From a construction perspective, the contractor's methodology will need to address disposal of collected water and the mitigation of harm to the nearby aquatic environment.

- The saturated loose sands below and adjacent to the pump station would be susceptible to liquefaction in response to the local design earthquake. This could results in loss of vertical bearing capacity for the pump station foundation as well as impart relatively substantial lateral loads on the pump station walls as the liquefied soils displace laterally towards the ocean. Related to this issue is the performance of buried piping entering the pump station, which would be expected to strain as a result of the permanent ground deformation.

The presence of potentially liquefiable soils at this site would render it a seismic Site Class "F" according to the 2012 BC Building Code. As a result, addressing (through mitigation) or incorporating the potential impact of these soils would be required for final design.

One possible practical approach to mitigation would be to relocate the pump station further to the south towards the area of higher ground. Based on the anticipated local soil conditions, it is expected that as the ground surface elevation increases toward the south (i.e. toward Park Avenue), the thickness of the saturated marine deposits will decrease and the surface of the glacial till will become closer to the ground surface. As such, relocating the pump station further to the south could be explored as an option to effectively reduce the geotechnical issues outlined above. Based on local experience, for a site where shallow glacial till is present, it would be considered to be a Site Class of "C". If the pump station cannot be relocated to better ground, the following further exploration and testing work would be recommended prior to final design.

A test pit should be excavated at the pump station location to create a trial exposure of the potential subsurface conditions and ground response that would be encountered during construction. Such a test pit would allow for an estimate of potential inflow rates of groundwater as well as an assessment of the side slope stability (i.e. susceptibility to sloughing, base heave, etc). This would be somewhat disruptive to the ground surface and restoration should allow for some additional landscaping.

Based on the test pit and existing borehole information, geotechnical parameters could be developed for input to the excavation design. These would include estimated inflow rates and volumes to assist a qualified dewatering contractor to develop a temporary dewatering system. Given the anticipated conditions, it is considered that a sump and pump system within the excavation would not be effective due to the potential influence on groundwater on the stability of the side slopes. An effective dewatering system such as well points or larger diameter wells would have to lower the local groundwater table to below the depth of installation for a specific distance beyond the outside of the excavation perimeter prior to excavation.

Final design will be influenced by the geometry of the pump station relative to the presence (top) of the dense till. While the relocation concept discussed above would greatly mitigate many of the foundation items discussed above, a detailed review will be required to assess lateral loads on the pump station, possible requirements for ground improvement (excavate and replace or in situ) beyond and below the footprint of the station, and the associated implications to ground conditions to buried piping as well as necessary temporary works.

5.2 PUMP STATION SITES NO. 2 AND 3

Pump Stations No. 2 and 3 were located further inland – and upslope – compared to Pump Station No. 1 (Figure 2). The boreholes at these locations encountered dense to very dense, natural silty sand (till) at about 1.8 m in Borehole BH16-02 and less than 0.6 m in BH16-03. No significant groundwater seepage was encountered in either of the boreholes.

For these sites, foundation design and construction considerations are relatively straight forward. Temporary excavations could be extended to the surface of the glacial till which would provide adequate bearing for the pump station foundations. At both sites, it is expected that there is adequate lateral space to accommodate graded side slopes above the glacial till. Based on the borehole information, it is expected that temporary excavations in the glacial till could be cut near vertically, subject to field verification.

Due to the presence of relatively shallow, competent glacial till at both of these locations, these sites would be considered as seismic Site Class "C" according to the 2012 BC Building Code.

Typical values of factored settlement serviceability bearing capacities for footings bearing on an approved subgrade of glacial till – as encountered in the boreholes – would range from about 175 to 200 kPa. Potential total and differential settlements under these conditions would be in the order of 25 mm and 19 mm, respectively. Critical to the bearing surface is the need for protection of approved surfaces against traffic disturbance and excessive moisture change.

The glacial till encountered in BH16-03 (Pump Station #3) was within 0.6 m of ground surface and very dense (according to the SPT blow count data). While this can be favourable in relation to foundation bearing, the very dense soil can present a challenge to effective excavation for the service trench lines and/or the pump station. Relatively large, tracker excavation equipment will likely be required to adequately or practically excavate the till soils in this area.

The glacial till contains fine grained particles and the contractor will need to develop an erosion and sediment control plan for water discharge from the sites.

6 FUTURE GEOTECHNICAL WORK

Further geotechnical input will be required as the pump stations move into detailed design. The extent of input will be influenced by the relocation option for Pump Station 1 described above. Future elements of work are anticipated to include:

- Review of proposed pump station design in relation to the results of the geotechnical assessment – especially with regard to depth of installation for Pump Station #1;
- Further testing of potential seepage and excavation sidewall conditions through advancement of a test pits at the Pump Station #1 site;
- Defining till surface in the vicinity of Pump Station 1 to assist in the relocation option; and
- Input to, or review of, excavation and dewatering plans for the pump station sites – especially Pump Station #1.

WSP would be pleased to discuss the requirements for future geotechnical work as the project progresses.

7 CLOSURE

This geotechnical assessment for the proposed pump station sites for the RDN's Bowser Village Centre was carried out in accordance with the terms and conditions of WSP's July 2105 Subconsultant Agreement with Stantec for this project. The Regional District of Nanaimo is considered to be an authorized user of the report subject to the terms of engagement under which the work was completed. The report has been prepared in accordance with the appended Terms of Reference for Geotechnical Reports.

We trust that the information presented above meets your current requirements. If you have any questions, or require further information, please contact the undersigned.

Yours truly,
WSP Canada Inc.

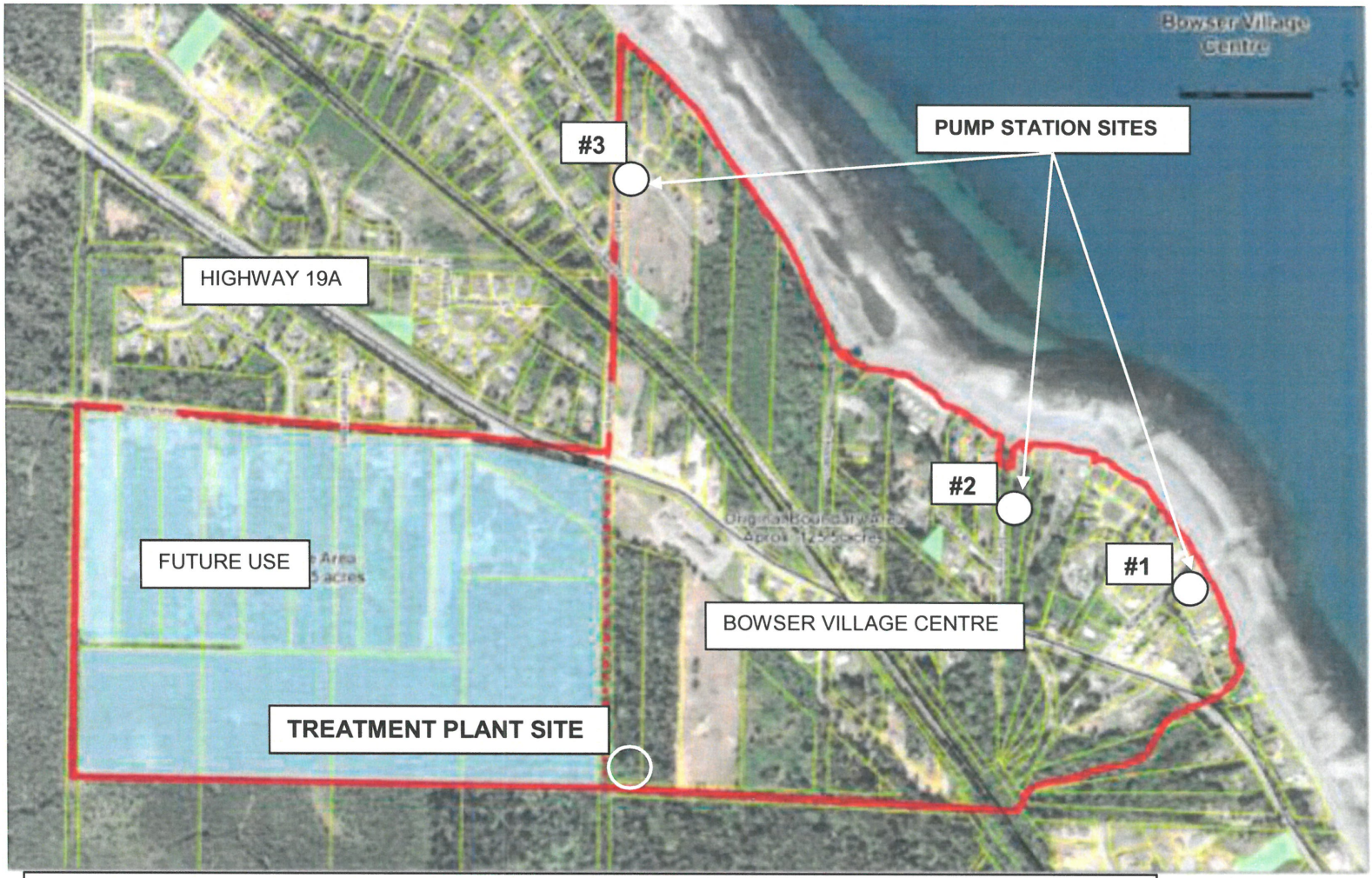
Review by:

Signatures on File

Per: Tom Oxland, P.Eng.
Senior Geotechnical Engineer

Carl Miller, P.Eng.
Senior Geotechnical Engineer

Attachments: Figure 1 – Site Location Plan
Figure 2 – Surficial Geology
Appendix 1. Borehole Summary Logs
Appendix 2. Terms of Reference for Geotechnical Reports



Based plan from Chatwin Engineering *Sewage Feasibility Study (2011).*

WSP	PROJECT: BOWSER VILLAGE CENTRE		
	TITLE: SITE LOCATION PLAN – PUMP STATION SITES		
	CLIENT: STANTEC / REGIONAL DISTRICT OF NANAIMO		
FIGURE NO.: 1	DATE: AUGUST 2016	FILE NO.: 151-64145-00	SCALE: NTS

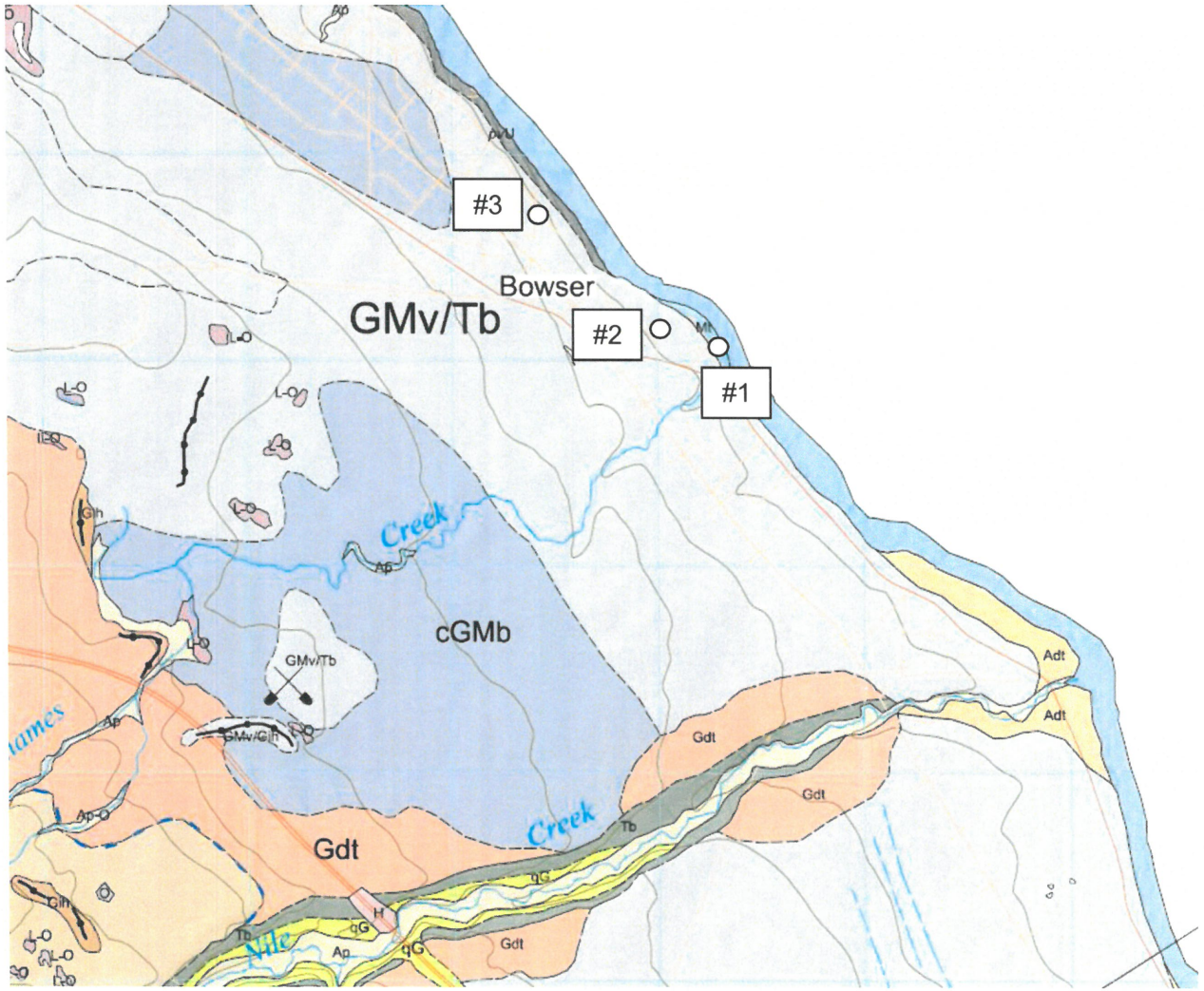
WSP Canada Inc.., 1935 Bollinger Road, Nanaimo, B.C., V9S 5W9 Phone: 250-753-1077 Fax: 250-53-1203 Email: nanaimo@wspgroup.com

LEGEND

GMv/Tb = veneer of marine sediments overlying a blanket of glacial till.

Mt = marine sediments consisting of fine-grained intertidal and/or beach (sand) deposits.

GSC Open File 7681
Surficial Geology – Deep Bay to Nanoose Harbour



WSP	PROJECT: BOWSER VILLAGE CENTRE		
	TITLE: SURFICIAL GEOLOGY – PUMP STATION SITES		
	CLIENT: STANTEC / REGIONAL DISTRICT OF NANAIMO		
FIGURE NO.: 2	DATE: AUGUST 2016	FILE NO.: 151-64145-00	SCALE: NTS

WSP Canada Inc.., 1935 Bollinger Road, Nanaimo, B.C., V9S 5W9 Phone: 250-753-1077 Fax: 250-753-1203 Email: nanaimo@wspgroup.com

Appendix I

BOREHOLE SUMMARY LOGS

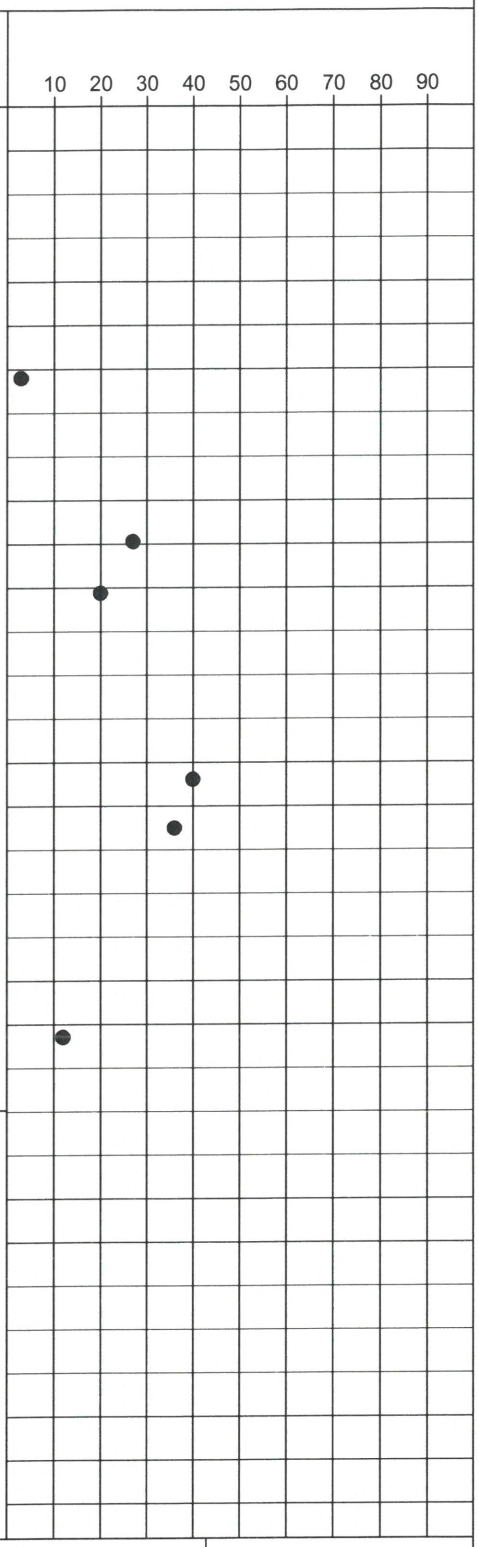
WSP Canada Inc.
1935 Bollinger Road
Nanaimo, B.C. V9S 5W9
Tel: +1 250-753-1077
Fax: +1 250-753-1203
www.wspgroup.com

Bowser Village Centre
Pump Station Sites
Geotechnical Assessment

BH16-01

Project No: 151-64145-00

Depth (m)	Depth (ft)	Description	C	N	Type	Water Level
		ORGANIC TOPSOIL				
		dense, brown, medium grained, SAND, traces silt and gravel, moist, dense				
	6			39	SPT	
	8	loose, dark brown, fine grained, silty SAND, some gravel, moist				
	10				G	
		loose, brown, fine grained SAND, trace silt, wet		5	SPT	
	14			3	SPT	Jun 17 2016
	16	light grey, fine to medium grained SAND, trace silt, saturated			G	
	20					
		dense, grey/brown, well grained SAND (TILL), silty, gravelly, wet		50	SPT	
	22	Standpipe Piezometer Installed				
		Bottom of hole at 7 metres.				



C: Condition of Sample
- Good
- Disturbed
- No Recovery

Type: Type of Sampler
- SPT : 2 in. standard
- ST : Shelby
- FP : Fixed Piston
- G : Grab
- CORE

N: Number of Blows
- WH : Weight of Hammer
- WR : Weight of Rod
- Standard Penetration Test : ASTM D1586
- Hammer Type:

- ● Moisture Content %
- ► Plastic Limit %
- ◄ Liquid Limit %
- ▼ Ground Water Level
- ∞ Shear strength in kPa (Torvane or Penetrometer)
- × Shear strength in kPa (Unconfined)
- ⊗ Shear strength in kPa (field vane)
- ⊠ Remolded strength in kPa
- ■ Percent Passing # 200 sieve

Drill Method: Hollow Stem Auger

Date Drilled: 17/06/2016

By: TWO

1 LOG PER PAGE 23/6/16

WSP Canada Inc.
1935 Bollinger Road
Nanaimo, B.C. V9S 5W9
Tel: +1 250-753-1077
Fax: +1 250-753-1203
www.wspgroup.com

Bowser Village Centre
Pump Station Sites
Geotechnical Assessment

BH16-02

Project No: 151-64145-00

Depth (m)	Depth (ft)	Description	C	N	Type	Water Level
		brown, well-graded SAND and GRAVEL (FILL), trace/some silt, moist				
	2	grey/brown, well-graded SAND, some gravel, trace silt, moist				
	4					
	6					
2		brown, well-graded, silty SAND (TILL), some gravel, moist		40	SPT	
	8					
	10			27	SPT	
	12					
4						
	14				G	
	16	dark grey, sandy SILT (TILL), some fine gravel, moist		30	SPT	
	18					
6						
	20	Bottom of hole at 6 metres.			G	
	22					
	24					
8						
	26					
	28					
	30					
	32					

10 20 30 40 50 60 70 80 90

C: Condition of Sample
Good
Disturbed
No Recovery

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
FP : Fixed Piston
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

- Moisture Content %
- Plastic Limit %
- Liquid Limit %
- Ground Water Level
- Shear strength in kPa (Torvane or Penetrometer)
- Shear strength in kPa (Unconfined)
- Shear strength in kPa (field vane)
- Remolded strength in kPa
- Percent Passing # 200 sieve

Drill Method: Hollow Stem Auger
Date Drilled: 17/06/2016
By: TWO

1 LOG PER PAGE 23/6/16

WSP Canada Inc.
1935 Bollinger Road
Nanaimo, B.C. V9S 5W9
Tel: +1 250-753-1077
Fax: +1 250-753-1203
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Bowser Village Centre
Pump Station Sites
Geotechnical Assessment

BH16-03

Project No: 151-64145-00

Depth (m)	Depth (ft)	Description	C	N	Type	Water Level
		well-graded, gravelly SAND (FILL), some silt, moist				
		dense, brown, well-graded, silty SAND (TILL), trace to some gravel, moist				
2	6	Grinding on auger below 2 m.		46	SPT	
	10	Difficult drilling below 3.2 m.		86	SPT	
4	12	Bottom of hole at 3.5 metres due to effective penetration refusal.				
6	20					
8	26					
	32					

10 20 30 40 50 60 70 80 90

C: Condition of Sample
Good
Disturbed
No Recovery

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
FP : Fixed Piston
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

- Moisture Content %
- Plastic Limit %
- Liquid Limit %
- Ground Water Level
- Shear strength in kPa (Torvane or Penetrometer)
- Shear strength in kPa (Unconfined)
- Shear strength in kPa (field vane)
- Remolded strength in kPa
- Percent Passing # 200 sieve

Drill Method: Hollow Stem Auger
Date Drilled: 17/06/2016
By: TWO

1 LOG PER PAGE 23/6/16

Appendix II

TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS

TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS ISSUED BY WSP CANADA INC.

1. STANDARD OF CARE

WSP Canada Inc. ("WSP") prepared and issued this geotechnical report (the "Report") for its client (the "Client") in accordance with generally-accepted engineering consulting practices for the geotechnical discipline. No other warranty, expressed or implied, is made. Unless specifically stated in the Report, the Report does not address environmental issues.

The terms of reference for geotechnical reports issued by WSP (the "Terms of Reference") contained in the present document provide additional information and caution related to standard of care and the use of the Report. The Client should read and familiarize itself with these Terms of Reference.

2. COMPLETENESS OF THE REPORT

All documents, records, drawings, correspondence, data, files and deliverables, whether hard copy, electronic or otherwise, generated as part of the services for the Client are inherent components of the Report and, collectively, form the instruments of professional services (the "Instruments of Professional Services"). The Report is of a summary nature and is not intended to stand alone without reference to the instructions given to WSP by the Client, the communications between WSP and the Client, and to any other reports, writings, proposals or documents prepared by WSP for the Client relative to the specific site described in the Report, all of which constitute the Report.

TO PROPERLY UNDERSTAND THE INFORMATION, OBSERVATIONS, FINDINGS, SUGGESTIONS, RECOMMENDATIONS AND OPINIONS CONTAINED IN THE REPORT, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WSP CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT AND ITS VARIOUS COMPONENTS.

3. BASIS OF THE REPORT

WSP prepared the Report for the Client for the specific site, development, building, design or building assessment objectives and purpose that the Client described to WSP. The applicability and reliability of any of the information, observations, findings, suggestions, recommendations and opinions contained in the Report are only valid to the extent that there was no material alteration to or variation from any of the said descriptions provided by the Client to WSP unless the Client specifically requested WSP to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information, observations, findings, suggestions, recommendations and opinions contained in the Report, or any component forming the Report, are for the sole use and benefit of the Client and the team of consultants selected by the Client for the specific project that the Report was provided. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION OR COMPONENT WITHOUT THE WRITTEN CONSENT OF WSP. WSP will consent to any reasonable request by the Client to approve the use of this Report by other parties designated by the Client as the "Approved Users". As a condition for the consent of WSP to approve the use of the Report by an Approved User, the Client must provide a copy of these Terms of Reference to that Approved User and the Client must obtain written confirmation from that Approved User that the Approved User will comply with these Terms of Reference, such written confirmation to be provided separately by each Approved User prior to beginning use of the Report. The Client will provide WSP with a copy of the written confirmation from an Approved User when it becomes available to the Client, and in any case, within two weeks of the Client receiving such written confirmation.

The Report and all its components remain the copyright property of WSP and WSP authorises only the Client and the Approved Users to make copies of the Report, but only in such quantities as are reasonably necessary for the use of the Report by the Client and the Approved Users. The Client and the Approved Users may not give, lend, sell or otherwise disseminate or make the Report, or any portion thereof, available to any party without the written permission of WSP. Any use which a third party makes of the Report, or any portion of the Report, is the sole responsibility of such third parties. WSP accepts no responsibility for damages suffered by any third party resulting from the use of the Report. The Client and the Approved Users acknowledge and agree to indemnify and hold harmless WSP, its officers, directors, employees, agents, representatives or sub-consultants, or any or all of them, against any claim of any nature whatsoever brought against WSP by any third parties, whether in contract or in tort, arising or related to the use of contents of the Report.

TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS ISSUED BY WSP CANADA INC. (continued)

5. INTERPRETATION OF THE REPORT

a. **Nature and Exactness of Descriptions**: The classification and identification of soils, rocks and geological units, as well as engineering assessments and estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1 above. The classification and identification of these items are judgmental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations or assessments utilizing the standards of Paragraph 1 involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to changes over time and the parties making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or when the Client has special considerations or requirements, the Client must disclose them to WSP so that additional or special investigations may be undertaken, which would not otherwise be within the scope of investigations made by WSP or the purposes of the Report.

b. **Reliance on information**: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site investigation and field review and on the basis of information provided to WSP. WSP has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, WSP cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.

c. **Additional Involvement by WSP**: To avoid misunderstandings, WSP should be retained to assist other professionals to explain relevant engineering findings and to review the geotechnical aspects of the plans, drawings and specifications of other professionals relative to the engineering issues pertaining to the geotechnical consulting services provided by WSP. To ensure compliance and consistency with the applicable building codes, legislation, regulations, guidelines and generally-accepted practices, WSP should also be retained to provide field review services during the performance of any related work. Where applicable, it is understood that such field review services must meet or exceed the minimum necessary requirements to ascertain that the work being carried out is in general conformity with the recommendations made by WSP. Any reduction from the level of services recommended by WSP will result in WSP providing qualified opinions regarding adequacy of the work.

6. ALTERNATE REPORT FORMAT

When WSP submits both electronic and hard copy versions of the Instruments of Professional Services, the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding upon WSP. The hard copy versions submitted by WSP shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions; furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed and sealed versions of the Instruments of Professional Services maintained or retained, or both, by WSP shall be deemed to be the overall originals for the Project.

The Client agrees that the electronic file and hard copy versions of Instruments of Professional Services shall not, under any circumstances, no matter who owns or uses them, be altered by any party except WSP. The Client warrants that the Instruments of Professional Services will be used only and exactly as submitted by WSP.

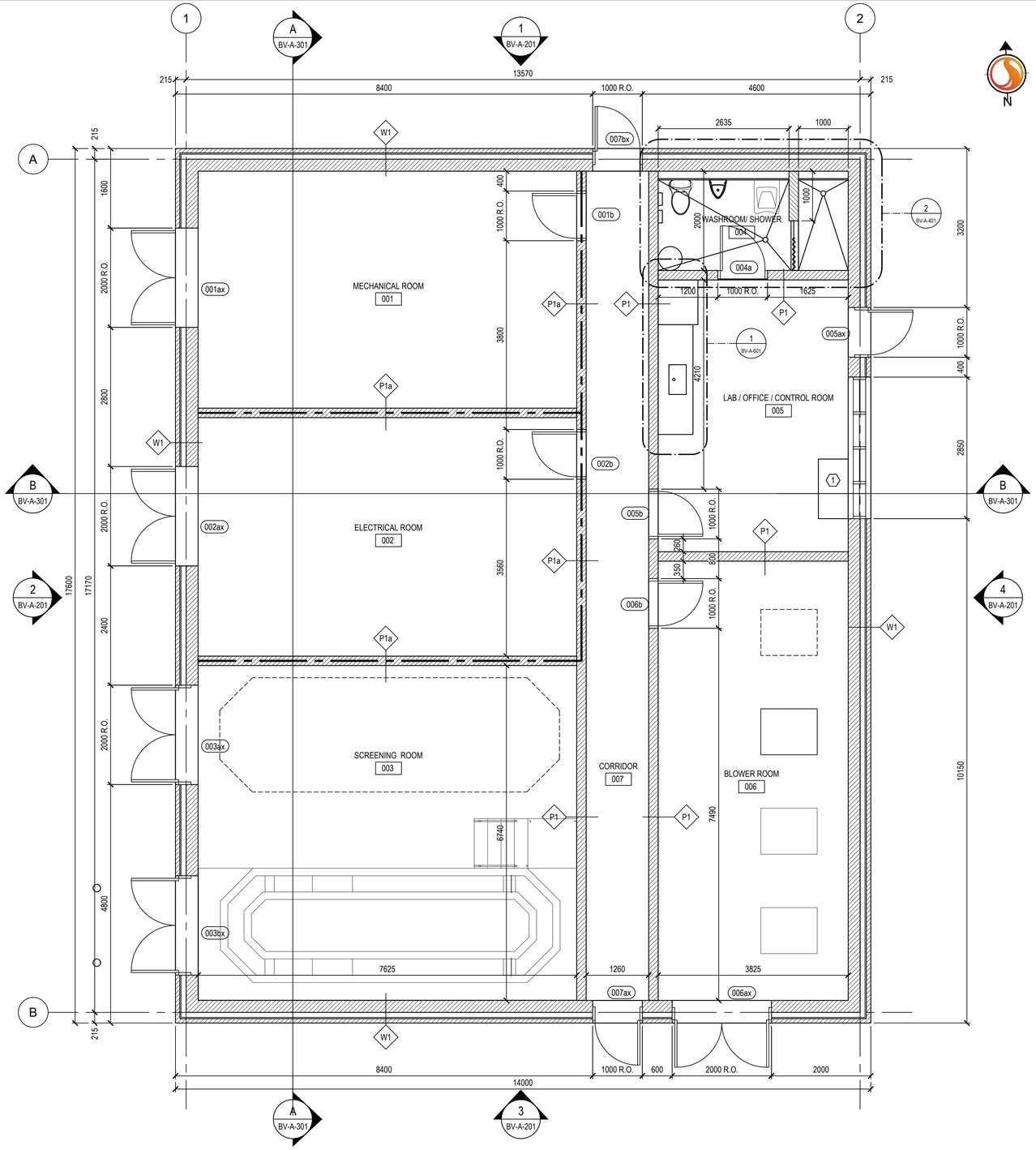
The Client recognizes and agrees that WSP prepared and submitted electronic files using specific software or hardware systems, or both. WSP makes no representation about the compatibility of these files with the current or future software and hardware systems of the Client, the Approved Users or any other party. The Client further agrees that WSP is under no obligation, unless otherwise expressly specified, to provide the Client, the Approved Users and any other party, or any or all of them, with specific software and hardware systems that are compatible with any electronic submitted by WSP. The Client further agrees that should the Client, an Approved User or a third party require WSP to provide specific software or hardware systems, or both, compatible with the electronic files prepared and submitted by WSP, for any reason whatsoever included but not restricted to an order from a court, then the Client will pay WSP for all reasonable costs related to the provision of the specific software or hardware systems, or both. The Client further agrees to indemnify and hold harmless WSP, its officers, directors, employees, agents, representative or sub-consultant, or any or all of them, against any claim or any nature whatsoever brought against WSP, whether in contract or in tort, arising or related to the provision or use or any specific software or hardware provided by WSP.

Appendix B Reference Drawings

Reference Drawings:

Bowser Sanitary System Wastewater Treatment Plant

Prepared by Stantec Consulting Ltd.



1 FIRST FLOOR PLAN
SCALE: 1:50

CONSTRUCTION NOTES:

1 600 x 1200 DESK C/W CHAIR (BY OWNER)

LEGEND

1HR FIRE RATED WALL

GEODETIC 49.1 = 0

Revision	By	Appd.	YY.MM.DD
FOR TENDER	BGL	SS	19.01.15
FOR 100% DESIGN	CA	CA	17.04.07
FOR 90% CLIENT REVIEW	CA	CA	16.11.07
Issued	By	Appd.	YY.MM.DD

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WASTEWATER TREATMENT PLANT
BOWSER, BC, CANADA

File Name: BV-A-101.DWG | OF Dwn. | CA Chkd. | CA Dsgn. | 16.11.07 YY.MM.DD

Title
FIRST FLOOR PLAN

Project No. 111700522
Scale 1:50 (0 0.5 1.5 2.5m)
Drawing No. BV-A-101
Sheet of
Revision 0

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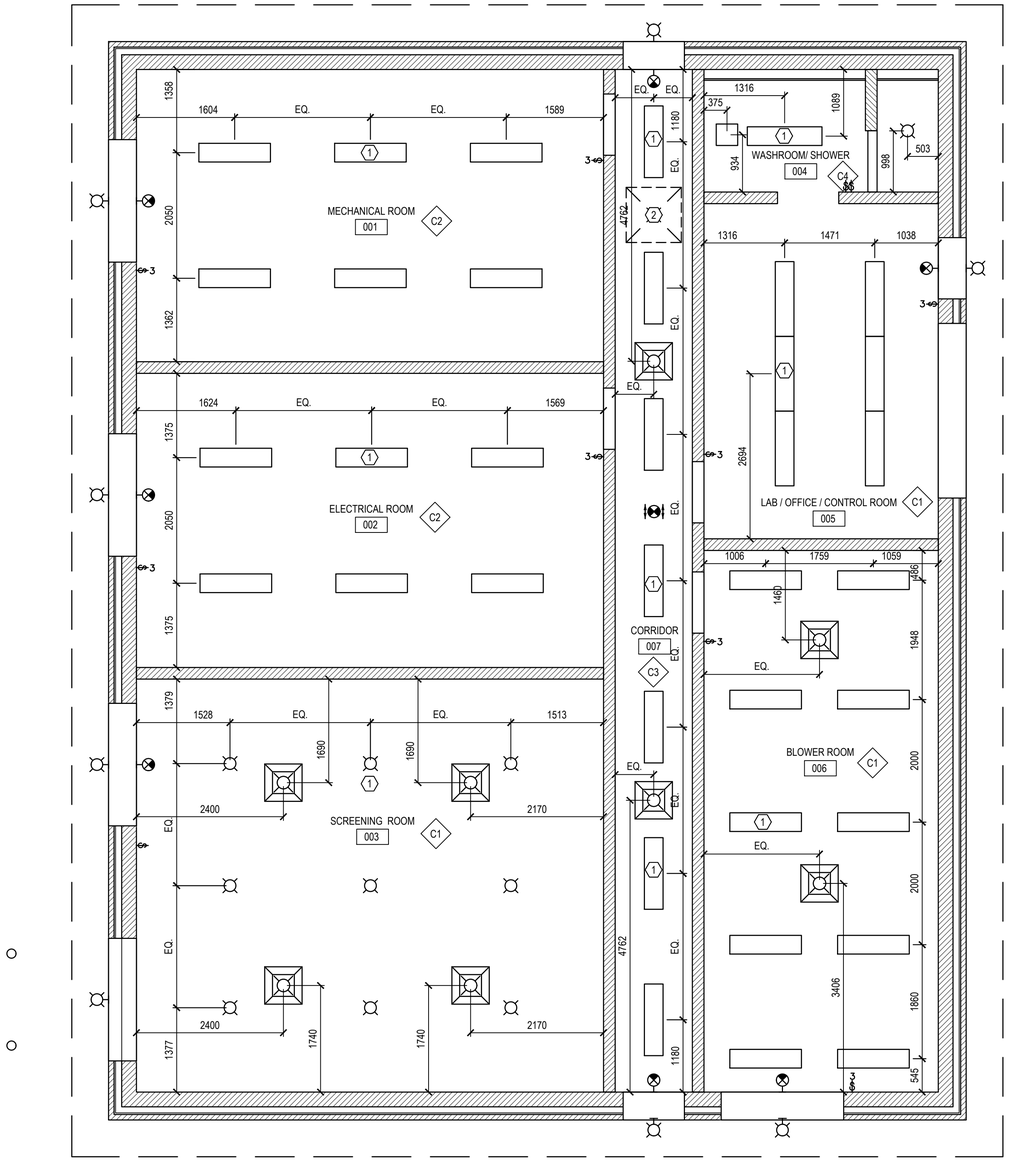
ORIGINAL SHEET - ISO A1



1 REFLECTED CEILING PLAN
SCALE: 1:50

PLAN AND SECTION NOTES

1. LIGHT FIXTURES. REFER TO ELECTRICAL (TYP)
2. ACCESS HATCH. REFER TO STRUCTURAL FOR DETAILS

Revision	By	Appd.	YY.MM.DD
FOR TENDER	BGL	SS	19.01.15
FOR 100% DESIGN	CA	CA	17.04.07
FOR 90% CLIENT REVIEW	CA	CA	16.11.07
Issued	By	Appd.	YY.MM.DD

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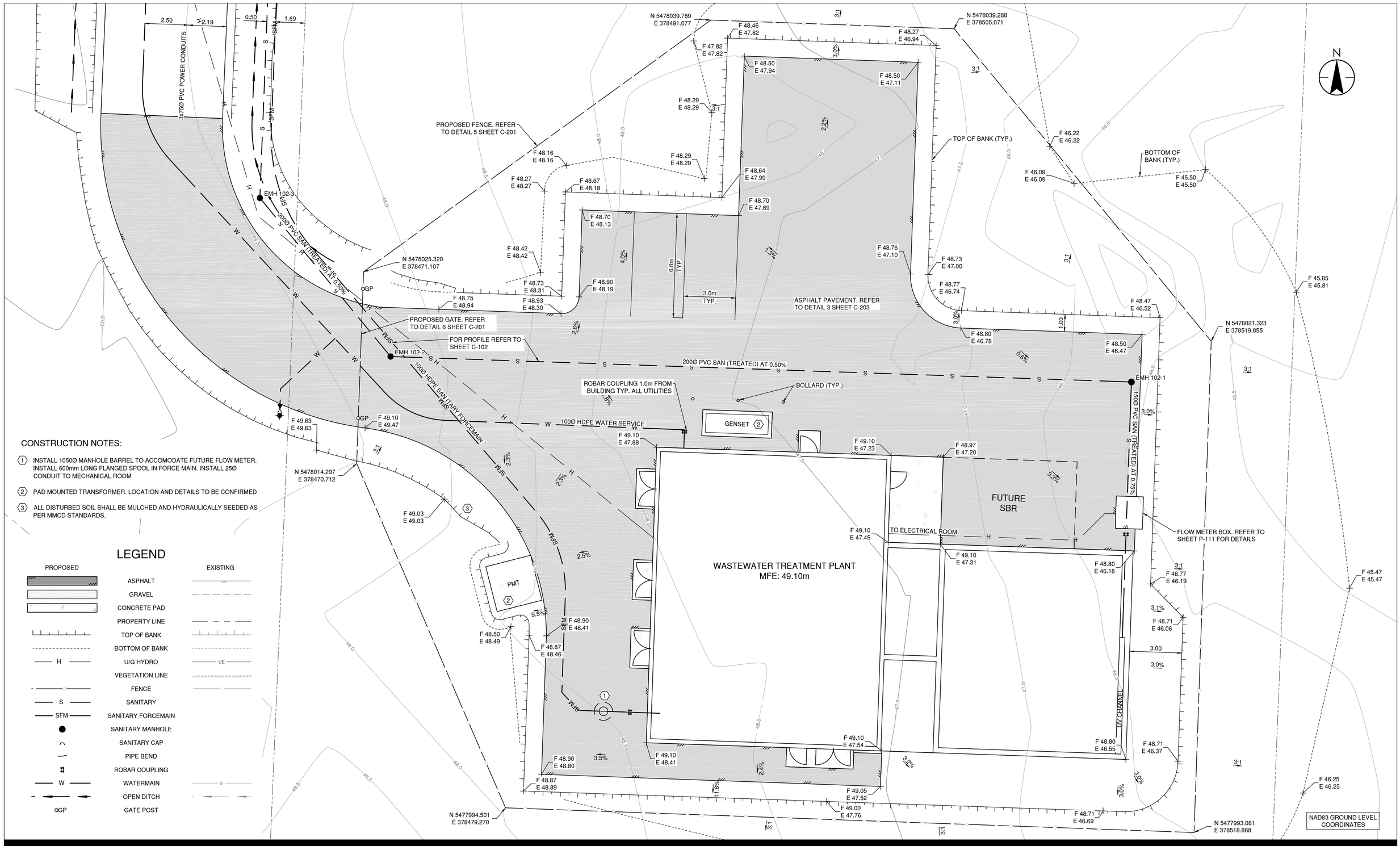
File Name: BV-A-102.DWG | OF Dwn. | CA Chkd. | CA Dsgn. | 16.11.07 YY.MM.DD

Title
REFLECTED CEILING PLAN

Project No. 111700522
Scale 1:50 (0 0.5 1.5 2.5m)
Drawing No. BV-A-102
Sheet of
Revision 0

ORIGINAL SHEET - ISO A1



CONSTRUCTION NOTES:

1. INSTALL 1050Ø MANHOLE BARREL TO ACCOMODATE FUTURE FLOW METER. INSTALL 600mm LONG FLANGED SPOOL IN FORCE MAIN. INSTALL 25Ø CONDUIT TO MECHANICAL ROOM
2. PAD MOUNTED TRANSFORMER. LOCATION AND DETAILS TO BE CONFIRMED
3. ALL DISTURBED SOIL SHALL BE MULCHED AND HYDRAULICALLY SEEDED AS PER MMCD STANDARDS.

LEGEND

PROPOSED		EXISTING
	ASPHALT	
	GRAVEL	
	CONCRETE PAD	
	PROPERTY LINE	
	TOP OF BANK	
	BOTTOM OF BANK	
H	U/G HYDRO	UE
	VEGETATION LINE	
	FENCE	
S	SANITARY	
SFM	SANITARY FORCEMAIN	
	SANITARY MANHOLE	
	SANITARY CAP	
	PIPE BEND	
	ROBAR COUPLING	
W	WATERMAIN	W
	OPEN DITCH	
GP	GATE POST	

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	19.01.15
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER, BC, CANADA

File Name: 00522_C101.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
WWTP - SITE PLAN

Project No. 111700522
Scale 1:100 (0 1 3 5m)
Drawing No. BV-C-101
Sheet
of
Revision 0

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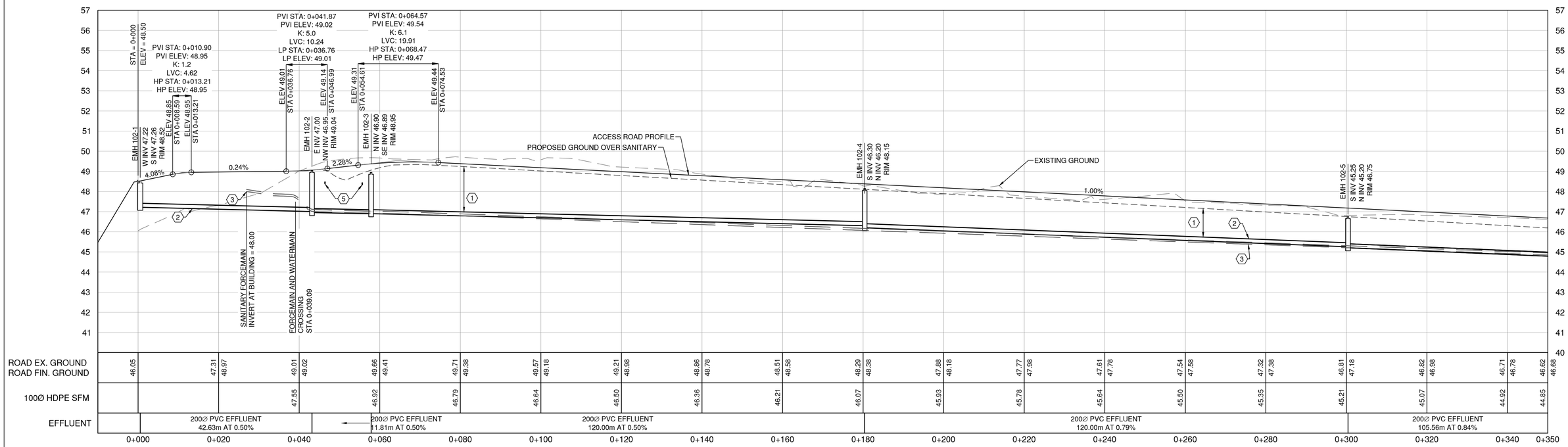


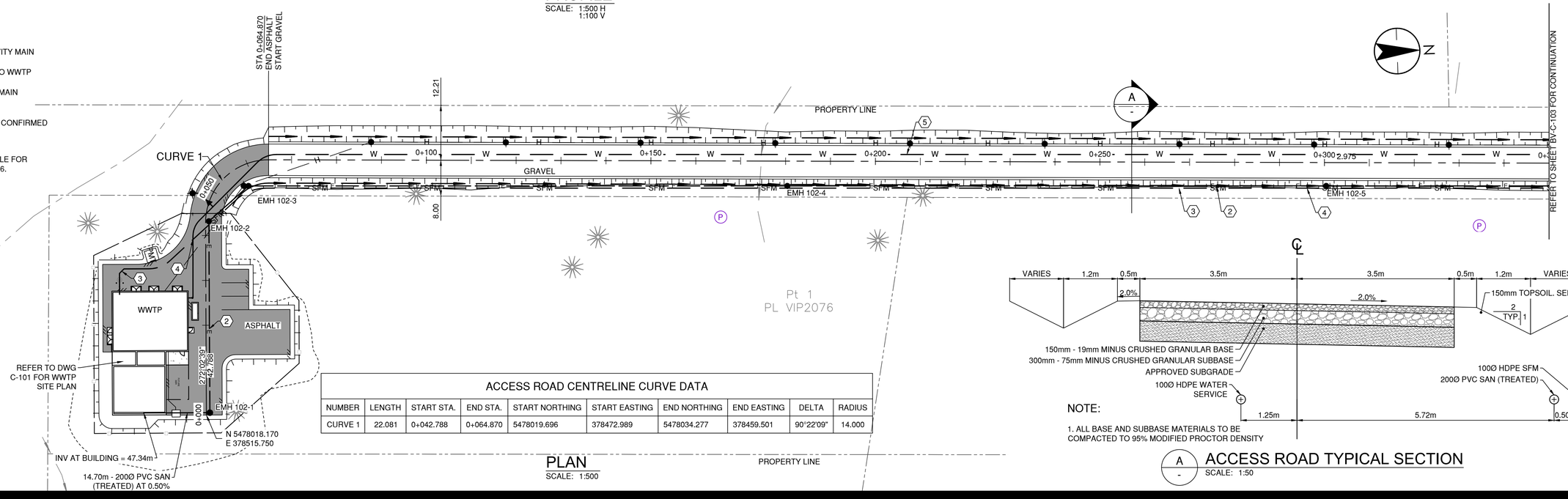
PROFILE
SCALE: 1:500 H
1:100 V

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 200Ø PVC TREATED SANITARY GRAVITY MAIN
3. 100Ø HDPE SANITARY FORCEMAIN TO WWTP
4. MIN. 450mm SEPARATION AT WATERMAIN CROSSING
5. 100Ø HDPE WATERMAIN. SIZE TO BE CONFIRMED NY BOWSER WATER WORKS

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886



1:500 0 5 15 25m
1:100 0 1 3 5m

ACCESS ROAD CENTRELINE CURVE DATA

NUMBER	LENGTH	START STA.	END STA.	START NORTHING	START EASTING	END NORTHING	END EASTING	DELTA	RADIUS
CURVE 1	22.081	0+042.788	0+064.870	5478019.696	378472.989	5478034.277	378459.501	90°22'09"	14.000

PLAN
SCALE: 1:500

NOTE:

1. ALL BASE AND SUBBASE MATERIALS TO BE COMPACTED TO 95% MODIFIED PROCTOR DENSITY

ACCESS ROAD TYPICAL SECTION
SCALE: 1:50

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	19.01.15
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER, BC, CANADA

File Name: 00522_C102.DWG | AF Dwn. | KP Chkd. | AG Dsgn. | 16.10.31 YY.MM.DD

Title
WWTP ACCESS ROAD AND UTILITIES STA 0+000 TO 0+360

Project No. 111700522
Scale AS SHOWN
Drawing No. BV-C-102
Sheet
Revision
of

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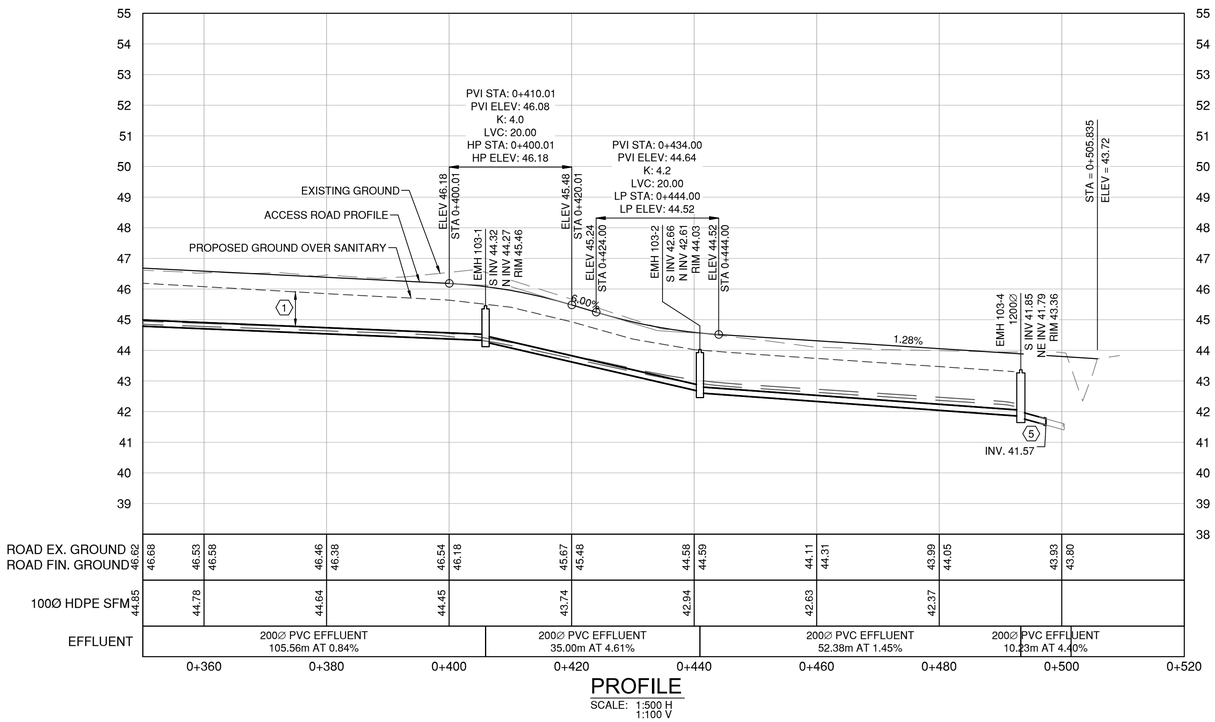

PROFILE
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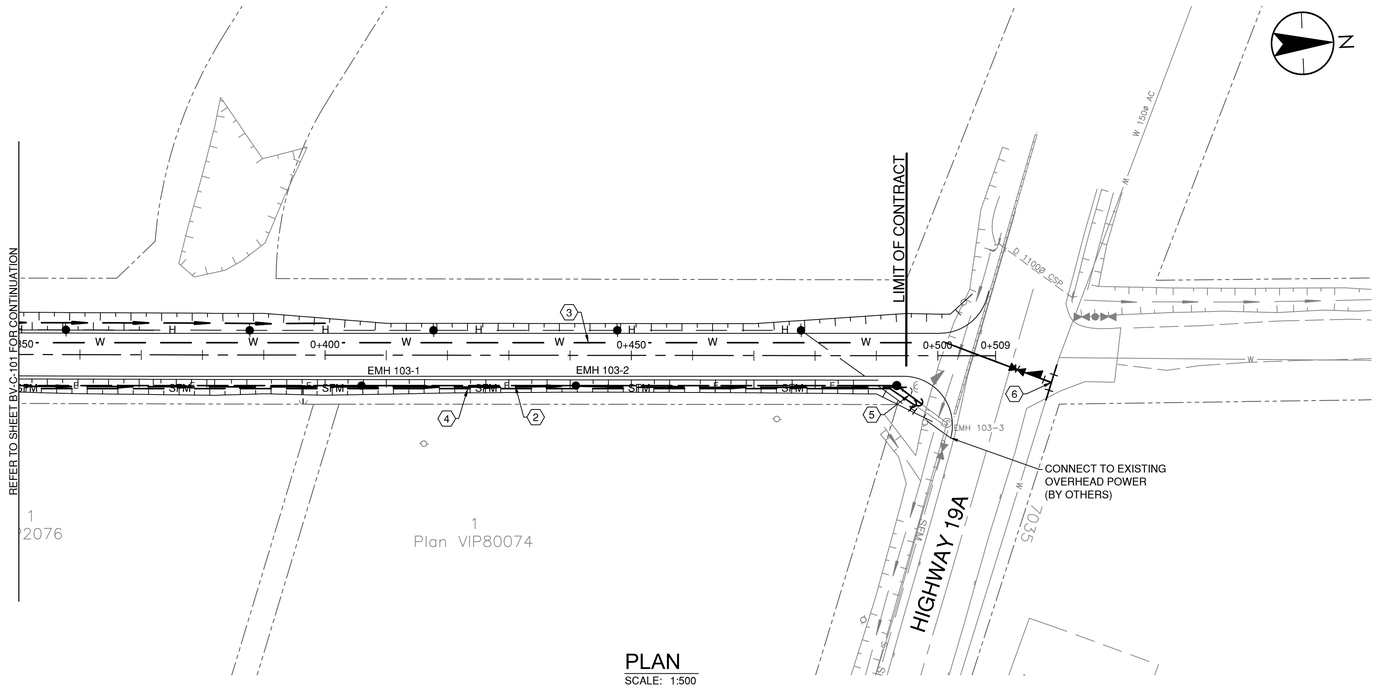

PLAN
SCALE: 1:500

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 200Ø PVC TREATED EFFLUENT GRAVITY MAIN
3. 100Ø HDPE WATERMAIN
4. 100Ø HDPE SANITARY FORCEMAIN TO WWTP
5. PROVIDE 5m STUB AND CAP FOR FUTURE CONNECTION. (CONNECT TO EXISTING STUB IF ALREADY IN PLACE)
6. CONNECTION TO EXISTING 150mm Ø A.C. WATER MAIN, WORK TO BE DONE WITH BOWSER WATER WORKS APPROVAL.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

1:500 0 5 15 25m
1:100 0 1 3 5m
1:50 0 0.5 1.5 2.5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	19.01.15
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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File Name: 00522_C102.DWG | AF Dwn. | KP Chkd. | AG Dsgn. | 16.10.31 YY.MM.DD

Title
WWTP UTILITIES FROM ACCESS ROAD TO HWY19A

Project No. 111700522
Scale AS SHOWN
Drawing No. BV-C-103
Sheet
Revision
of

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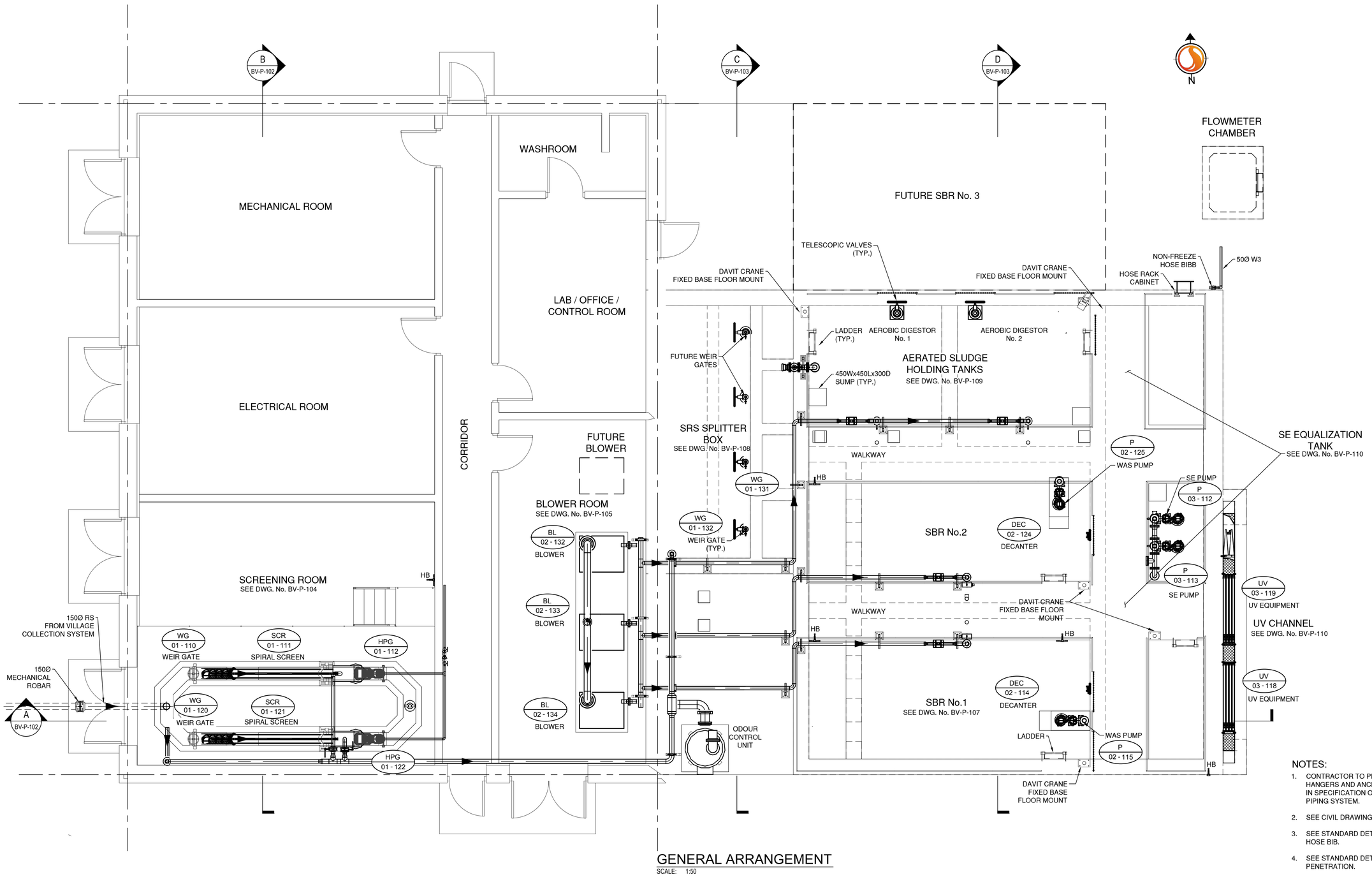

GENERAL ARRANGEMENT

SCALE: 1:50

NOTES:

1. CONTRACTOR TO PROVIDE ALL PIPE SUPPORTS AND HANGERS AND ANCHORS, INCLUDING SEISMIC AS INDICATED IN SPECIFICATION OR AS REQUIRED TO PROVIDE A COMPLETE PIPING SYSTEM.
2. SEE CIVIL DRAWINGS FOR YARD PIPING AND SITE GRADING.
3. SEE STANDARD DETAILS FOR HOSE RACK AND NON FREEZE HOSE BIB.
4. SEE STANDARD DETAIL DRAWINGS FOR PIPE SUPPORTS AND PENETRATION.

Revision	By	Appd.	YY.MM.DD
ISSUED FOR TENDER	BG	SS	19.01.15
ISSUED FOR 100% DESIGN	ESD	DL	17.04.07
ISSUED FOR 90% CLIENT REVIEW	ESD	DL	16.11.07
Issued	By	Appd.	YY.MM.DD

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File Name: BV-P-101.DWG | CT Dwn. | ESD Chkd. | DL Dsgn. | 16.11.07 YY.MM.DD

Title
GENERAL ARRANGEMENT PLAN

Project No. 111700522
Scale 1:50 (0, 0.5, 1.5, 2.5m)
Drawing No. BV-P-101
Sheet of
Revision 0

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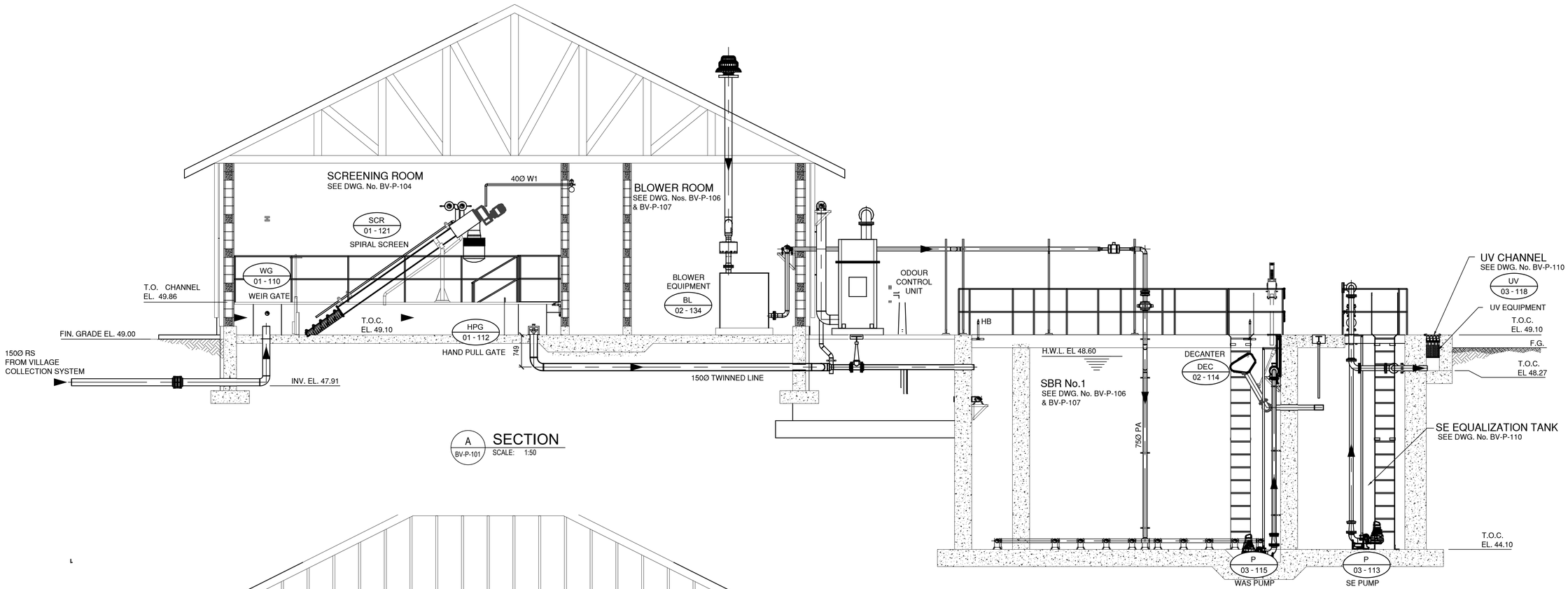

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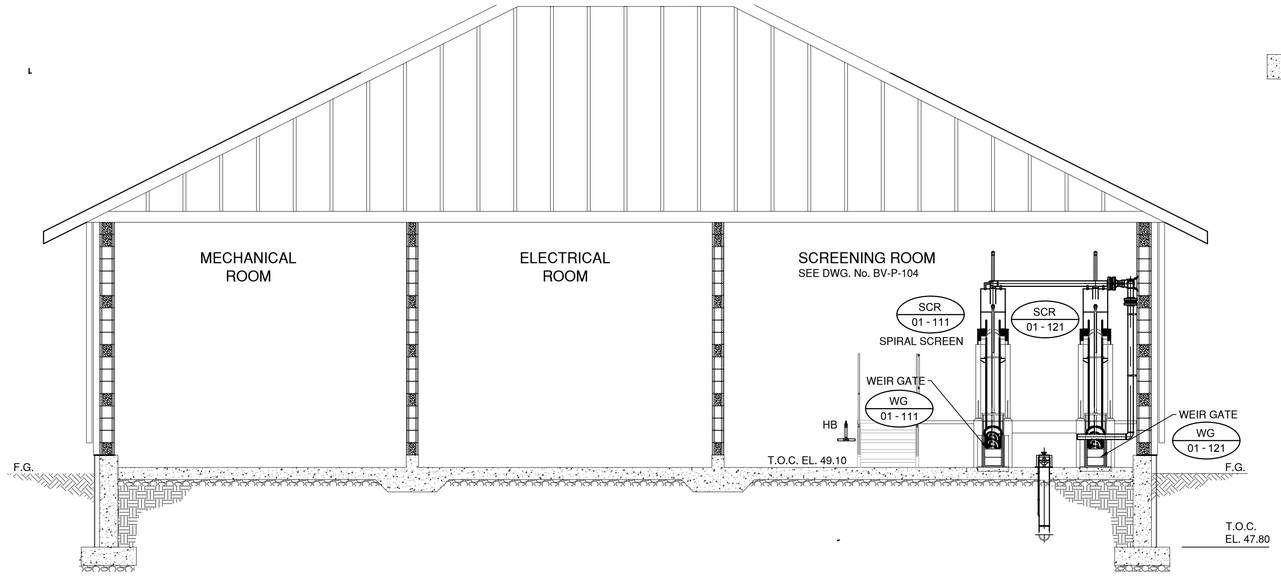

B BV-P-101 **SECTION**
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Revision	By	Appd.	YY.MM.DD
ISSUED FOR TENDER	BG	SS	19.01.15
ISSUED FOR 100% DESIGN	ESD	DL	17.04.07
ISSUED FOR 90% CLIENT REVIEW	ESD	DL	16.11.07
Issued	By	Appd.	YY.MM.DD

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File Name: BV-P-102.DWG	CT	CA	CA	16.03.25
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
GENERAL ARRANGEMENT
SECTION 1 OF 2

Project No.	Scale	Revision
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Drawing No.	Sheet	
BV-P-102	of	

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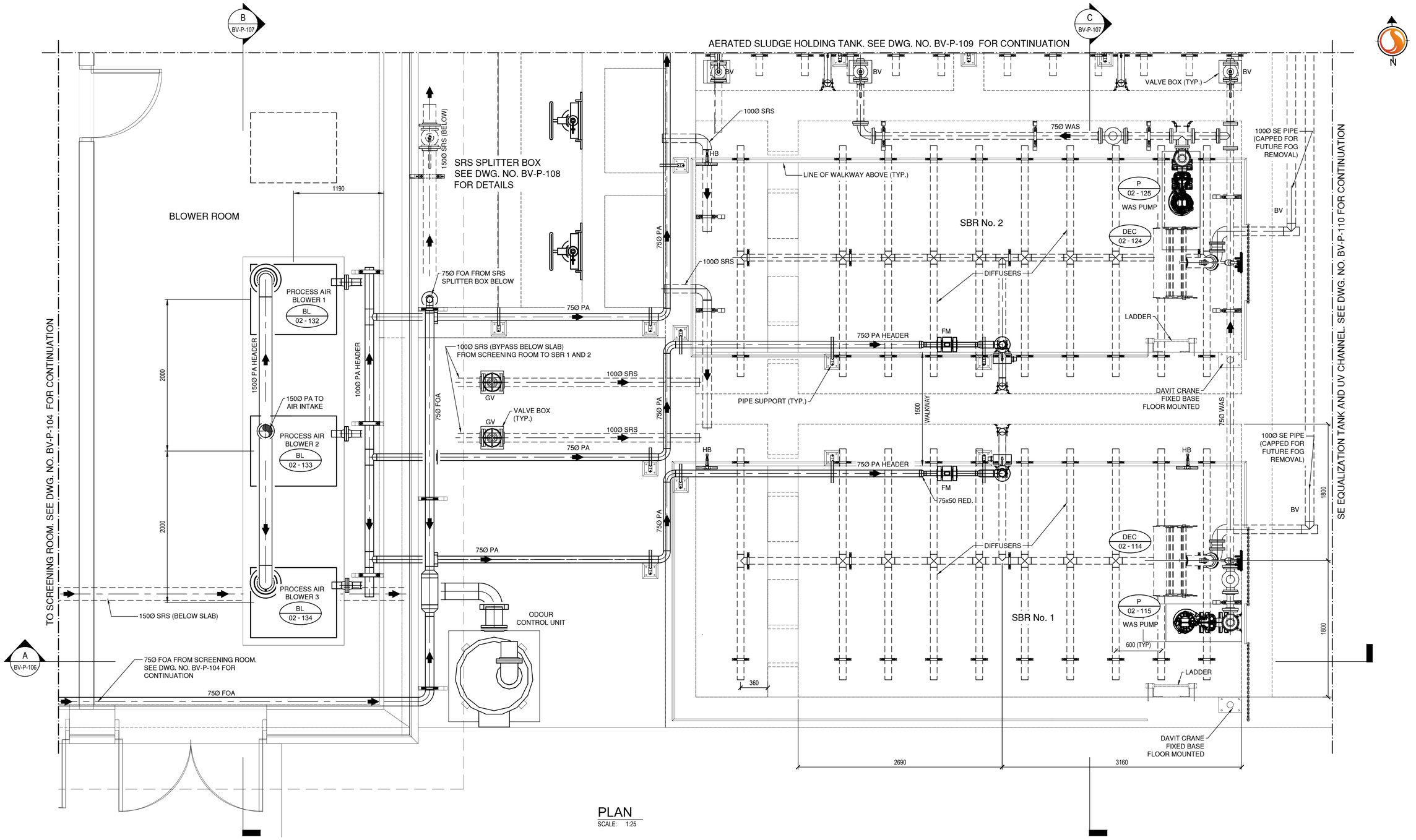

PLAN
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1/15/2019 12:55 PM DGUTIERREZ

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ISSUED FOR TENDER	BG	SS	19.01.15
ISSUED FOR 100% DESIGN	ESD	DL	17.04.07
ISSUED FOR 90% CLIENT REVIEW	ESD	DL	16.11.07
Issued	By	Appd.	YY.MM.DD

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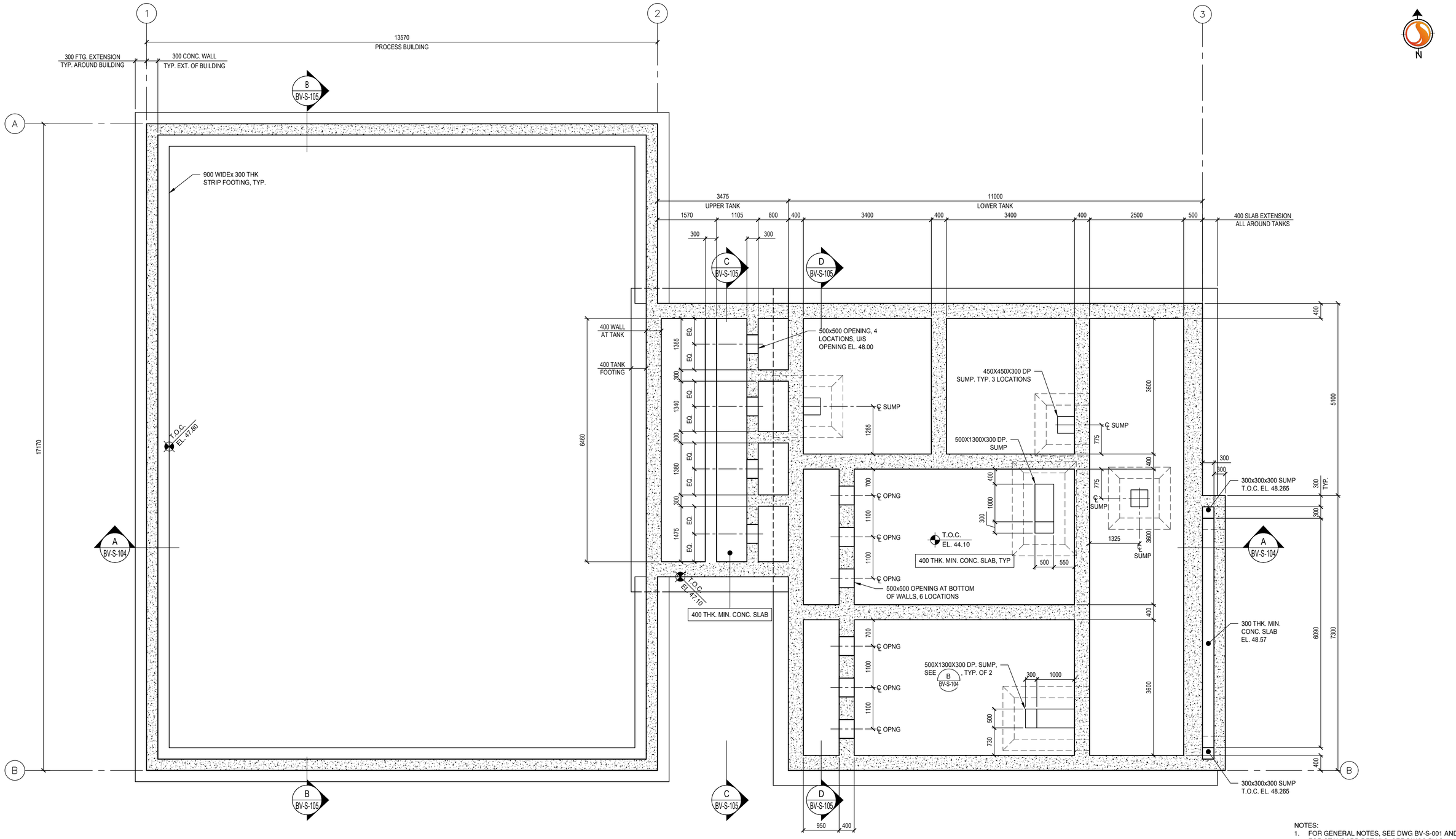
File Name: BV-P-105.DWG	CT	CA	CA	16.03.25
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
BLOWER ROOM AND SBR 1&2
PLAN

Project No. 111700522
Scale 1:25 (0 0.25 0.75 1.25m)
Drawing No. BV-P-105
Sheet
Revision 0
of



1 - PLAN
SCALE: 1:50

NOTES:
1. FOR GENERAL NOTES, SEE DWG BV-S-001 AND FOR STANDARD DETAILS, SEE DWGS BV-S-002 TO S007.
2. SLOPE ALL SLABS MIN. 2% TO DRAINS AND SUMPS.

Revision	By	Appd.	YY.MM.DD
ISSUED FOR TENDER	SG	SG	19.01.15
ISSUED FOR 100% DESIGN	SG	SG	17.04.07
ISSUED FOR 90% CLIENT REVIEW	SG	SG	16.11.07
Issued	By	Appd.	YY.MM.DD

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File Name: 0522_S101.DWG	RA	PT	SSG	17.04.07
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
FOUNDATION LAYOUT

Project No. 111700522
Scale 1:50 (0 0.5 1.5 2.5m)
Drawing No. BV-S-101
Sheet
Revision 0
of

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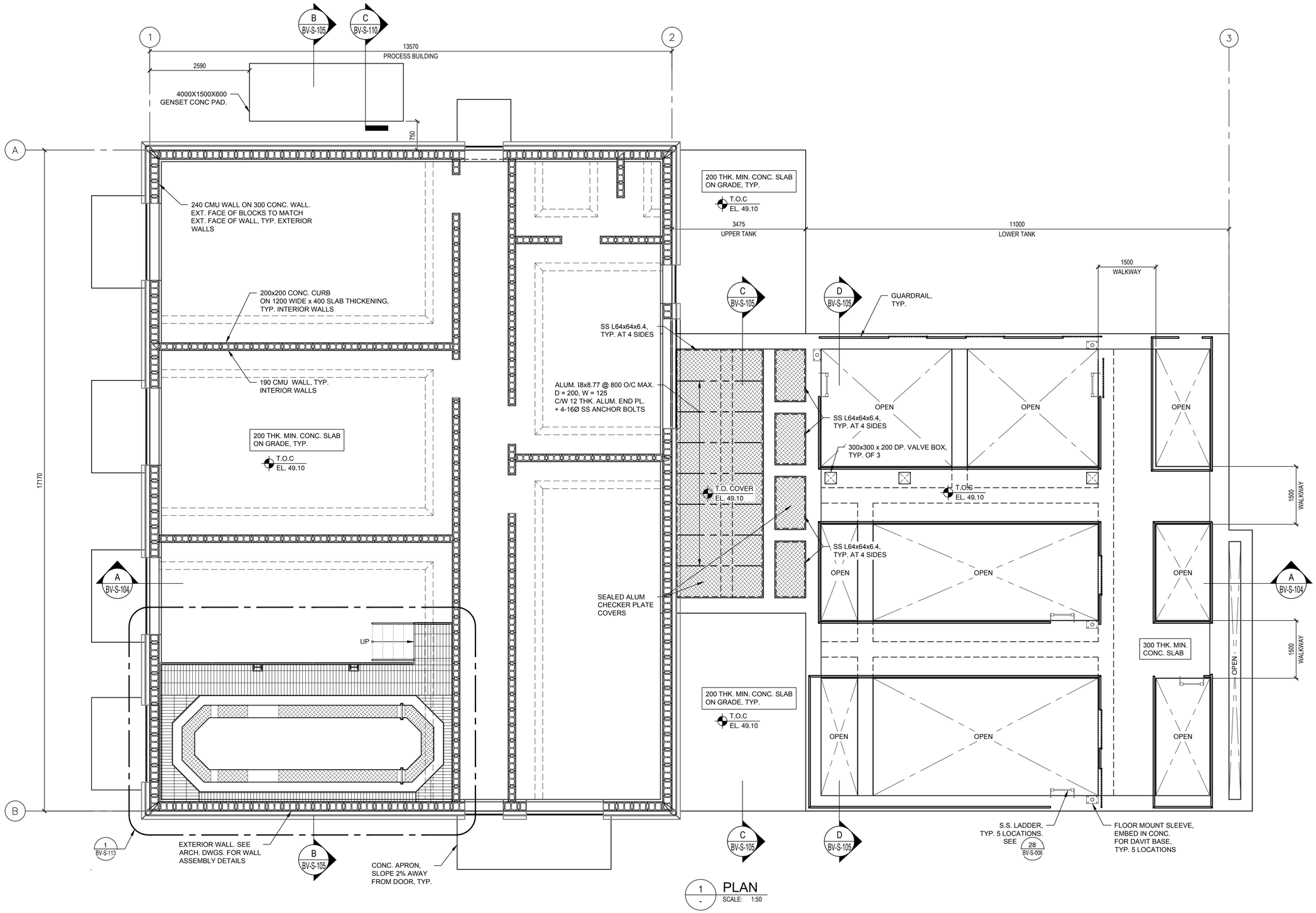

1 PLAN
SCALE: 1:50

NOTES:
1. FOR GENERAL NOTES, SEE DWG BV-S-001 AND FOR STANDARD DETAILS, SEE DWGS BV-S-002 TO S007.
2. SLOPE ALL SLABS MIN. 2% TO DRAIN.

Revision	By	Appd.	YY.MM.DD
ISSUED FOR TENDER	SG	SG	19.01.15
ISSUED FOR 100% DESIGN	SG	SG	17.04.07
ISSUED FOR 90% CLIENT REVIEW	SG	SG	16.11.07
Issued	By	Appd.	YY.MM.DD

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WASTEWATER TREATMENT PLANT
BOWSER, BC, CANADA

File Name: 0522_S102.DWG	RA	PT	SSG	17.04.07
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
MAIN FLOOR LAYOUT

Project No. 111700522
Scale 1:50 (0 0.5 1.5 2.5m)
Drawing No. BV-S-102
Sheet
Revision 0 of

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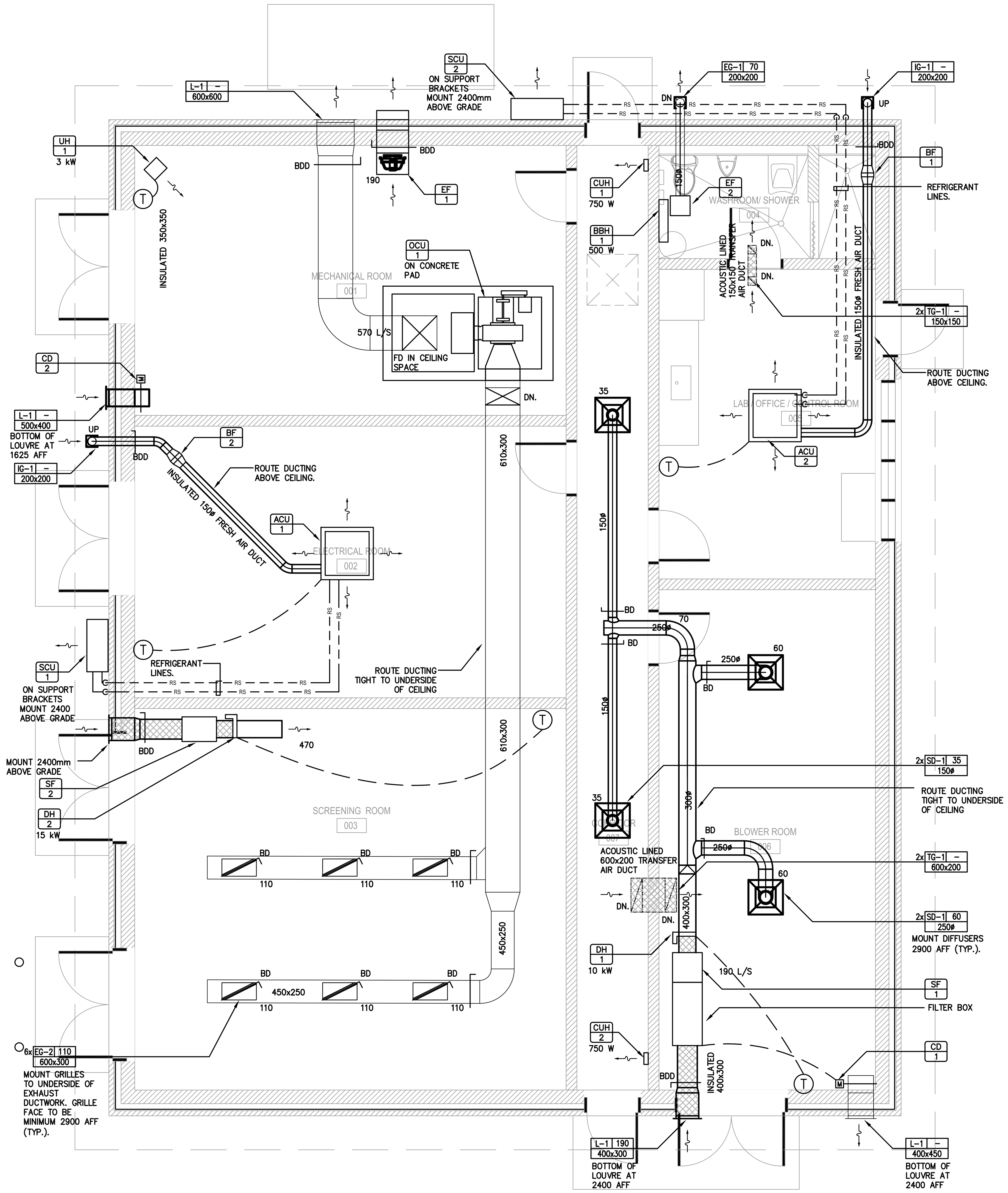
ORIGINAL SHEET - ISO A1



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Revision	By	Appd.	YY.MM.DD
ISSUED FOR TENDER	IC	IC	19.01.15
ISSUED FOR 100% DESIGN	ESD	DL	17.04.07
ISSUED FOR 90% CLIENT REVIEW	ESD	DL	16.11.07
Issued	By	Appd.	YY.MM.DD

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BOWSER, BC, CANADA

File Name: BV-M-200.DWG

Dwn. Chkd. Dsgn. YY.MM.DD

Title

HVAC FLOOR PLAN

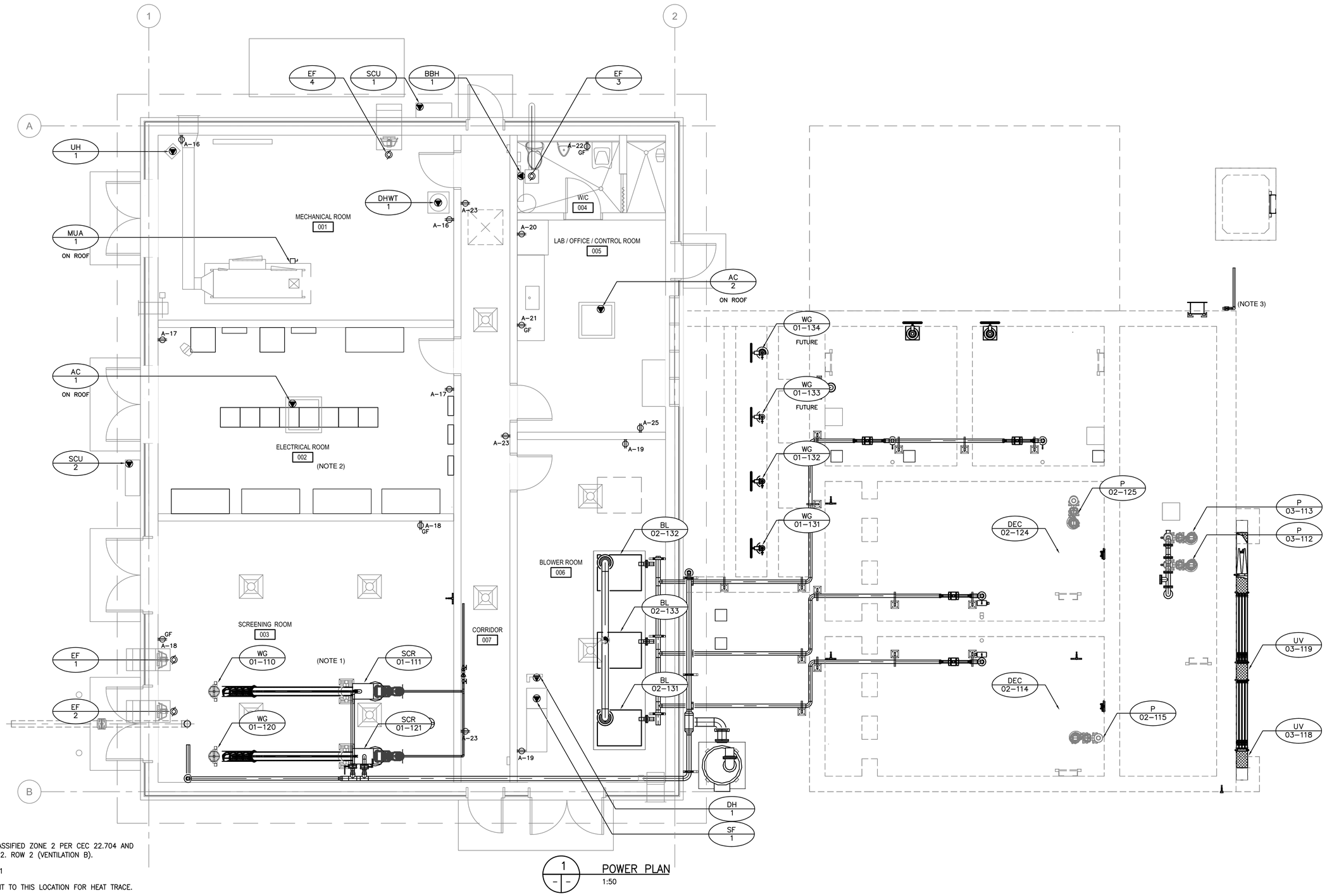
Project No. 111700522

Scale 1:50 (0 0.5 1.5 2.5m)

Drawing No. BV-M-200

Sheet 2 of 5

Revision 0



NOTES:

1. SCREENING ROOM CLASSIFIED ZONE 2 PER CEC 22.704 AND NFPA820 TABLE 5.2.2. ROW 2 (VENTILATION B).
2. REFERENCE BV–E–101
3. ALLOW 120Vac CIRCUIT TO THIS LOCATION FOR HEAT TRACE.

1 – – POWER PLAN
1:50

Revision	By	Appd.	YY.MM.DD
FOR TENDER	SM	SL	19.01.15
FOR 100% DESIGN	SM	SL	17.04.07
FOR 90% CLIENT REVIEW	SM	SL	16.11.07
Issued	By	Appd.	YY.MM.DD

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WASTEWATER TREATMENT PLANT
BOWSER, BC, CANADA

File Name: BV-E-100.DWG | Dwn. | Chkd. | Dsgn. | YY.MM.DD

Title
ELECTRICAL
POWER PLAN

Project No. 1111700522 | Scale 1:50

Drawing No. BV-E-100 | Sheet of | Revision 0

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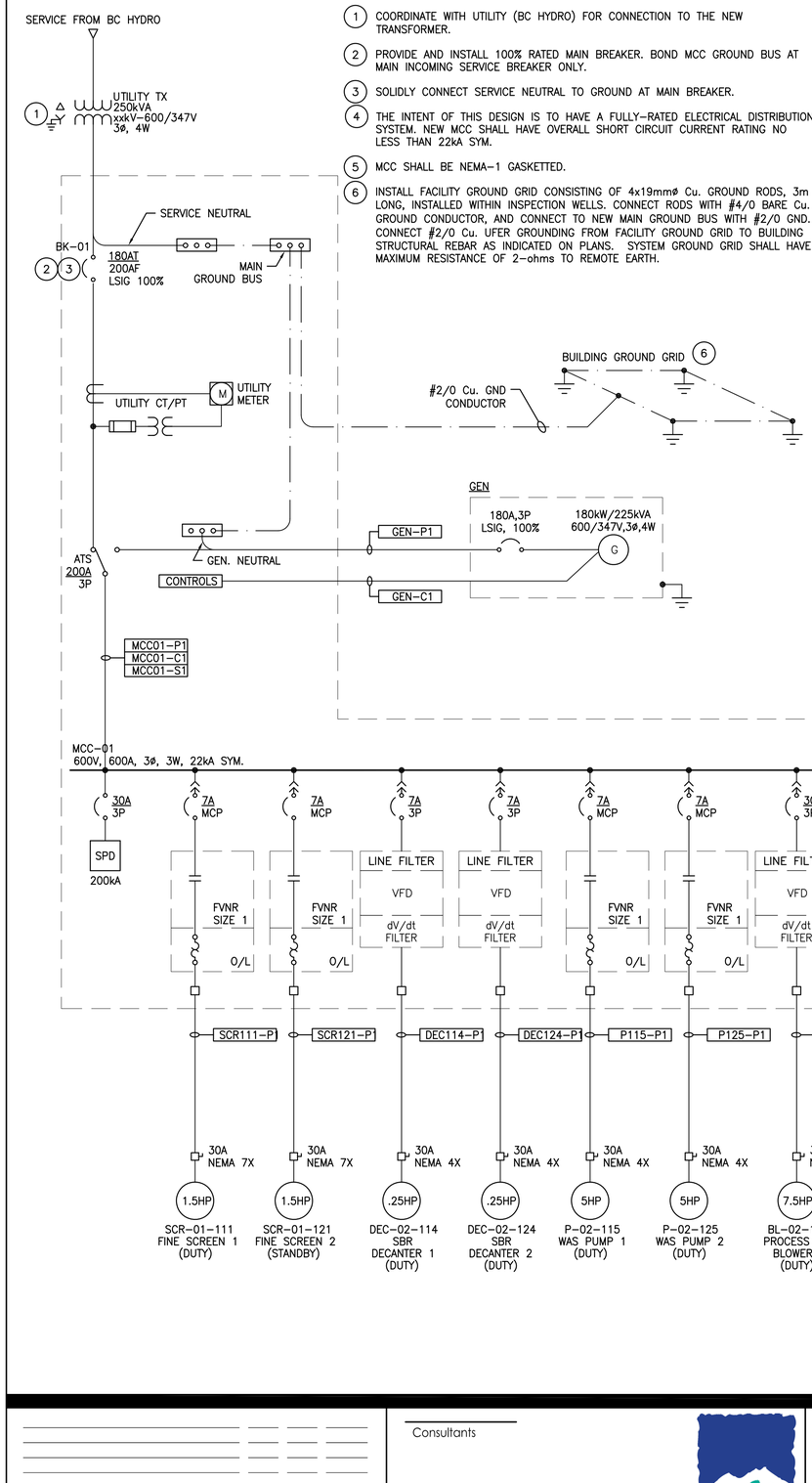
1/17/2019 3:11 PM EDELPIN

ORIGINAL SHEET - ISO A1

KEYNOTES:

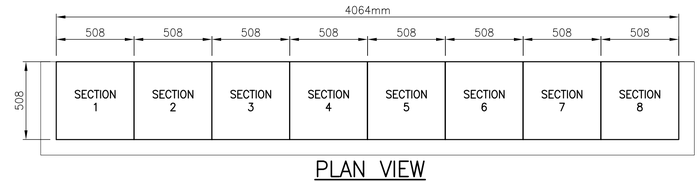
1. COORDINATE WITH UTILITY (BC HYDRO) FOR CONNECTION TO THE NEW TRANSFORMER.
2. PROVIDE AND INSTALL 100% RATED MAIN BREAKER. BOND MCC GROUND BUS AT MAIN INCOMING SERVICE BREAKER ONLY.
3. SOLIDLY CONNECT SERVICE NEUTRAL TO GROUND AT MAIN BREAKER.
4. THE INTENT OF THIS DESIGN IS TO HAVE A FULLY-RATED ELECTRICAL DISTRIBUTION SYSTEM. NEW MCC SHALL HAVE OVERALL SHORT CIRCUIT CURRENT RATING NO LESS THAN 22kA SYM.
5. MCC SHALL BE NEMA-1 GASKETTED.
6. INSTALL FACILITY GROUND GRID CONSISTING OF 4x19mmø Cu. GROUND RODS, 3m LONG, INSTALLED WITHIN INSPECTION WELLS. CONNECT RODS WITH #4/0 BARE Cu. GROUND CONDUCTOR, AND CONNECT TO NEW MAIN GROUND BUS WITH #2/0 GND. CONNECT #2/0 Cu. UFER GROUNDING FROM FACILITY GROUND GRID TO BUILDING STRUCTURAL REBAR AS INDICATED ON PLANS. SYSTEM GROUND GRID SHALL HAVE MAXIMUM RESISTANCE OF 2-ohms TO REMOTE EARTH.



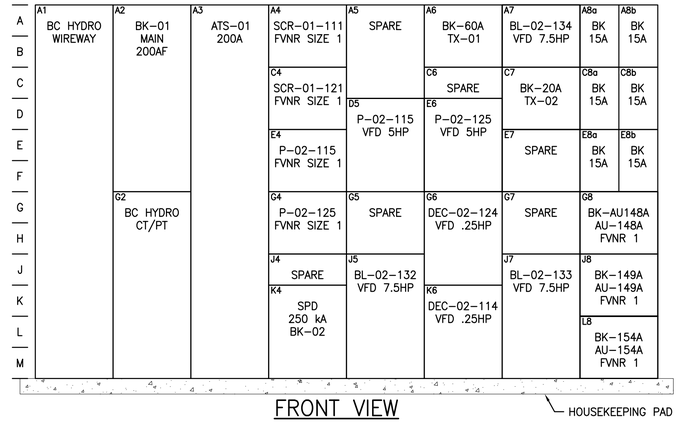
LOAD CALCULATION

EQUIPMENT LIST		Starter	DESIGN EQUIPMENT LOADS							
			Load Info				Demand Loads (A)		Connected Loads	
			DUTY Stand-By	(kW)	(kVA)	(HP)	Cont.	Inter.	(kW)	(A)
SCR-01-111	Fine Screen 1	FVNR	D	1.1	1.1	1.5	2.1		1.1	2.1
SCR-01-121	Fine Screen 2	FVNR	Stand-By	1.1	1.1	1.5	0.0		1.1	0.0
DEC-02-114	SBR Decanter 1	VFD	D	0.2	0.2	0.3	0.0		0.2	0.0
DEC-02-124	SBR Decanter 2	VFD	D	0.2	0.2	0.3	0.0		0.2	0.0
P-02-115	WAS Pump 1	FVNR	D	3.7	3.7	5.0	6.1		3.7	6.1
P-02-125	WAS Pump 2	FVNR	D	3.7	3.7	5.0	6.1		3.7	6.1
BL-02-132	Process Air Blower 1	VFD	D	5.6	5.6	7.5	9.0		5.6	9.0
BL-02-133	Process Air Blower 2	VFD	D	5.6	5.6	7.5	9.0		5.6	9.0
BL-02-134	Process Air Blower 3	VFD	Stand-By	5.6	5.6	7.5	0.0		5.6	0.0
P-03-112	SE Pump 1	VFD	D	3.7	3.7	5.0	6.1		3.7	6.1
P-03-113	SE Pump 2	VFD	Stand-By	3.7	3.7	5.0	0.0		3.7	0.0
SCU1		BKR	D	5.1	5.1	6.8	4.9		5.1	4.9
DHWT1	Domestic Hot Water Tank	BKR	D	4.5	4.5	6.0	4.3		4.5	4.3
DH1	Duct Heater	BKR	D	10.0	10.0	13.4	9.6		10.0	9.6
SCU2		BKR	D	3.8	3.8	5.1	3.7		3.8	3.7
MUA1	Makeup Air Unit	BKR	D	21.0	21.0	28.2	20.2		21.0	20.2
UH1	Unit Heater	BKR	D	3.0	3.0	4.0	2.9		3.0	2.9
UV-03-118	UV Reactor 1	BKR	D	3.0	3.0	4.0	2.9		3.0	2.9
UV-03-119	UV Reactor 2	BKR	Stand-By	3.0	3.0	4.0	0.0		3.0	2.9
PNL-01	Distribution Panel	BKR	D	36.0	45.0		34.6		36.0	34.6
PNL-02	Distribution Panel	BKR	D	12.0	15.0		11.5		12.0	11.5
AH1	Air Handling Unit	BKR	D	1.1	1.1		1.1		1.1	1.1

Demand Load Amps: 134.1 A
+25% Largest Motor: 2.3 A
Spare Capacity: 30% 40.9 A
Feeder Size: 177.3 A
Breaker Size: 100% 177 --> 180A Breaker

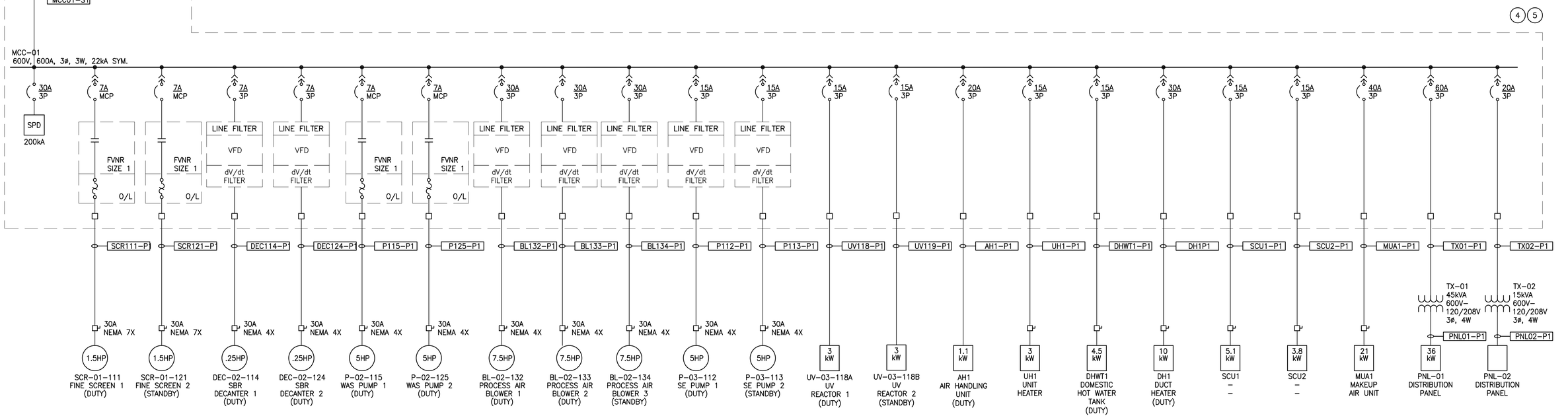


PLAN VIEW



FRONT VIEW

1 — MCC LAYOUT
1:20



Revision	By	Appd.	YY.MM.DD
FOR TENDER	SM	SL	19.01.15
FOR 100% DESIGN	SM	SL	17.04.07
FOR 90% CLIENT REVIEW	SM	SL	16.11.07
Issued	By	Appd.	YY.MM.DD

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REGIONAL DISTRICT OF NANAIMO

BOWSER SANITARY SYSTEM
WASTEWATER TREATMENT PLANT
BOWSER, BC, CANADA

File Name: BV-E-104.DWG | Dwn. | Chkd. | Dsgn. | YY.MM.DD

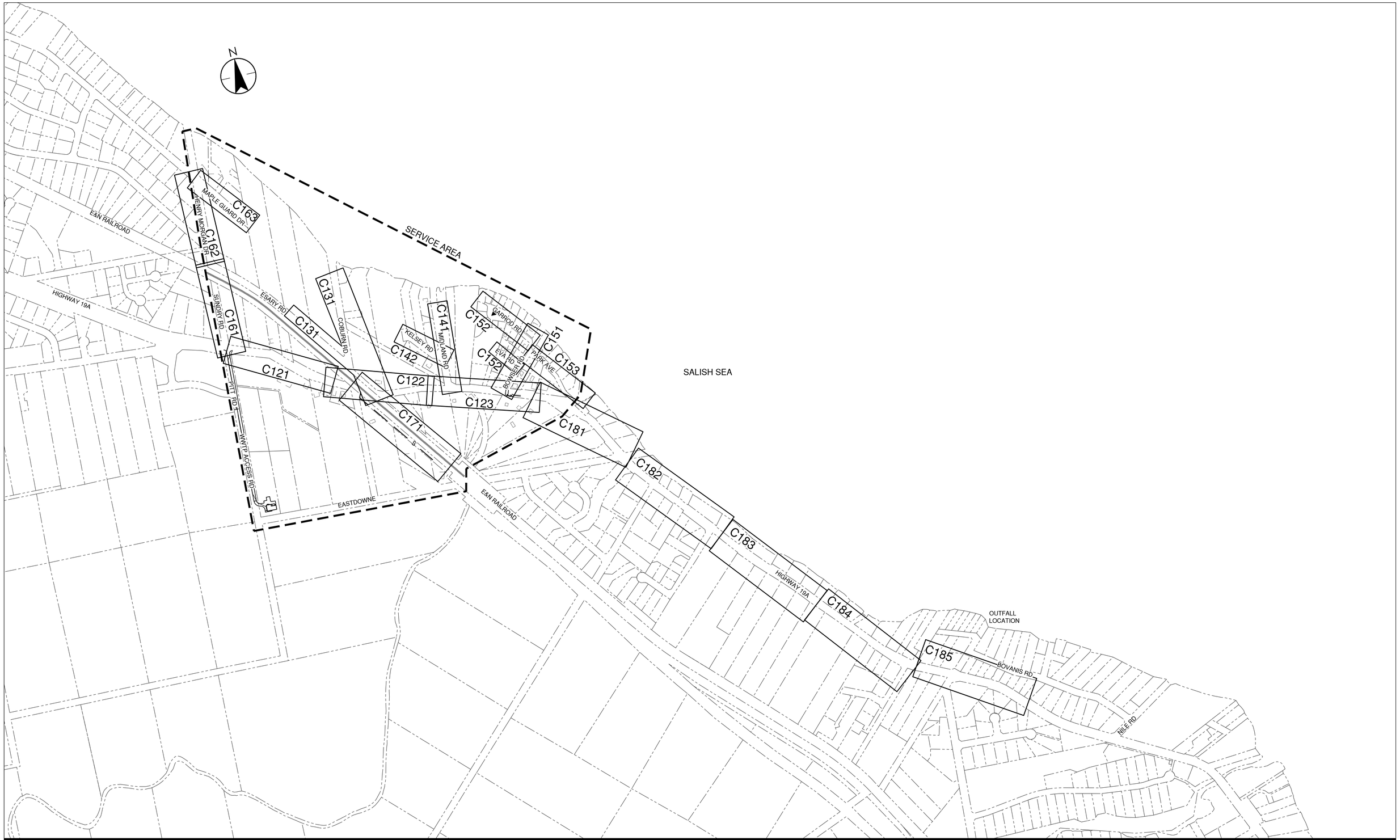
Title
ELECTRICAL
SINGLE LINE DIAGRAM
AND MCC LAYOUT

Project No. 111700522
Scale N.T.S.
Drawing No. BV-E-104
Sheet of
Revision 0

Reference Drawings:

Bowser Sanitary System Collection

Prepared by Stantec Consulting Ltd.



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1/15/2019 9:30 AM HLEE

ORIGINAL SHEET - ISO A1

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	19.01.11
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION

BOWSER, BC, CANADA

File Name: 00522_C100.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title

KEY PLAN

Project No. 111700522

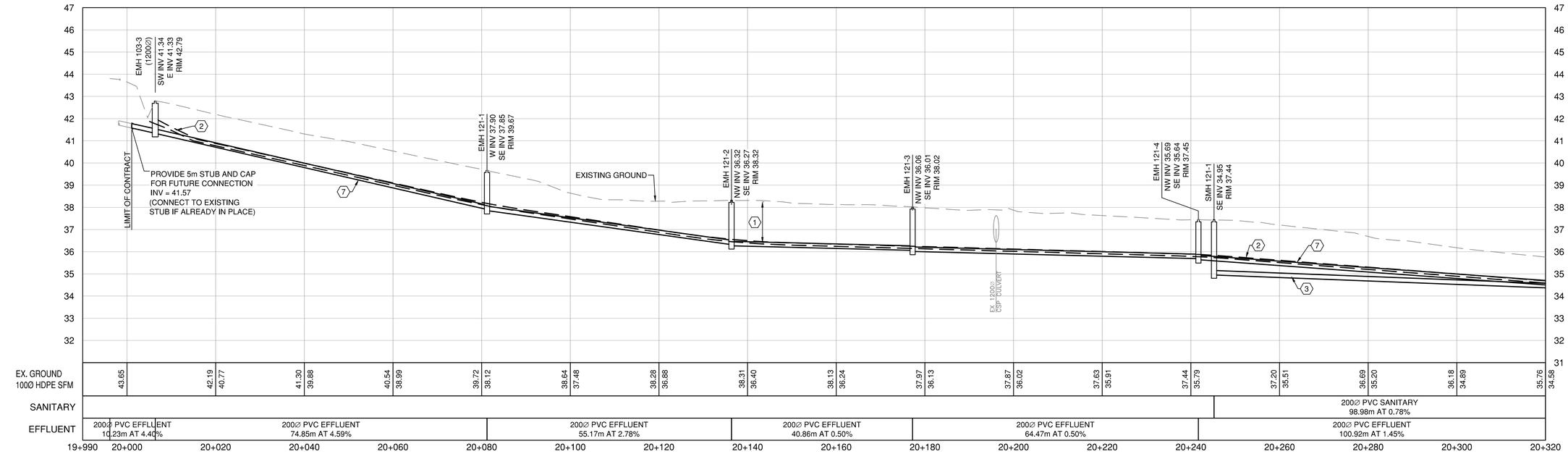
Scale 1:2500 (0 25 75 125m)

Drawing No. BV-C-100

Sheet

Revision 0

of



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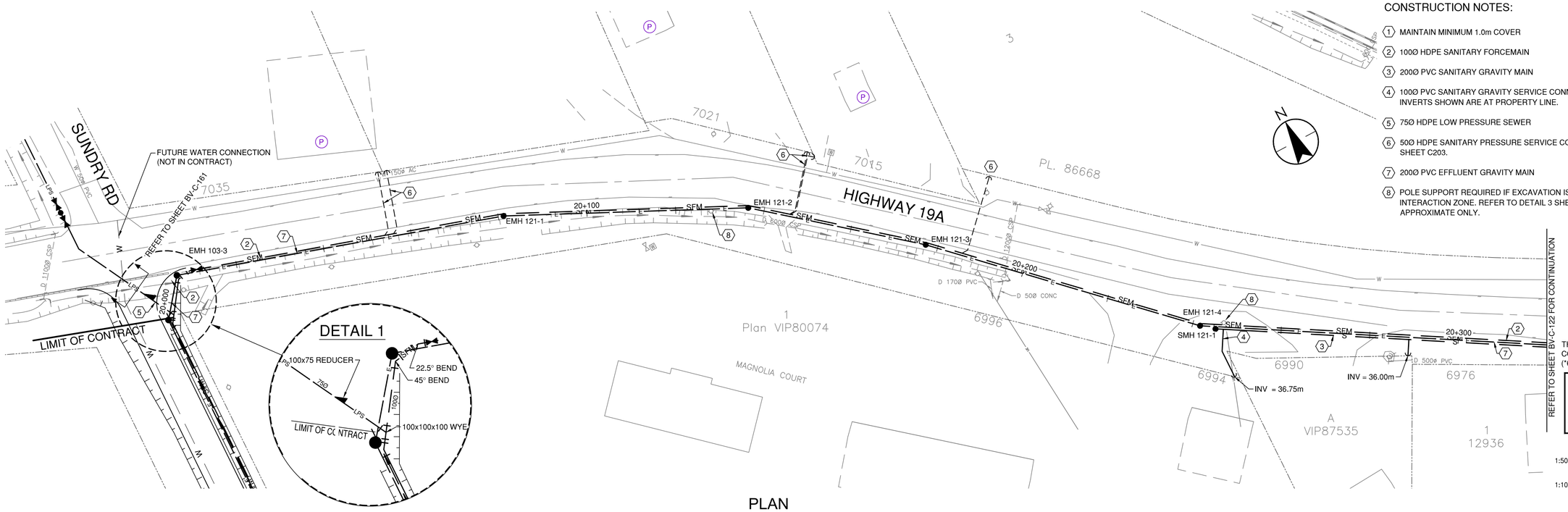

PLAN
SCALE: 1:500

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 100Ø HDPE SANITARY FORCEMAIN
3. 200Ø PVC SANITARY GRAVITY MAIN
4. 100Ø PVC SANITARY GRAVITY SERVICE CONNECTION (TYP.) AS PER MMCD DRAWING S7. INVERTS SHOWN ARE AT PROPERTY LINE.
5. 75Ø HDPE LOW PRESSURE SEWER
6. 50Ø HDPE SANITARY PRESSURE SERVICE CONNECTION (TYP.) REFER TO DETAIL 1 SHEET C203.
7. 200Ø PVC EFFLUENT GRAVITY MAIN
8. POLE SUPPORT REQUIRED IF EXCAVATION IS WITHIN THE SOIL FOUNDATION INTERACTION ZONE. REFER TO DETAIL 3 SHEET C-202. POLE LOCATIONS SHOWN ARE APPROXIMATE ONLY.

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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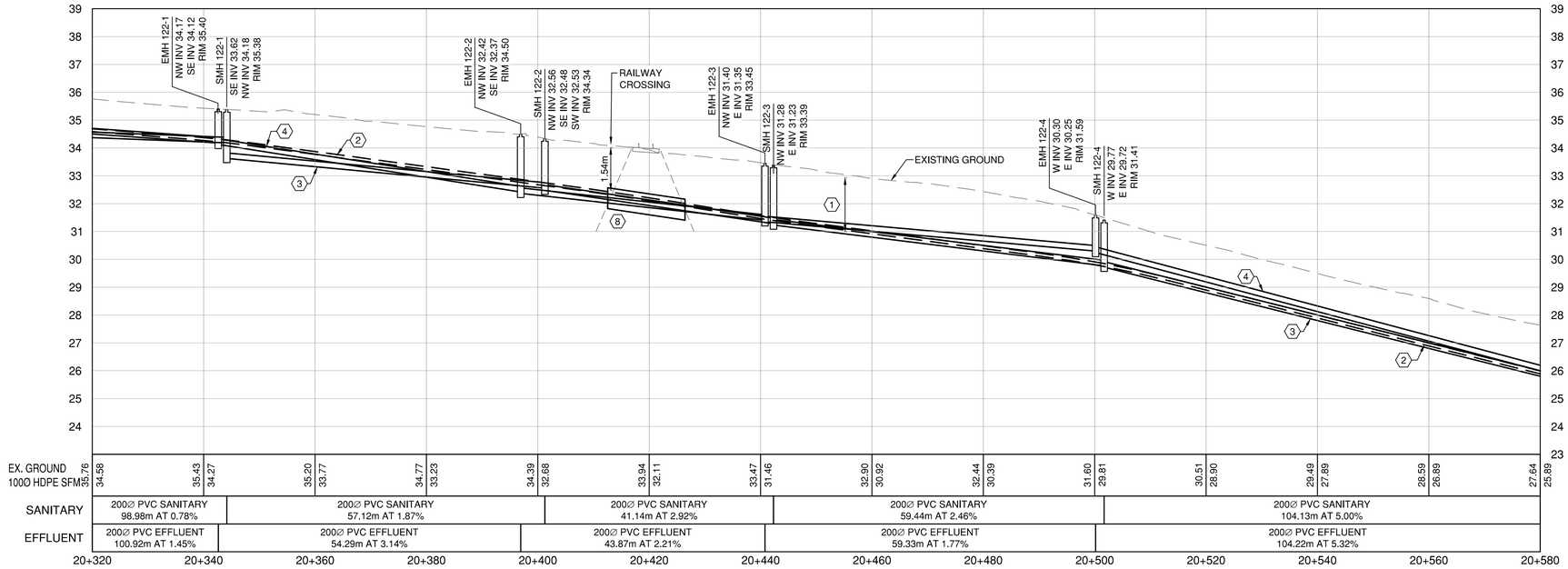
BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C120.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
SANITARY MAIN HIGHWAY 19A
STA 20+000 TO 20+320

Project No.	Scale	
111700522	AS SHOWN	
Drawing No.	Sheet	Revision
BV-C-121	of	0



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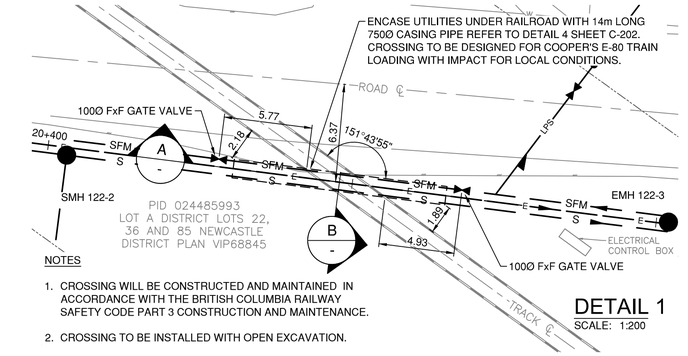

DETAIL 1
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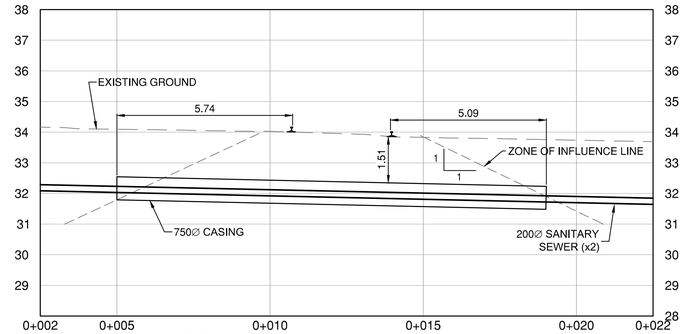

A ℄ PIPE CROSSING PROFILE
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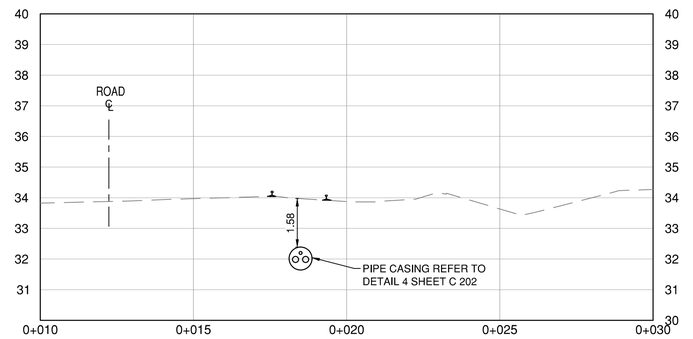
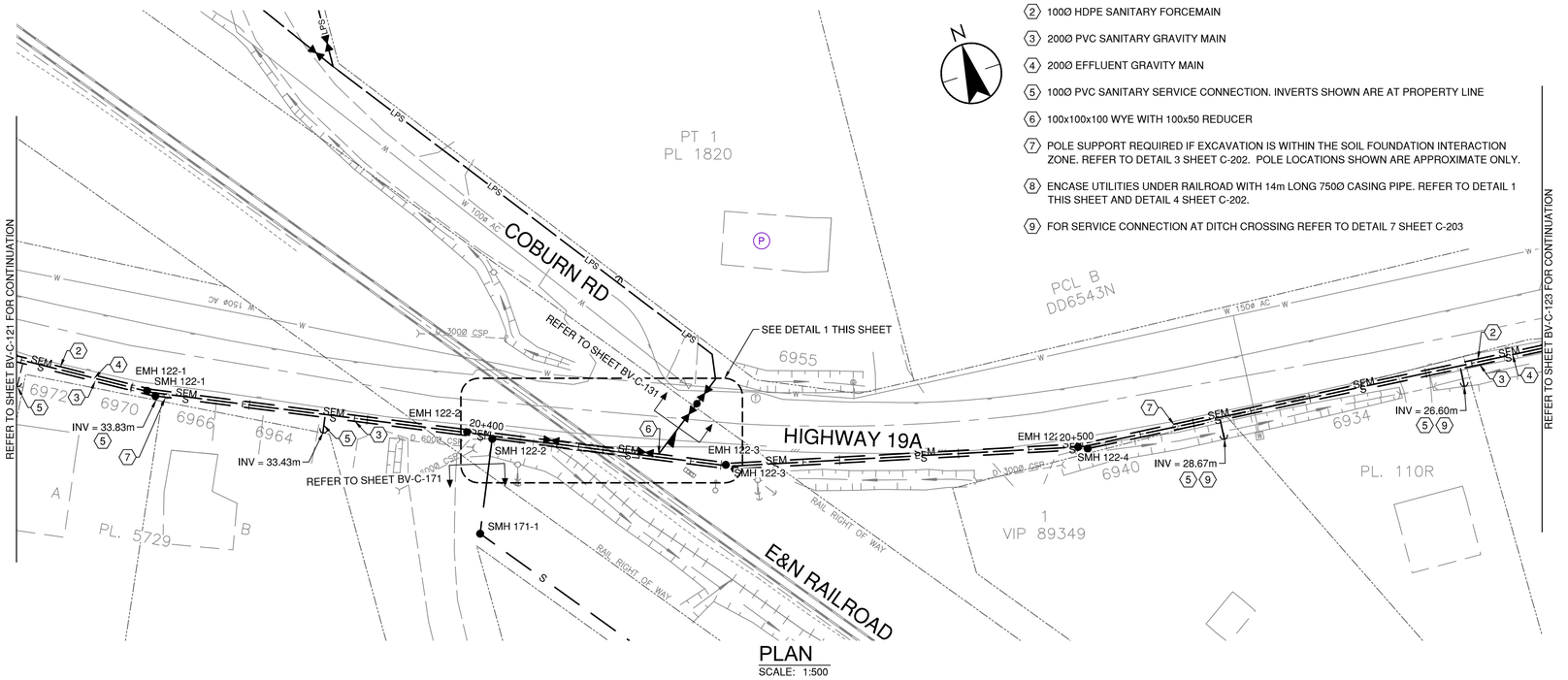


B ℄ PIPE CROSSING CROSS SECTION
SCALE: 1:100

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 100Ø HDPE SANITARY FORCEMAIN
3. 200Ø PVC SANITARY GRAVITY MAIN
4. 200Ø EFFLUENT GRAVITY MAIN
5. 100Ø PVC SANITARY SERVICE CONNECTION. INVERTS SHOWN ARE AT PROPERTY LINE
6. 100x100x100 WYE WITH 100x50 REDUCER
7. POLE SUPPORT REQUIRED IF EXCAVATION IS WITHIN THE SOIL FOUNDATION INTERACTION ZONE. REFER TO DETAIL 3 SHEET C-202. POLE LOCATIONS SHOWN ARE APPROXIMATE ONLY.
8. ENCASE UTILITIES UNDER RAILROAD WITH 14m LONG 750Ø CASING PIPE. REFER TO DETAIL 1 THIS SHEET AND DETAIL 4 SHEET C-202.
9. FOR SERVICE CONNECTION AT DITCH CROSSING REFER TO DETAIL 7 SHEET C-203



PLAN
SCALE: 1:500

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

1:500 0 5 15 25m
1:200 0 2 6 10m
1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C120.DWG | AF Dwn. | KP Chkd. | AG Dsgn. | 16.10.31 YY.MM.DD

Title
SANITARY MAIN HIGHWAY 19A
STA 20+320 TO 20+580

Project No. 111700522
Scale AS SHOWN
Drawing No. BV-C-122
Sheet of
Revision 0

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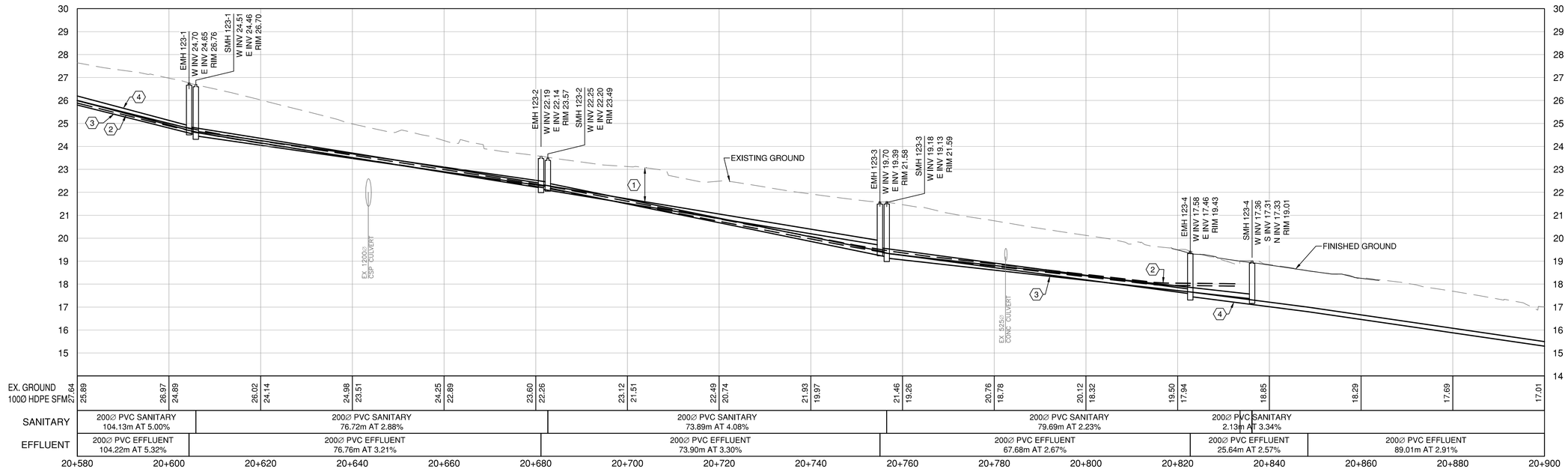
ORIGINAL SHEET - ISO A1



PROFILE
SCALE: 1:500 H
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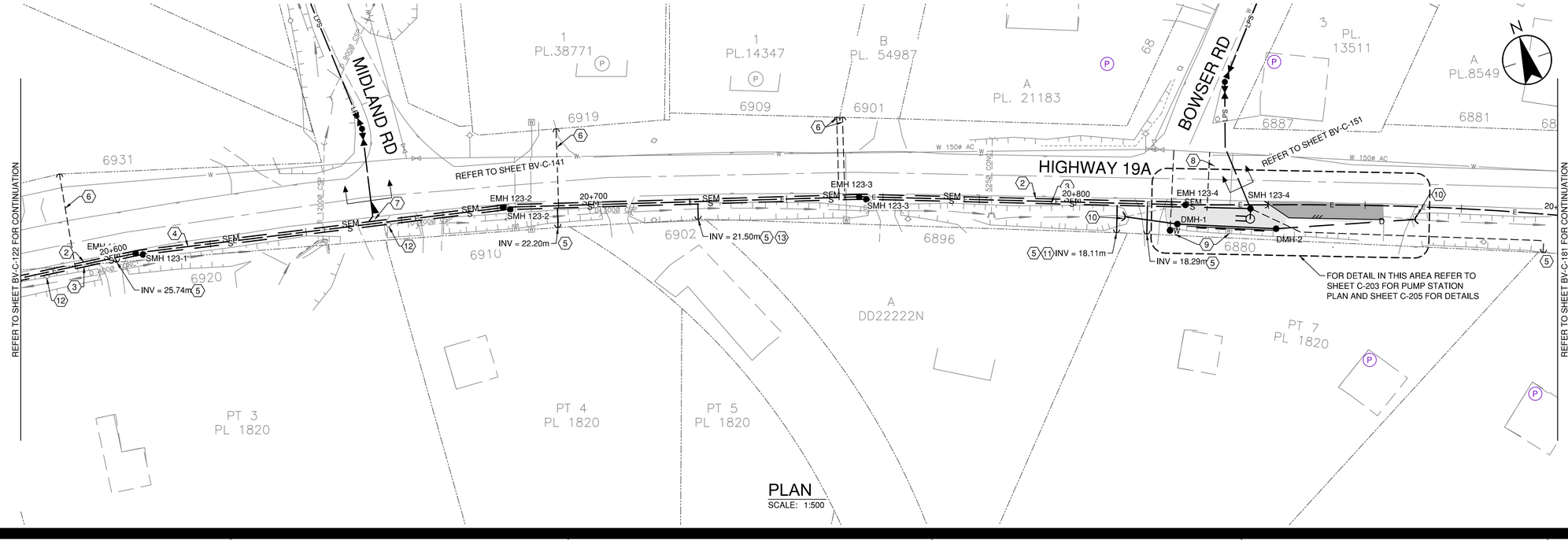

PLAN
SCALE: 1:500

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 100Ø HDPE SANITARY FORCEMAIN
3. 200Ø PVC SANITARY GRAVITY MAIN
4. 200Ø PVC EFFLUENT GRAVITY MAIN
5. 100Ø PVC SANITARY SERVICE CONNECTION (TYP.) INVERTS SHOWN ARE AT PROPERTY LINE
6. 50Ø HDPE SANITARY PRESSURE SERVICE CONNECTION (TYP.) REFER TO DETAIL 1 SHEET C203.
7. 100x100x100 TEE C/W - 100x75 REDUCER
8. PROVIDE 19Ø WATER SERVICE
9. PROVIDE NEW WATER SERVICE AND CONNECTION TO 6880 ISLAND HIGHWAY. EXISTING SERVICE TO BE ABANDONED.
10. INSTALL NEW CONC. BLOCK HEADWALL AS PER MMCD STD. DRAWING S15
11. FOR SERVICE CONNECTION AT DITCH CROSSING REFER TO DETAIL 7 SHEET C-203
12. POLE SUPPORT REQUIRED IF EXCAVATION IS WITHIN THE SOIL FOUNDATION INTERACTION ZONE. REFER TO DETAIL 3 SHEET C-202. POLE LOCATIONS SHOWN ARE APPROXIMATE ONLY.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

1:500 0 5 15 25m
1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C120.DWG | AF Dwn. | KP Chkd. | AG Dsgn. | 16.10.31 YY.MM.DD

Title
SANITARY MAIN HIGHWAY 19A
STA 20+580 TO 20+900

Project No. 111700522
Scale AS SHOWN
Drawing No. BV-C-123
Sheet of
Revision 0

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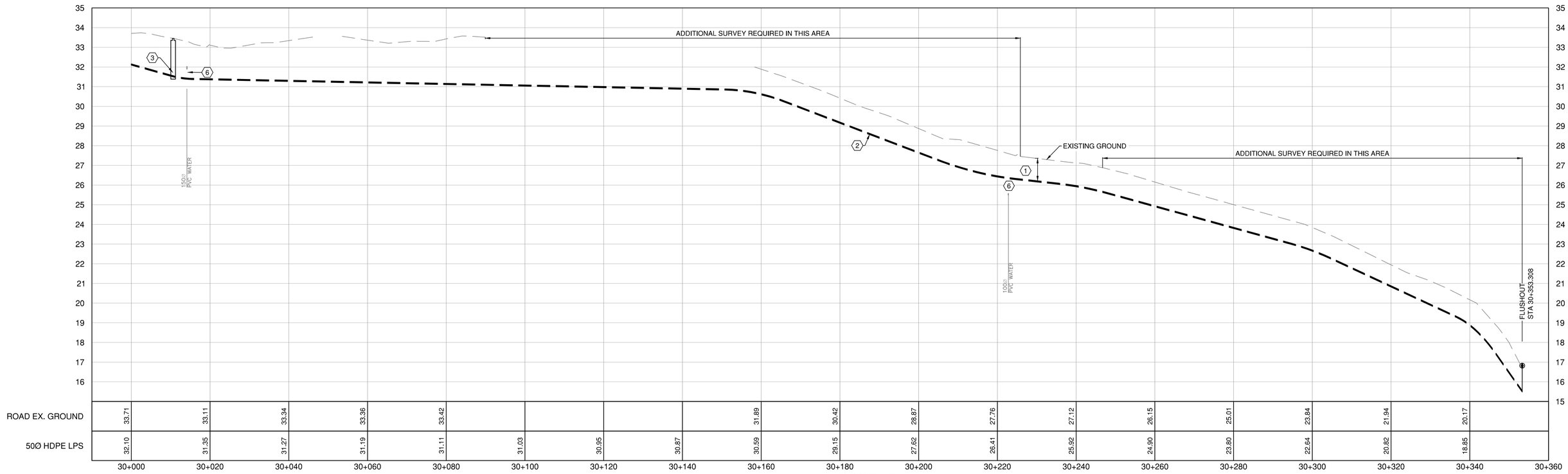
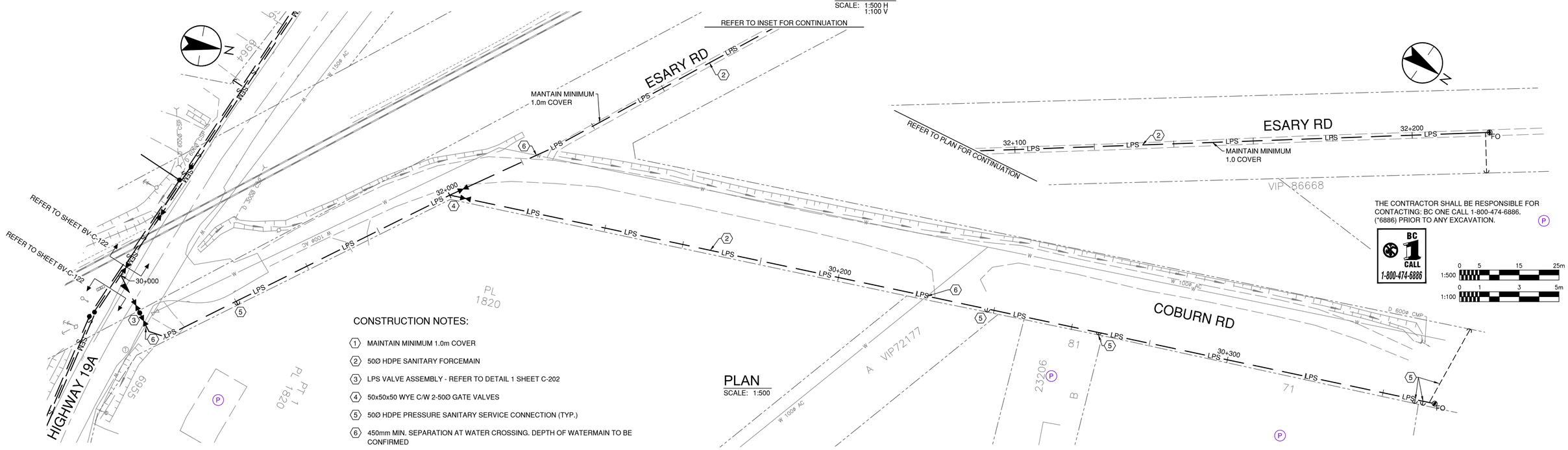
ORIGINAL SHEET - ISO A1



PROFILE

SCALE: 1:500 H
1:100 V



PLAN

SCALE: 1:500

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 50Ø HDPE SANITARY FORCEMAIN
3. LPS VALVE ASSEMBLY - REFER TO DETAIL 1 SHEET C-202
4. 50x50x50 WYE C/W 2-50Ø GATE VALVES
5. 50Ø HDPE PRESSURE SANITARY SERVICE CONNECTION (TYP.)
6. 450mm MIN. SEPARATION AT WATER CROSSING. DEPTH OF WATERMAIN TO BE CONFIRMED

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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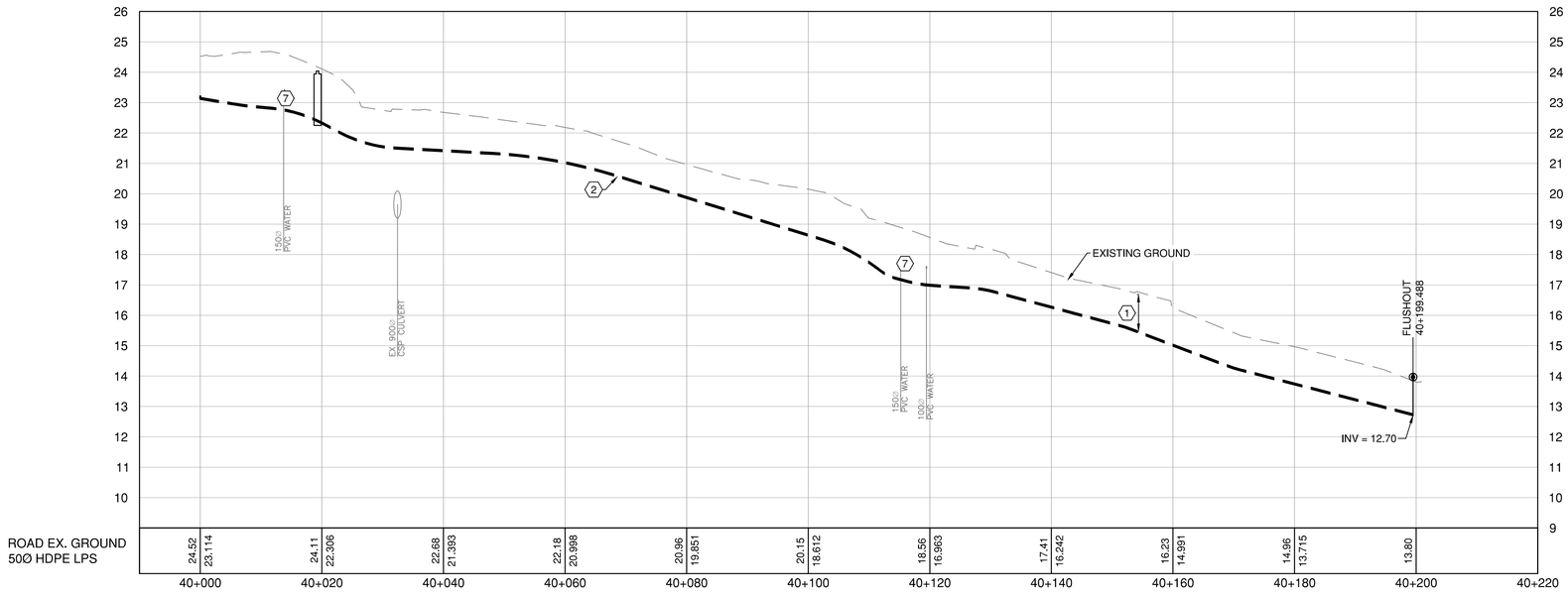
BOWSER, BC, CANADA

File Name: 00522_C130.DWG | Dwn. AF | Chkd. KP | Dsgn. AG | YY.MM.DD 16.10.31

Title
SANITARY MAIN COBURN RD
STA 30+000 TO 30+340

Project No. 111700522
Scale AS SHOWN
Drawing No. BV-C-131
Sheet
Revision 0



PROFILE

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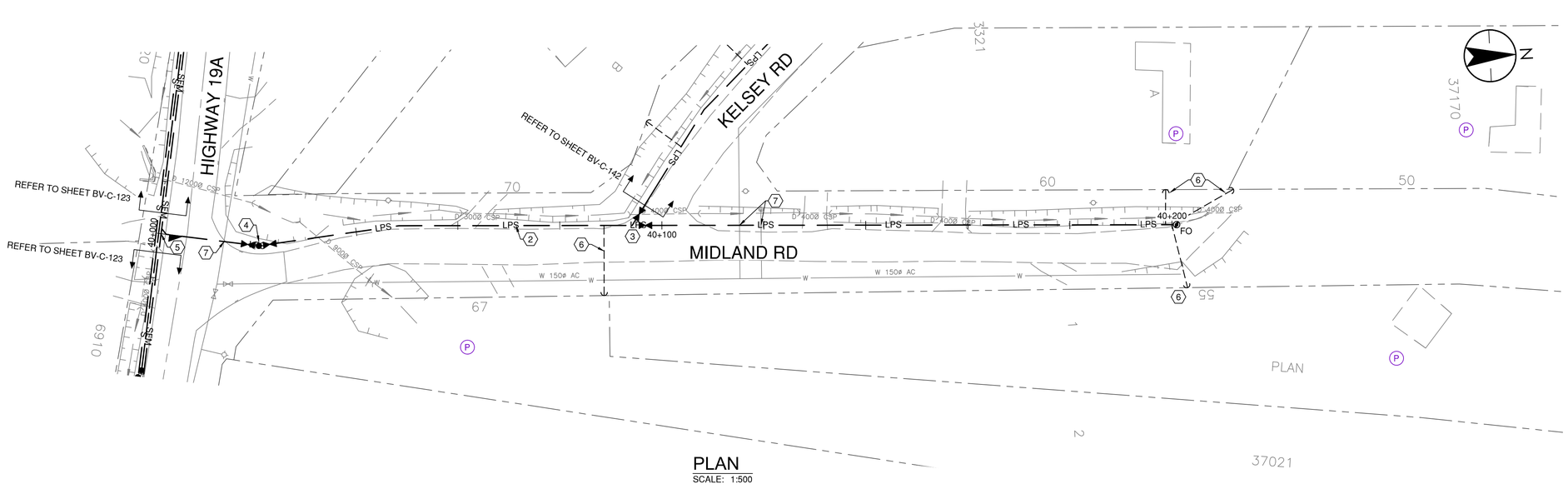

PLAN

SCALE: 1:500

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 50Ø HDPE LOW PRESSURE SEWER
3. 50x50x50 WYE
4. LPS VALVE ASSEMBLY - REFER TO DETAIL 1 SHEET C-202
5. 100x100x100 WYE WITH 100x50 REDUCER
6. 50Ø HDPE SANITARY PRESSURE SERVICE CONNECTION (TYP.) REFER TO DETAIL 1 SHEET C203.
7. 450mm MIN. SEPARATION AT WATER CROSSINGS. DEPTHS OF WATERMAINS TO BE CONFIRMED BY CONTRACTOR IN FIELD

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

1:500 0 5 15 25m

1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C140.DWG | Dwn. AF | Chkd. KP | Dsgn. AG | YY.MM.DD 16.10.31

Title
SANITARY MAIN MIDLAND RD
STA 40+000 TO 40+210

Project No. 111700522
Scale AS SHOWN
Drawing No. BV-C-141
Sheet of
Revision 0

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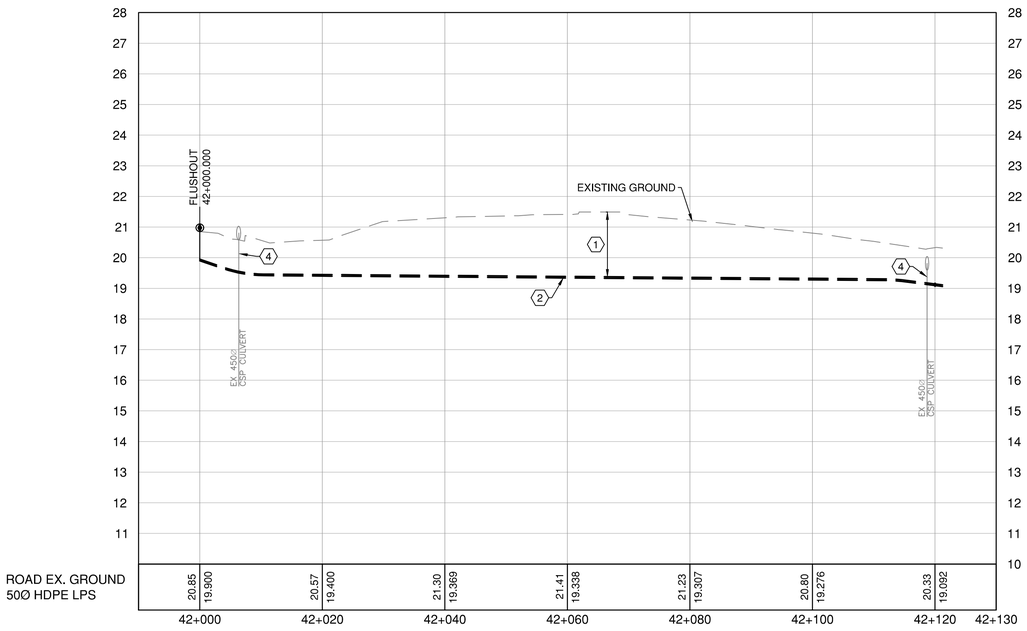

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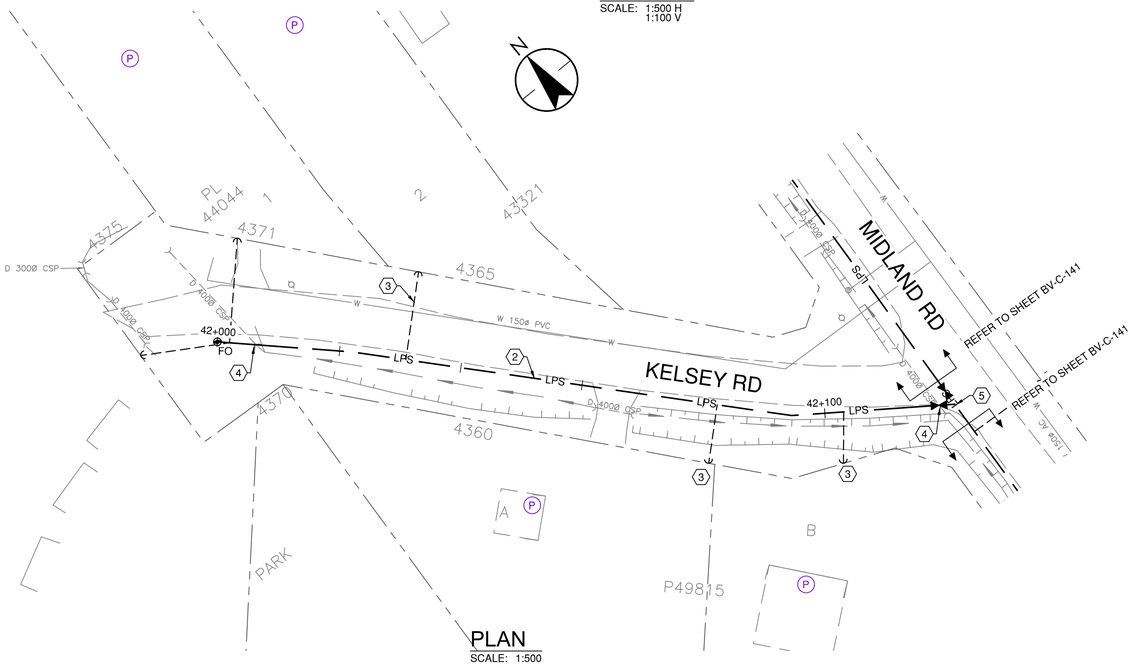

PLAN

SCALE: 1:500

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 50Ø HDPE LOW PRESSURE SEWER
3. 50Ø HDPE SANITARY PRESSURE SERVICE CONNECTION (TYP.) REFER TO DETAIL 1 SHEET C203.
4. MAINTAIN MIN. 450mm SEPARATION.
5. 50x50x50 HDPE WYE

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

1:500 0 5 15 25m

1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C140.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
SANITARY MAIN KELSEY RD
STA 42+000 TO 42+120

Project No.	Scale	
111700522	AS SHOWN	
Drawing No.	Sheet	Revision
BV-C-142	of	0

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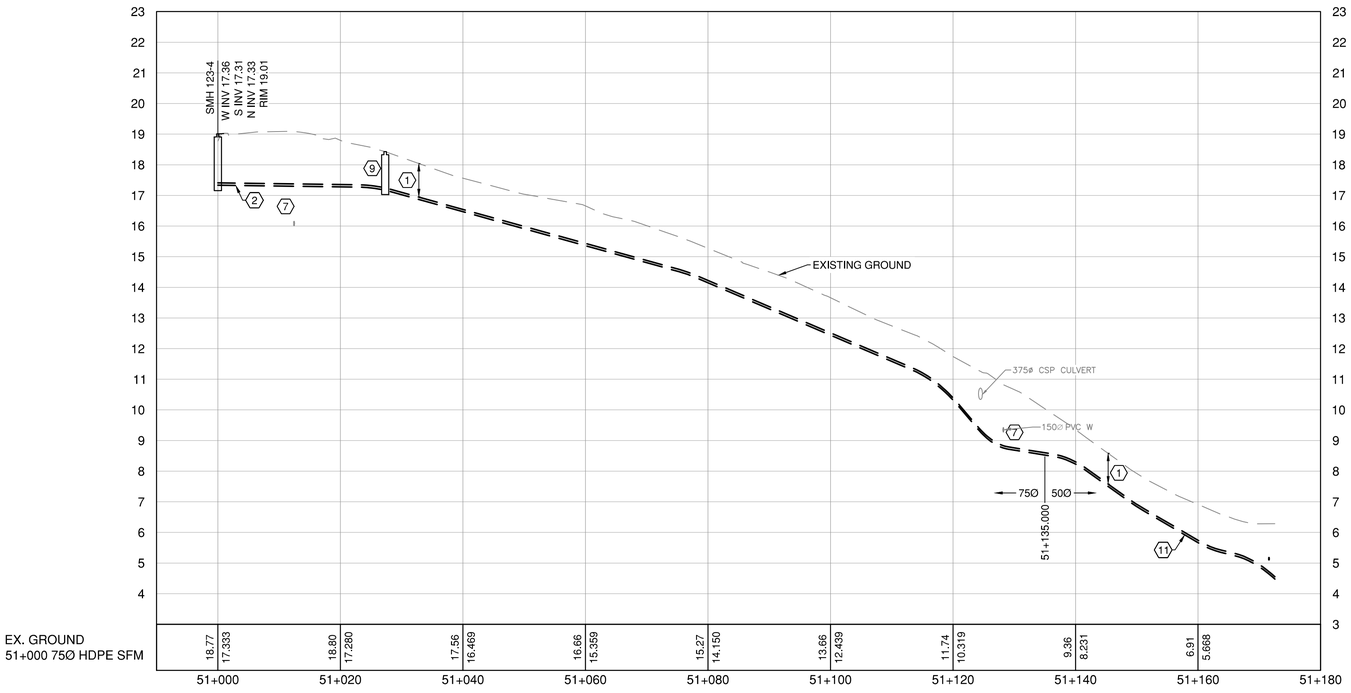

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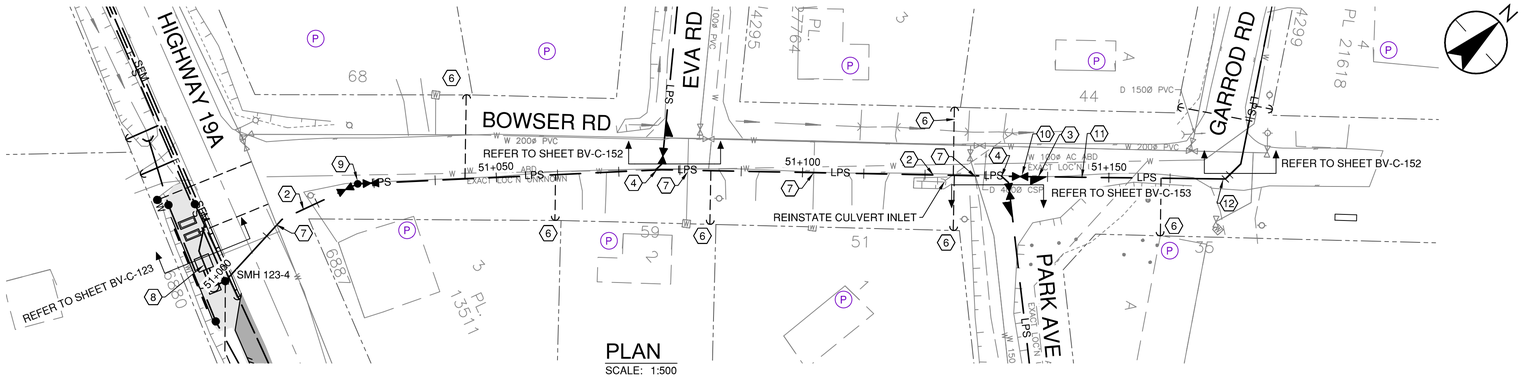
1:100 V



PLAN

SCALE: 1:500

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 75Ø HDPE LOW PRESSURE SEWER
3. 75x50 REDUCER
4. 75x75x75 WYE
5. 200Ø PVC SANITARY GRAVITY MAIN
6. 50Ø HDPE SANITARY PRESSURE SERVICE CONNECTION (TYP.) REFER TO DETAIL 1 SHEET C203.
7. 450mm MIN. SEPARATION AT WATER CROSSINGS
8. PUMP STATION - REFER TO SHEET C-203 FOR DETAILS
9. LPS VALVE ASSEMBLY - REFER TO DETAIL 1 SHEET C-202
10. 75 GATE VALVE
11. 50Ø HDPE LOW PRESSURE SEWER
12. 50Ø 45° BEND

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

1:500 0 5 15 25m

1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C150.DWG | AF Dwn. | KP Chkd. | AG Dsgn. | 16.10.31 YY.MM.DD

Title
SANITARY MAIN BOWSER RD
STA 50+000 TO 50+200

Project No. 111700522
Scale AS SHOWN
Drawing No. BV-C-151
Sheet of
Revision 0

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1/10/2019 9:29 AM HLEE

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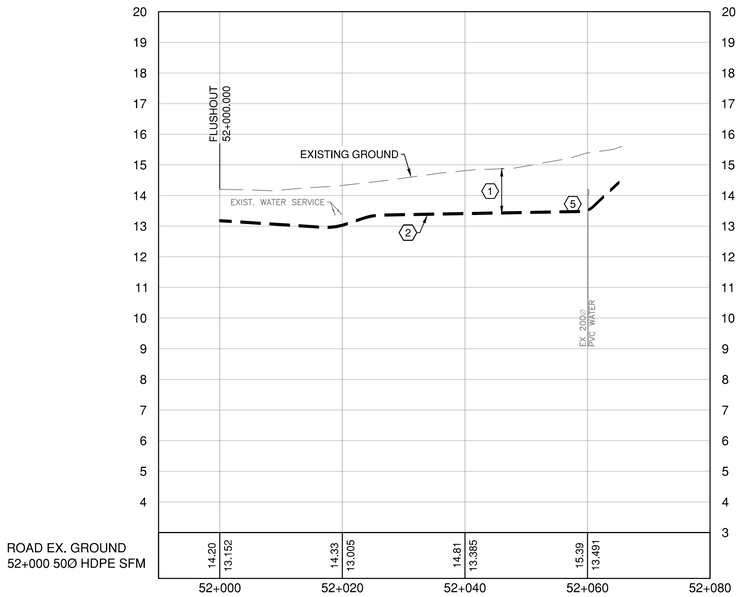
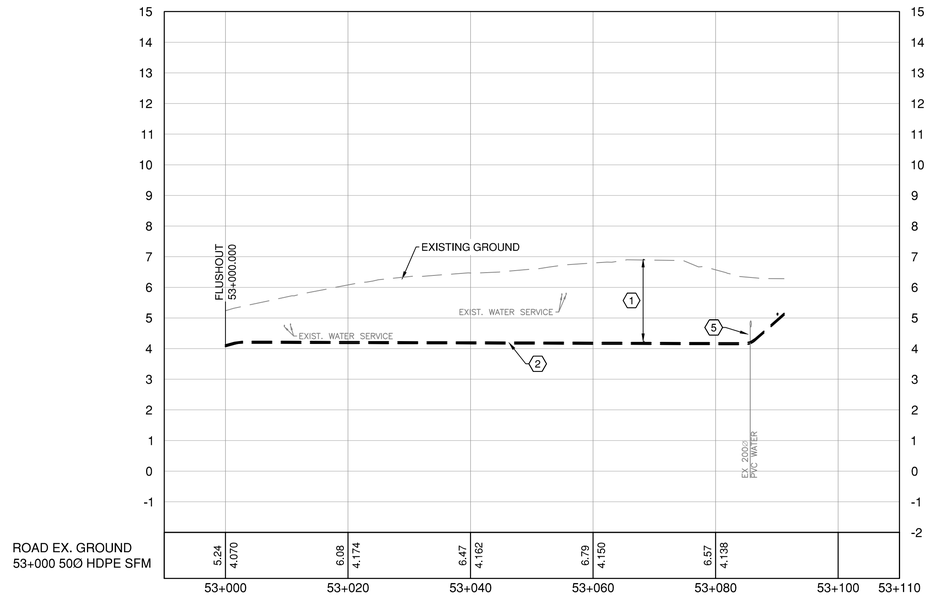


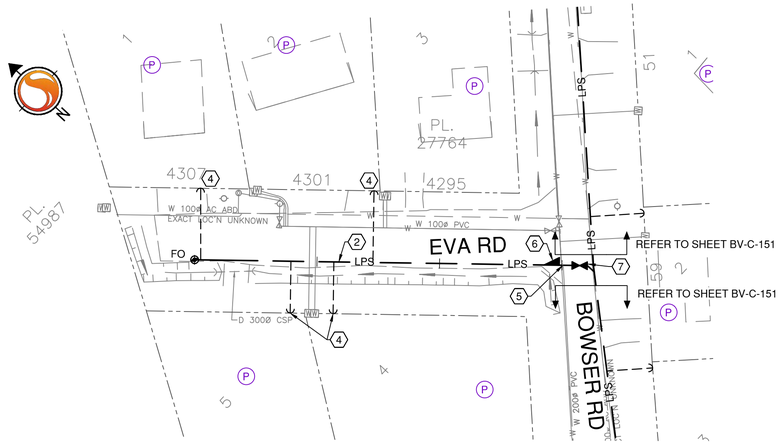
E□A RD PROFILE

SCALE: 1:500 H
1:100 V



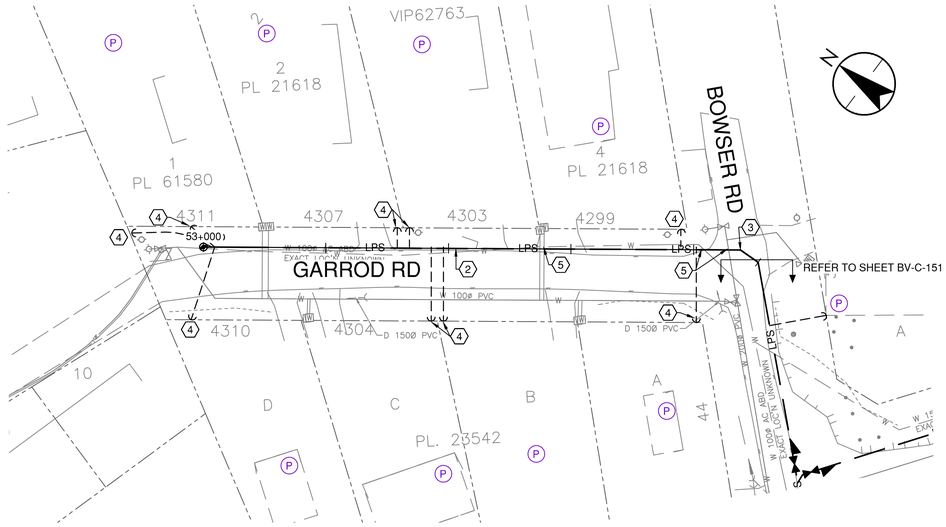
GARROD RD PROFILE

SCALE: 1:500 H
1:100 V



E□A RD PLAN

SCALE: 1:500



GARROD RD PLAN

SCALE: 1:500

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 50Ø HDPE LOW PRESSURE SEWER
3. 1 - 50Ø 11.25° BEND
4. 50Ø HDPE SANITARY PRESSURE SERVICE CONNECTION (TYP.) REFER TO DETAIL 1 SHEET C203.
5. 450mm MIN. SEPARATION AT WATER CROSSINGS
6. 75x50 REDUCER
7. 75 GATE VALVE

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

1:500 0 5 15 25m
1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C150.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
SANITARY MAINS EVA RD AND GARROD RD

Project No.	Scale	
111700522	AS SHOWN	
Drawing No.	Sheet	Revision
BV-C-152	of	0

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1/10/2019 9:30 AM HLEE

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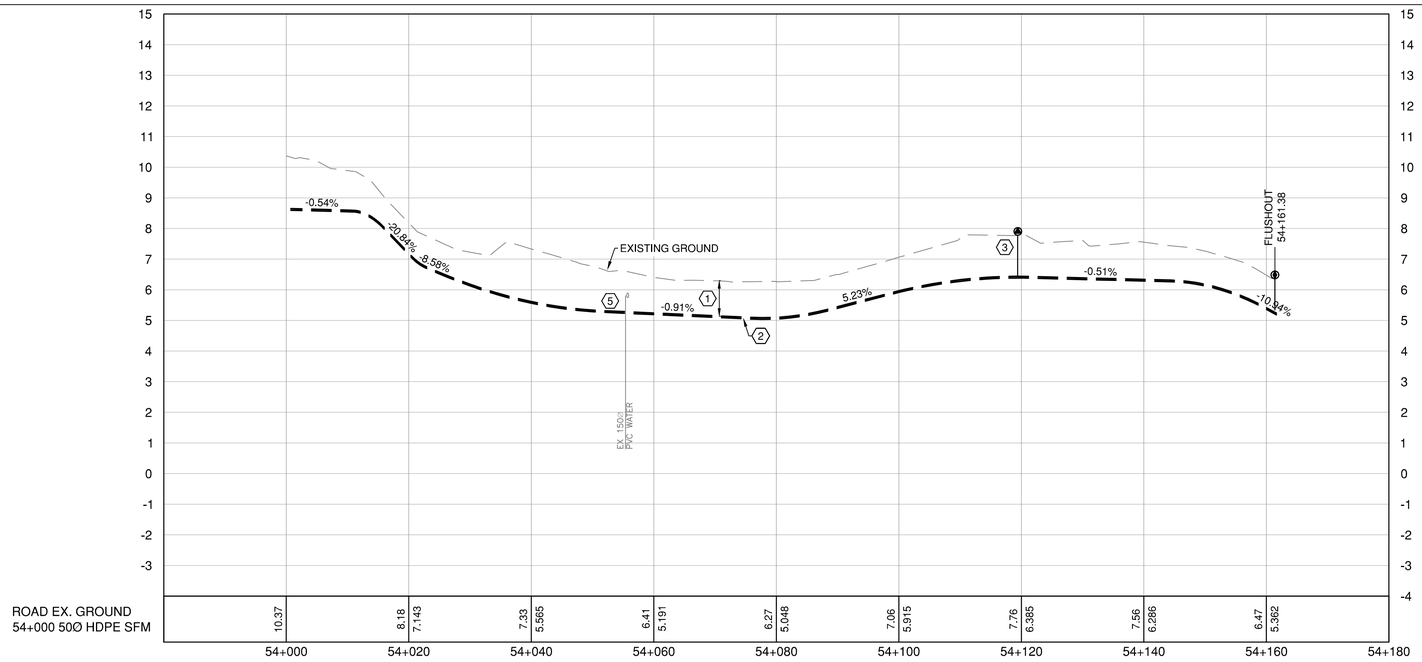

PROFILE

SCALE: 1:500 H
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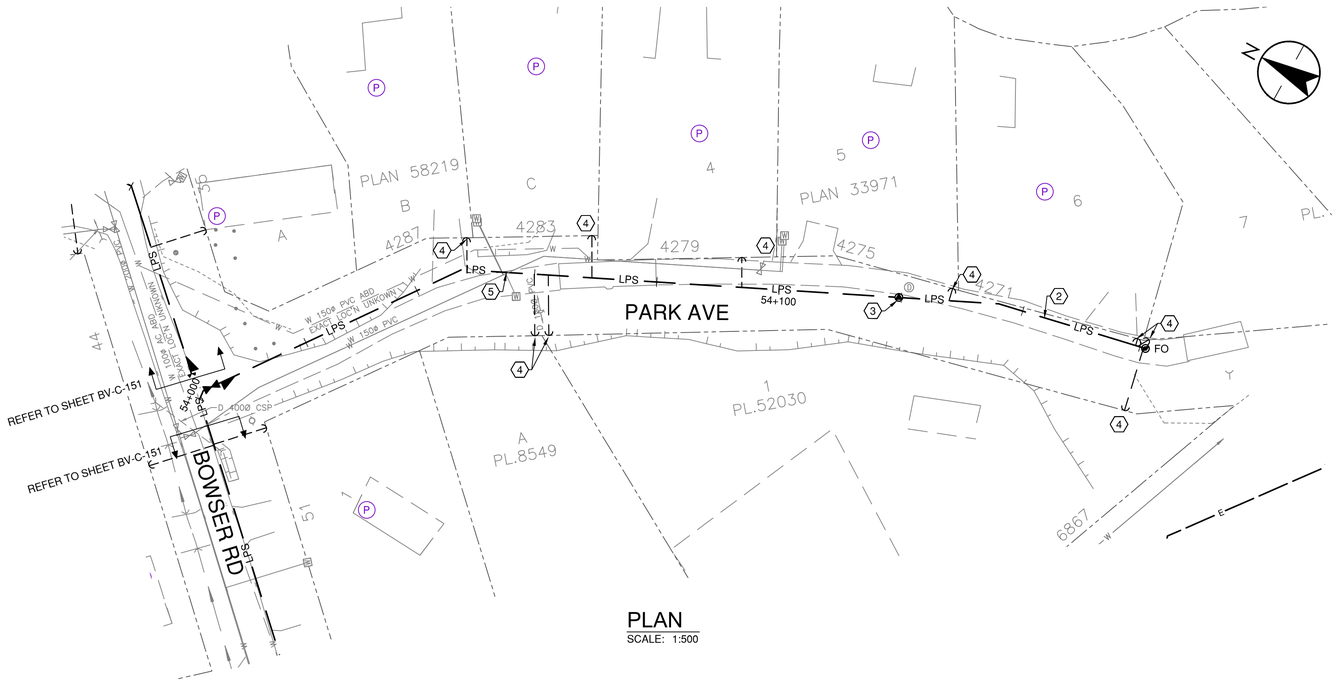

PLAN

SCALE: 1:500

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 50Ø HDPE LOW PRESSURE SEWER
3. AIR RELEASE VALVE - REFER TO DETAIL 8 SHEET C203.
4. 50Ø HDPE SANITARY PRESSURE SERVICE CONNECTION (TYP.) REFER TO DETAIL 1 SHEET C203.
5. 450mm MIN. SEPARATION AT WATER CROSSINGS

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

1:500 0 5 15 25m
1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C150.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
SANITARY MAIN PARK AVE
54+000 TO 54+160

Project No.	Scale	
111700522	AS SHOWN	
Drawing No.	Sheet	Revision
BV-C-153	of	0

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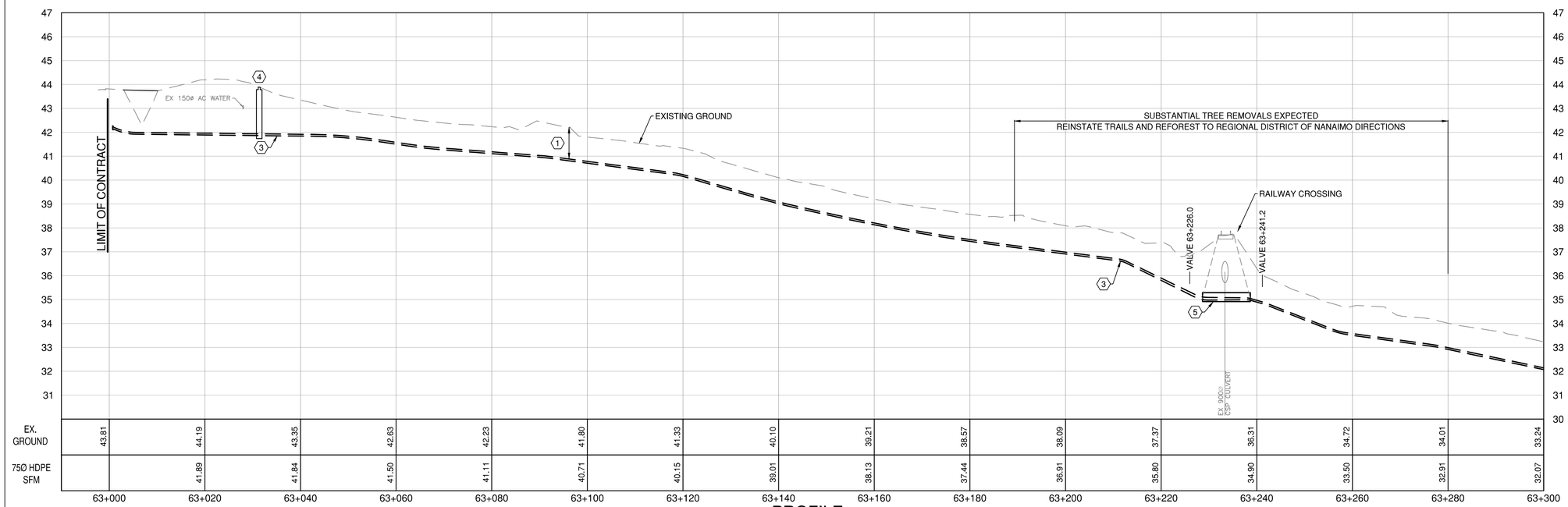
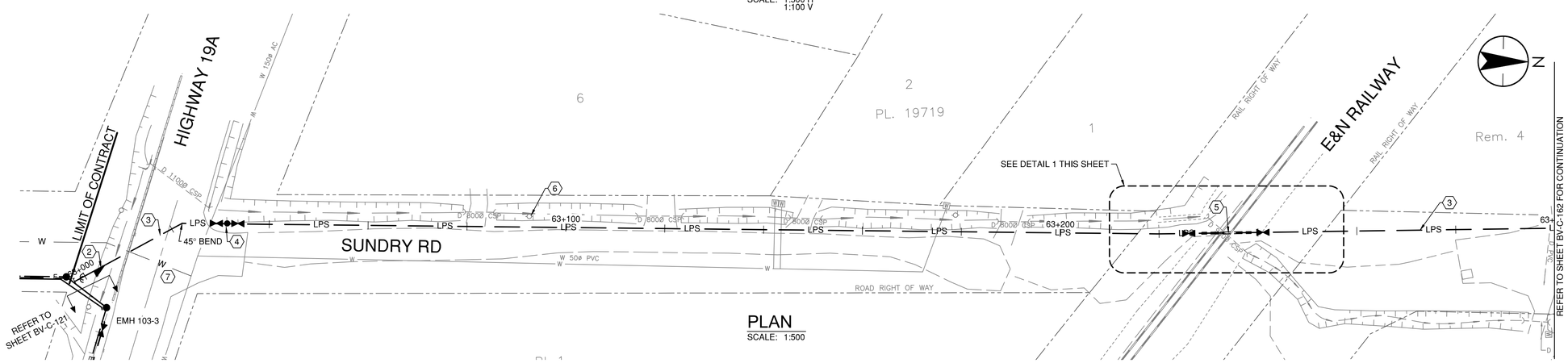


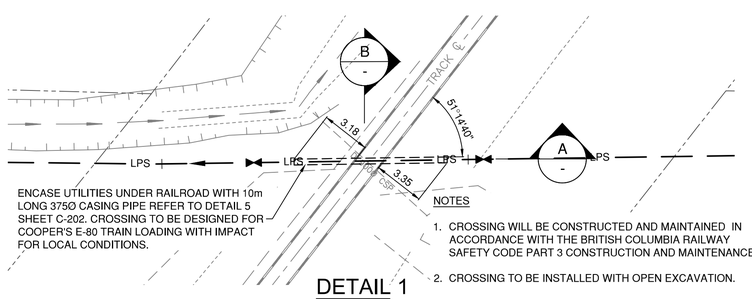
PROFILE
SCALE: 1:500 H
1:100 V

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 100x75 REDUCER
3. 75Ø HDPE LOW PRESSURE SEWER
4. LPS VALVE ASSEMBLY REFER TO DETAIL 1 SHEET C-202
5. ENCASE UTILITIES UNDER RAILROAD WITH 10m - 375Ø CASING PIPE. REFER TO DETAIL 5 SHEET C-202. INSTALL 2 - 75Ø FxF VALVES ON MAIN
6. POLE LOCATIONS SHOWN ARE APPROXIMATE ONLY.
7. FUTURE WATER CONNECTION (NOT IN CONTRACT).



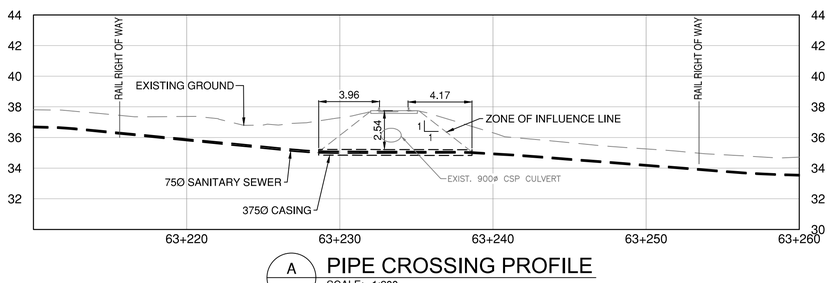
PLAN
SCALE: 1:500



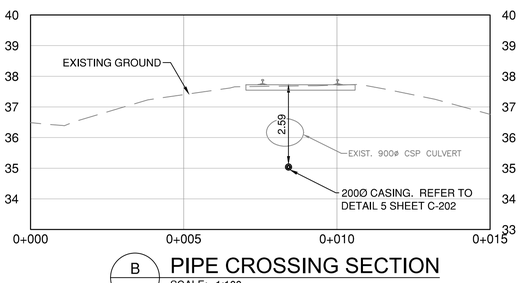
NOTES

1. CROSSING WILL BE CONSTRUCTED AND MAINTAINED IN ACCORDANCE WITH THE BRITISH COLUMBIA RAILWAY SAFETY CODE PART 3 CONSTRUCTION AND MAINTENANCE.
2. CROSSING TO BE INSTALLED WITH OPEN EXCAVATION.

DETAIL 1
SCALE: 1:200



A
PIPE CROSSING PROFILE
SCALE: 1:200



B
PIPE CROSSING SECTION
SCALE: 1:100

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC ONE CALL 1-800-474-6886

1:500 0 5 15 25m
1:200 0 2 6 10m
1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C160.DWG | AF Dwn. | KP Chkd. | AG Dsgn. | 16.10.31 YY.MM.DD

Title
SANITARY MAIN SUNDRY RD
STA 63+000 TO 63+300

Project No. 111700522
Scale AS SHOWN
Drawing No. BV-C-161
Sheet
Revision 0
of

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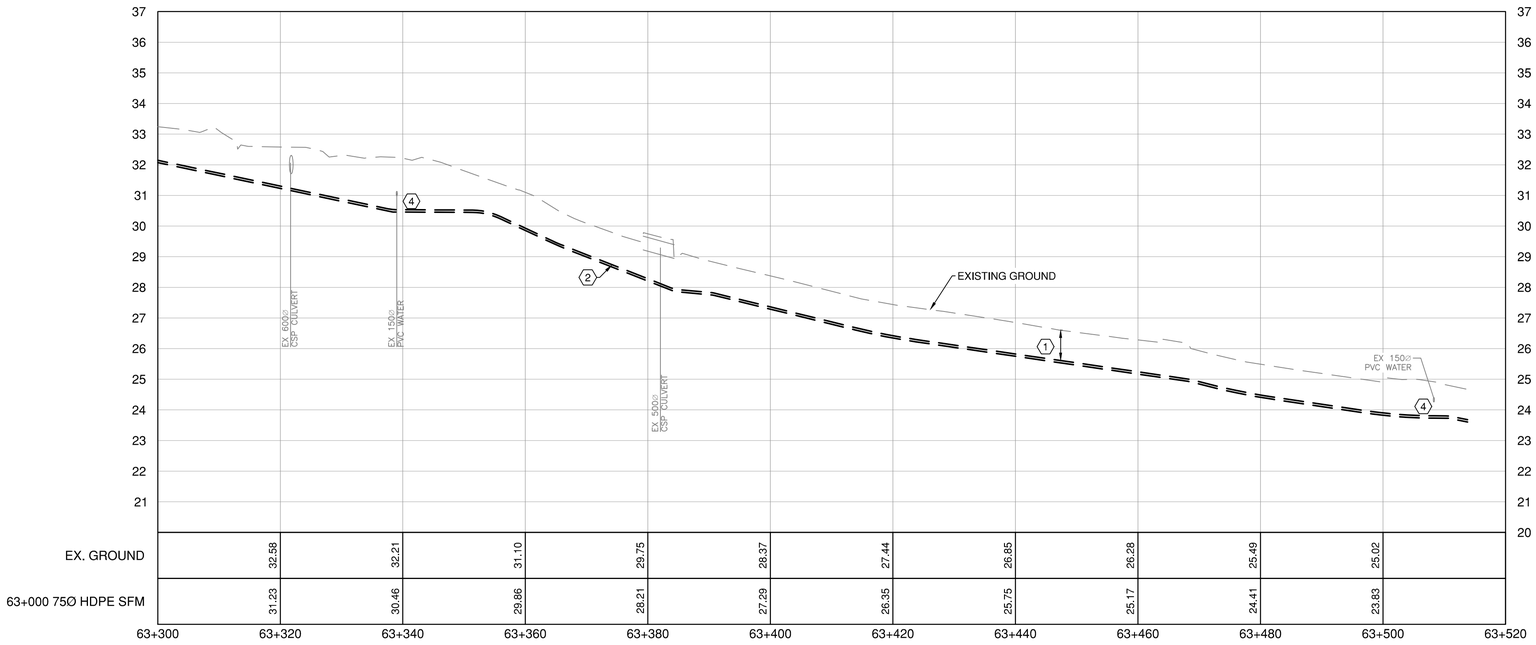

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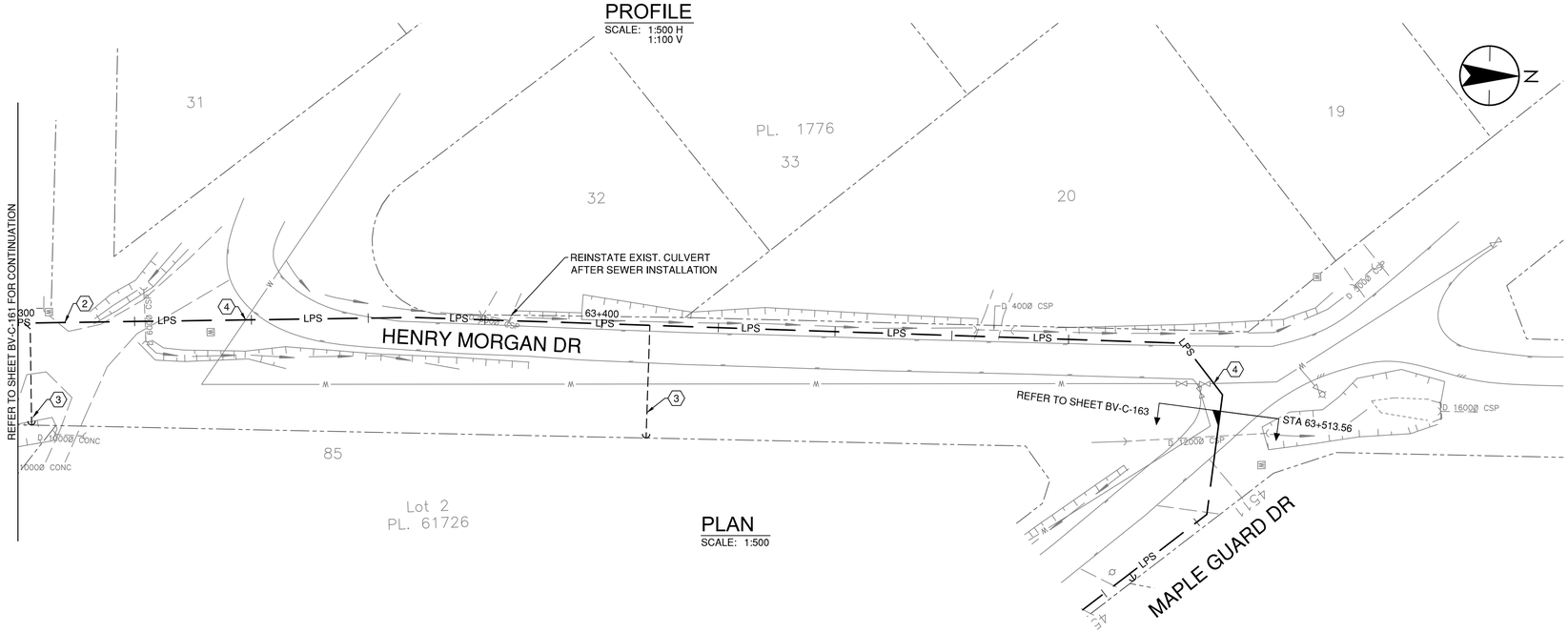

PLAN
SCALE: 1:500

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 75Ø HDPE LOW PRESSURE SEWER
3. 50Ø HDPE SANITARY PRESSURE SERVICE CONNECTION (TYP.) REFER TO DETAIL 1 SHEET C203.
4. MIN. 450mm SEPARATION AT WATERMAIN CROSSING. DEPTH OF WATERMAIN TO BE CONFIRMED BY CONTRACTOR IN FIELD

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

1:500 0 5 15 25m
1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C160.DWG | Dwn. AF | Chkd. KP | Dsgn. AG | YY.MM.DD 16.10.31

Title
SANITARY MAIN HENRY MORGAN DR STA 63+300 TO 63+500

Project No. 111700522
Scale AS SHOWN
Drawing No. BV-C-162
Sheet of
Revision 0

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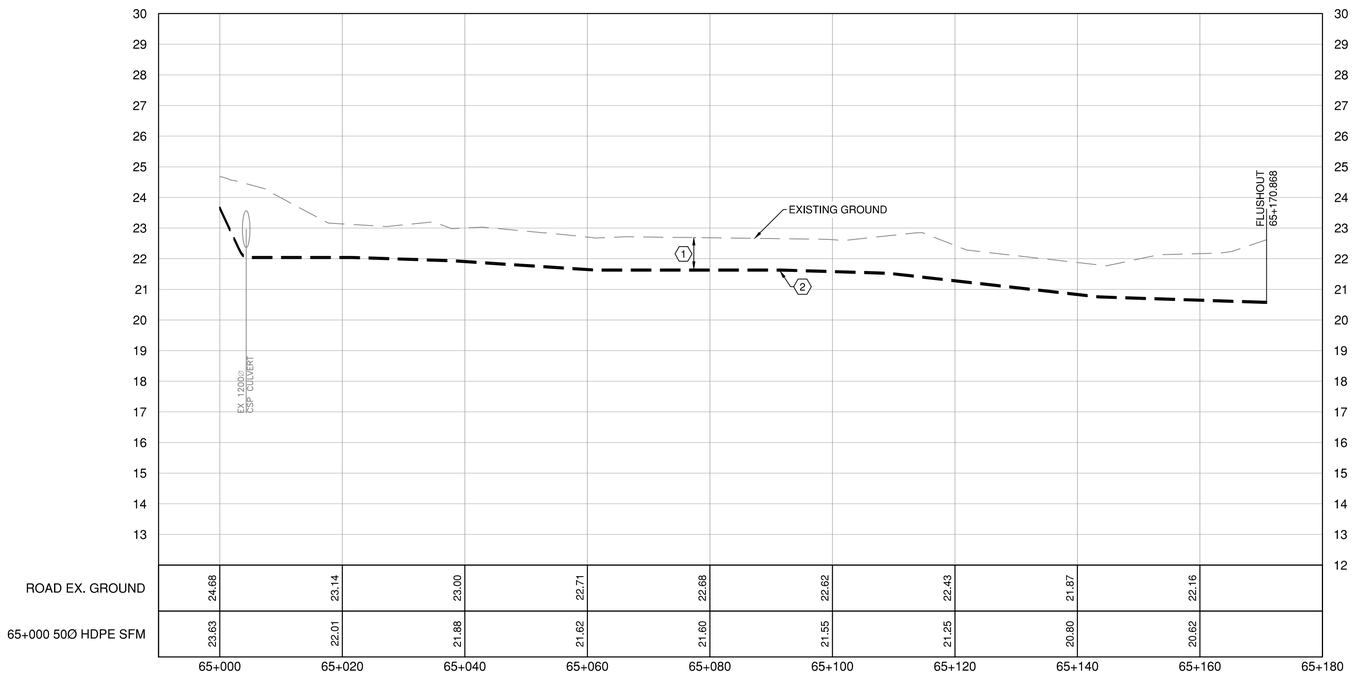

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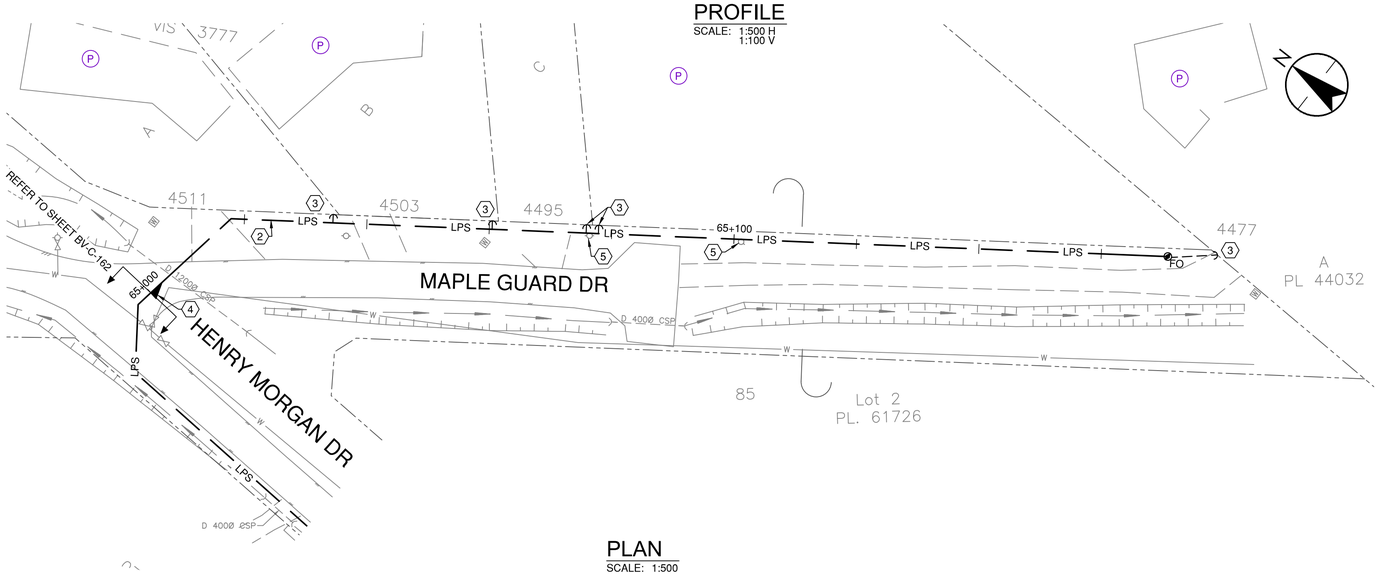

PLAN
SCALE: 1:500

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 50Ø HDPE LOW PRESSURE SEWER
3. 50Ø HDPE SANITARY PRESSURE SERVICE CONNECTION (TYP)
4. 75x50 REDUCER
5. POLE SUPPORT REQUIRED IF EXCAVATION IS WITHIN THE SOIL FOUNDATION INTERACTION ZONE. REFER TO DETAIL 3 SHEET C-202. POLE LOCATIONS SHOWN ARE APPROXIMATE ONLY.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

1:500 0 5 15 25m
1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER, BC, CANADA

File Name: 00522_C160.DWG | Dwn. AF | Chkd. KP | Dsgn. AG | YY.MM.DD 16.10.31

Title
SANITARY MAIN MAPLE GUARD DR STA 65+000 TO 65+170

Project No. 111700522
Scale AS SHOWN
Drawing No. BV-C-163
Sheet of
Revision 0

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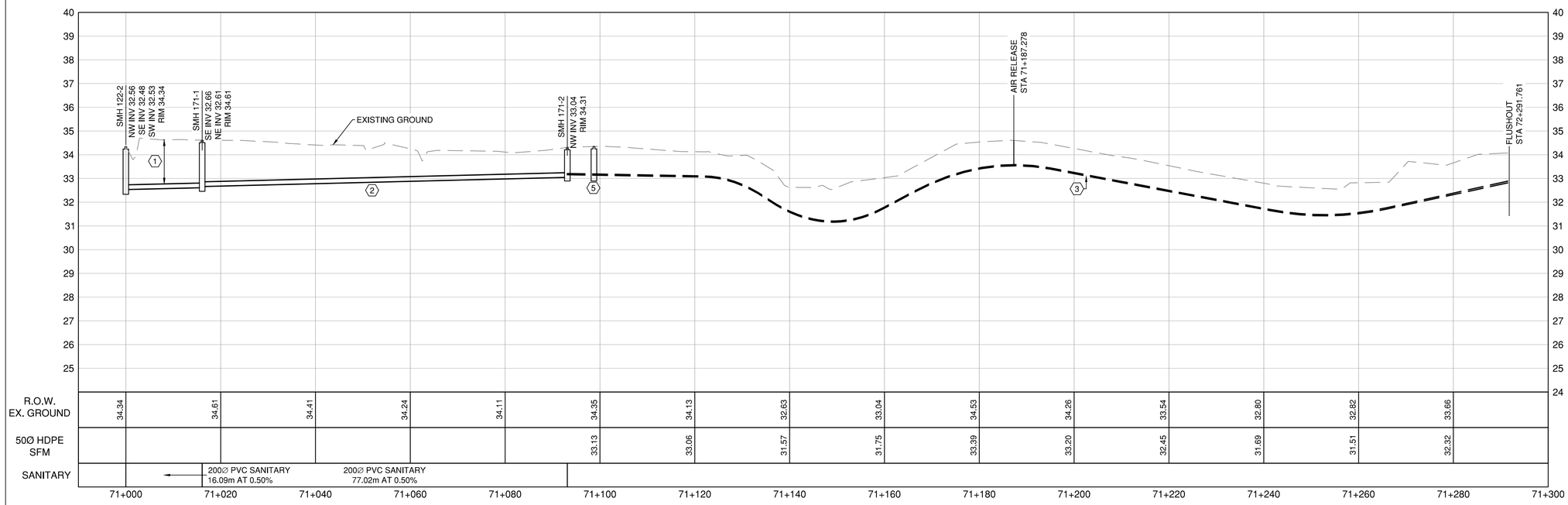

PROFILE
SCALE: 1:500 H
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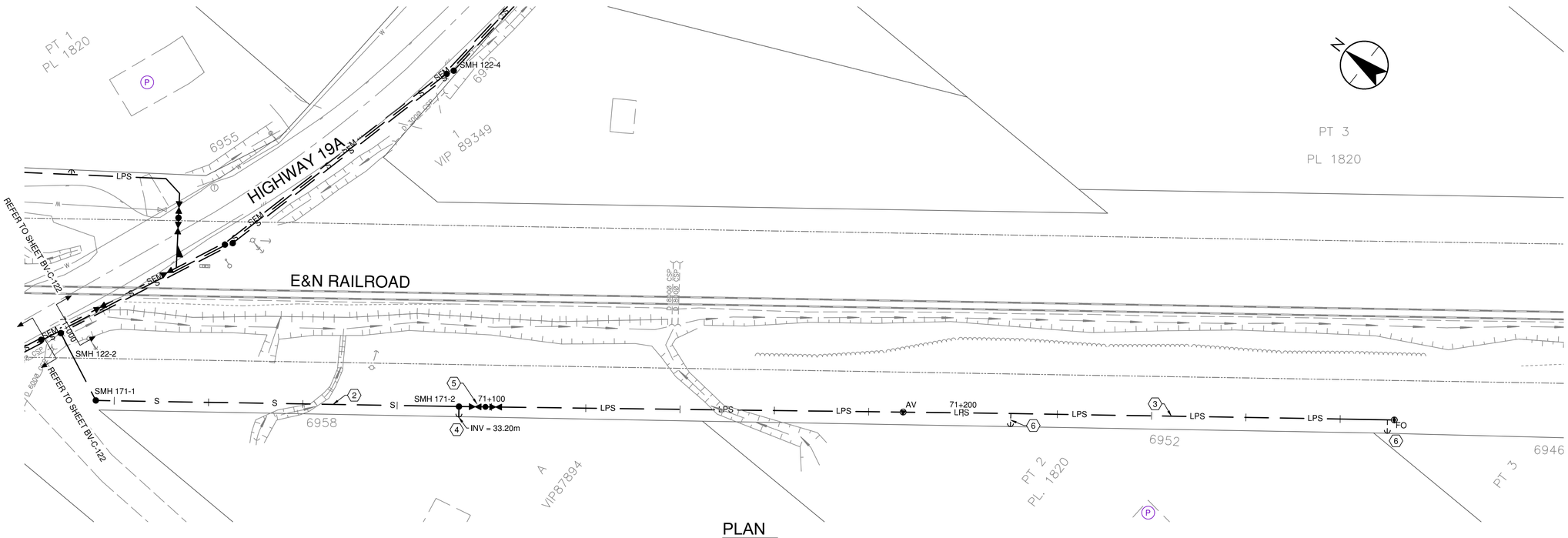
CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 200Ø PVC SANITARY GRAVITY MAIN
3. 50Ø HDPE LOW PRESSURE SEWER
4. 100Ø PVC SANITARY SERVICE CONNECTION (TYP.) INVERTS SHOWN ARE AT PROPERTY LINE
5. LPS VALVE ASSEMBLY - REFER TO DETAIL 1 SHEET C-202
6. 50Ø HDPE SANITARY PRESSURE SERVICE CONNECTION (TYP.)



PLAN
SCALE: 1:500

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

1:500 0 5 15 25m
1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C170.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
SANITARY MAIN E&N RAILROAD
STA 71+000 TO 71+290

Project No.	Scale	
111700522	AS SHOWN	
Drawing No.	Sheet	Revision
BV-C-171	of	0

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1/10/2019 9:31 AM HLEE

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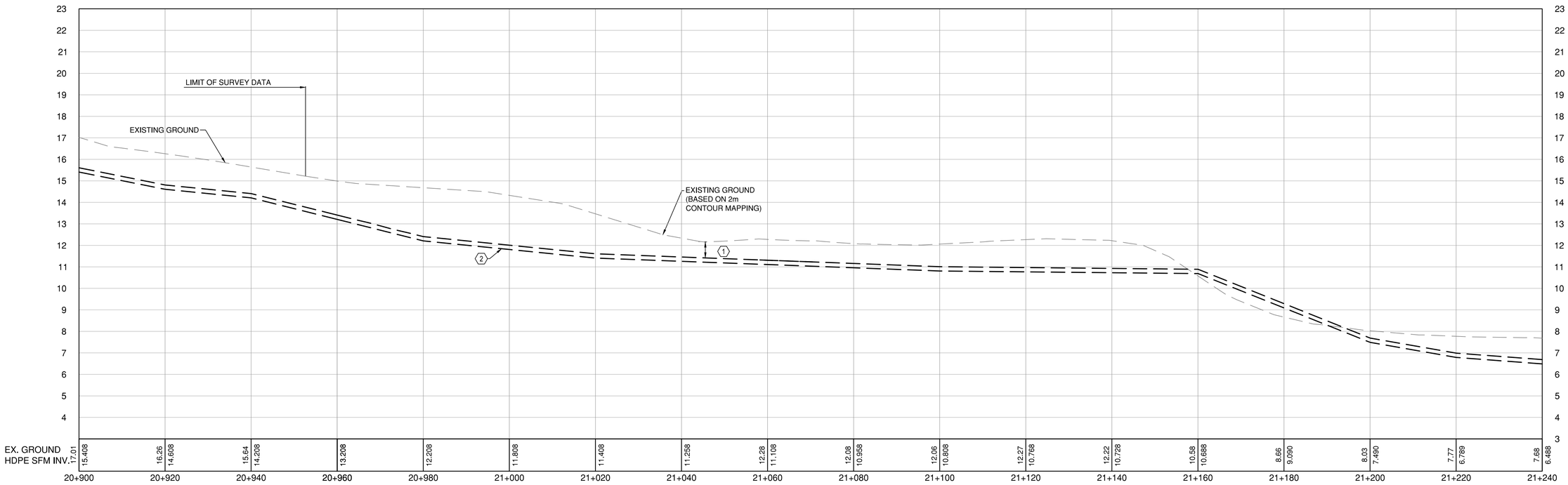

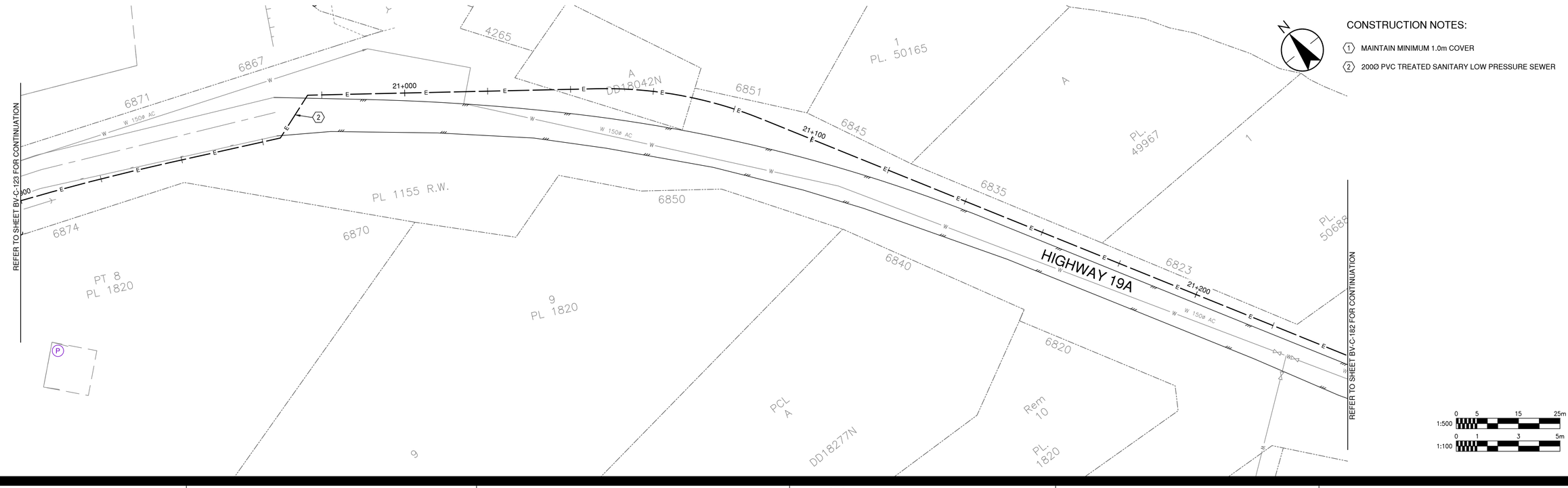

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 200Ø PVC TREATED SANITARY LOW PRESSURE SEWER

1:500 0 5 15 25m

1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	19.01.11
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION

BOWSER, BC, CANADA

File Name: 00522_C190.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title

SANITARY MAIN HIGHWAY 19A STA 20+900 TO 21+240

Project No.	Scale	
111700522	AS SHOWN	
Drawing No.	Sheet	Revision
BV-C-181	of	0

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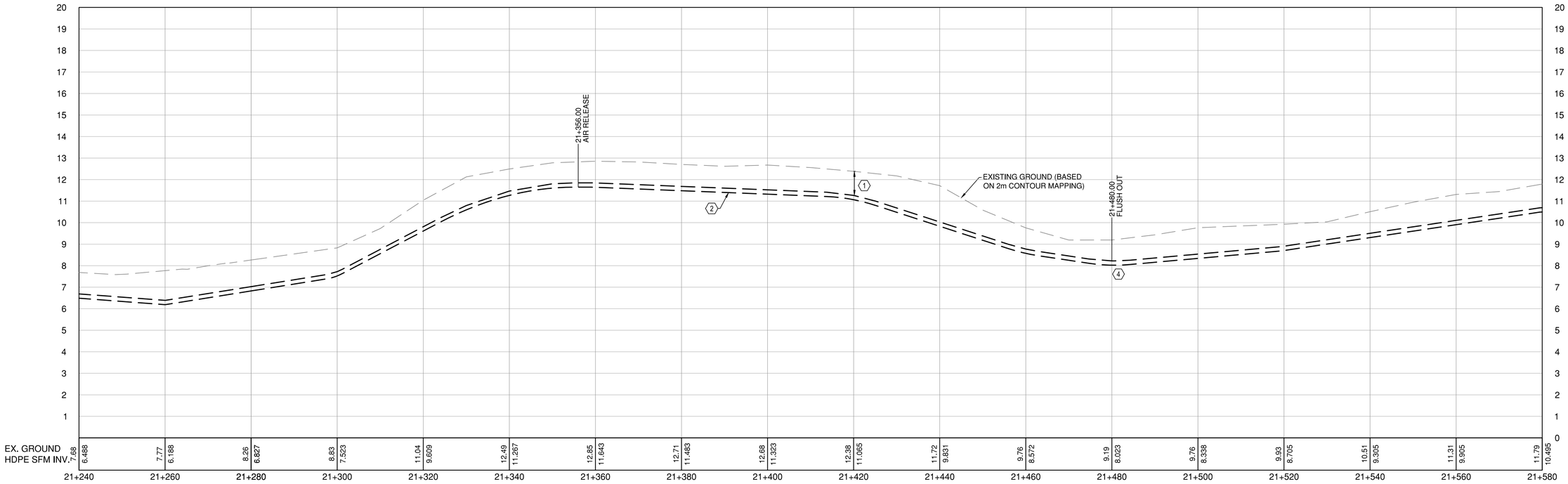

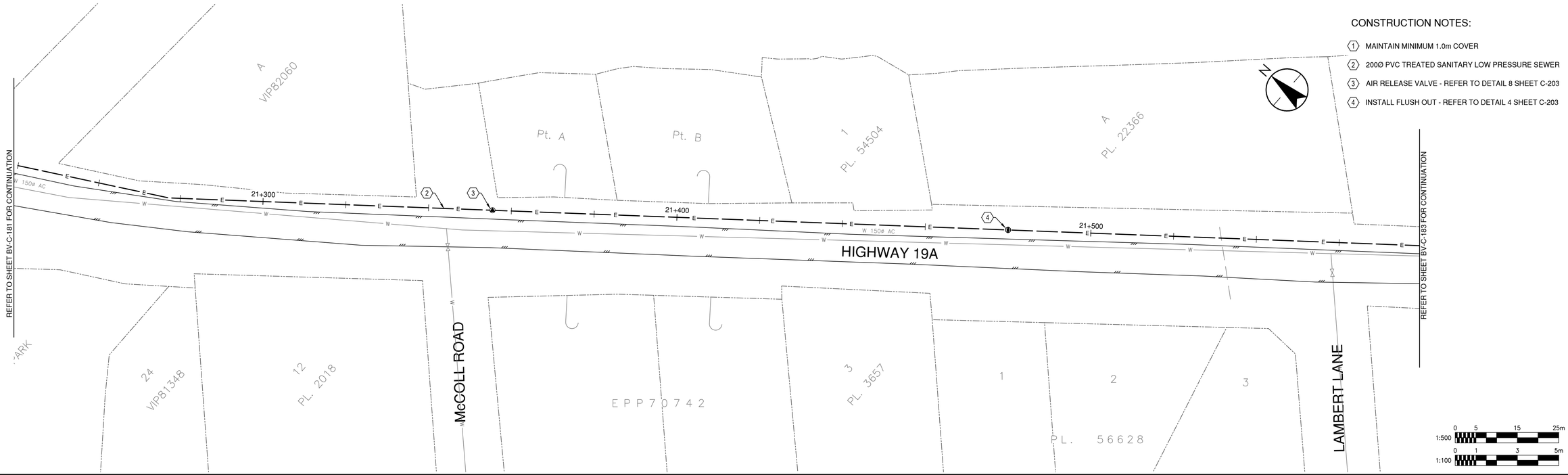

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 200Ø PVC TREATED SANITARY LOW PRESSURE SEWER
3. AIR RELEASE VALVE - REFER TO DETAIL 8 SHEET C-203
4. INSTALL FLUSH OUT - REFER TO DETAIL 4 SHEET C-203

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	19.01.11
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM
COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C190.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
SANITARY MAIN HIGHWAY 19A
STA 21+240 TO 21+580

Project No.	Scale	
111700522	AS SHOWN	
Drawing No.	Sheet	Revision
BV-C-182	of	0

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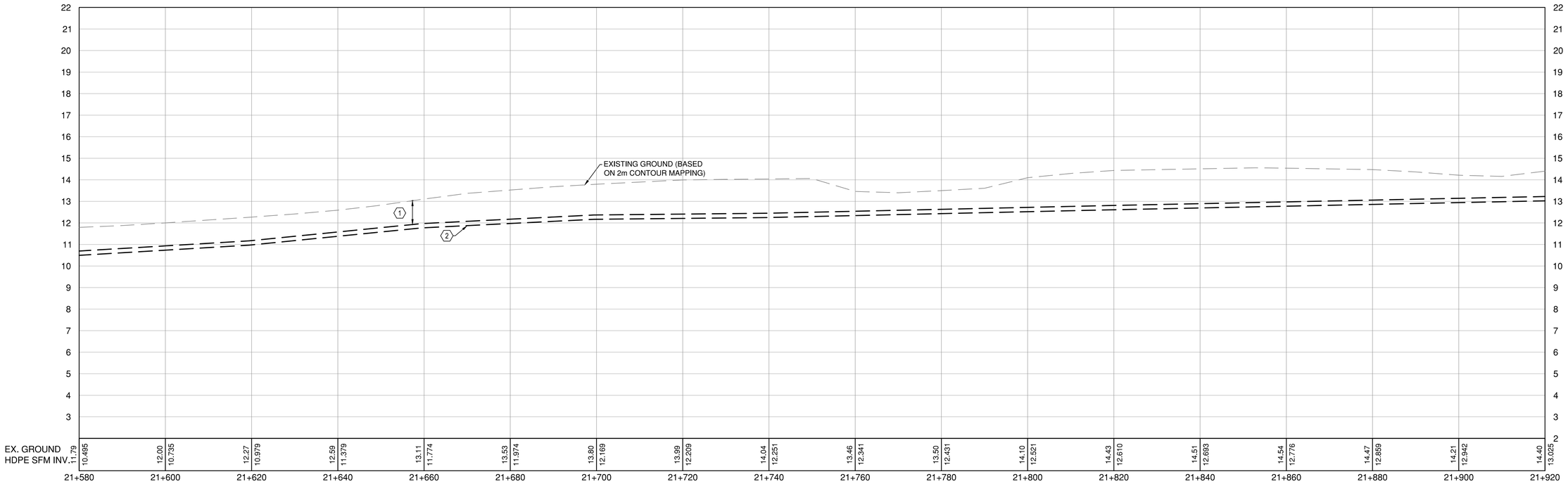
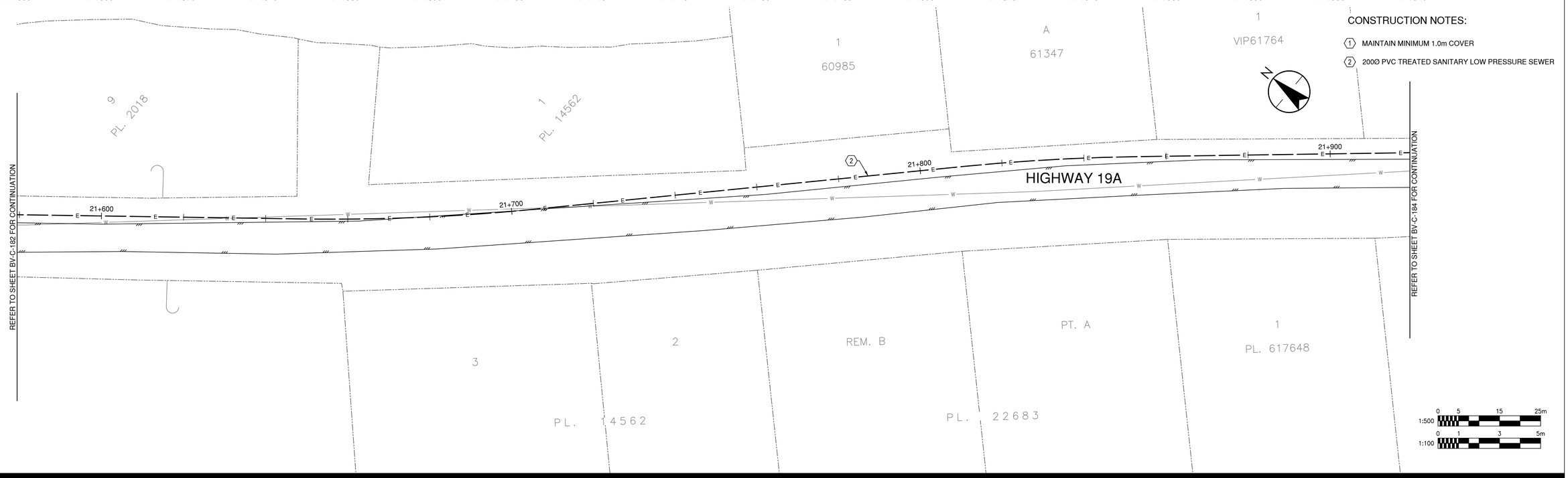
1/15/2019 9:25 AM HLEE

ORIGINAL SHEET - ISO A1





CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 200Ø PVC TREATED SANITARY LOW PRESSURE SEWER

0 5 15 25m
1:500

0 1 3 5m
1:100

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	19.01.11
Issued	By	Appd.	YY.MM.DD

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BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

File Name: 00522_C190.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
SANITARY MAIN HIGHWAY 19A
STA 21+580 TO 21+920

Project No.	Scale	
111700522	AS SHOWN	
Drawing No.	Sheet	Revision
BV-C-183	of	0

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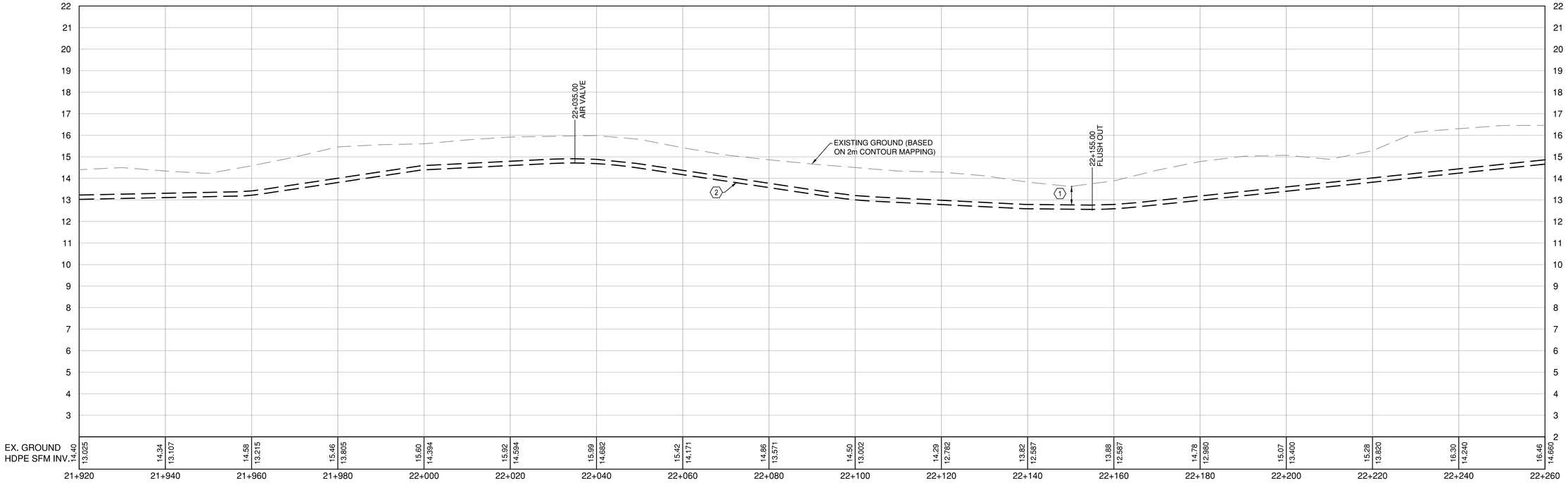

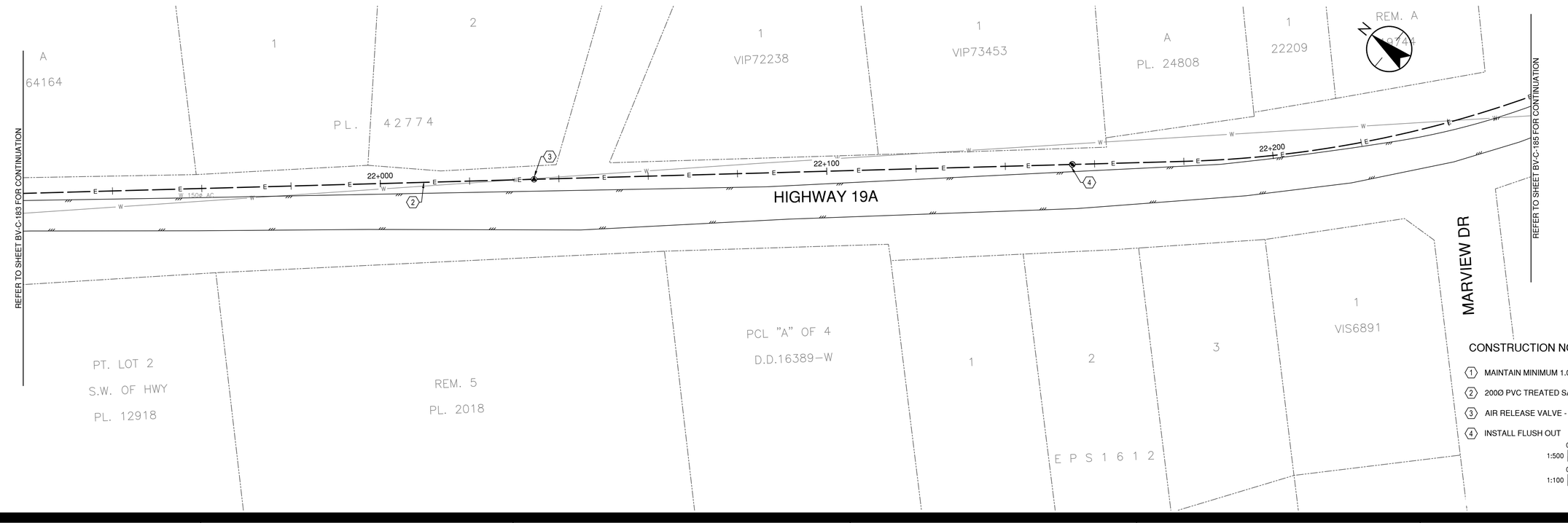

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 200Ø PVC TREATED SANITARY LOW PRESSURE SEWER
3. AIR RELEASE VALVE - REFER TO DETAIL 7 SHEET C-203
4. INSTALL FLUSH OUT

1:500 0 5 15 25m

1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	19.01.11
Issued	By	Appd.	YY.MM.DD

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File Name: 00522_C190.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
SANITARY MAIN HIGHWAY 19A
STA 21+920 TO STA 22+260

Project No.	Scale	
111700522	AS SHOWN	
Drawing No.	Sheet	Revision
BV-C-184	of XX	0

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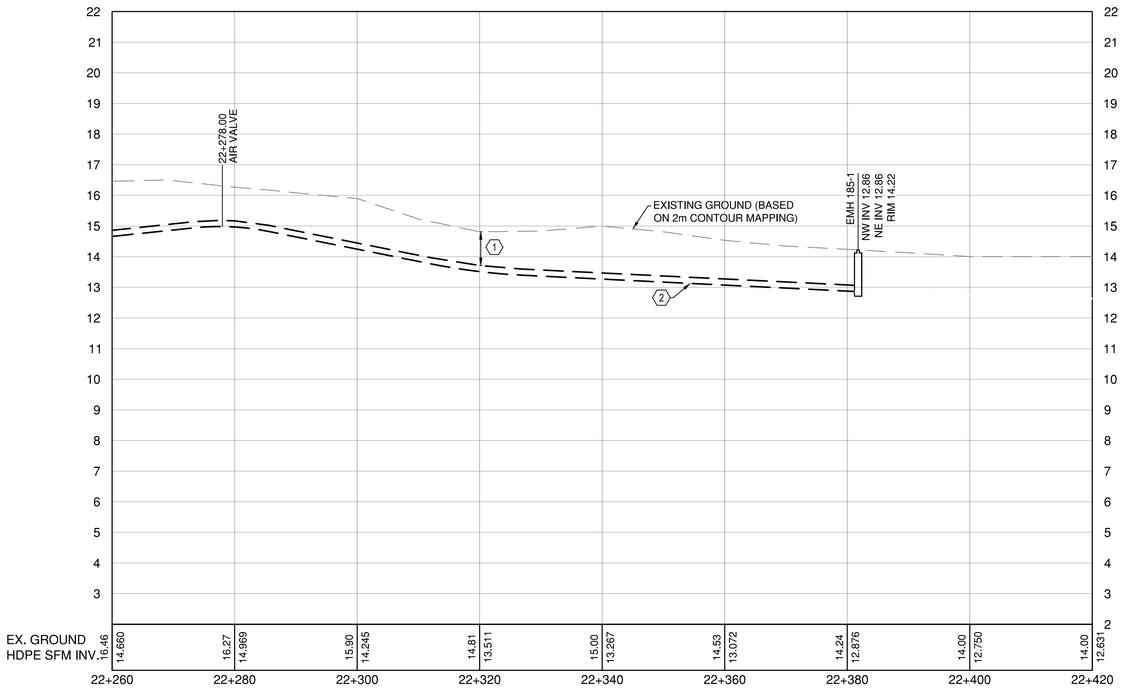

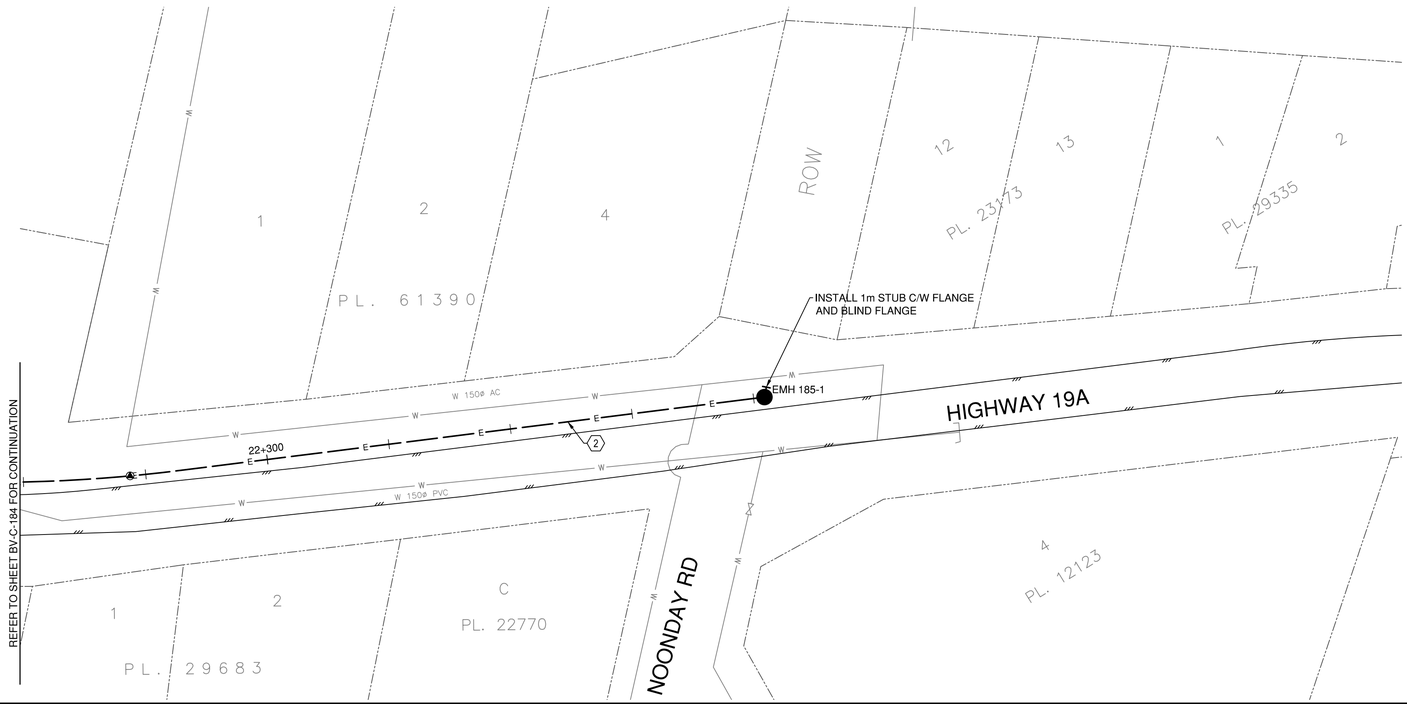

CONSTRUCTION NOTES:

1. MAINTAIN MINIMUM 1.0m COVER
2. 200Ø PVC TREATED SANITARY LOW PRESSURE SEWER

1:500 0 5 15 25m

1:100 0 1 3 5m

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	19.01.11
Issued	By	Appd.	YY.MM.DD

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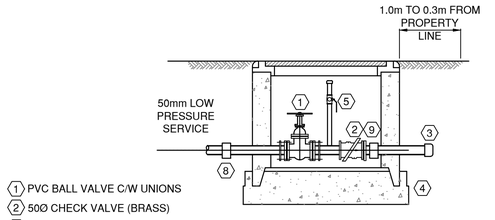
File Name: 00522_C190.DWG	AF	KP	AG	16.10.31
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
SANITARY MAIN HIGHWAY 19A
STA 22+260 TO 22+382

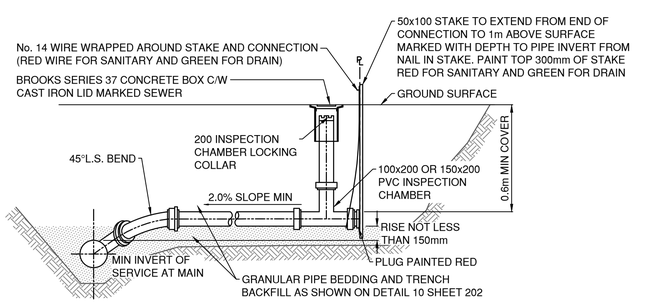
Project No.	Scale	
111700522	AS SHOWN	
Drawing No.	Sheet	Revision
BV-C-185	of	0

ORIGINAL SHEET - ISO A1



1. PVC BALL VALVE C/W UNIONS
2. 50Ø CHECK VALVE (BRASS)
3. LEAVE SUFFICIENT ROOM FOR CAP REMOVAL AND 50 EXTENSION TO ON SITE PUMP UNIT
4. 900Ø MANHOLE BARREL C/W MANHOLE FRAME AND COVER
5. 12Ø STEM VALVE AND CAP C/W 500x12Ø TEE (FOR PRESSURE TESTING)
6. ALL PIPE IN AND OUT TO BE SCHEDULE 80 PVC
7. VALVING TO BE PVC BALL VALVE AND NON FREEZING OR INSULATED
8. CEBEX COMPRESSION FITTING (HDPE) AND FEMALE IPT
9. UNION WITH TWO FEMALE IPT

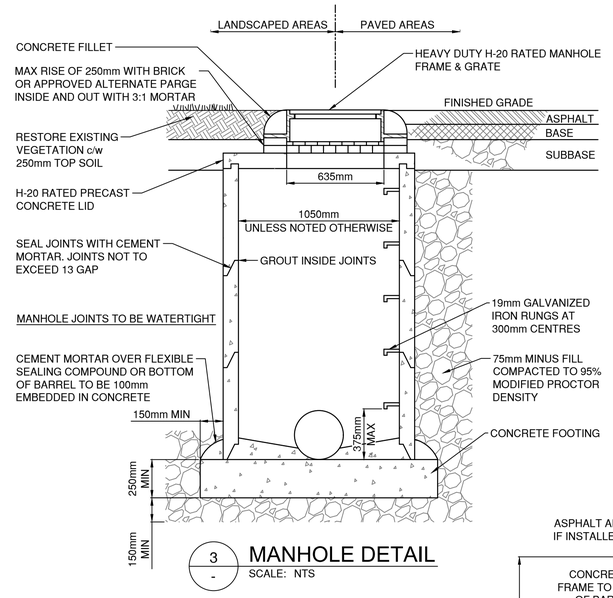
1 - LOW PRESSURE SER□ICE CONNECTION DETAIL
SCALE: NTS



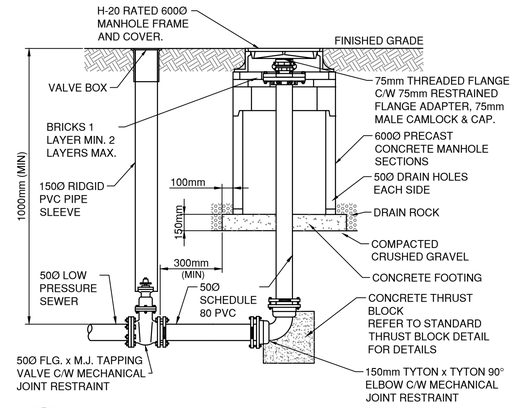
NOTES:

1. STANDARD SANITARY CONNECTIONS TO BE 100Ø
2. MINIMUM COVER OF EARTH OVER PIPE - 0.6m
3. CLASS B BEDDING FOR PIPE.
4. POSITION OF ALL TEES & WYES TO BE MEASURED & RECORDED BY CONTRACTOR.
5. TERMINATE SERVICE WITH INSPECTION CHAMBER AND BROOKS 37 CONC BOX C/W CAST IRON LID AS PER MMCD S9.

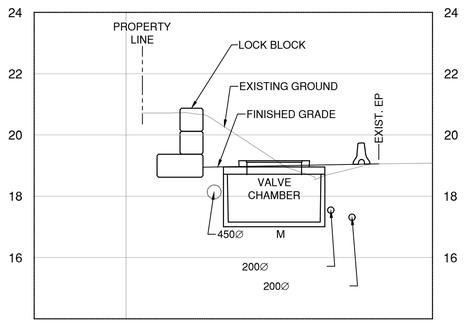
2 - SANITARY SEWER GRA□ITY SER□ICE CONNECTION DETAIL
SCALE: NTS



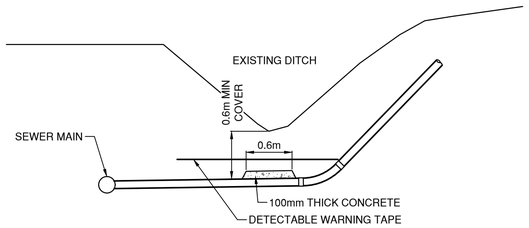
3 - MANHOLE DETAIL
SCALE: NTS



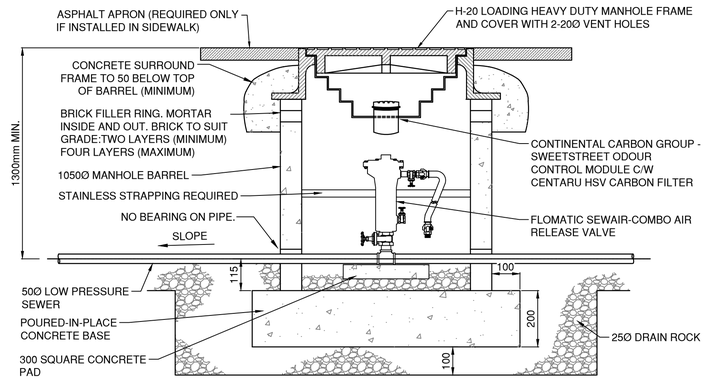
4 - FLUSH OUT ASSEMBLY DETAIL
SCALE: NTS



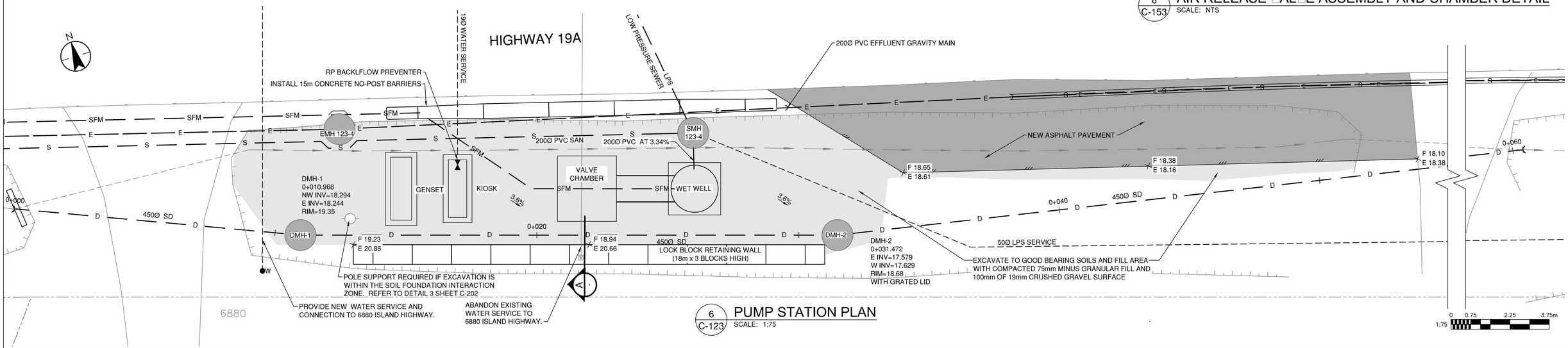
5 - SECTION A
SCALE: 1:100



7 - SANITARY SEWER SER□ICE CONNECTION AT DITCH CROSSING DETAIL
SCALE: NTS



8 C-153 - AIR RELEASE □AL□E ASSEMBLY AND CHAMBER DETAIL
SCALE: NTS



6 C-123 - PUMP STATION PLAN
SCALE: 1:75

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23

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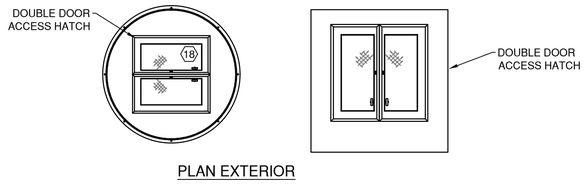
BOWSER SANITARY SYSTEM COLLECTION
BOWSER, BC, CANADA

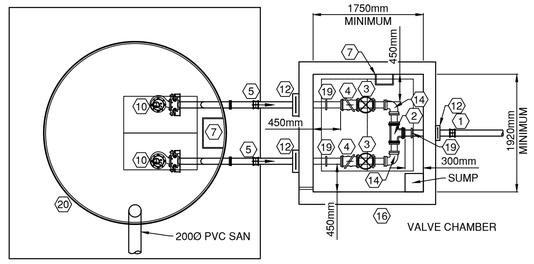
File Name: 00522_C202.DWG | AF Dwn. | KP Chkd. | AG Dsgn. | 16.10.31 YY.MM.DD

Title
DETAILS

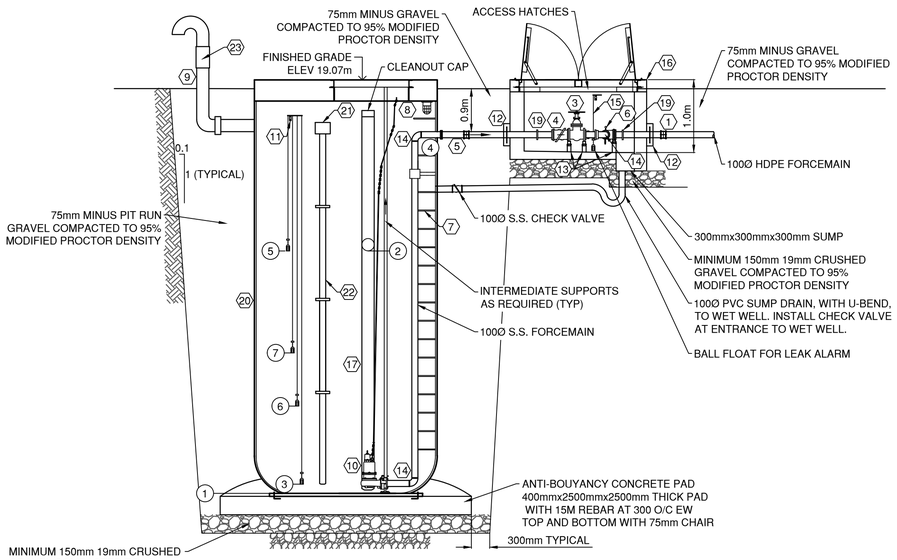
Project No. 111700522
Scale AS SHOWN
Drawing No. BV-C-203
Sheet of
Revision 0



PLAN EXTERIOR



PLAN INTERIOR



SECTIONAL ELEVATION

PUMP STATION DATA: TO BE CONFIRMED

# PUMPS	-	2 (1 DUTY/ 1 STANDBY)
CAPACITY	-	6.7 L/S @ 58m TDH
SOLIDS PASSING SIZE	-	75mm

BILL OF MATERIALS

NO.	QUANTITY	DESCRIPTION
1	1	100Ø S.S. FLEXIBLE COUPLING ADAPTOR TIED BACK TO VALVE CHAMBER
2	1	100Fx100Fx100F S.S. TEE
3	2	100Fx100F S.S. BUTTERFLY VALVE
4	2	100Fx100F S.S. CHECK VALVE
5	2	100Ø S.S. FLEXIBLE COUPLING ADAPTOR RESTRAINED BACK TO WET WELL AND VALVE CHAMBER
6	1	19mm NIPPLE WITH PRESSURE GAUGE c/w S.S. ISOLATION VALVE AND DIAPHRAGM SEAL
7	2	FRAME MOUNTED S.S. LADDER WITH RETRACTABLE SAFETY HAND GRAB
8	1	EXPLOSION PROOF LIGHT
9	1	200Ø AIR VENT C/W BIRD SCREEN. CONFIRM END LOCATION IN FIELD
10	2	DUPLEX NON CLOG SEWAGE PUMP. FLYGT NP 3153SH3 23HP TO BE CONFIRMED
11	1	S.S. SUPPORT BRACKET AND FLOATS (4)
12	3	560mmx560mmx9.5mm THRUST PLATE ENCASED IN CONCRETE THRUST BLOCK POURED AGAINST CHAMBER WALL
13	6	STANDON MODEL S89 FLANGE SUPPORT
14	6	100FxF 90° S.S. BEND
15	1	S.S. SUPPORT BRACKET AND FLOAT
16	1	CONCRETE VALVE BOX WITH DOUBLE DOOR ALUMINUM HATCH WITH SAFETY STAY AND LOCK HASP
17	1	200Ø PVC PIPE SECURED TO TANK WALL WITH CAP ON TOP. EXTEND 100mm BELOW PUMP OFF ELEVATION.
18	2	HATCH WITH SAFETY GRATING SIZED TO PROVIDE UNOBSTRUCTED ACCESS TO PUMPS
19	3	S.S. VICTAULIC COUPLING
20	1	1800Ø I.D. FRP WET WELL
21	1	LVS ULTRASONIC LEVEL SENSOR C/W S.S. MOUNTING BAR
22	1	150Ø SEAMLESS DISTILLING TUBE BETWEEN THE PUMP OFF ELEVATION AND THE MILTRONICS UNIT; CONTRACTOR TO CUT ENDS OF THE TUBE AT 45° ANGLES, AND KEEP BELOW PUMP OFF ELEVATION.
23	1	ACTIVATED CHARCOAL FILTER

NOTES:
1. PROVIDE FLANGE ADAPTORS AS REQUIRED TO MATCH VALVE FLANGES.
2. ISOLATION KITS TO BE PROVIDED ON ALL FLANGE TO FLANGE CONNECTIONS FOR STAINLESS STEEL TO CAST IRON.

SANITARY PUMP STATION ELEVATIONS

NO.	FEATURE	ELEVATION
1	BOTTOM OF TANK	15.44
2	INVERT IN FROM SAN	17.24
3	PUMP OFF	15.84
4	INVERT OUT TO VALVE CHAMBER	17.90
5	HIGH LEVEL ALARM	17.24
6	LEAD ON	16.54
7	LAG ON	16.94

1 / - PUMP STATION 1 DETAIL
SCALE: NTS

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING: BC ONE CALL 1-800-474-6886. (*6886) PRIOR TO ANY EXCAVATION.

BC 1 CALL 1-800-474-6886

Revision	By	Appd.	YY.MM.DD
FOR TENDER	DP	AG	18.12.21
FOR 100% DESIGN	DP	AG	17.04.07
FOR 90% CLIENT REVIEW	DP	AG	16.10.31
FOR 90% DESIGN	DP	AG	16.09.23
Issued	By	Appd.	YY.MM.DD

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File Name: 00522_C205.DWG | AF Dwn. | KP Chkd. | AG Dsgn. | 16.10.31 YY.MM.DD

Title
SANITARY PUMP STATION DETAILS

Project No. 111700522
Scale 1:50 (0, 0.5, 1.5, 2.5m)
Drawing No. BV-C-205
Sheet of
Revision 0

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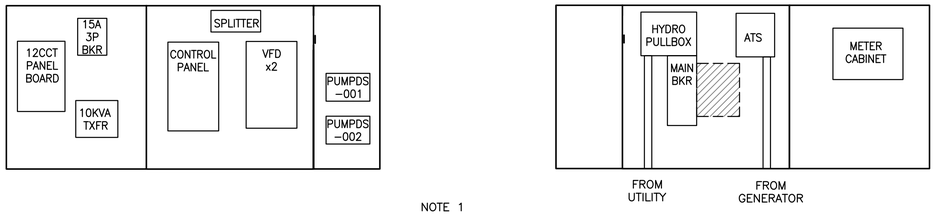
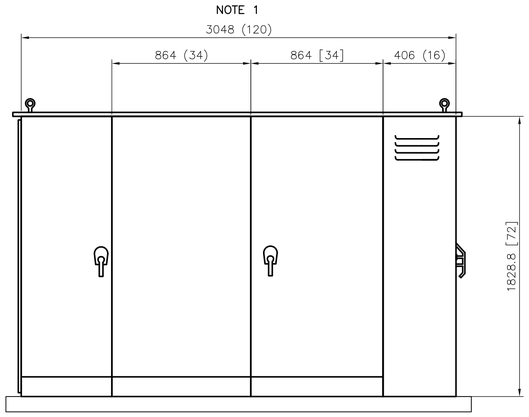
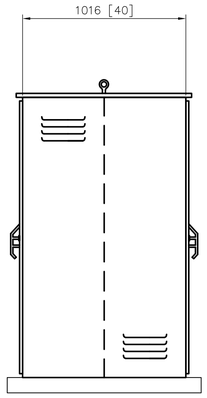


NOTE 1

1 E–101 ENCLOSURE LAYOUT–FRONT INTERIOR VIEW
NTS

2 E–101 ENCLOSURE LAYOUT–BACK INTERIOR VIEW
NTS





3 E–101 ENCLOSURE LAYOUT–EXTERIOR FRONT VIEW
NTS

4 E–101 ENCLOSURE LAYOUT–EXTERIOR SIDE VIEW
NTS

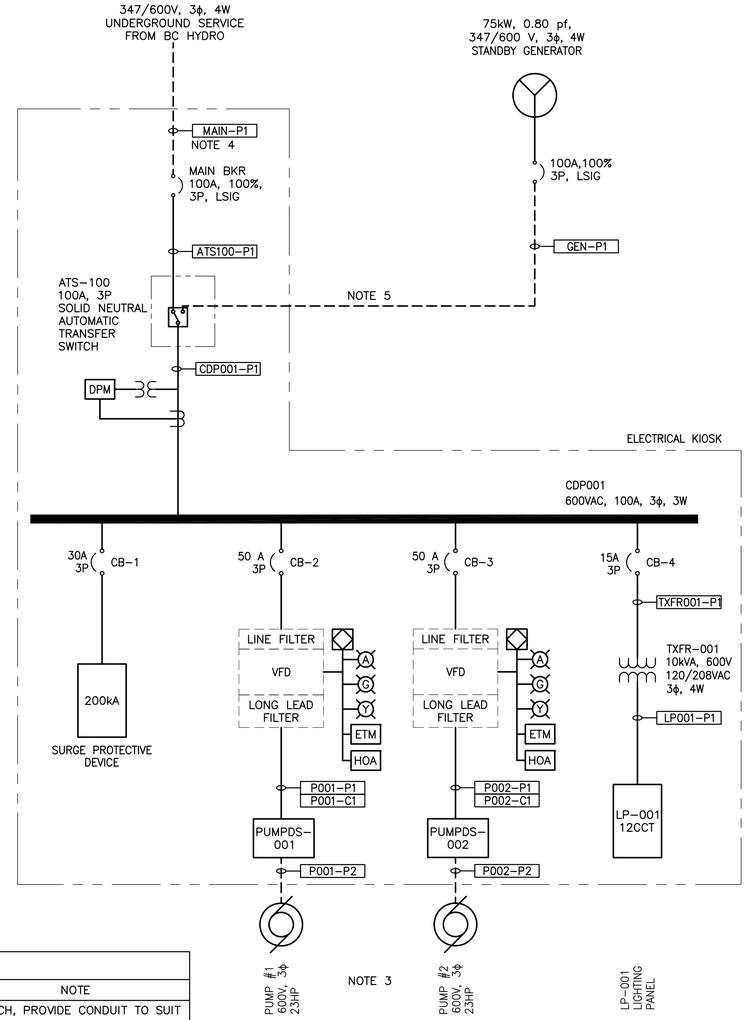
PNL LP–001 120/208V 120 AMP.						LOCATION: – INSIDE ENCLOSURE			
LOAD (W)	DESCRIPTION	BKR. SIZE	CCT. NO.	A B C	CCT. NO.	BKR. SIZE	DESCRIPTION	LOAD (W)
500	KIOSK HEATER	15A	1		2	15A	CONVENIENCE RECEPTACLES	200
NOTE 2 –	KIOSK VENTILATION	15A	3		4	15A	KIOSK LIGHTS	200
1000	UPS PLC POWER RECEPTACLE	15A	5		6	15A	SPARE	–
–	SPARE	15A	7		8	15A	SPARE	–
–	SPARE	15A	9		10	15A	SURGE SUPPRESSOR	–
–	SPARE	15A	11		12	2P		
NOTES					TOTAL ø A – 700			
					TOTAL ø B – 200			
					TOTAL ø C – 1000			
					TOTAL – 1900			

5 E–101 PANEL LP–001 SCHEDULE
NTS

CABLE SCHEDULE						
TAG	#	SIZE	TYPE	FROM (TERM. DEVICE)	TO (TEM. DEVICE)	NOTE
MAIN–P1	–	–	–	UTILITY	MAIN BREAKER	BY BCH, PROVIDE CONDUIT TO SUIT
ATS100–P1	3C	2 AWG	RW90 IN CONDUIT	MAIN BREAKER	ATS	
GEN–P1	4C	4 AWG	RW90 IN CONDUIT	STANDBY GENERATOR	ATS	
CDP001–P1	3C	2 AWG	RW90 IN CONDUIT	ATS	ELECTRICAL KIOSK BUS	
P001–P1	3C	10 AWG	RW90 IN CONDUIT	VFD–001	PUMPDS–001	
P002–P1	3C	10 AWG	RW90 IN CONDUIT	VFD–002	PUMPDS–002	
P001–P2	–	–	–	PUMPDS–001	PUMP #1	VENDOR SUPPLIED
P002–P2	–	–	–	PUMPDS–002	PUMP #2	VENDOR SUPPLIED
TXFR001–P1	3C	12 AWG	RW90 IN CONDUIT	ELECTRICAL KIOSK BUS	TXFR–001	
LP001–P1	3C	10 AWG	RW90 IN CONDUIT	TXFR–001	LP–001	
P001–C1	2C	14 AWG	RW90 IN CONDUIT	VFD–001	PUMPDS–001	
P002–C1	2C	14 AWG	RW90 IN CONDUIT	VFD–002	PUMPDS–002	

NOTE 3

7 E–101 CABLE SCHEDULE
NTS



6 E–101 SINGLE LINE DIAGRAM
NTS

NOTES:

1. MEASUREMENT UNITS: MILLIMETER(INCHES).
2. NOT USED.
3. ALL FIELD WIRING IS DASHED.
4. CONNECT SERVICE NEUTRAL @ MAIN BREAKER
5. CONNECT GENERATOR NEUTRAL @ ATS

Revision	By	Appd.	YY.MM.DD
FOR TENDER	SM	SL	19.01.15
FOR 100% DESIGN	SM	SL	17.04.06
FOR 90% DESIGN	SM	SL	16.10.31
Issued	By	Appd.	YY.MM.DD

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File Name: BV-E-101.DWG | Dwn. | Chkd. | Dsgn. | YY.MM.DD

Title
ELECTRICAL
SINGLE LINE DIAGRAM

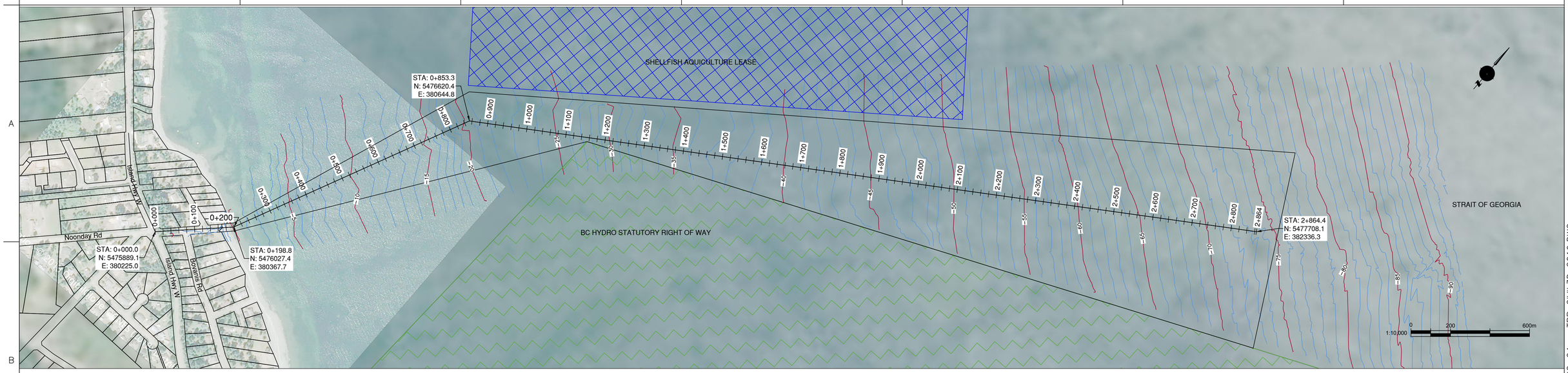
Project No.	Scale	
111700522	N.T.S.	
Drawing No.	Sheet	Revision
BV-E-101	of	0

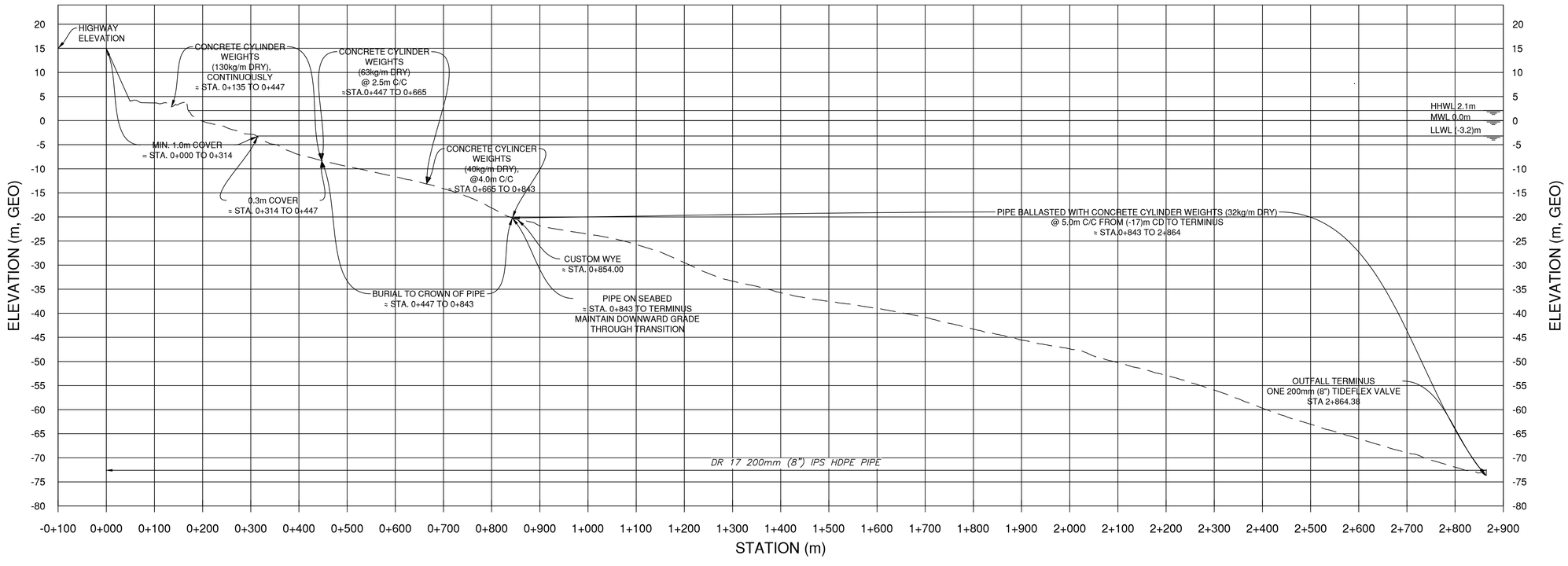
ORIGINAL SHEET - ISO A1

Reference Drawings:

Bowser Outfall Plan and Profile

Prepared by GreatPacific Consulting Ltd.





DATE	DESCRIPTION	DRAWN	DESIGNED	APPROVED
2019 - 02 - 06	ISSUED FOR CLIENT REVIEW - TENDER APPENDIX	TB	TB	JC

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GREATPACIFIC CONSULTING LTD
202–2780 VETERANS MEMORIAL PARKWAY
VICTORIA, BC V9B 3S6
778–433–2672
www.greatpacific.ca

PERMIT/STAMP:

NOTES:

NOT FOR CONSTRUCTION

ISSUED FOR CONTRACTOR QUALIFICATION
FEBRUARY 06, 2019

CLIENT:
REGIONAL DISTRICT OF NANAIMO

REGIONAL DISTRICT OF NANAIMO
BOWSER OUTFALL
PLAN AND PROFILE

DRAWING NUMBER: 001

PROJECT NUMBER: 1034–006

SCALE: 1:5000

REV: Rev 0

FILE: W:\1034-006 - RDN - BOWSER DETAILED DESIGN\DRAWINGS\WORKING\1034-006 - RDN - BOWSER - IFT(FULL) - PLAN - REVA - 2019-02-04 - TRB CIVIL3D 2019.DWG