DISTRICT OF SOOKE
WWTP EXPANSION PROJECT
2022

ADDENDUM NO. 1

August 5th, 2022

This addendum forms part of the Tender Documents and shall be read, interpreted, and coordinated with all other parts. The costs of all elements contained herein shall be included in the submission. The following revisions, changes, corrections, additions, and or deletions supersede the information contained in the original Documents to the extent referenced and shall become part thereof.

This addendum relates to the tender entitled "DISTRICT OF SOOKE WWTP EXPANSION PROJECT 2022", issued on BC Bid on July 27th, 2022 (Package)

Addendum Item 1
Responses to
Questions from Bidders

1) None Received to date.

Addendum Item 2
Drawing
Changes/Additions

The following drawings have been added to the Package or revised as part of this addendum.

REVISED
- G002 – General Drawing List
- I002 – Process & Instrumentation Diagram
- I003 – Process & Instrumentation Diagram
- I004 – Process & Instrumentation Diagram
- I005 – Process & Instrumentation Diagram
- I006 – Process & Instrumentation Diagram
- I007 – Process & Instrumentation Diagram
- I008 – Process & Instrumentation Diagram
- I009 – Process & Instrumentation Diagram
- E612 – Electrical MCC Layout and Panel 'A'
- E613 – Electrical Cable Schedule

NEW
- I010 – Instrumentation Instrumentation / Control System
- I501 – Instrumentation ACP-500 Control Panel
- I502 – Instrumentation ACP-500 PLC I/O SLOTS 0-3
- I503 – Instrumentation ACP-500 PLC I/O SLOTS 6-7
- I504 – Instrumentation ACP-500 PLC I/O SLOTS 10-12

Addendum Item 3
Specification/Document
Changes/Additions

The following specifications in the Package have been removed as part of this addendum.

- 260000 – General Electrical Requirements

The following specifications have been added to the Package as part of this addendum:

- 250501 – Process Control and Instrumentation General Provisions
- 251400 – Control Panels
- 253101 – Instrumentation
- 260501 – Common Work Results for Electrical
- 260536 – Cable Tray
- 260544 – Installation of Cables in Trenches and Conduits

The following specifications have been replaced in the Package as part of this addendum:

- 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings

The following specification clauses in the Package have been changed as part of this addendum.

a) 26 05 21 Wires and Cables
   Delete document title (CONTRACT: WWTP UPGRADE 2020)[1]
b) 26 05 21 Wires and Cables
   Replace clause 1.3.1 with
   "1.3.1 Submit product data in accordance with Section 26 05 01 – Common Work Results for Electrical."
c) 26 05 21 Wires and Cables
   Replace clause 2.4.1 with
   "2.4.1 Non-Metallic sheathed copper cable type: NMD 90, size as indicated."
d) 26 05 21 Wires and Cables
   Replace clause 3.2.1.2 with
   "3.2.1.2 In cabletroughs in accordance with Section 26 05 44."
e) 26 05 21 Wires and Cables
   Replace clause 3.4.3 with
   "3.4.3 Ground control cable shield at the source cabinet related to the cable."
f) 26 05 21 Wires and Cables
   Replace clause 3.7.1 with
   "3.7.1 For branch circuit wiring, following identification system shown on the drawings and as specified in Section 26 05 01."
g) 26 05 22 Connectors and Terminations
   Replace clause 1.1.1 with
   "1.1.1 Submit product data sheets in accordance with Section 26 05 01."

[1] "CONTRACT: WWTP UPGRADE 2020" text within any specifications to be deleted.

h) 26 05 26 Grounding and Bonding for Electrical Systems
Replace clause 1.1.1 with
"1.1.1 Refer to Section 26 05 01."
i) 26 05 26 Grounding and Bonding for Electrical Systems
Replace clause 3.4.1 with
"3.4.1 Perform tests in accordance with Section 26 05 01, Section 26 08 00, and Section 26 79 00."
j) 26 08 00 Commissioning Electrical Systems
Replace clause 3.1.7 with
"3.1.7 In cooperation with Division 40, take clamp-on ammeter readings of all phases of all mechanical and packaged process equipment motors with motors running under full load condition. Readings to be logged, tabulated, and incorporated in the operating and maintenance manuals."
k) 26 20 00 Low Voltage Electrical Distribution
Replace clause 1.12.2.1 with
"1.12.2.1 The Process / Mechanical components and systems, specified in Division 40."
l) 26 24 19 Motor Control Centers
Replace clause 1.2.1 with
"1.2.1 Submit shop drawings in accordance with Section 26 05 01."
m) 26 24 19 Motor Control Centers
Replace clause 2.7.1 with
"2.7.1 Apply finishes in accordance with Section 26 05 01."
n) 26 27 16 Electrical Cabinet and Enclosures
Replace clause 1.1.1 with
"1.1.1 Equipment, products, and execution must meet all requirements detailed in Section 26 05 01."
o) 26 27 16 Electrical Cabinet and Enclosures
Replace clause 2.5.1 with
"2.5.1 Refer to Section 26 05 01 for nameplate specification."
p) 26 27 16 Electrical Cabinet and Enclosures
Replace clause 3.1.1 with
"3.1.1 Refer to Section 26 05 01 Part 3."
q) 26 27 16 Electrical Cabinet and Enclosures
Replace clause 3.3.3 with
"3.3.3 All instruments within the panel shall be identified as per Section 25 31 01, and the contract drawings."
r) 26 27 26 Motor Control Centers
Replace clause 1.2.1 with
"1.2.1 Submit shop drawings in accordance with Section 26 05 01."
s) 26 27 26 Motor Control Centers
Replace clause 2.5.1 with
"2.5.1 Apply finishes in accordance with Section 26 05 01."
t) 26 27 26 Motor Control Centers
Replace clause 2.6.1 with
"2.6.1 Provide equipment identification in accordance with Section 26 05 01."
u) 26 28 23 Disconnect Switches Fused and Non-Fused
Replace clause 2.1.3 with

"2.1.3 Finish: One primer coat and one finish coat on all metal surfaces, colours as per Section 26 05 01."

v) 26 28 23 Disconnect Switches Fused and Non-Fused
Replace clause 3.1.4 with
"3.1.4 Identification: Provide lamacoid plate in accordance with Section 26 05 01, on each switch showing voltage, source of supply and load being fed, for example:
Door Controller
120/208 Volts
Fed from LP-A"

w) 26 29 23 Variable Frequency Motor Controllers
Replace clause 1.2.1 with
"1.2.1 Submit shop drawings in accordance with Section 26 05 01."

x) 26 29 23 Variable Frequency Motor Controllers
Replace clause 1.4.4 with
"1.4.4 Where a voltage disturbance exceeds the VFD's process controller capability to maintain drive operation, the drive must have 'flying start' functionality."

y) 26 29 23 Variable Frequency Motor Controllers
Replace clause 2.7.2 with
"2.7.2 The VFD shall have communications capability to interface with the facility local control panel (ACP500) or associated vendor control panel, via the MCC's network (DeviceNet). Alternate acceptable communications is Ethernet/IP."

z) 26 29 23 Variable Frequency Motor Controllers
Replace clause 2.7.6.1 with
"2.7.6.1 Field selector switch set to "Remote" enables the motor to be started, stopped and speed controlled by the PLC as shown on the drawings."

aa) 26 29 23 Variable Frequency Motor Controllers
Replace clause 2.7.6.4 with
"2.7.6.4 The Control System Integrator is identified by The District of Sooke and shall complete all integration work on the System PLC and SCADA, and integration of the Vendor package(s)."

bb) 26 29 23 Variable Frequency Motor Controllers
Replace clause 2.10 with
"2.10 Finishes
2.10.1 Apply finishes in accordance with Section 26 24 19."

cc) 26 30 10 Connections to Mechanical Equipment
Replace clause 1.1 with
"1.1 Related Work
1.1.1 Mechanical: Division 23
1.1.2 Process: Division 40"

dd) 26 50 00 Lighting
Replace clause 1.4.1 with
"1.4.1 Submit shop drawings for all luminaires in accordance with Section 26 05 01."

ee) 26 79 00 Acceptance Testing and Calibration for Instrumentation
Replace clause 1.1 with
"1.1 The Work includes the provision of all necessary testing, instrumentation calibration, and installation verification, complete with written reports prior to

system completion. After system completion (or part thereof), the Contractor shall commence commissioning and start-up activities as specified in this specification and Section 26 99 20."

ff) 26 79 00 Acceptance Testing and Calibration for Instrumentation
Replace clause 1.2 with
"1.2 Refer to Section 25 31 01 for general instrumentation and control requirements related to testing, calibration, and installation verification."

gg) 26 79 00 Acceptance Testing and Calibration for Instrumentation
Replace clause 3.2.3 with
"3.2.3 Include calibration reports in the operating and maintenance manuals described in Section 25 31 01."

The following documents have been provided for information only.

- Construction Environmental Management Plan, August 3rd 2022

End of Addendum

Acknowledgement of this Addendum in your Tender submission is required.

Shaun Swarbrick, P.Eng

DRAWING LIST

GENERAL
G001 COVER
G002 DRAWING LIST

CIVIL
C001 SITE PLAN
C002 SITE GRADING AND DRAINAGE
C003 SITE UTILITIES

STRUCTURAL
S001 GENERAL NOTES
S010 CONSTRUCTION STANDARDS - SHEET 1
S011 CONSTRUCTION STANDARDS - SHEET 2
S012 CONSTRUCTION STANDARDS - SHEET 3
S013 CONSTRUCTION STANDARDS - SHEET 4
S101 DISC FILTER, UV CHANNEL AND SLUDGE THICKENER CONCRETE OUTLINE - PLANS
S301 CONCRETE OUTLINE SECTIONS - SHEET 1
S302 CONCRETE OUTLINE SECTIONS - SHEET 2
S601 REINFORCEMENT - PLANS
S602 REINFORCEMENT - SECTIONS - SHEET 1
S603 REINFORCEMENT - SECTIONS - SHEET 2

PROCESS
P001 FLOW DIAGRAM
P002 HYDRAULIC PROFILE
P003 MISCELLANEOUS DETAILS
P300 SBR - PLAN
P301 SBR - SECTION
P500 DISC FILTER, EQUALIZATION TANK AND SLUDGE THICKENER - PLAN
P501 DISC FILTER AND EQUALIZATION TANK SECTIONS - SHEET 1
P502 DISC FILTER AND EQUALIZATION TANK SECTIONS - SHEET 2
P600 BLOWER ROOM
P800 BILL OF MATERIALS

MECHANICAL
M500 STORAGE ROOM PLUMBING AND HVAC

INSTRUMENTATION
I001 PROCESS & INSTRUMENTATION LEGEND
I002 PROCESS & INSTRUMENTATION DIAGRAM
I003 PROCESS & INSTRUMENTATION DIAGRAM
I004 PROCESS & INSTRUMENTATION DIAGRAM
I005 PROCESS & INSTRUMENTATION DIAGRAM
I006 PROCESS & INSTRUMENTATION DIAGRAM
I007 PROCESS & INSTRUMENTATION DIAGRAM
I008 PROCESS & INSTRUMENTATION DIAGRAM
I009 PROCESS & INSTRUMENTATION DIAGRAM
I010 INSTRUMENTATION/CONTROL SYSTEM
I501 ACP-500 CONTROL PANEL
I502 ACP-500 PLC I/O SLOTS 0-3
I503 ACP-500 PLC I/O SLOTS 6-7
I504 ACP-500 PLC I/O SLOTS 10-12 (A)

ELECTRICAL
E001 LEGENDS AND SYMBOLS
E002 STANDARD DETAILS
E003 NOT USED
E004 STANDARD DETAILS
E100 SITE PLAN
E300 SBR - PLAN
E500 DISC FILTER, UV CHANNEL AND SLUDGE THICKENER - PLAN
E600 BLOWER ROOM AND GENERATOR / ELECTRICAL ROOM
E610 EXISTING SINGLE LINE DIAGRAM
E611 SINGLE LINE DIAGRAM
E612 MCC LAYOUT & PANEL SCHEDULE (A)
E613 CABLE SCHEDULE
E614 VFD WIRING SCHEMATICS

Revision	By	Appd.	YY.MM.DD
A ISSUED FOR TENDER ADDENDUM 01	TY	TDC	22.08.05

Issued	By	Appd.	YY.MM.DD
5 ISSUED FOR TENDER	SS	BP	22.07.25
4 ISSUED FOR BUILDING PERMIT	SS	BP	22.07.20
3 ISSUED FOR 90% SUBMISSION	SS	BP	22.06.03
2 ISSUED FOR TENDER IFT 2022-004	SS	BP	22.04.12
1 ISSUED FOR 50% REVIEW	SS	BP	22.02.09

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Client/Project
District of Sooke
SOOKE WWTP EXPANSION PROJECT
Sooke, BC Canada

File Name: 20131_g002.dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	AF	SS	BP	8/4/2022

Title
GENERAL
DRAWING LIST

Project No.	Scale	
111720131	NOT TO SCALE	
Drawing No.	Sheet	Revision
G002	2 of 49	A

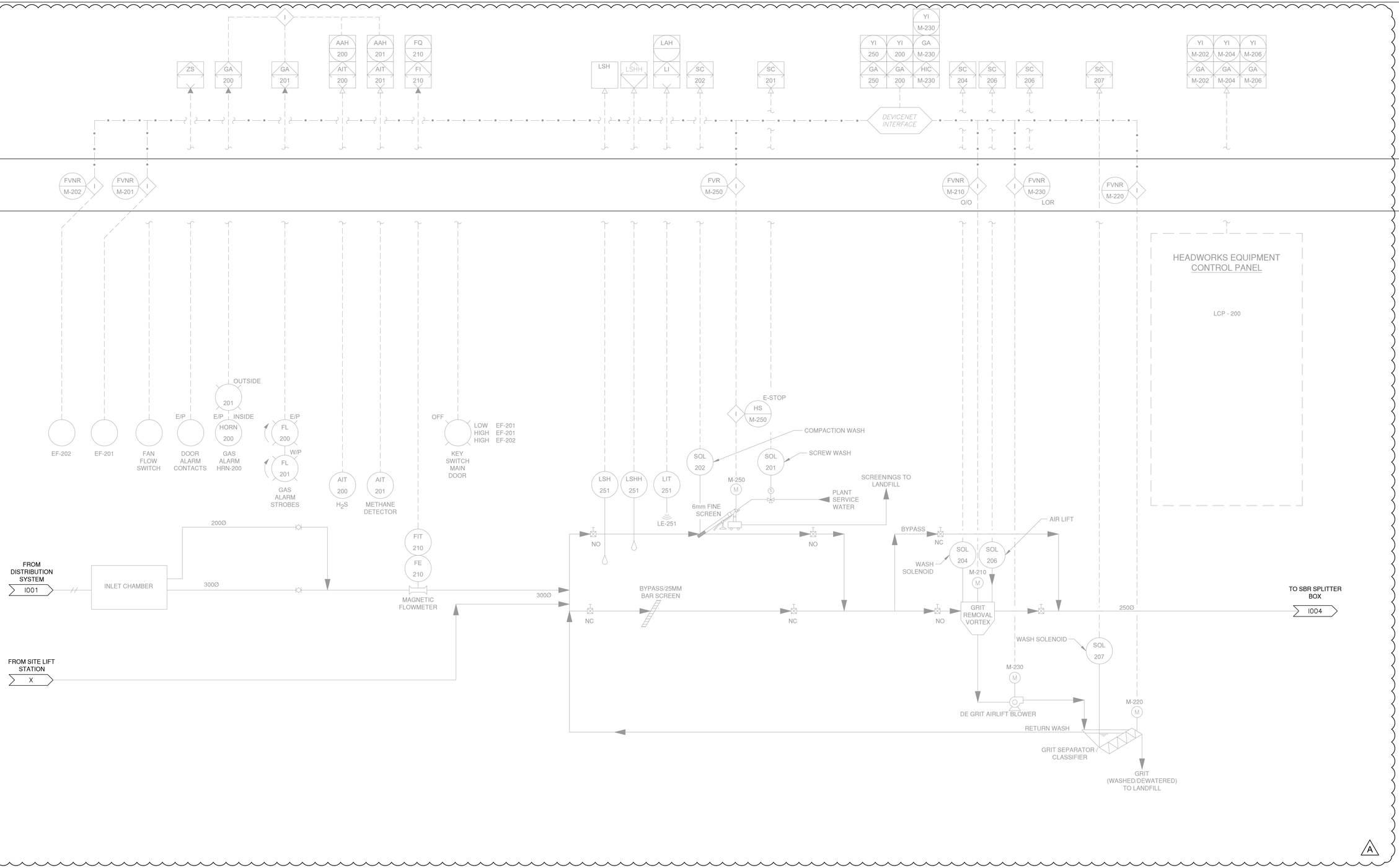
ORIGINAL SHEET - ISO A1

SCADA

PLC / HMI

MCC (600VAC)

FIELD



A	ISSUED FOR TENDER ADDENDUM 01	TY	TDC	22.08.05
Revision		By	Appd.	YY.MM.DD
4	ISSUED FOR TENDER	SS	BP	22.07.25
3	ISSUED FOR 90% SUBMISSION	SS	BP	22.04.03
2	ISSUED FOR TENDER IFT 2022-004	SS	BP	22.04.12
1	ISSUED FOR 50% REVIEW	SS	BP	22.02.09
Issued		By	Appd.	YY.MM.DD

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File Name: 20131_I001_7_9.dwg	AF	SS	BP	8/5/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title

PROCESS & INSTRUMENTATION DIAGRAM

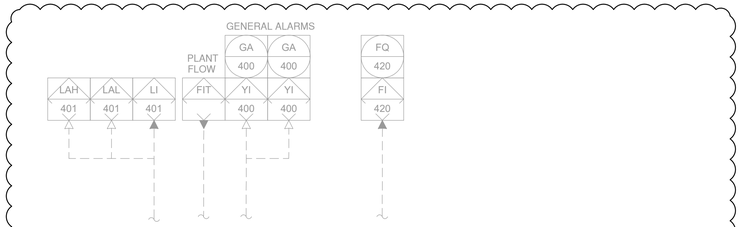
Project No.	Scale	
111720131	NOT TO SCALE	
Drawing No.	Sheet	Revision
I002	29 of 49	A

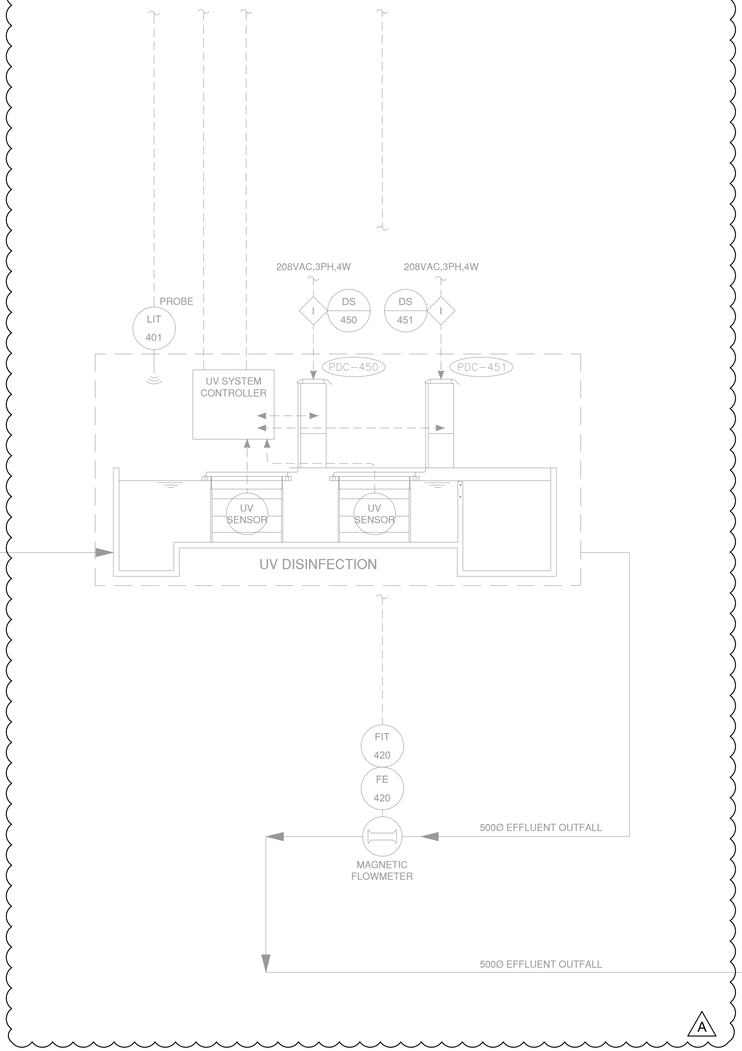
SCADA

PLC / HMI

MCC
(600VAC)

FIELD





FROM TERTIARY FILTER
1007

SCADA

PLC / HMI

MCC
(600VAC)

FIELD

A	ISSUED FOR TENDER ADDENDUM 01	TY	TDC	22.08.05
Revision		By	Appd.	YY.MM.DD
2	ISSUED FOR TENDER	SS	BP	22.07.25
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Title
PROCESS & INSTRUMENTATION DIAGRAM

Project No.	Scale	
111720131	NOT TO SCALE	
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I003	30 of 49	A

SCADA

PLC / HMI

MCC (600VAC)

FIELD

QI 310 | QI 311 | GA 310 | GA 311 | SIC 310 | SIC 311 | PAH 301 | TAH 302 | DPAH 303 | PAH 304 | TAH 305 | DPAH 306

DEVICENET INTERFACE

VFD 310 I LRO

VFD 311 I LRO

KEY SWITCH MAIN DOOR

PSH 301 | TSH 302 | DPSH 303

PSH 304 | TSH 305 | DPSH 306

BLR-310

BLR-311

SBR BLOWERS A

QI 313 | GA 313 | SIC 313 | PAH 351 | TAH 352 | DPAH 353

DEVICENET INTERFACE

VFD 313 I LRO

PSH 351 | TSH 352 | DPSH 353

BLR-313

QI P-331 | QI P-330 | GA P-331 | GA P-330 | HIC P-331 | HIC P-330

DEVICENET INTERFACE

VFD P-331 I LRO

VFD P-330 I LRO

ETHERNET INTERFACE

ZIC 311 | ZIC 316

DEVICENET INTERFACE

VFD 310 I LRO

VFD 315 I LRO

120VAC

LCP-300/PLC (CONTROL LOGIX)

YI	YI	TI	ZI 301	ZSO 302	LI 312	LI 317
YI	YI	FC 301	ZI 302	ZSC 301	LAH 313	LAH 318
YI	YI	FC 302	ZSO 301	ZSC 302	AI 321	AI 322

ZSO 311 | ZSO 316

ZSC 311 | ZSC 316

CONTINUED ON I005

200Ø

PI 512

ZIT 301 | ZSC 301 | ZSO 301

120VAC M BFV-301

PSV 320

LSH 313

AIT 320 DO

AE 321 | LIT 312

SBR TANK No. 1 SBR-310

M ZSC 311 | ZSO 311

DECANTER M-311

TO TERTIARY FILTER I007

PSV 315

TO SBR #3 AND #4 I005

FROM FILTRATE x

FROM HEADWORKS I002

250Ø

INFLUENT SPLITTER BOX

TO SBR #3 AND #4 I005

ZIT 302 | ZSC 302 | ZSO 302

120VAC M BFV-302

DO AIT 322

LSH 318 | AE 322 | LIT 317

SBR TANK No. 2 SBR-315

M ZSC 316 | ZSO 316

DECANTER M-316

TO SLUDGE THICKENER EQUALIZATION TANK I009

TO EXISTING DIGESTER I006

FROM WAS PUMPS NEW I005

NC

NC

M P-330 WAS PUMP

M P-331 WAS PUMP

A

Revision	By	Appd.	YY.MM.DD
A ISSUED FOR TENDER ADDENDUM 01	TY	TDC	22.08.05

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4 ISSUED FOR TENDER	SS	BP	22.07.25
3 ISSUED FOR 90% SUBMISSION	SS	BP	22.06.03
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1 ISSUED FOR 50% REVIEW	SS	BP	22.02.09

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File Name: 20131_I001_7_9.dwg | Dwn. AF | Chkd. SS | Dsgn. BP | YY.MM.DD 8/5/2022

Title
PROCESS & INSTRUMENTATION DIAGRAM

Project No. 111720131
Scale NOT TO SCALE
Drawing No. I004
Sheet 31 of 49
Revision A

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ORIGINAL SHEET - ISO A1

SCADA

PLC / HMI

MCC (600VAC)

FIELD

QI P-332 | QI P-333 | GA P-332 | GA P-333 | HIC P-332 | HIC P-333

DEVICENET INTERFACE

ETHERNET INTERFACE

ZIC 334 | ZIC 334

DEVICENET INTERFACE

XA 992

VFD P-332 LRO | I

VFD P-333 LRO | I

VFD 334 LRO | I

VFD 344 LRO | I

XA 992

120VAC

A

LCP-300/PLC (CONTROL LOGIX)

YI	YI	TI XXX	ZI 303	ZSO 304	LI 332	LI 342
YI	YI	FC 303	ZI 304	ZSC 303	LAH 333	LAH 343
YI	YI	FC 304	ZSO 303	ZSC 304	AI 331	AI 341

ZSO 334 | ZSO 344

ZSC 334 | ZSC 344

CONTINUED ON I004

ZIT 303 | ZSC 303 | ZSO 303

LSH 333

AIT 331

DO

AE 331 | LIT 332

PSV 330

120VAC

M

FROM SBR BLOWERS I004

200Ø

BFV–303

SBR TANK No. 3

SBR–320

M

ZSC 334 | ZSO 334

DECANTER

M–321

TO TERTIARY FILTER I007

PSV 340

FROM INFLUENT SPLITTER BOX I004

INFLUENT SPLITTER BOX

ZIT 302 | ZSC 302 | ZSO 302

120VAC

M

BFV–304

DO

AIT 341

LSH 343 | AE 341 | LIT 342

SBR TANK No. 4 (FUTURE)

SBR–325

M

ZSC 344 | ZSO 344

DECANTER

M–344

NC

M

P–332

WAS PUMP

TO SLUDGE THICKENER I009

NC

TO EX DIGESTER AND SLUDGE THICKER EQ TANK I004

M

P–333

WAS PUMP

A

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A	ISSUED FOR TENDER ADDENDUM 01	TY	TDC	22.08.05
Revision		By	Appd.	YY.MM.DD
4	ISSUED FOR TENDER	SS	BP	22.07.25
3	ISSUED FOR 90% SUBMISSION	SS	BP	22.06.03
2	ISSUED FOR TENDER IFT 2022-004	SS	BP	22.04.12
1	ISSUED FOR 50% REVIEW	SS	BP	22.02.09
Issued		By	Appd.	YY.MM.DD

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SOOKE WWTP EXPANSION PROJECT

Sooke, BC Canada

File Name: 20131_I001_7_9.dwg	AF Dwn.	SS Chkd.	BP Dsgn.	8/5/2022 YY.MM.DD

Title

PROCESS & INSTRUMENTATION DIAGRAM

Project No.	Scale
111720131	NOT TO SCALE

Drawing No.	Sheet	Revision
I005	32 of 49	A

ORIGINAL SHEET - ISO A1

SCADA

PLC / HMI

MCC (600VAC)

FIELD

QI M-510 | QI M-511
GA M-510 | GA M-511
HIC M-510 | HIC M-511

PAH 501 | TAH 502 | DPAH 503 | PAH 504 | TAH 505 | DPAH 506

DEVICENET INTERFACE

VFD M-510 — I — LRO

I — VFD M-511 — LRO

LAH 536 | LAH 531 | LI 530 | LI 535

QI P-620 | QI P-621
GA P-620 | GA P-621
HIC P-620 | HIC P-621

CONTINUED ON DRAWING I005

SCADA

PLC / HMI

MCC (600VAC)

FIELD

PI 522

PI 523

NC

PSH 501 | TSH 502 | DPSH 503

PSH 504 | TSH 505 | DPSH 506

M

BLR–510 | DIGESTER BLOWERS | BLR–511

A

AEROBIC DIGESTER TANK No. 1

LSH 531

PROBE

LIT 530

LE 530

AEROBIC DIGESTER TANK No. 2

LSH 536

PROBE

LIT 535

LE 535

TELESCOPING VALVE V-640

TELESCOPING VALVE V-641

DETAILED ON DRAWING I005

VFD P-620 — I

I — VFD P-621

CENTRIFUGE PACKAGE

DS P-620 — I

I — DS P-621

M

CENTRIFUGE FEED PUMP P–620

NC

CENTRIFUGE FEED PUMP P–621

TO CENTRIFUGE

I008

FROM WAS THICKENER

I009

FROM WAS PUMPS

I004

TO SITE LIFT STATION

I008

A

A	ISSUED FOR TENDER ADDENDUM 01	TY	TDC	22.08.05
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4	ISSUED FOR TENDER	SS	BP	22.07.25
3	ISSUED FOR 90% SUBMISSION	SS	BP	22.06.03
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Issued		By	Appd.	YY.MM.DD

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Sooke, BC Canada

File Name: 20131_001_7_9.dwg	AF	SS	BP	8/5/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title

PROCESS & INSTRUMENTATION DIAGRAM

Project No. 111720131

Scale NOT TO SCALE

Drawing No. I006

Sheet 33 of 49

Revision A

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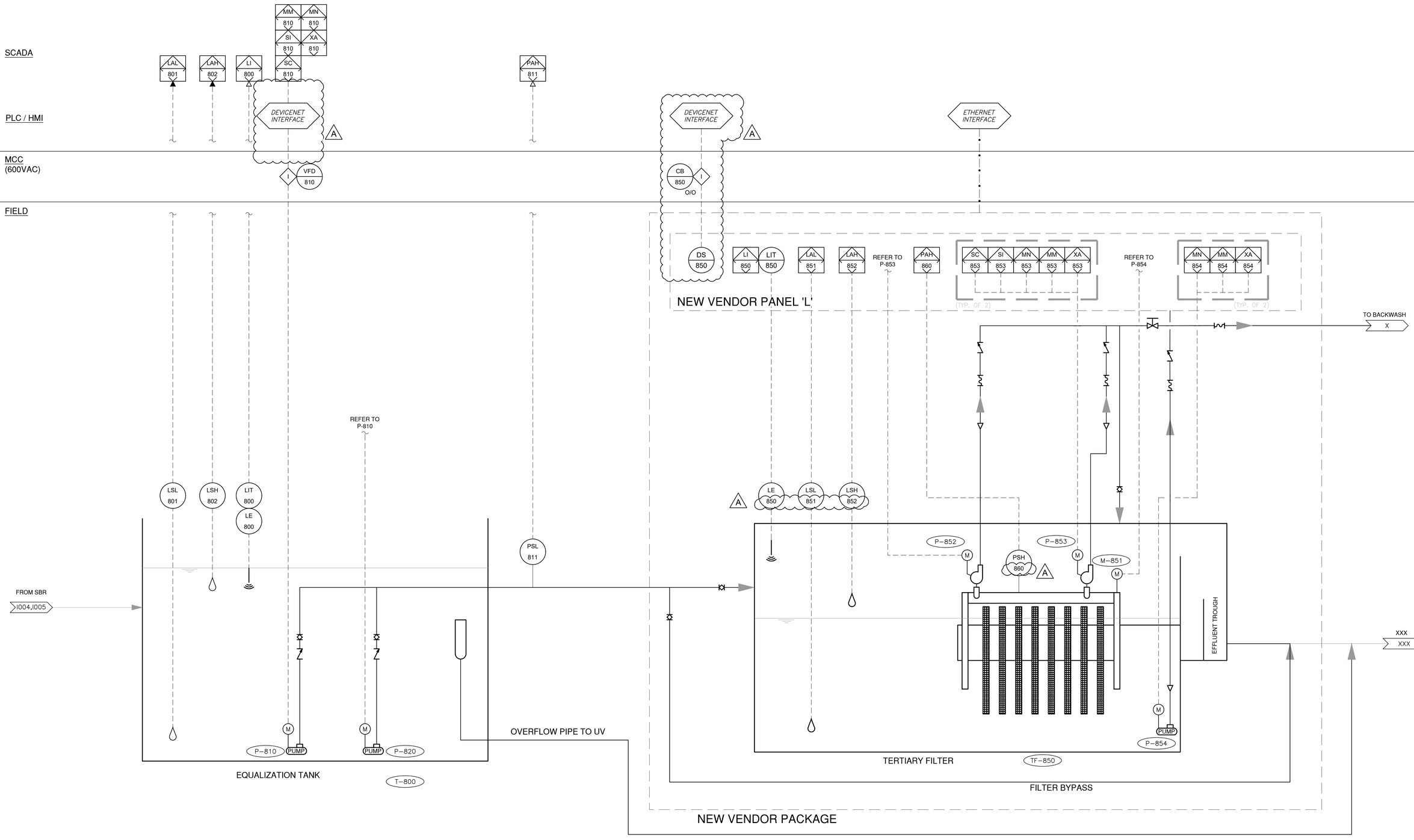
ORIGINAL SHEET - ISO A1

SCADA

PLC / HMI

MCC
(600VAC)

FIELD



A	ISSUED FOR TENDER ADDENDUM 01	TY	TDC	22.08.05
Revision		By	Appd.	YY.MM.DD
4	ISSUED FOR TENDER	SS	BP	22.07.25
3	ISSUED FOR 90% SUBMISSION	SS	BP	22.06.03
2	ISSUED FOR TENDER IFT 2022-004	SS	BP	22.04.12
1	ISSUED FOR 50% REVIEW	SS	BP	22.02.09
Issued		By	Appd.	YY.MM.DD

Consultants

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Client/Project

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SOOKE WWTP EXPANSION PROJECT

Sooke, BC Canada

File Name: 20131_I001_7_9.dwg	AF	SS	BP	8/5/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title

PROCESS & INSTRUMENTATION DIAGRAM

Project No.	Scale	
111720131	NOT TO SCALE	
Drawing No.	Sheet	Revision
I007	34 of 49	A

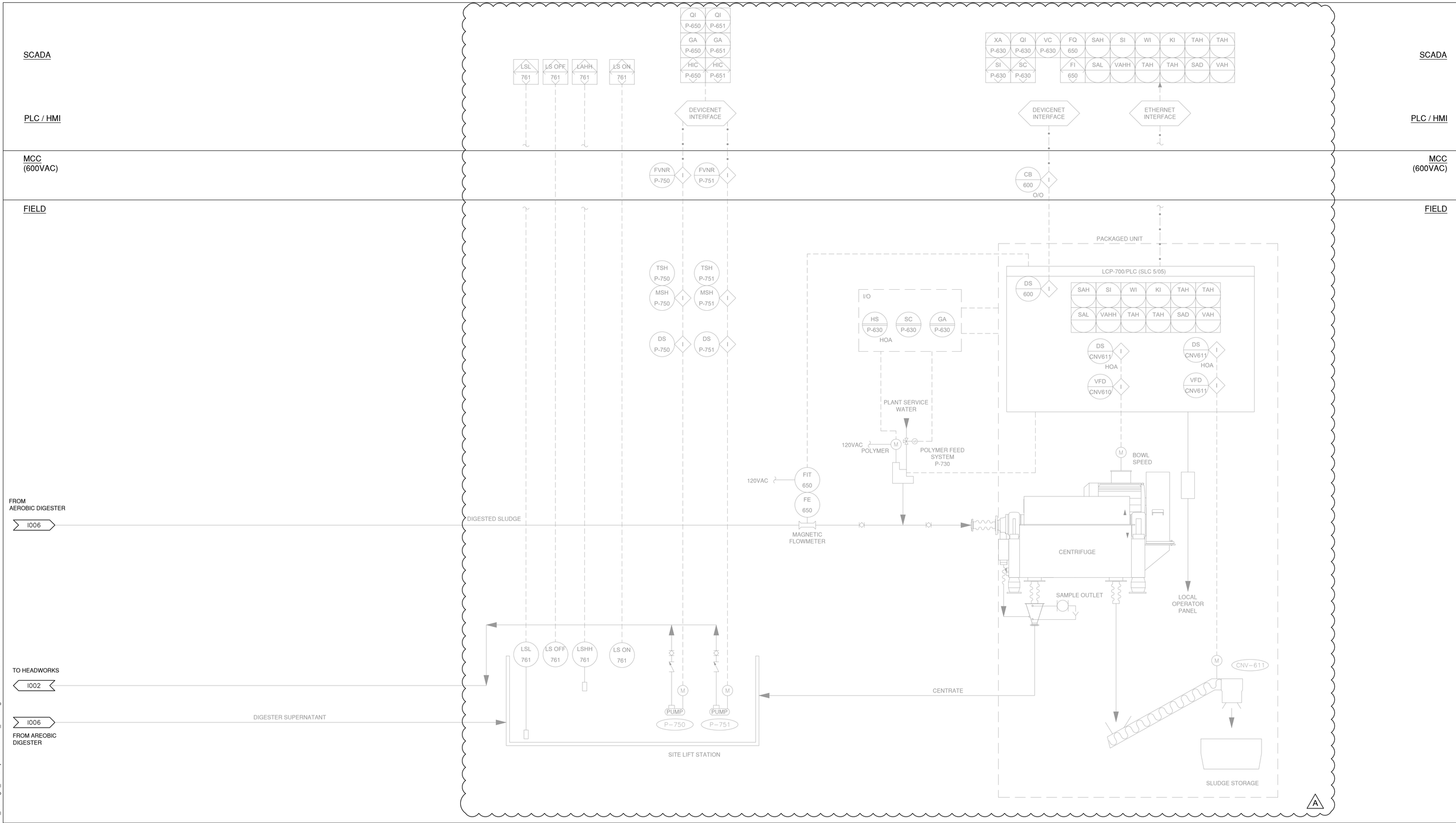
ORIGINAL SHEET - ISO A1

SCADA

PLC / HMI

MCC
(600VAC)

FIELD



A	ISSUED FOR TENDER ADDENDUM 01	TY	TDC	22.08.05
Revision		By	Appd.	YY.MM.DD
3	ISSUED FOR TENDER	SS	BP	22.07.25
2	ISSUED FOR TENDER IFT 2022-004	SS	BP	22.04.12
1	ISSUED FOR 50% REVIEW	SS	BP	22.02.09
Issued		By	Appd.	YY.MM.DD

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SOOKE WWTP EXPANSION PROJECT

Sooke, BC Canada

File Name: 20131_I008.dwg	AF	SS	BP	8/4/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title

PROCESS & INSTRUMENTATION DIAGRAM

Project No.	Scale	
111720131	NOT TO SCALE	
Drawing No.	Sheet	Revision
I008	35 of 49	A

ORIGINAL SHEET - ISO A1

SCADA

PLC / HMI

MCC
(600VAC)

FIELD

XA 990

XA 991

DEVICENET INTERFACE

CB 930 — I — O/O

ETHERNET INTERFACE

DS 930

LI 901

LAL 902

LAH 903

SC 910 | SI 910 | MN 910 | MM 910 | XA 910

HS P-920 | SC P-920 | GA P-920 — HOA

DS 940 — I

VFD 940 — I

SC 940 | SI 940 | MN 940 | MM 940 | XA 940

NEW VENDOR PANEL 'L'

A

FSH 990

DOMESTIC WARM H2O
I00X

EMERGENCY EYEWASH AND SHOWER

LSL 991

PLANT SERVICE WATER

120VAC

POLYMER

M

POLYMER FEED SYSTEM P-730

ST-930

VENDOR DEFINED

SLUDGE THICKENER

ST-930

M

PUMP

P-940

TO AEROBIC DIGESTERS
I006

I006

LSL 902

LSH 903

LIT 901

A

FROM WAS PUMPS
I004,I005

M

PUMP

P-910

WAS EQUALIZATION TANK

FILTRATE TO INFLUENT SPLITTER BOX
I004

TO FILTRATE IN LIFT STATION
I008

\\CA0208-PPFSS01\workgroup\1117active\111720131\4_drawings_current\process\20131_I001_7_9.dwg 8/5/2022 8:34 AM THYOUNG

A	ISSUED FOR TENDER ADDENDUM 01	TY	TDC	22.08.05
Revision		By	Appd.	YY.MM.DD
4	ISSUED FOR TENDER	SS	BP	22.07.25
3	ISSUED FOR 90% SUBMISSION	SS	BP	22.06.03
2	ISSUED FOR TENDER IFT 2022-004	SS	BP	22.04.12
1	ISSUED FOR 50% REVIEW	SS	BP	22.02.09
Issued		By	Appd.	YY.MM.DD

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File Name: 20131_I001_7_9.dwg	AF	SS	BP	8/5/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
PROCESS & INSTRUMENTATION DIAGRAM

Project No. 111720131

Scale NOT TO SCALE

Drawing No. I009

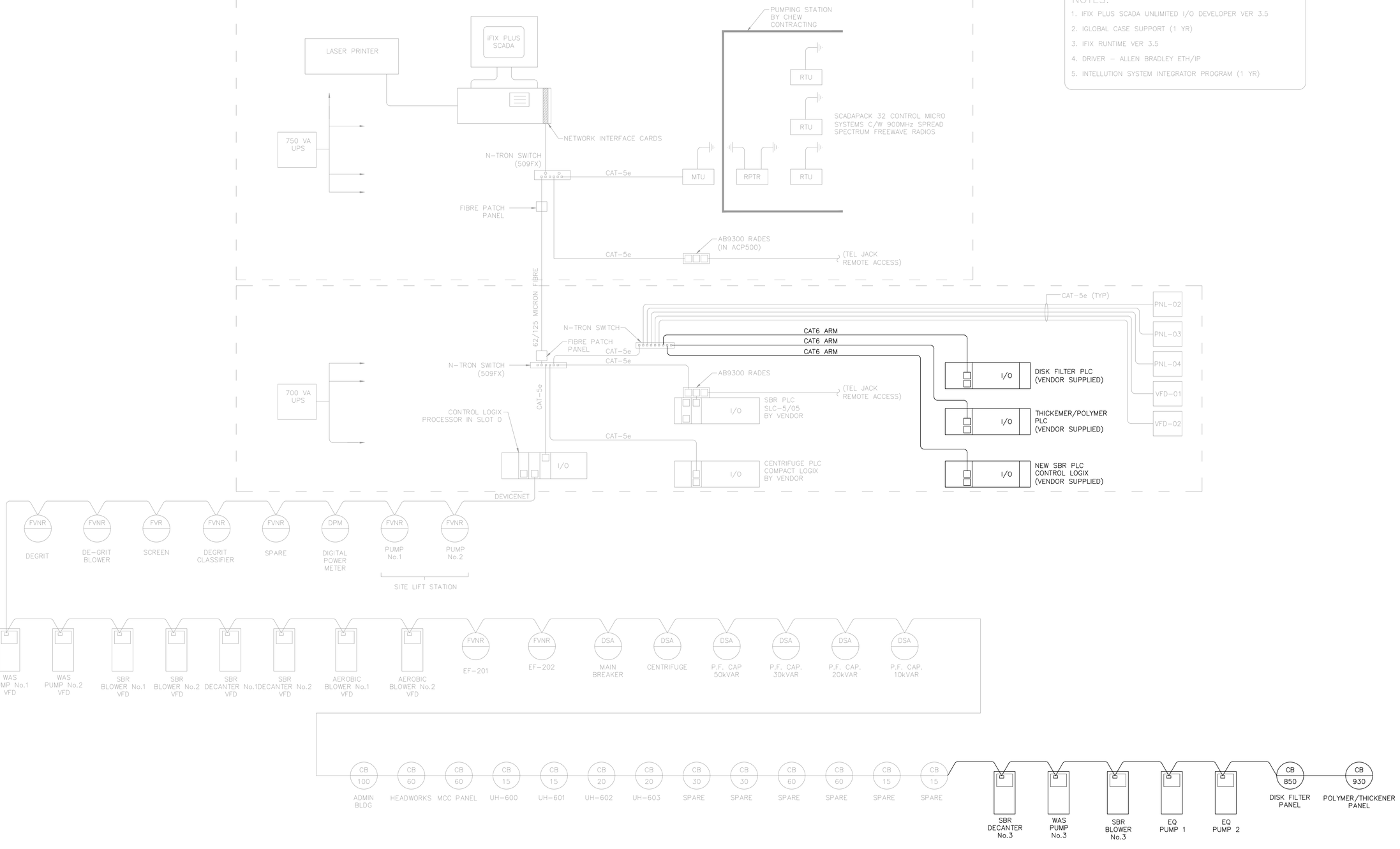
Sheet 36 of 49

Revision A

ORIGINAL SHEET - ISO A1

NOTES:

1. IFIX PLUS SCADA UNLIMITED I/O DEVELOPER VER 3.5
2. IGLOBAL CASE SUPPORT (1 YR)
3. IFIX RUNTIME VER 3.5
4. DRIVER – ALLEN BRADLEY ETH/IP
5. INTELLUTION SYSTEM INTEGRATOR PROGRAM (1 YR)



Revision	By	Appd.	YY.MM.DD
1 ISSUED FOR TENDER ADDENDUM 01	TY	JL	22.08.05
CREATED FROM RECORD DRAWING I006			
Issued	By	Appd.	YY.MM.DD

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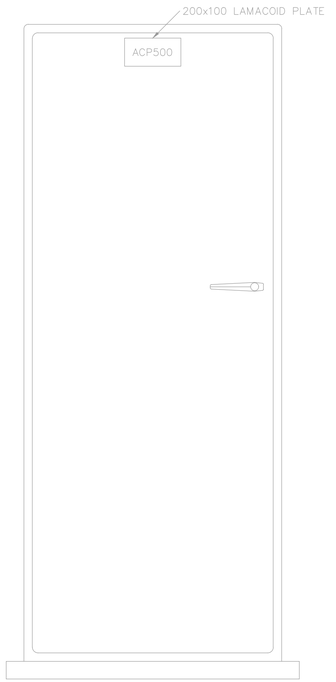
File Name: 20131_I010.dwg	AF	SS	BP	8/4/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title

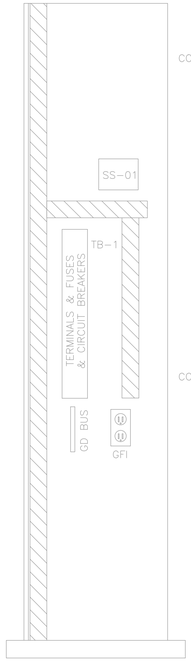
INSTRUMENTATION
INSTRUMENTATION/CONTROL SYSTEM

Project No.	Scale	
111720131	AS NOTED	
Drawing No.	Sheet	Revision
I010	of 49	0

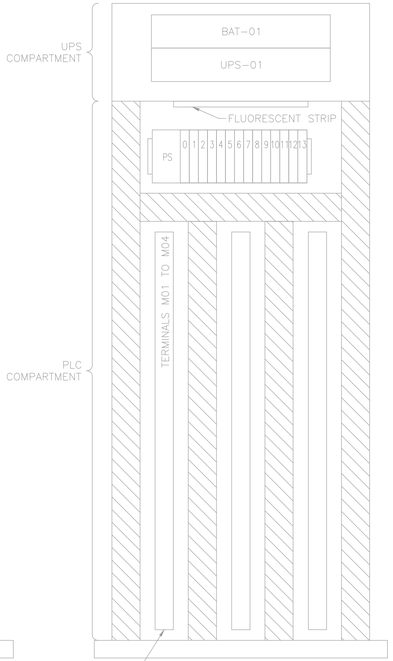
ORIGINAL SHEET - ISO A1



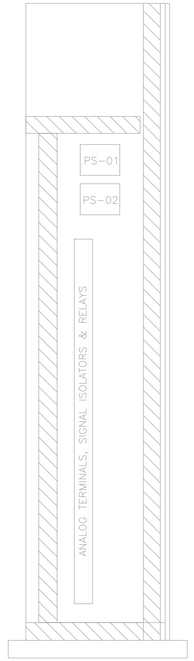
FRONT



LEFT PAN



BACK PAN

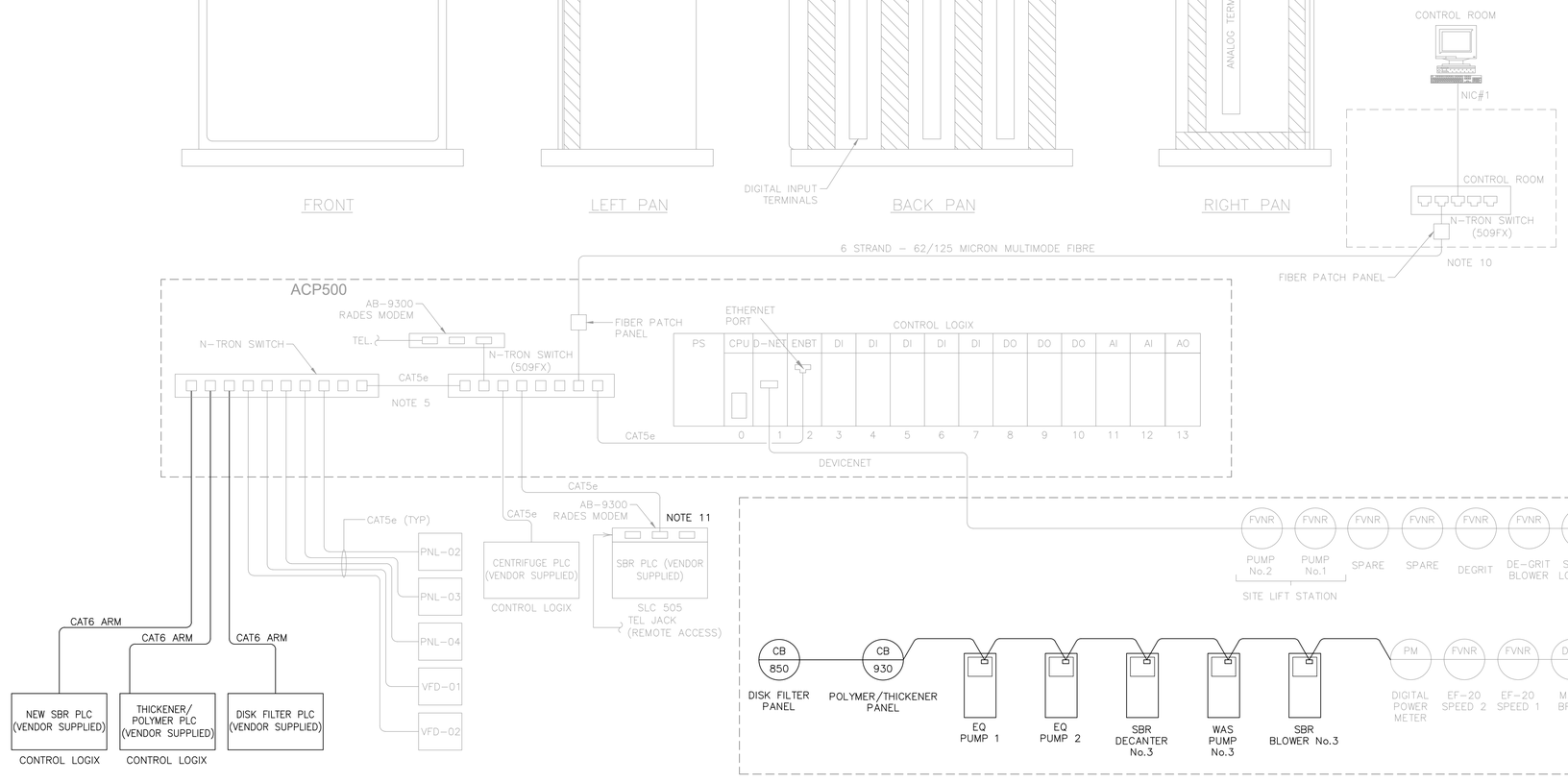


RIGHT PAN

ITEM NO.	DESCRIPTION	PART NO.	QUANTITY
T01	WIELAND – TERMINAL BLOCKS (TWO LEVEL) 6mm	WK4 E/U	AS REQUIRED
	WIELAND END PLATE FOR WK4 E/U	AP 4 E	AS REQUIRED
	WIELAND PARTITION PLATE FOR WK4 E/U	TW 4 E	AS REQUIRED
T02	WIELAND – TERMINAL BLOCKS	WK 4/U	AS REQUIRED
	WIELAND END PLATE FOR WK4/U		AS REQUIRED
T03	WIELAND – END BRACKET	9708/2 S 35	AS REQUIRED
T04	WIELAND – GROUNDING TERMINALS	WK 4 SL/U	AS REQUIRED
FUSE	WELAND – FUSED TERMINAL BLOCKS	WKI 4 TKG-D-SL	AS REQUIRED
	WIELAND END PLATE FOR WKI 4 TKG-D-SL FUSE BLOCK	API 4/3	AS REQUIRED
	WIELAND FUSE HOLDER, 24V BLOWN FUSE INDICATOR	Si ST LED	AS REQUIRED
FUSE	WIELAND – FUSED TERMINAL BLOCKS	WKI T TKG-D-SL	AS REQUIRED
	WELAND FUSE HOLDER, 120V BLOWN FUSE INDICATOR	Si ST GL	AS REQUIRED
N	WIELAND – TERMINAL BLOCKS	WK 4/U	AS REQUIRED
PS-01,02	AC POWER SUPPLY (24V,10A)	S82F-3024	1
GFI	GF RECEPTACLE 120V AC C/W TWO CONNECTIONS		1
CB	ALLEN BRADLEY CIRCUIT BREAKER	1492-CB16	3
UPS-01	LIEBERT UPS	GXT2-2000RT120	1
SS-01	LIEBERT SURGE SUPPRESSOR	IE-120	1
BAT-01	LIEBERT BATTERY		1

PLC BILL OF MATERIALS

ITEM NO.	DESCRIPTION	PART NO.	QUANTITY
PS	CONTROL LOGIX PS	1756-PA72	1
CPU	CONTROL LOGIX PROCESSOR	1756-L55M13	1
D-NET	DEVICENET SCANNER	1756-DNB	1
DI	DIGITAL INPUT MODULE	1756-IA16I	5
DO	ISOLATED RELAY OUTPUT MODULE	1756-OX8I	3
AI	ANALOG INPUT MODULE	1756-IF6I	2
AO	ANALOG OUTPUT MODULE	1756-OF6CI	1
SPACE	SPACE MODULE	1756-N2	0
–	CONTROL LOGIX SLOT CHASSIS (13 SLOTS)	1756-A13	1
ENBT	ETHERNET MODULE	1756-ENBT	2
–	N-TRON SWITCH C/W ONE 24V POWER SUPPLY (1.5A)	509FX-ST	2



NOTES:

1. NOT ALL DEVICES ARE SHOWN.
2. USE GXT2U UPS WALL MOUNT BRACKET KIT FOR UPS INSTALLATION.
3. PANEL CONTRACTOR TO VERIFY ALL PART NUMBERS AND QUANTITIES.
4. DEVICENET 24VDC PS IN MCC.
5. N-TRON SWITCH PS IN ACP900 TO BE CONNECTED TO PS-01 AND PS-02.
6. N-TRON SWITCH PS IN CONTROL ROOM TO BE CONNECTED TO CONTROL POWER UPS.
7. DSA MODULES FOR CIRCUIT BREAKER STATUS AND POWER FACTOR CAPACITOR CONTACTORS CONTROL AND STATUS.
8. MAIN SCADA COMPUTER TO BE POWERED FROM CONTROL PANEL UPS.
9. PROVIDE LIEBERT INTELLISLOT INTERFACE FOR RELAY CONTACTS. WIRE SUMMARY ALARM AND LOW BATTERY ALARM TO PLC.
10. PROVIDE 24VDC 1.5A POWER SUPPLY FOR N-TRON SWITCH AND CONNECT TO UPS-1.
11. EXISTING SBR CONTROL PANEL TO BE DECOMMISSIONED ONCE NEW SBR CONTROL PANEL IS FULLY COMMISSIONED AND TESTED WITH EXISTING SBR 1 AND 2.

Revision	By	Appd.	YY.MM.DD
1 ISSUED FOR TENDER ADDENDUM 01	TY	JL	22.08.05
CREATED FROM RECORD DRAWING I503			
Issued	By	Appd.	YY.MM.DD

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Sooke, BC Canada

File Name: 20131_I501.dwg	AF	SS	BP	8/4/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
INSTRUMENTATION
ACP-500 CONTROL PANEL

Project No.	Scale	
111720131	AS NOTED	
Drawing No.	Sheet	Revision
I501	of 49	0

ORIGINAL SHEET - ISO A1

SLOT #0
1756-LG1
PROCESSOR

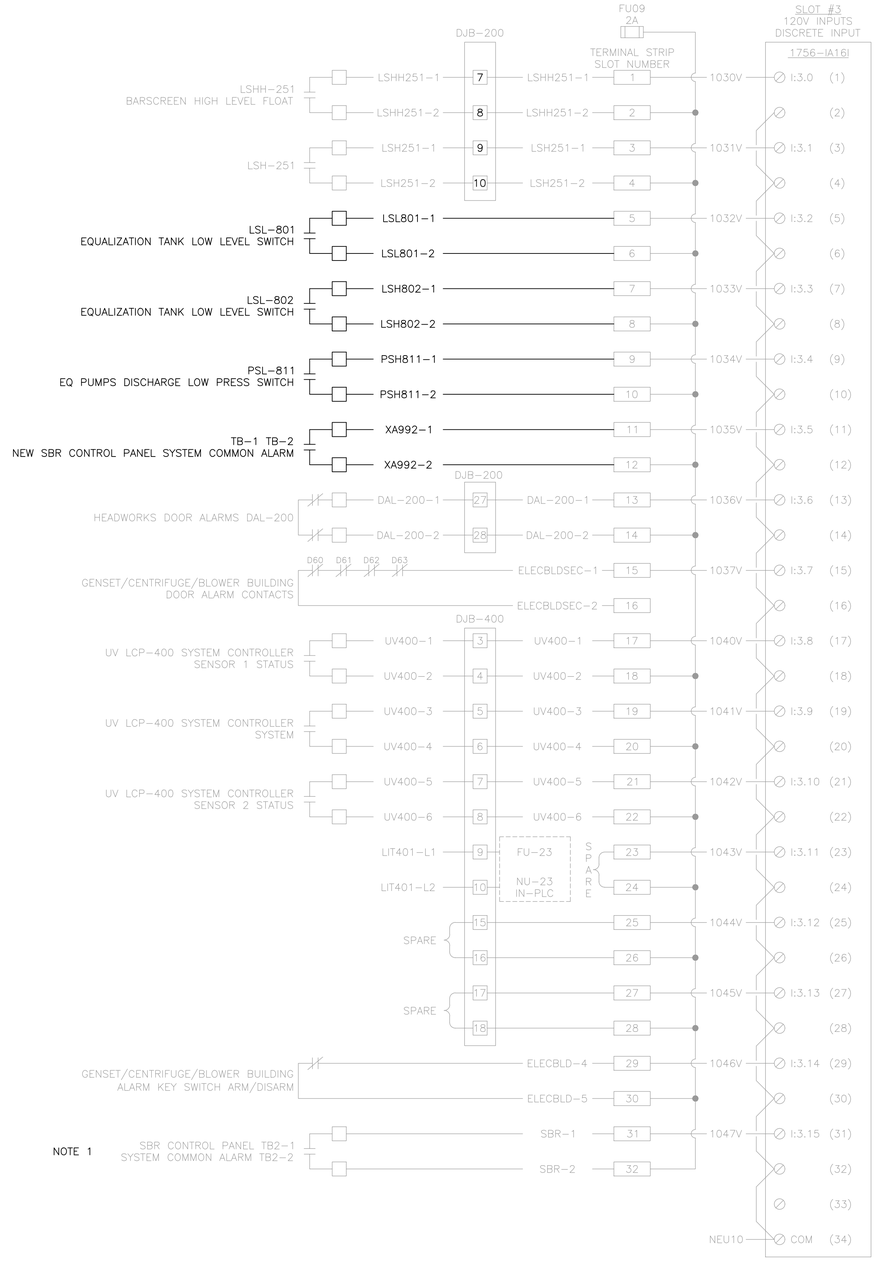
1756-LG1

SLOT #1
DEVICENET SCANNER

1756-DNB

SLOT #2
ETHERNET MODULE

1756-ENBT



NOTES:

1. EXISTING SBR CONTROL PANEL IO TO BE REMOVED ONCE NEW SBR CONTROL PANEL IS FULLY COMMISSIONED AND TESTED FOR EXISTING SBR 1 AND 2.

Revision	By	Appd.	YY.MM.DD
1 ISSUED FOR TENDER ADDENDUM 01	TY	JL	22.08.05
CREATED FROM RECORD DRAWING I505			
Issued	By	Appd.	YY.MM.DD

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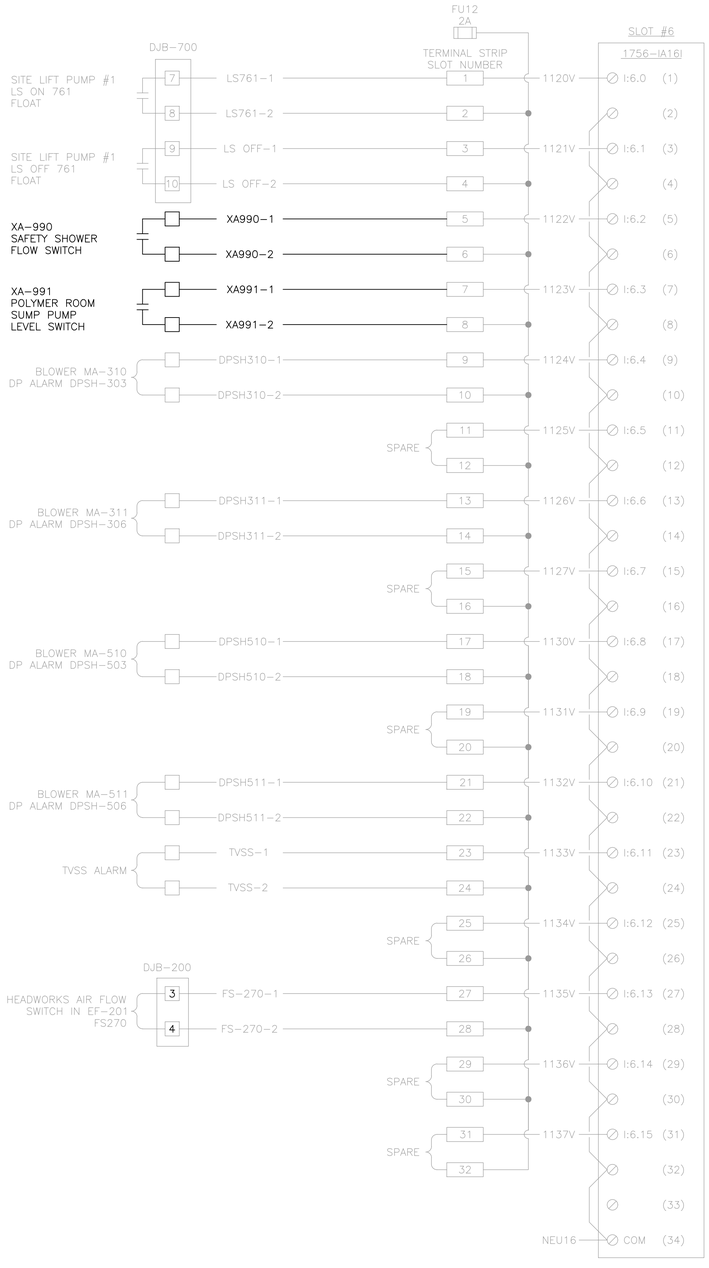
Sooke, BC Canada

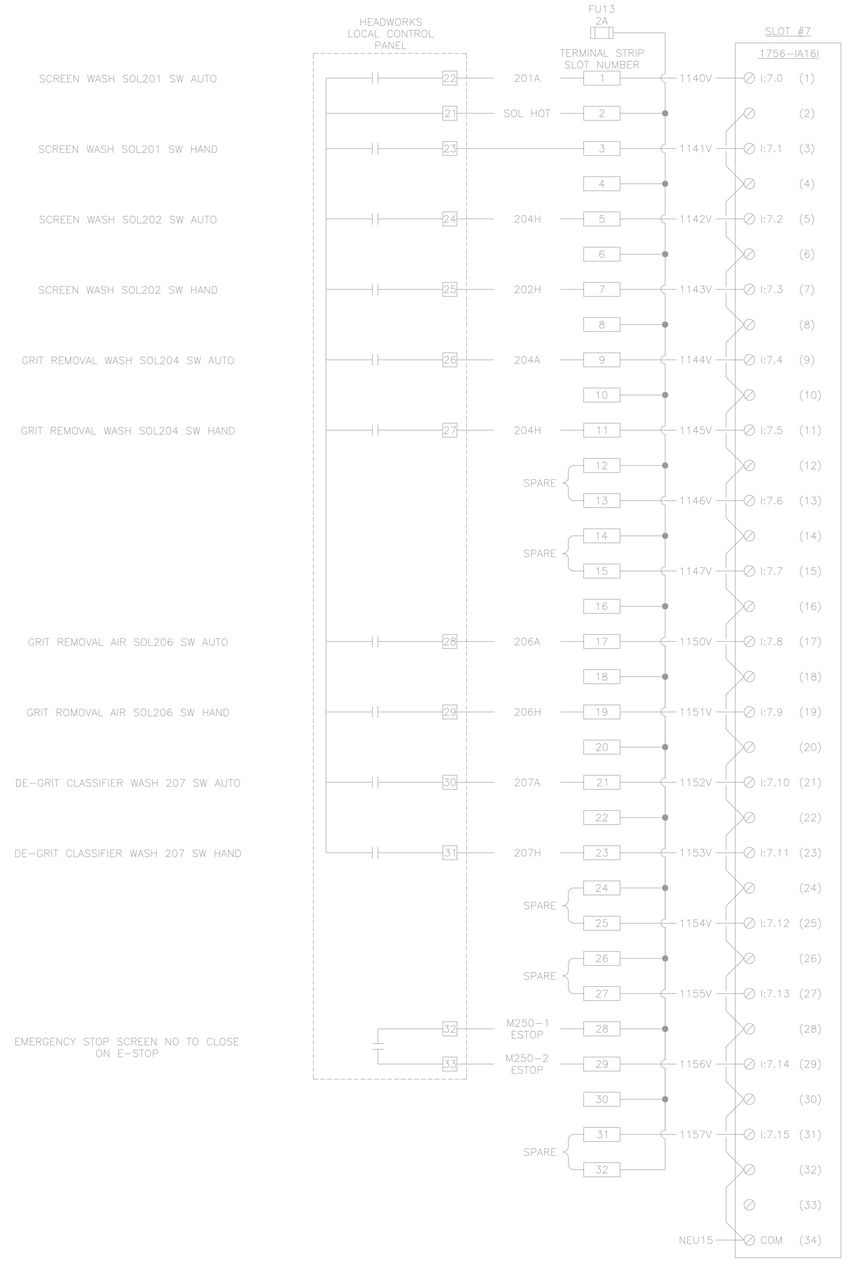
File Name: 20131_I502.dwg	AF	SS	BP	8/4/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
INSTRUMENTATION
ACP-500 PLC I/O SLOTS 0 - 3

Project No.	Scale	
111720131	AS NOTED	
Drawing No.	Sheet	Revision
I502	of 49	0

ORIGINAL SHEET - ISO A1





Revision	By	Appd.	YY.MM.DD
1 ISSUED FOR TENDER ADDENDUM 01	TY	JL	22.08.05
CREATED FROM RECORD DRAWING I507			
Issued	By	Appd.	YY.MM.DD

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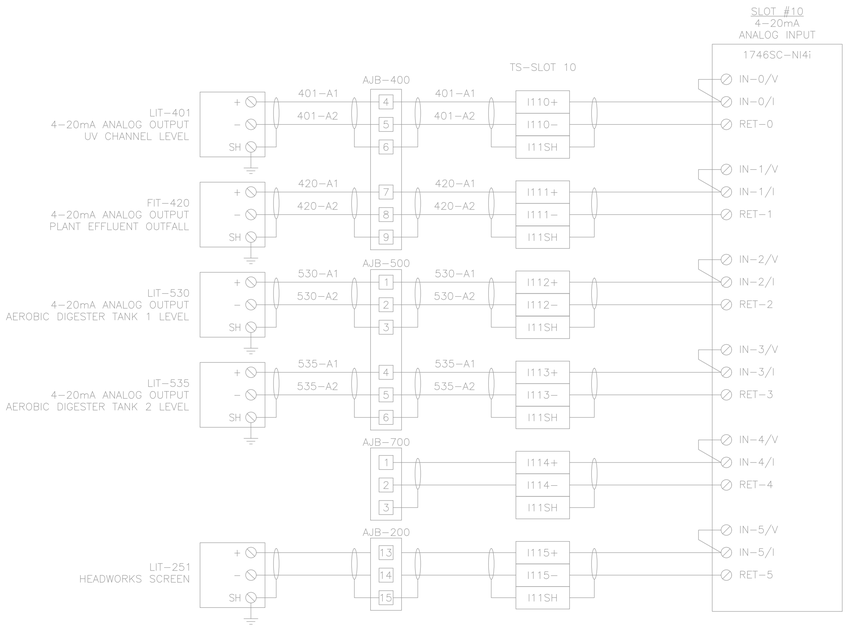
Sooke, BC Canada

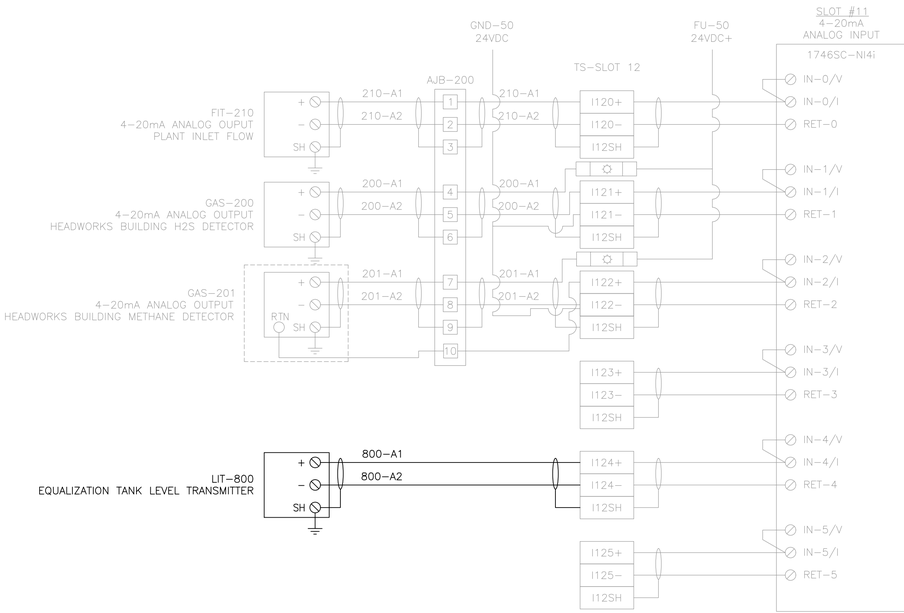
File Name: 20131_I503.dwg	AF	SS	BP	8/4/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

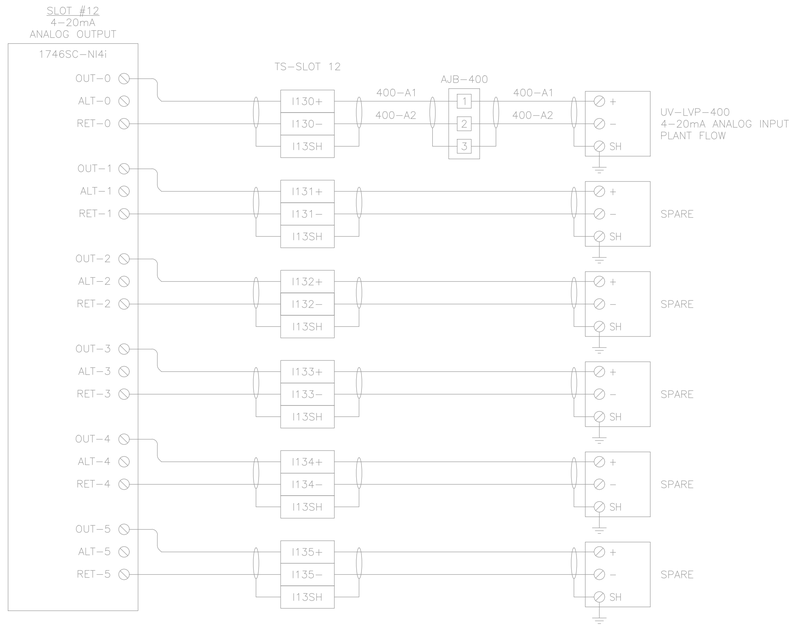
Title
INSTRUMENTATION
ACP-500 PLC I/O SLOTS 6-7

Project No.	Scale	
111720131	AS NOTED	
Drawing No.	Sheet	Revision
I503	of 49	0

ORIGINAL SHEET - ISO A1







Revision	By	Appd.	YY.MM.DD
1 ISSUED FOR TENDER ADDENDUM 01	TY	JL	22.08.05
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Issued	By	Appd.	YY.MM.DD

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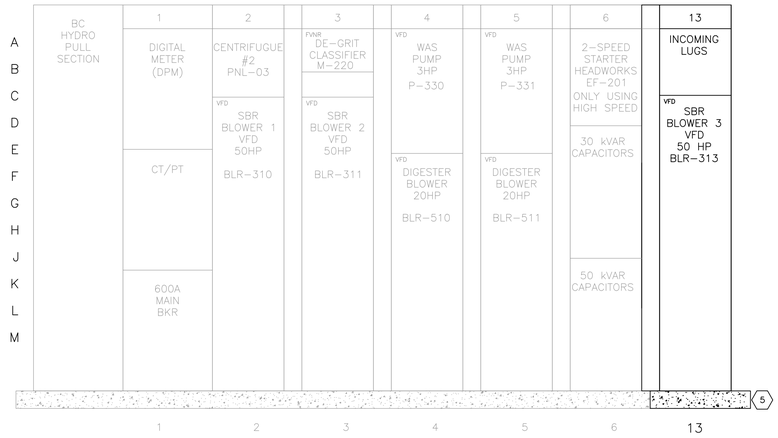
File Name: 20131_I504.dwg	AF	SS	BP	8/4/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
INSTRUMENTATION
ACP-500 PLC I/O SLOTS 10-12

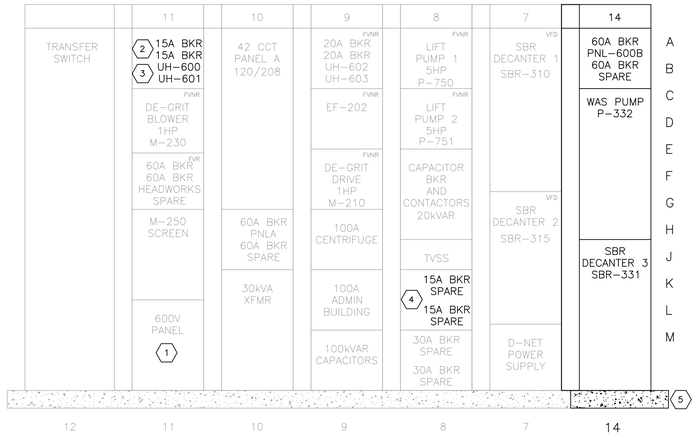
Project No.	Scale	
111720131	AS NOTED	
Drawing No.	Sheet	Revision
I504	of 49	0

ORIGINAL SHEET - ISO A1



MCC1 SECTION LAYOUT (FRONT)

N.T.S.



MCC1 SECTION LAYOUT (BACK)

N.T.S.

PANEL – A
MOUNTING –
LOCATION – MCC ROOM

VOLTS – 120/208V, 3ø, 4W
MAIN BUS – 225A
MAIN BREAKER – 125A

LOAD	DESCRIPTION	BKR	CIRCUIT	BKR	DESCRIPTION	LOAD
	BATTERY CHARGER	15	1 – 2	15	LTG – CENTRIFUGE	
	OUTSIDE LIGHTING	15	3 – 4	15	REC – CENTRIFUGE	
	EMERG. LTG. CENTRIFUGE	15	5 – 6	15	SPARE	
	LCP POWER – CENTRIFUGE	15	7 – 8	15	EXHAUST FAN EF-600	
	SPARE	15	9 – 10	15	EXHAUST FAN EF-601	
	SPARE	15	11 – 12	15	EXHAUST FAN EF-602	
	NEW SBR CONTROL PANEL	20	13 – 14	15	REC	
	POLYMER RM. EXHAUST FAN	15	15 – 16	15	BLOWER RM LIGHTING	
	SBR CONTROL PANEL	15	17 – 18	15	POLYMERE RM. LIGHTING	
	UV PDC PWR	15	19 – 20	15	REC	
	UV PDC PWR	15	21 – 22	15	GEN RM LIGHTING	
	UV PDC PWR	15	23 – 24	20	UNIT HEATER UH-1	
	UV PDC PWR	15	25 – 26	2P		
	UV PDC PWR	15	27 – 28	20	UNIT HEATER UH-2	
	UV PDC PWR	15	29 – 30	2P		
	PLC PWR	15	31 – 32	15	SPARE	
	PLC PWR	15	33 – 34	15	SPARE	
	PLC PWR	15	35 – 36	15	ENG HEATER	
	SPARE	15	37 – 38	15	PJB – 300	
	REC LIFT STATION	15	39 – 40	15	PJB – 300	
	SBR 3 EXTERIOR LIGHTING	15	41 – 42	15	PJB – 300	

DISTRIBUTION PANEL LAYOUT

SCALE NTS

NOTES:

1. EXISTING FEED TO PANEL P–600 BREAKER AND CONDUCTORS TO BE REMOVED. PANEL P–600 IS TO BE RE–FED FROM A NEW 150A 3P BREAKER INSTALLED IN THE SAME SPACE. PANEL FEED CONDUCTORS TO BE REPLACED WITH NEW CONDUCTORS AS SHOWN ON THE SINGLE LINE DIAGRAM.
2. EXISTING FEED TO UNIT HEATERS UH–600 AND UH–601 BREAKERS AND CONDUCTORS TO BE REMOVED. UH–600 UH–601 ARE TO BE RE–FED FROM NEW 15A 3P BREAKERS INSTALLED IN PANEL P–600. CONDUCTORS TO THE TWO UNIT HEATERS MAY BE EXTENDED AS REQUIRED VIA A NEW JUNCTION BOX IN THE ELECTRICAL ROOM CEILING SPACE.
3. PROVIDE AND INSTALL A NEW 150A 3P BREAKER IN MCC SECTION 11 (SPACE A/B/C) TO FEED THE TWO NEW MCC SECTION 13 AND 14, PROVIDE NEW FEED CONDUCTORS FROM NEW BREAKERS TO INCOMING LUGS IN SECTION 13 OF NEW MCC.
4. REPLACE EXISTING SPARE 15A 3P BREAKER IN SECTION 8 (SPACE J/K/L) WITH A NEW 40A 3P BREAKER TO FEED THE NEW HOT WATER TANK LOCATED IN THE NEW POLYMER ROOM.
5. EXTEND EXISTING HOUSE KEEPING PAD AT THE SAME HEIGHT TO ACCOMMODATE THE NEW MCC SECTIONS 13 AND 14.

A

A	ISSUED FOR TENDER ADDENDUM 01	TY	TDC	22.08.05
Revision		By	Appd.	YY.MM.DD
3	ISSUED FOR TENDER	TY	TDC	22.07.25
2	ISSUED FOR BUILDING PERMIT	TY	TDC	22.07.20
1	ISSUED FOR 90% SUBMISSION	TY	TC	22.06.03
Issued		By	Appd.	YY.MM.DD

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File Name: 20131_e612.dwg	AF	SS	BP	8/4/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
ELECTRICAL
MCC LAYOUT AND PANEL 'A'

Project No.	Scale	
111720131	AS NOTED	
Drawing No.	Sheet	Revision
E612	47 of 49	A

CABLE SCHEDULE

ID	SHORT TAG	TAG	SOURCE	DESTINATION	TYPE	INSTANCE	CABLE DETAILS	ROUTING DETAILS	REV	COMMENTS
50	P50	MCC1/MCC1.13–P1	MCC1	MCC1.13	P	1	3C #1/0 TECK	RANDOM SPACING TRAY	A	
51	P51	MCC1/PB–600V–P1	MCC1	PB–600V	P	1	3C #2 TECK	RANDOM SPACING TRAY	A	
52	P52	MCC1/HWTANK–01–P1	MCC1	HWTANK–01	P	1	3C #10 TECK	RANDOM SPACING TRAY	A	
53	P53	MCC1–14/M–321–P1	MCC1–14	M–321	P	1	3C #12 VFD CABLE	RANDOM SPACING TRAY	B	
54	P54	MCC1.14/M–332–P1	MCC1.14	M–332	P	1	3C #12 VFD CABLE	RANDOM SPACING TRAY	B	
55	P55	MCC1.14/PNL–600B–P1	MCC1.14	PNL–600B	P	1	3C #8 TECK	RANDOM SPACING TRAY	A	
56	P56	MCC1.13/M–313–P1	MCC1.13	M–313	P	1	3C#10 VFD CABLE	RANDOM SPACING TRAY	B	
57	P57	PB–600V/UH–600–P1	PB–600V	UH–600	P	1	3C #12 TECK	RANDOM SPACING TRAY	A	
58	P58	PB–600V/UH–601–P1	PB–600V	UH–601	P	1	3C #12 TECK	RANDOM SPACING TRAY	A	
59	P59	PB–600V/DISKFILTCP–01–P1	PB–600V	DISKFILTCP–01	P	1	3C #12 TECK	RANDOM SPACING TRAY	A	
60	P60	PB–600V/THKPLYCP–01–P1	PB–600V	THKPLYCP–01	P	1	3C #12 TECK	RANDOM SPACING TRAY	A	
61	P61	PNL–600B/M–910–P1	PNL–600B	M–910	P	1	3C #12 TECK	RANDOM SPACING TRAY	B	
62	P62	PNL–600B/M–810–P1	PNL–600B	M–810	P	1	3C #12 TECK	RANDOM SPACING TRAY	B	
63	P63	PNL–600B/M–820–P1	PNL–600B	M–820	P	1	3C #12 TECK	RANDOM SPACING TRAY	B	
64	P64	PNL–A/PLYEXFAN–01–P1	PNL–A	PLYEXFAN–01	P	1	2C #12TECK	RANDOM SPACING TRAY	A	
65	P65	PNL–A/PLYRMLIGHTS–P1	PNL–A	PLYRMLIGHTS	P	1	2C #12TECK	RANDOM SPACING TRAY	A	
66	P66	PNL–A/SBR3LIGHTS–P1	PNL–A	SBR3LIGHTS	P	1	2C #12TECK	RANDOM SPACING TRAY	A	
67	P67	PNL–A/UH–1–P1	PNL–A	UH–1	P	1	2C #2 TECK	RANDOM SPACING TRAY	A	
68	P68	PNL–A/UH–2–P1	PNL–A	UH–2	P	1	2C #2 TECK	RANDOM SPACING TRAY	A	
69	P69	PNL–A/SBRCP–02–P1	PNL–A	SBRCP–02	P	1	2C #12TECK	RANDOM SPACING TRAY	A	
50	C50	MCC1.14/SBRDEC–03–C1	MCC1.14	SBRDEC–03	C	1	12C #14 TECK	RANDOM SPACING TRAY	A	
51	C51	MCC1.13/SBRBLO–03–C1	MCC1.13	SBRBLO–03	C	1	12C #14 TECK	RANDOM SPACING TRAY	A	
52	C52	MCC1.13/WAS–03–C1	MCC1.13	WAS–03	C	1	12C #14 TECK	RANDOM SPACING TRAY	A	
53	C53	ACP–500/LSL–801–C1	ACP–500	LSL–801	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
54	C54	ACP–500/LSH–802–C1	ACP–500	LSH–802	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
55	C55	ACP–500/PSL–811–C1	ACP–500	PSL–811	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
56	C56	ACP–500/FSH–990–C1	ACP–500	FSH–990	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
57	C57	ACP–500/LSH–991–C1	ACP–500	LSH–991	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
58	C58	ACP–500/SBRCP–02–C1	ACP–500	SBRCP–02	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
59	C59	SBRCP–02/PSH–351–C1	SBRCP–02	PSH–351	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
60	C60	SBRCP–02/TSH–352–C1	SBRCP–02	TSH–352	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
61	C61	SBRCP–02/DPSH–353–C1	SBRCP–02	DPSH–353	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
62	C62	SBRCP–02/LSH–333–C1	SBRCP–02	LSH–333	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
63	C63	SBRCP–02/ZSO–303–C1	SBRCP–02	ZSO–303	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
64	C64	SBRCP–02/ZSC–303–C1	SBRCP–02	ZSC–303	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
65	C65	SBRCP–02/ZSO–334–C1	SBRCP–02	ZSO–334	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	

CABLE SCHEDULE CONTINUED

66	C66	SBRCP–02/ZSC–334–C1	SBRCP–02	ZSC–334	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
67	C67	DISKFILTCP–01/LSL–851–C1	DISKFILTCP–01	LSL–851	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
68	C68	DISKFILTCP–01/LSH–852–C1	DISKFILTCP–01	LSH–852	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
69	C69	DISKFILTCP–01/PSH–860–C1	DISKFILTCP–01	PSH–860	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
70	C70	THKPLYCP–01/LSL–901–C1	THKPLYCP–01	LSL–901	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
71	C71	THKPLYCP–01/LSH–902–C1	THKPLYCP–01	LSH–902	C	1	2C #14 TECK	RANDOM SPACING TRAY	B	
72	C72	THKPLYCP–01/P–930A–C1	THKPLYCP–01	P–930A	C	1	4C #14 TECK	RANDOM SPACING TRAY	B	
73	C73	THKPLYCP–01/P–930B–C1	THKPLYCP–01	P–930B	C	1	4C #14 TECK	RANDOM SPACING TRAY	B	
50	A50	ACP–500/LIT–800–A1	ACP–500	LIT–800	A	1	1PR #16 TPSH	RANDOM SPACING TRAY	B	
51	A51	SBRCP–02/AIT–331–A1	SBRCP–02	AIT–331	A	1	1PR #16 TPSH	RANDOM SPACING TRAY	B	
52	A52	SBRCP–02/LIT–332–A1	SBRCP–02	LIT–332	A	1	1PR #16 TPSH	RANDOM SPACING TRAY	B	
53	A53	SBRCP–02/ZIT–303–A1	SBRCP–02	ZIT–303	A	1	1PR #16 TPSH	RANDOM SPACING TRAY	B	
54	A54	SBRCP–02/BFV–303–A1	SBRCP–02	BFV–303	A	1	1PR #16 TPSH	RANDOM SPACING TRAY	B	
55	A55	DISKFILTCP–01/LIT–850–A1	DISKFILTCP–01	LIT–850	A	1	1PR #16 TPSH	RANDOM SPACING TRAY	B	
56	A56	THKPLYCP–01/LIT–900–A1	THKPLYCP–01	LIT–900	A	1	1PR #16 TPSH	RANDOM SPACING TRAY	B	
57	A57	THKPLYCP–01/M–930A–A1	THKPLYCP–01	M–930A	A	1	1PR #16 TPSH	RANDOM SPACING TRAY	B	
58	A58	THKPLYCP–01/M–930B–A1	THKPLYCP–01	M–930B	A	1	1PR #16 TPSH	RANDOM SPACING TRAY	B	
50	D50	ACP–500/SBRCP–02–D1	ACP–500	SBRCP–02	D	1	CAT6 Arm	RANDOM SPACING TRAY	B	
51	D51	ACP–500/DISKFILTCP–01–D1	ACP–500	DISKFILTCP–01	D	1	CAT6 Arm	RANDOM SPACING TRAY	B	
52	D52	ACP–500/THKPLYCP–01–D1	ACP–500	THKPLYCP–01	D	1	CAT6 Arm	RANDOM SPACING TRAY	B	
53	D53	ACP–500/M–313–D1	ACP–500	M–313	D	1	DeviceNet	RANDOM SPACING TRAY	B	
54	D54	ACP–500/M–321–D1	ACP–500	M–321	D	1	DeviceNet	RANDOM SPACING TRAY	B	
55	D55	ACP–500/M–332–D1	ACP–500	M–332	D	1	DeviceNet	RANDOM SPACING TRAY	B	
56	D56	ACP–500/M–810–D1	ACP–500	M–810	D	1	DeviceNet	RANDOM SPACING TRAY	B	
57	D57	ACP–500/M–820–D1	ACP–500	M–820	D	1	DeviceNet	RANDOM SPACING TRAY	B	
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59	D59	THKPLYCP–01/M–940–D1	THKPLYCP–01	M–940	D	1	DeviceNet	RANDOM SPACING TRAY	B	
60	D60	DISKFILTCP–01/M–851–D1	DISKFILTCP–01	M–851	D	1	DeviceNet	RANDOM SPACING TRAY	B	
61	D61	DISKFILTCP–01/M–852–D1	DISKFILTCP–01	M–852	D	1	DeviceNet	RANDOM SPACING TRAY	B	
62	D62	DISKFILTCP–01/M–853–D1	DISKFILTCP–01	M–853	D	1	DeviceNet	RANDOM SPACING TRAY	B	
63	D63	DISKFILTCP–01/M–854–D1	DISKFILTCP–01	M–854	D	1	DeviceNet	RANDOM SPACING TRAY	B	
64	D64	ACP–500/CB–850–D1	ACP–500	CB–850	D	1	DeviceNet	RANDOM SPACING TRAY	B	
65	D65	ACP–500/CB–930–D1	ACP–500	CB–930	D	1	DeviceNet	RANDOM SPACING TRAY	B	

A

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Consultants

Permit-Seal

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Client/Project
District of Sooke
SOOKE WWTP EXPANSION PROJECT
Sooke, BC Canada

File Name: 20131_e613.dwg	AF	SS	BP	8/4/2022
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
ELECTRICAL
CABLE SCHEDULE

Project No.	Scale	
111720131	AS NOTED	
Drawing No.	Sheet	Revision
E613	48 of 49	A

SOOKE WASTEWATER TREATMENT PLANT EXPANSION PROJECT

Construction Environmental Management Plan (CEMP)

August 3, 2022

Prepared for:
District of Sooke
2205 Otter Point Road
Sooke, BC V9Z 1J2

Prepared by:
Stantec Consulting Ltd.
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Burnaby, BC V5H 0C6

Limitations and Sign-off

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Acronyms / Abbreviations

AIA	Archaeological Impact Assessment
BC	British Columbia
BMP	Best Management Practice
CCME	Canadian Council of Ministers of the Environment
CEMP	Construction Environmental Management Plan
the District	District of Sooke
DFO	Fisheries and Oceans Canada
ECCC	Environment and Climate Change Canada
EM	Environmental Monitor
ENV	Ministry of Environment and Climate Change Strategy
ESC	Erosion and Sediment Control
HADD	Harmful alteration, disruption, or destruction
HCA	*Heritage Conservation Act*
LOA	Letter of Advice
m	meter
MOF	Ministry of Forests
MOE	Ministry of Environment
MWLAP	Ministry of Water, Land and Air Protection
QEP	Qualified Environmental Professional
RAPR	Riparian Areas Protection Regulation
RFR	Request for review
SARA	*Species at Risk Act*
SDS	Safety Data Sheet
SBR	Sequencing Batch Reactor
SPEA	Streamside Protection and Enhancement Area
Stantec	Stantec Consulting Ltd.
TBD	To be determined
WSA	*Water Sustainability Act*
WWTP	Wastewater Treatment Plant

1 Introduction

Stantec Consulting Ltd. (Stantec) was retained by the District of Sooke (the District) to prepare the following Construction Environmental Management Plan (CEMP) to support construction of the expansion of the existing Sooke Wastewater Treatment Plant (WWTP). The expansion consists of the addition of a new digester and a third sequencing batch reactor (SBR) tank, and a fourth SBR tank is planned within the next ten years. The scope of this CEMP is specific to the construction of the new digester and third SBR tank (the Project). The Project will include typical construction activities (excavation, grading, erection of structures) to build the SBR tank and ancillary features including roadways within the existing Sooke WWTP property.

This CEMP provides guidance on environmental regulatory requirements, best management practices (BMPs), mitigation measures, and controls to be used during construction to maintain regulatory compliance and to avoid or limit potential Project-related adverse environmental effects. It is informed by the results of site assessments and outlines roles and responsibilities, environmental protection measures, and environmental monitoring and reporting. It contains the following components:

- Project overview, location, and roles and responsibilities of the environmental management team and construction personnel
- Description of the environmental setting
- Regulatory framework
- Environmental protection measures, mitigations, and controls
- Environmental monitoring and reporting requirements
- Emergency and Project contacts

The CEMP is a living document and is intended to be updated by the Contractor as Project work activities and schedule are developed. The CEMP will be re-issued by the Contractor for construction as Project conditions, execution plans, and schedules are established. The CEMP will be reviewed and revised and updated by the Contractor throughout construction of the Project.

All personnel working on the Project must comply with the CEMP and complete the Project in compliance with applicable environmental legislation and authorizations.

The objectives of the CEMP are therefore to:

- Enable compliance with project-related regulatory requirements, authorizations, and guidance
- Protect environmental values as identified in Section 2.4 within and adjacent to the Project during construction.

2 Project Information

The following sections include information about the Project location, the Project and site description, and Project schedule.

2.1 Project Location

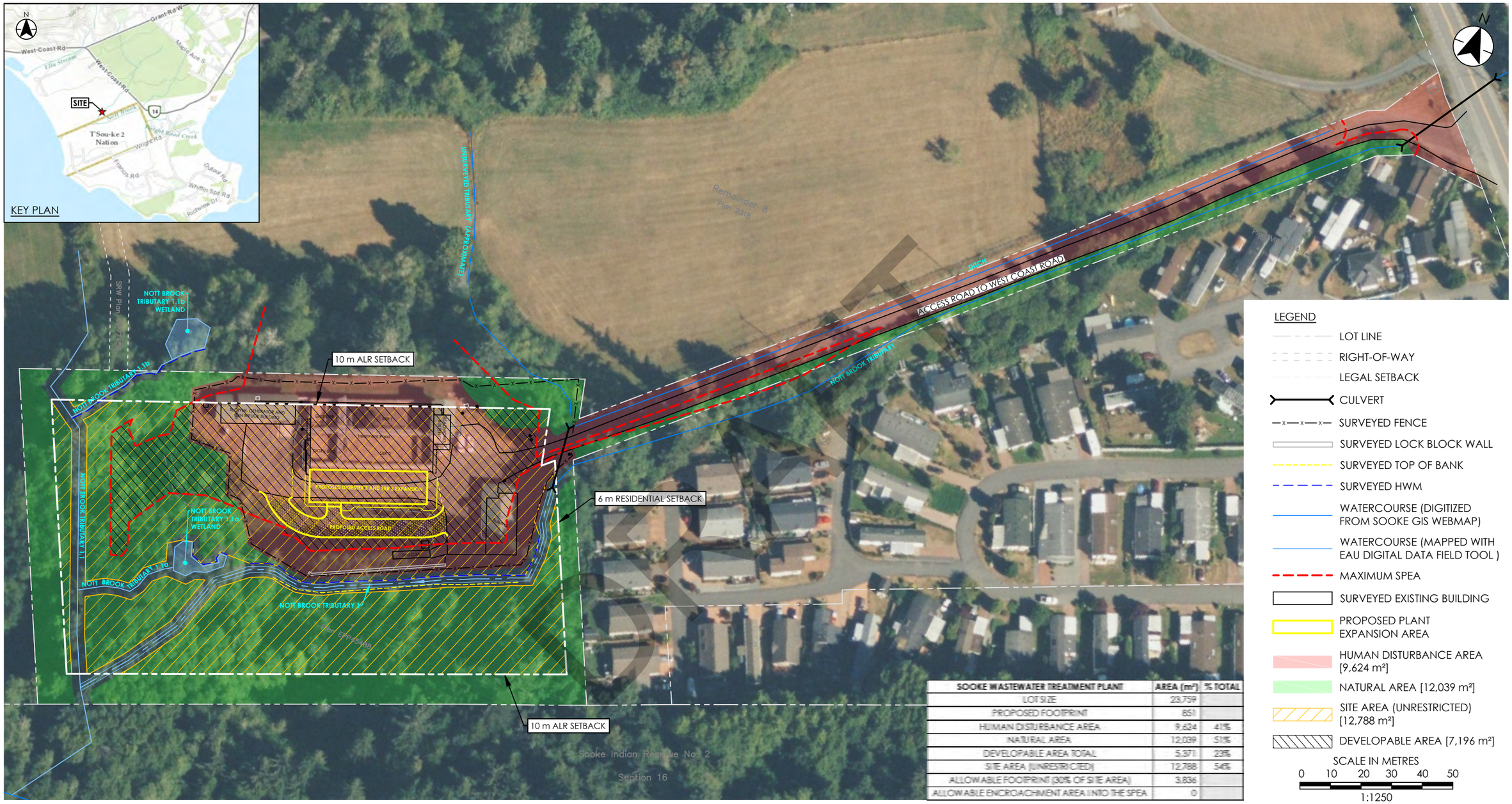
The existing WWTP and Project Site are located at 7113 West Coast Rd. in the District of Sooke (the Site) (Figure 1). The Site is located southwest of West Coast Road as part of Lot 8, Sections 1, 2 and 3 of the District of Sooke, Plan 2318. A 320-meter (m) access road is used to access the Site from West Coast Road. The Site is located north of the T'Sou-ke Nation Reserve #2, which includes a large undeveloped area. The Site elevation slopes from a high of nine m to a low on the west side of 4.5 to 5.5 m. The WWTP discharges treated effluent through a 2,400 m long and 30 m deep marine outfall to the Juan de Fuca Straight via a four-port diffuser.

2.2 Project Description

The District's existing wastewater infrastructure was completed and commissioned in 2005 for a defined Sewer Specified Area that accommodated an initial population of 5,500 or 1350 homes. The sewer system is an integral part of the environmental remediation and protection of Sooke Harbour and Basin. One of the goals of the project was to replace septic fields in the core area, whose runoff accumulates into local waterways. This provided for rehabilitation of the Sooke Harbour and Basin and protection of the area's freshwater systems. As the District's wastewater system approaches capacity, compliance issues are of concern to the District as they become liable for damages and face potential fines from provincial and federal agencies.

The T'Sou-ke Nation has been in discussions with the District (for 10+ years) to expand its services to both reserve lands in an effort to improve water quality by eliminating septic systems within the reserves thus preventing sewage from escaping into the Sooke Basin. The District is aware that areas outside the Sewage Specified Area have the potential for failing septic systems. This results in the release of sewage into the Sooke Basin causing significant environmental concerns that impact the water quality and best use of the Basin by both the District and the T'Sou-ke Nation.

To meet the imminent needs, an expansion of the WWTP is proposed to meet increased demand on the plant. To increase the maximum discharge of treated effluent, a new digester and SBR tank is proposed to be constructed on the south wall of the existing structure (SBR #3). A fourth SBR is expected to be constructed south of SBR #3 within the next 10 years. This CEMP is specific to the construction of SBR #3. The SBR #3 and SBR #4 expansion will allow for an increased maximum discharge of treated effluent from 6,900 m^3/day to 13,800 m^3/day. The details of the proposed WWTP expansion are included within Appendix A – Basis of Design Report.



SOOKE WASTEWATER TREATMENT PLANT	AREA (m²)	% TOTAL
LOT SIZE	23,759	
PROPOSED FOOTPRINT	851	
HUMAN DISTURBANCE AREA	9,624	41%
NATURAL AREA	12,039	51%
DEVELOPABLE AREA TOTAL	5,371	23%
SITE AREA (UNRESTRICTED)	12,788	54%
ALLOWABLE FOOTPRINT (30% OF SITE AREA)	3,836	
ALLOWABLE ENCROACHMENT AREA INTO THE SPEA	0	

Stantec

ORIGINAL SHEET - ANSI B

Sources
- AERIAL IMAGERY FROM MICROSOFT BING WEB MAPPING SERVICE (WMS)

Project Information
Project No.: 111720131
Scale: 1:1250
Date: 2022-AUG-03
Drawn by: G. HUYNH
Checked by: P. REECE

Project Location
SOOKE WASTEWATER TREATMENT PLANT
SOOKE, BC

Client/Project
DISTRICT OF SOOKE

SOOKE WASTEWATER TREATMENT PLANT EXPANSION
CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

TITLE
SOOKE WWTP EXPANSION PROJECT SITE OVERVIEW

Figure No.
1

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2022/08/03 12:23 PM By: Huynh, Gordon

The proposed WWTP expansion is to be completed in two phases, with each phase adding a new SBR, a digester, and new a new gravel access road around the proposed SBR. Each SBR has an area of 290 m^2, the digester has an area of approximately 135 m^2, and the area of the gravel access road is approximated as 352 m^2 (Figure 1). The total area of the proposed development for both phases is 1,202 m^2. The existing facility would be retained with adjustments to access roads, parking, and landscaping around the site to fit with the proposed development.

Based on the site conditions in the geotechnical engineer's report (Appendix B – Geotechnical Report), the results of the subsurface exploration and subsequent laboratory testing demonstrated that the proposed WWTP expansion could be supported on a raft foundation made from stiff to very stiff native clay and clayey sand soils. Site preparation activities would include stripping organics, removing soil backfill from the south wall of SRB #2, and excavation of the expansion footprint to achieve design subgrade elevation. Any soft or loose soils detected within the exposed subgrade should be excavated and replaced with structural fill. Backfilling and compaction are to be reviewed by a geotechnical engineer. Excavations of up to 3 m deep are expected and will be cut at appropriate angles and depths to maintain slope stability. Conventional sump and pumps would be used to control groundwater during excavation activities. A perimeter drainage system, consisting of at least 150 mm diameter perforated ridged wall pipe, was also proposed to direct runoff away from building areas.

2.3 Project Schedule

A construction activities schedule is not currently available.

2.4 Environmental Setting

2.4.1 AQUATIC ENVIRONMENT

The Project Site is located within the Nott Brook watershed. Nott Brook acts as the primary drainage of the watershed and contains two main channels (Nott Brook Tributary 1 and 1.1, respectively) (Figure 1). These reaches converge near the southwest corner of the WWTP property line; however, only Nott Brook Tributary 1 is close enough to act as a drainage reservoir for potential run-off from the Project footprint. There are at least seven watercourses/water bodies located on or adjacent to the Project Site (Figure 1) including four streams, a ditch and two wetlands:

- Nott Brook Tributary 1 flows along the south side of the WWTP within the property.
- Nott Brook Tributary 1.1, an unmapped tributary flowing along the west side of the WWTP property from the agricultural area to the north.
- Two small tributaries Nott Brook Tributary 1.1a and 1.1b, both of which flow southwest into Tributary 1.1 from two separate wetland areas.

- Nott Brook Tributary 1.1a Wetland 1 (located on the southwest corner of the WWTP) and Nott Brook Tributary 1.1b Wetland (located on the northwest corner of the WWTP). Both wetlands are supplied by groundwater emergence and seepage.
- A drainage ditch, located along the north side of the access road to West Coast Road, also drains directly into the Nott Brook Tributary.

Nott Brook Tributary 1 is a stream with an average width of 1.6 m and a gradient of 2%. The channel has a riffle-pool morphology; however, the stream has been channelized and straightened adjacent to the WWTP. Flow is from east to west with contributions from the north at the WWTP gate from the access road ditch and a surveyed tributary though a 400 mm culvert, runoff from the WWTP yard at the southeast corner, and from Nott Brook Tributary 1.1 near the southwest corner of the site.

The forested area west of the WWTP contains two wetlands which appear to be natural seepage areas. These wetlands drain to the west and southwest respectively within small tributaries into Nott Brook Tributary 1.1. The area west of the WWTP is generally a wet forest with wetland conditions west and south of the site with wetlands present on the agricultural property adjacent. The geotechnical report noted that the water table is ~3 m below the surface of the grade within the WWTP, which explains some of the conditions observed.

The gravel access road to the WWTP is bounded on the south by Nott Brook Tributary 1 and a roadside ditch on the north. Along the access road, Nott Brook Tributary 1 is located within a narrow riparian area between the access road and the manufactured home park located to the southeast. Nott Brook Tributary 1 was not surveyed in detail in this area but is assumed to have similar conditions to those observed south of the WWTP. The roadside ditch contained limited indicators of regular flow, likely flowing primarily after rainfall events or when the groundwater table is high. Flow from the ditch does connect to the unsurveyed tributary located northeast of the WWTP.

There is fish habitat present In Nott Brook, (i.e., undercut banks, spawning gravels, riparian vegetation providing coverage). The confluence between Nott Brook and Nott Brook Tributary 1 contained good habitat for typical coastal anadromous species such as coastal cutthroat trout (*Oncorhynchus clarki clarki*), steelhead trout (*Oncorhynchus mykiss*) and coho salmon (*Oncorhynchus kisutch*). ENKON Environmental found several resident coastal cutthroat trout in a portion of Nott Brook (Associated Engineering 2002). Due to its proximity to the ocean, the lack of a gradient barrier, and undisturbed downstream reaches, it is likely that anadromous species could, or have inhabited reaches of Nott Brook. During the site visit, no fish were visually observed, and no fish sampling was completed.

2.4.2 WILDLIFE

The Project Site is located on the east side of Sooke Bay, within 600 m of the shoreline, on the edge of a forested area that includes the T'Sou-ke Nation Reserve #2 to the south and a rural residential and agricultural area to the north. The Site is west of the residential core of Sooke. A diversity of wildlife use the habitats adjacent to the Site, including songbirds, raptors (hawks and owls), small mammals (rodents, squirrels, raccoon [*Procyon lotor*], river otter [*Lontra canadensis*], mink [*Neovison vison*]), ungulates (e.g., black-tailed deer [*Odocoileus hemionus*]), large mammals (e.g., black bear [*Ursus americanus*],

cougar [*Puma concolor*] [see BC Conservation Foundation, 2022]), amphibians, and reptiles. Species of conservation concern with potential to occur adjacent to the Site are olive-sided flycatcher (*Contopus cooperi*), common nighthawk (*Chordeiles minor*), barn swallow (*Hirundo rustica*), western screech-owl (*Megascops kennicottii kennicottii*), great blue heron (*Ardea herodias fannini*), Roosevelt elk (*Cervus elaphus roosevelti*), little brown myotis (*Myotis lucifugus*), and western toad (*Anaxyrus boreas*).

Wildlife presence within the Site is expected to be limited as the area is developed, in use, and fenced. Wildlife most likely to occur within the Site are birds, small mammals, and reptiles. Given the adjacency of riparian areas and small wetlands to the Site, amphibians (i.e., western toad) may also occur intermittently within the Site. There is the potential for birds to nest within the Site (e.g., barn swallow, killdeer [*Charadrius vociferus*]) and bats may roost in on or in buildings within the Site. Swallows and bats may forage above the Site.

The Site is located within critical habitat for two species at risk (i.e., species listed under Schedule 1 of the *Species at Risk Act*): northern painted turtle – Pacific Coast population (*Chrysemys picta pop. 1*)[1] and little brown myotis (Government of BC, 2022b). Characteristics of critical painted turtle aquatic habitat include shallow, warm, slow-moving or stagnant freshwater with emergent or floating vegetation that can include logs or large woody debris (ECCC, 2018a). Terrestrial habitat for painted turtle consists of open areas with sandy, gravel or silty substrates and little to no vegetation (ECCC, 2018a). Little brown myotis critical habitat is identified by hibernacula, which is a site where one or more bats hibernate in the winter (ECCC, 2018b). Hibernaculum sites include subterranean features with multiple entry and exit points, such as caves, tunnels, rock crevices, and hollow trees where light and noise levels are low (ECCC, 2018b). The Site does not have the biophysical attributes of critical habitat for either species and there are no known occurrences of painted turtle or bat hibernaculum recorded within 1 km of the Site (BC CDC, 2022).

Observations from the Site visit in March 2022 included wildlife trails along the riparian and through the forest west of the Site, a Roosevelt elk track west of the Site, and sightings of black-tailed deer. No stick nests or signs of raptor use (e.g., plucking stations, fecal wash) were observed; however, several trees adjacent to the Site offered suitable perching and nesting habitat for raptors (e.g., bald eagle [*Haliaeetus leucocephalus*]) and potentially great blue heron. There are multiple records of great blue heron and bald eagle nests in the Sooke Basin Area (Government of BC, 2022b).

2.4.3 VEGETATION

The Site is located within the Coastal Western Hemlock (CWHxm) biogeoclimatic zone. Forested areas around the Site are generally defined by western hemlock (*Tsuga heterophylla*), Douglas-fir (*Pseudotsuga menziesi*i), western redcedar (*Thuja plicata*), grand fir (*Abies grandis*), arbutus (*Arbutus menziesii*), and red alder (*Alnus rubra*) (Green & Klinka, 1994).

The tree species present along Nott Brook Tributary 1 are primarily red alder, Douglas-fir with some western redcedar, and western hemlock. The shrub layer is primarily red elderberry (*Sambucus racemosa*) salmonberry (*Rubus spectabilis*), sword fern (*Polystichum munitum*), and willow (*Salix* sp.).

[1] Formerly western painted turtle – Pacific coast population (per BC CDC, 2022)

The herb layer consists primarily of mosses, foamflower (*Tiarella trifoliata*), and skunk cabbage (*Lysichiton americanum*).

Invasive plant species occurrences within 1 km of the Site are Himalayan blackberry (*Rubus armeniacus*), Himalayan balsam (*Impatiens glandulifera*), English ivy (*Hedera helix*), and Scotch broom (*Cytisus scoparius*) (MOF, 2022). During the field survey, additional invasive species identified along the banks of the Nott Brook tributaries were English holly (*Ilex aquifolium*) and reed canary grass (*Phalaris arundinacea*). There are no notable areas of invasive species within the Site footprint, as it was cleared by previous WWTP development.

No federally- or provincially listed plant species of conservation concern were recorded within 1 km of the Site (Government of BC, 2022b) or observed during the field survey.

2.4.4 ARCHAEOLOGY

An Archaeological Desktop Review was conducted on the Project Site which provided a preliminary evaluation of potential impacts to archaeological resources (Appendix C – Archeological Desktop Review). It did not involve input from Indigenous groups with the understanding that the District will engage them on the Project.

According to Provincial records, an archaeological impact assessment (AIA) of the Sooke Wastewater Service Project was undertaken in 2004 under HCA Permit 2004-0387. The AIA included surface inspection and subsurface shovel testing of a section of a proposed sewer outfall right-of-way at 7117 West Coast Road and resulted in the identification of archaeological site DcRw-41 (Nicholls, 2004), located approximately 475 m southwest of the Site. No other archaeological sites were identified during this study which included both surface and subsurface inspection to the north, northwest, west and southwest of the Project Site. No other archaeological field studies have been carried out in or near the Project Site.

Based on the results of the 2004 AIA, the lack of any prominent landforms in the Project Site, the level of past disturbance associated with initial WWTP development, and the nature of proposed Project development plans, the Desktop Review determined that there was low potential for archaeological deposits to be present in the Project area. No further archaeological assessment was recommended for the Project.

3 Regulatory Requirements

3.1 Federal and Provincial Legislation

Based on the Project construction and environmental setting, federal and provincial environmental legislation outlined in Table 1 are anticipated to be applicable to the Project. The Project is exempt from the District of Sooke Noise Control Bylaw No. 485, 2011 as the activities are related to public works, by the District of Sooke employees or agents.

Table 1 Applicable Federal and Provincial Environmental Legislation

Act or Regulation	Agency	Description	Applicability to Project	Management
Federal				
Fisheries Act	Fisheries and Oceans Canada (DFO)	A Request for Review (RFR) seeks a formal opinion from DFO through a Letter of Advice (LOA) as to whether a harmful alteration, disruption, or destruction (HADD) of fish habitat is likely to occur as a result of Project activities. When work cannot avoid or mitigate a HADD, the Project requires an authorization under Section 35(2) of the *Fisheries Act* for the Project to proceed without contravening the Act.	The Project will not intrude into the SPEA of any of the onsite watercourses. As such, riparian impacts are not anticipated.	Assuming there is no change in design, intrusion into the SPEA, or HADD submission of a RFR should not be required.
Migratory Birds Convention Act	Environment and Climate Change Canada (ECCC)	Prohibits the unauthorized taking or killing of migratory birds, their nests and eggs and the deposition of harmful substances in areas frequented by migratory birds. This prohibition includes "incidental take" which is defined as the inadvertent harming, killing, disturbance or destruction of migratory birds, nests, and eggs.	The possibility exists that birds may nest within the Site (e.g., barn swallow, killdeer).	The Project will implement bird nest mitigation measures under the direction of the Environmental Monitor, in consultation with a Qualified Environmental Professional (QEP), that are consistent with best management practices and guidance from ECCC.
*Species at Risk Act (*SARA)	ECCC, Canadian Wildlife Service, or DFO	Provides for legal protection of wildlife species and the conservation of their biological diversity. The Act outlines the commitment to prevent wildlife species from becoming extinct and securing the necessary actions for their recovery.	The possibility exists that species listed under Schedule 1 of SARA may interact with the Project (e.g., western toad, barn swallow, little brown myotis). Permits are only required if construction entails the salvage and relocation of SARA listed species during Project construction, which is unlikely to occur.	The Project will implement species at risk mitigation measures under the direction of the Environmental Monitor, in consultation with a QEP, that are consistent with provincial and federal guidance and best management practices.
Provincial				
Environmental Management Act	BC Ministry of Environment and Climate Change Strategy (ENV)	Contaminated Sites Regulation and Hazardous Waste Regulation – Prohibits the introduction of waste into the environment in a way that will cause pollution, except in accordance with a regulation, permit, approval or code of practice issued under the Act.	Fueling, emissions, and potential spills from construction equipment and vehicles have the potential to release pollution and wastes into the environment	Procedures and protocols to manage spills and emissions will be implemented by the Contractor and a Spill Response Plan is detailed in this preliminary CEMP (Section 5.10.1).
Heritage Conservation Act (HCA)	Archaeology Branch of Ministry of Forests (MOF)	Protects archaeological sites and objects on private and Provincial Crown land in BC, including Provincial heritage sites, burial places with historical or use before AD 1846, and heritage wrecks. The Heritage Inspection Permit is not a regulatory requirement, rather it is a recommended risk management tool. The inspection determines the presence of archaeological sites which warrant protection, or are already protected, under the Act.	The possibility exists, although unlikely, that unidentified archaeological resources are present.	In the unlikely event that suspected archaeological resources are encountered during proposed Project activities, all work in the immediate vicinity of the find(s) must cease and the Archaeology Branch contacted for appropriate guidance and direction. Minimum of 30 days required for Inspection Permit.
Riparian Areas Protection Act and the Riparian Areas Protection Regulation (RAPR)	BC Ministry of Forests (MOF)	Required if the detailed design includes potential intrusion into riparian habitat, to confirm the resulting extent and location of the Streamside Protection and Enhancement Area (SPEA), or to calculate appropriate habitat balance and offsetting for Project impacts.	The proposed access road south of the SBR #3 does not encroach into the minimum SPEA for Nott Brook Tributary 1.	A QEP must provide an RAPR Assessment Report to determine an appropriate SPEA using the detailed assessment methodology. This report is currently being prepared and will be submitted prior to construction
Water Sustainability Act (WSA)	MOF and BC Ministry of Land, Water and Resource Stewardship	Short-term Water Use approvals pursuant to Section 10 of the WSA allows the diversion and use of water from a stream or an aquifer, and the temporary construction of works on the stream or aquifer for a period of up to 24 months. This also includes dewatering during construction activities.	Previous groundwater investigations have confirmed that the water table could begin 1.2 m below ground level. If dewatering requires pumping groundwater from excavations, a Section 10 Use Approval under the WSA would be required.	WSA Section 10 Water Use will be applied for through Front Counter BC. A permit with conditions is anticipated to allow groundwater pumping, diversion and dewatering during construction activities. Review period for WSA Section 10 Use Approval is typically 3 to 6 months or more, with review periods dependent on project complexity and stakeholder engagement.

Table 1 Applicable Federal and Provincial Environmental Legislation

Act or Regulation	Agency	Description	Applicability to Project	Management
Provincial (cont'd)				
Wildlife Act	BC Ministry of Forests (MOF) and BC Ministry of Land, Water and Resource Stewardship	Protects wildlife, endangered species, and wildlife habitat.	A General Wildlife Permit under the Act is required for salvage and relocation of fish and wildlife. The Project is not expected to require salvage or relocation of fish or wildlife (i.e., amphibians).	In the unlikely event it is required, salvage and relocation of fish and wildlife, including preparation of permit applications, will be undertaken by a QEP. A review period of up to 60 days (or more) is typical for permits under the Act.

4 Contacts and Responsibilities

4.1 Key Contacts

The key Project personnel involved with the planning and implementation of the CEMP are listed in Table 2, followed by a description of their roles. All onsite personnel must work in accordance with applicable authorizations and engineering specifications. In addition, personnel must comply with the site-specific mitigation measures identified in this CEMP and/or provide suitable alternative approaches that have been approved by the District and/or their environmental designate. Onsite crews and staff will be introduced to the CEMP and are required to implement it properly as part of standard operating procedures.

Table 2 Key Project Contacts

Role	Organization	Name	Phone
Environmental Manager	TBD	TBD	TBD
Environmental Monitor	TBD	TBD	TBD
Construction Manager (Contractor)	TBD	TBD	TBD
NOTE: TBD = to be determined			

4.1.1 RESPONSIBILITIES OF THE DISTRICT ENVIRONMENTAL MANAGER

The District Environmental Manager will monitor the Contractor and construction activities for compliance on behalf of the District. The District Environmental Manager will provide ongoing direction on compliance with authorizations, permit conditions, regulations, this Project CEMP, and industry BMPs (see Section 5). The District Environmental Manager will assess potential risks during pre-construction planning and construction and will review, observe, and report on environmental issues and mitigation related to construction activities.

Environmental reporting is an integral part of environmental management compliance and adaptive management during construction. The District Environmental Manager will review reports prepared by the Environmental Monitor (EM) and provide feedback to the EM prior to submission to regulatory agencies.

Tasks assigned to the District Environmental Manager include, but are not limited to, the following:

- Update the CEMP as needed and communicate updates to Project personnel, including review of mitigation measures and controls to adaptively manage implementation, maintenance, and function of controls.
- Review construction schedules and procedures.

- Provide leadership to Project personnel about the importance of meeting regulatory requirements and complying with industry and District BMPs and standards.
- Update Project personnel on the environmental conditions, approvals, and regulatory requirements where required (e.g., in the event of changes to approvals).
- Implement monitoring programs and protocols in coordination with the Environmental Monitor (EM).
- Review monitoring reports prior to submission to the applicable regulatory agencies, if required.
- Report to and regularly communicate with the District.

4.1.2 RESPONSIBILITIES OF THE ENVIRONMENTAL MONITOR

The EM will report to the District Environmental Manager and will actively monitor construction for compliance with all permit and authorization conditions, contract documents, applicable regulations and guidelines, and implementation of controls and mitigations defined in this CEMP and the Contractor's Project specific construction environmental protection plans. The EM role will be combined with the Construction Observer assigned to the project. The Construction Observer will be trained in the application of Erosion and Sediment Control (ESC) BMPs.

The primary tasks to be performed, and the responsibilities of the EM and supporting personnel will include, but not be limited to, the following:

- Set a prescribed monitoring schedule prior to Project start; this may be based on conditions outlined in regulatory approvals.
- Verify required permits, licenses, and approvals are in place prior to the start of construction activities.
- Monitor compliance with permit conditions, the CEMP, and other regulatory conditions issued for the Project.
- Prepare and submit environmental monitoring reports following review by the District Environmental Manager to the applicable regulatory agencies and report any non-compliance issues or unanticipated adverse effects to the environment.
- Update Project personnel on the environmental conditions, approvals, and regulatory requirements where required (e.g., in the event of changes to approvals).
- Coordinate with Contractor staff on the implementation and maintenance of mitigation measures used to avoid and limit potential environment effects.
- Conduct on site environmental monitoring.
- Remain on-call during non-critical work activities and be able to respond to environmental issues in a timely way.
- Advise the Project key contacts (Table 2) if Project activities have caused or are likely to cause an environmental incident and make recommendations for proactive corrective actions and maintenance of mitigation measures.

- Communicate directly with Project members and provide technical advice to proactively resolve or address immediate environmental issues to maintain compliance with the CEMP and permit conditions.
- Provide technical assistance and communication on environmental matters to the District Environmental Manager and the Contractor.
- Check equipment and vehicles on site for hydrocarbon leaks, including for fuel delivery and refueling procedures.
- Verify that emergency spill and fire equipment caches are adequately supplied.
- Report construction activities in daily or weekly environmental compliance reports, supplemented with field notes and photographs. Frequency of reporting to be determined between the District Environmental Manager.

4.1.3 RESPONSIBILITIES OF THE CONTRACTOR CONSTRUCTION MANAGER

Tasks and responsibilities associated with the Construction Manager (the Contractor's Project Manager) include, but are not limited to, the following:

- Review of construction schedules and procedures for potential implications on worker health and safety, site security, and environmental effects.
- Developing project-specific Work Procedures that comply with requirements of appropriate regulatory authorities and recognized best-practices in construction safety.
- Restricting site access to authorized personnel.
- Reviewing this preliminary CEMP with their staff and subcontractors before construction and implementing the mitigation measures listed.
- Verifying required permits, licenses, and approvals are in place prior to the start of the construction activities.
- Complying with and ensuring that personnel, subtrades/subcontractors will comply with the Project permits, applicable regulations, this CEMP, and applicable BMPs and standards.
- Report environmental incidents to the EM in a timely manner and act to prevent a re-occurrence of those incidents.

5 Mitigation Measures

Without the implementation of mitigation measures, construction activities associated with the Project have the potential to cause adverse environmental effects.

Table 3 identifies the main environmental components and potential adverse effects which could occur during the construction phases of the Project. Through the implementation of appropriate mitigation measures, potential effects associated with the Project can be avoided or limited.

Table 3 Project Environmental Components and Potential Adverse Effects

Environmental Components	Potential Adverse Effects
Fish and Fish Habitat; Groundwater, and Surface Water	• Change in water quality due to improper fuel management, spills[1] and/or improper or insufficient erosion and sediment control • Changes to fish habitat resulting from introduction of deleterious substances and accidents, malfunctions, and spills
Wildlife and Wildlife Habitat	• Potential disturbance, harm, or mortality of wildlife, including nesting birds, amphibians, reptiles, and mammals resulting from Project activities, accidents, malfunctions, and spills
Vegetation and Soils	• Introduction of invasive species to Project Site and surrounding area • Potential contamination of vegetation and soils due to improper fuel management • Potential adverse effects on soils due to improper erosion and sediment control and soil management
Archaeology	• Temporary disturbance of archaeological artifacts during ground disturbance activities • Permanent alteration of archaeological artifacts during ground disturbance activities
Air Quality and Noise	• Change of air quality and noise emissions resulting from vehicular passage and Project activities

NOTES:

[1] Accidents, malfunctions and spills include hydrocarbon leaks (hydraulic lines on equipment), fuel spills (fueling vessels, equipment, improper storage), structural failures, spills or leaks of other contaminants (e.g., paint, chemicals, concrete).

It should be noted that the RAPR (see Table 1 in Section 3.1) includes “Measures” to protect the setback. The Measures have been incorporated into the following sections where applicable.

5.1 Best Management Practices and Guidance

Environmental protection measures are based on BMPs, standard industry procedures, and an understanding of the environmental baseline conditions within and adjacent to the Project area. Guidance and BMP documents used to develop the mitigation measures in this CEMP include, but are not limited to:

- Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia – Section 5.8 West Coast Region (MOE, 2014).
- Requirements and Best Management Practices for Making Changes In and About a Stream in British Columbia (Government of BC, 2022a).
- Field Guide to Fuel Handling, Transportation, and Storage (MWLAP, 2002).
- British Columbia Ministry of Environment and Climate Change Strategy (ENV). 2022. Approved and Working Water Quality Guidelines for Aquatic Life (ENV 2022).
- Environment and Climate Change Canada's General Nesting periods of Migratory Birds in Canada (ECCC, 2018).
- Guidelines for Raptor Conservation During Urban and Rural Land Development in British Columbia (MOE, 2013).
- Best Management Practices for Bats in British Columbia (MOE, 2022).

5.2 General Practices

Table 4 provides general mitigation measures applicable to Project activities.

Table 4 Project Mitigation Measures

Category	Mitigation Measures
Permits	• Copies of all issued authorizations and permits will be on site and readily available. • Construction-related restrictions, conditions, or mitigation measures that are part of the regulatory permits will be communicated to the field crew. • All work shall comply with requirements of all applicable legislation, authorizations, permits, and the CEMP.
Training	• Personnel will be adequately trained and will use appropriate personal protective equipment.
Tailgate Meetings	• The CEMP and environmental regulatory permit requirements will be reviewed by the Contractor and EM, followed by a briefing to crews.
Stop Work	• Crews will stop work and contact the EM for assistance prior to commencing or continuing any activities that may pose any environmental or archaeological risk not addressed in this document. • The EM and Environmental Manager will have authority to issue a Stop Work order where activities are adversely affecting, or will adversely affect, the environment or archaeological resources. The EM will also make active recommendations in the field for avoiding and mitigating potential project-related effects.

Table 4 Project Mitigation Measures

Category	Mitigation Measures
Site Cleanliness	• Sites will be kept in good order, tidy during activities, and left in a good condition at the end of the Project. Solid waste will be managed to avoid conflicts with wildlife.
Waste Disposal	• The Contractor will collect all construction debris and other waste materials and dispose of at an approved upland facility, where applicable.
Contractors/ Subcontractors	• Contractors and subcontractors will comply with the mitigation measures outlined in all permit conditions, the CEMP, and measures/controls identified within Project regulatory permits. • The Contractor and EM will implement appropriate work procedures, instructions, and controls to prevent and/or reduce adverse environmental impacts.
Reporting	• The EM will establish and maintain effective environmental reporting protocols.
Stockpiles/ Laydown Areas	• Stockpiling of material and laydown area shall be in accordance with BMPs and limited to approved areas.
Containment and Spill Management	• An appropriate spill prevention, containment, and clean-up contingency plan for hydrocarbon products, sediment, and other deleterious substances shall be put in place prior to work commencing. • Appropriate spill containment and clean-up supplies shall be kept available on site whenever the works are underway. Personnel working on the Project should be familiar with implementing the spill clean-up plan and deployment of spill response materials. A large spill kit will be on site which contains enough booms to contain a major spill. Biodegradable hydraulic fluid will be used, where possible. • The EM and Contractors will provide immediate response to emergencies and incidents and notify the District and other relevant agencies of spills of deleterious substances and other emergencies. • Preventative and corrective measures will be undertaken in response to non-conformance with regulatory approvals, permit conditions, the CEMP, and/or, procedures and plans.
Safety Data Sheets	• Chemical products will have their applicable Safety Data Sheets (SDS) onsite and readily available.
Soils, Erosion, and Sediment Control	• Care should be taken to prevent sediment from being exposed and mobilized into the nearby aquatic environment, including the use of erosion and sediment control measures.
Air Quality/ Emissions	• Idling of equipment will be reduced, where possible. • Low sulphur fuel will be used where possible. • Work will be planned to optimize efficiency. • Equipment will be well-maintained. • Smoking will only be permitted in designated areas. Fire suppressing equipment must be present.

Table 4 Project Mitigation Measures

Category	Mitigation Measures
Dust Control	• Where Project-related traffic creates a hazardous or irritating level of dust to nearby receptors, dust control on existing access roads will be achieved through the application of water, as practicable. • Chemical dust suppressants will not be applied
Operation of Machinery	• Machinery will arrive clean and will be maintained to prevent fluid leaks and invasive plant species transfer. • Machinery will be washed, refueled, and serviced, and fuel and other materials will be stored in a manner to prevent deleterious substances from entering soil or water.
Excavated Soils	• Excavated soils will not be deposited into the aquatic environment. • Suspected contaminated soils will be segregated for assessment and determination of handling, transport, and disposal requirements per applicable regulations and contract specifications.
Archaeology/ Heritage Resources	• Chance Find Protocol – all work in the immediate vicinity of a find(s) must cease and the Archaeology Branch contacted for appropriate guidance and direction.
Invasive/Noxious Plants	• During construction, the undercarriages, tracks, tires, and blades of vehicles and equipment will be cleaned (washed) prior to entering construction sites to prevent movement and establishment of invasive and noxious weeds.
Wildlife	• Chance discovery of wildlife within the Site (e.g., nests, roosting bats, dead, sick or injured animals) will be reported to the EM as soon as possible; the EM will then determine the appropriate action(s) to be undertaken, in consultation with a qualified professional, as needed. • Wildlife will not be fed. Meals and food waste will be securely stored in vehicles, buildings, or appropriate disposal facilities to reduce attraction of wildlife to the Site.

5.3 Fish Protection

Fish species and fish habitats that exist within and adjacent to the Project Site have the potential to be adversely affected by Project activities. The mitigation measures outlined in Table 5 will be applied to mitigate effects on fish and fish habitat. The mitigation measures identified for ESC (Section 5.4), vegetation management (Section 5.5), waste management (Section 5.7), and spill prevention and response (Section 5.10.1) will also be protective of fish and fish habitat.

Table 5 Fish Protection Mitigation Measures

Category	Mitigation Measure
Permits	• Works will be conducted in accordance with guidance from DFO's LOA, or *Fisheries Act* Authorization conditions for the project, if applicable.
Fish Protection	• Work will be conducted such that no contaminated water or other effluent potentially harmful to aquatic life enters any waterbody. Contaminated water or effluent may include silt laden water, site run off, oil/fuel spills, sewage, etc.
Deleterious Substances	• Deleterious substances (e.g., fine sediments, hydrocarbons, contaminants) will not be deposited into fish habitat. • Equipment and machinery must be clean and in good operating condition (e.g., power washed and free of leaks or excess oil and grease). No equipment refueling or servicing is undertaken within thirty (30.0) m of any stream or surface water drainage. • Hydraulic machinery on Site must use environmentally sensitive hydraulic fluids which are non-toxic to aquatic life and are biodegradable. • When not in use and on Site, equipment must have spill-trays placed underneath points of potential leakage (e.g., fuel tanks).

5.4 Erosion and Sediment Control

General mitigation measures designed to limit potential effects to nearby aquatic environments from the erosion and sedimentation are provided in Table 6. Sediment inputs to the aquatic environment can increase turbidity levels, directly affecting the quality of fish habitat. Additional site-specific protection measures may be required at the direction of the EM or their delegate depending on site conditions.

Table 6 Mitigation Measures for Erosion and Sediment Control (ESC)

Activity/Concern	Mitigation Measure
Erosion and Sediment Control Measures	• The Contractor will take a precautionary approach to ESC. Sediment control measures will be put into place before starting works that may result in sediment mobilization or cause erosion. • When project activities have the potential to release sediment, ESC control measures will be installed by the Contractor between construction areas and aquatic environments. Additional site-specific protection measures may be required at the direction of the EM or their delegate. • The Contractor will use coverings, such as tarps, synthetic material (e.g., polyethylene sheeting) or other protective material, to limit exposed erodible material. • If ditches and diversions are constructed to control site construction water, they will not directly discharge sediment-laden surface flows into ditches, drains, or other sensitive habitats. Flows will be diverted to a sediment and erosion control structure or a vegetated area where flow can slowly infiltrate. • ESC measures will remain in place and be maintained throughout construction activities and will only be removed once construction is complete, and ground conditions have stabilized. • Turbid surface water and construction impacted runoff will be detained on Site for treatment prior to discharge.

Table 6 Mitigation Measures for Erosion and Sediment Control (ESC)

Activity/Concern	Mitigation Measure
Rain or Storm Events	• The Contractor will be prepared for rain or storm events by implementing additional control measures, including covering excavated material, stockpiles, and other erosion prone areas with organic or synthetic material. • In the event that a storm event is too severe to manage effectively, the Contractor will stop work.
Environmental Monitoring	• ESC measures will be maintained and repaired regularly by the Contractor and the EM will monitor the functionality and effectiveness of the measures.
Spoil Stockpiles	• Excavated soils/spoil stockpiles will be placed as far from any watercourse as practicable and erosion and sediment control measures identified in the ESC Plan will be applied to and/or around the spoil piles.
Runoff Outlet	• Surface water runoff outlets need to be protected to prevent additional scour and erosion
Slope stability (RAPR Measure)	• Excavation cut slopes should be prepared in a stable configuration to ensure stability over the short to medium term in the event the lots are not developed immediately

5.5 Vegetation Management

The Project is expected to have limited adverse effects on vegetation. Table 7 outlines mitigation measures that will be implemented to avoid and reduce project-related effects on vegetation. The mitigation measures identified for fish protection (Section 5.3), ESC (Section 0), waste management (Section 5.7), and spill prevention and response (Section 5.10.1) will also be protective of vegetation.

Table 7 Vegetation Mitigation Measures

Category	Mitigation Measure
Access	• Areas of work and access routes must be clearly marked onsite prior to starting work, (e.g., for work, staging, storage, access) and the route taken must minimize disturbance to riparian vegetation.
Traffic and Parking	• Vehicle and equipment traffic will avoid vegetated areas, except where specified by construction plans or authorized by the EM. • Keep all access and egress of machinery to the access road and other vehicle and machinery designated areas. • Establish tree protection zones around the roots or driplines of trees to be maintained. Demarcate these zones with snow fencing and signage. (RAPR Measure)

Table 7 Vegetation Mitigation Measures

Category	Mitigation Measure
Invasive Species	• During construction, the undercarriages, tracks, tires, and blades of vehicles and equipment will be cleaned (washed) before entering the Site to reduce the potential for establishment and spread of invasive plants • Disturbed areas will be stabilized and covered to limit the potential for the creation of microhabitats for the establishment of invasive species. • Imported material (e.g., soils, fill) must be free of invasive species to the extent feasible.
Danger Trees (RAPR Measure)	• Review arborist report to determine location of danger trees that could affect the SPEA • Danger trees to be topped and left as "wildlife trees" as determined by the project environmental consultant or project arborist • Removed trees to be replaced at a 3:1 ratio with native trees
Windthrow (RAPR Measure)	• If removal of trees is required, consult with an arborist to determine if this will result in windthrow effects • Address windthrow, if it occurs, in consultation with the arborist

5.6 Wildlife Management

The Project has the potential to effect wildlife directly (e.g., physical interaction with equipment) and indirectly (e.g., sensory disturbance from construction activities). Table 8 outlines mitigation measures that will be implemented to avoid and reduce Project-related effects on wildlife and wildlife habitat. The mitigation measures identified for fish protection (Section 5.3), ESC (Section 5.4), vegetation management (Section 5.5), waste management (Section 5.7), and spill prevention and response (Section 5.10.1) will also be protective of wildlife and wildlife habitat.

Table 8 Wildlife Mitigation Measures

Category	Mitigation Measure
Wildlife Attractants	• Wildlife will not be fed. • Meals and food waste will be securely stored in vehicles, buildings, or appropriate disposal facilities to reduce attraction of wildlife to the Site.
Dead, Sick, or Injured Animals	• Observations ('chance discovery') of dead, sick, or injured animals within or adjacent to the Site (including along the existing access road) during construction will be reported to the EM as soon as possible. The EM will then determine the appropriate action(s) to be undertaken, in consultation with a QEP, as needed.
Birds and Bird Nests	• Observations (chance discovery) of bird nests or nesting bird behaviour (e.g., adult carrying food) within or adjacent to the Site during construction will be reported to the EM as soon as possible. The EM will then determine the appropriate action(s) to be undertaken, in consultation with a QEP, as needed. Potential mitigation measures include implementation of species-specific no-disturbance buffers around active nests.

Table 8 Wildlife Mitigation Measures

Category	Mitigation Measure
Bats	• Observations (chance discovery) of bats within the Site (i.e., roosting on or within buildings or other structures) during construction will be reported to the EM as soon as possible. The EM will then determine the appropriate action(s) to be undertaken, in consultation with a QEP, as needed.
Amphibians and Reptiles	• Observations (chance discovery) of amphibians or reptiles within the Site during construction will be reported to the EM as soon as possible. The EM will then determine the appropriate action(s) to be undertaken, in consultation with a QEP, as needed.
Species at Risk	• Observations (chance discovery) of species at risk within or adjacent to the Site (including along the existing access road) during construction will be reported to the EM as soon as possible. The EM will then determine the appropriate action(s) to be undertaken, in consultation with a QEP, as needed.

5.7 Waste Management

Waste from Project activities has the potential to adversely affect aquatic and terrestrial environments through ineffective onsite management and inappropriate disposal. To reduce this risk, the mitigation measures outlined in Table 9 will be implemented.

Table 9 Waste Management Mitigation Measures

Category	Mitigation Measure
Waste	• Waste or any miscellaneous unused materials will be recovered for either recycling or disposal in a designated facility or placed in storage. Under no circumstances will materials be deliberately thrown into the aquatic or terrestrial environment. • On-site personnel will make best efforts to prevent debris from entering the aquatic environment. • Litter in the form of coffee cups, lunch wrappers, cigarette butts, and other such items will be placed in covered trash containers. • Construction debris/waste will be collected, transported, and disposed of off-site and in accordance with applicable legislation, guidelines, and best management practices.
Portable Toilets	• Portable toilets will be located a minimum of 30 m from any waterbody. Sewage from portable toilets will be disposed of in an approved sewage disposal facility by approved subcontractors on an as-needed basis.
Hazardous Waste	• Sorbent materials or soils saturated with hydrocarbons (greater than or equal to 3% by weight) are classified as hazardous waste under the British Columbia *Environmental Management Act* and will be managed accordingly. • Used petroleum products, including their empty containers, will be collected and transported to a licensed recycling facility in approved storage containers following applicable regulations.

5.8 Fuel Management

Mitigation measures for fuel management should be implemented to adequately protect the environment from the potential release of construction-related fuels and products at the Project Site. The mitigation measures described in Table 10 will be implemented for the Project.

Table 10 Fuel Management Mitigation Measures

Category	Mitigation Measure
Spill Coordinator	• The Contractor will appoint a spill coordinator who has knowledge of spill mitigation, containment, and reporting procedures. • The spill coordinator will keep an inventory of hazardous materials on site.
Training	• The Contractor will provide on-site staff with training in the use of hazardous materials and comply with the SDS for the fuels in use. • The Contractor will confirm on-site personnel know the location of spill kits, containment booms, and other spill control materials and that they are readily accessible.
Fuel Handling Guide	• Fuel handling, storage, and labelling procedures shall be consistent with *A Field Guide to Fuel Handling, Transportation and Storage* (MWLAP, 2002).
Fuel	• Where possible, fuel storage and equipment or machinery refueling and servicing will occur a minimum of 30 m from any waterbody. Where operational constraints require fuel storage, equipment or machinery re-fueling and servicing within 30 m of wetted habitat, measures to prevent the release or spill of hazardous materials will be discussed with the District and approved by the Environmental Manager. • Storage of fuels and petroleum products will comply with safe operating procedures, including containment facilities, in case of a spill. • Portable fuel tanks (e.g., jerry cans) will be stored within leak-proof secondary containment with absorbent pads with a capacity of 110% of its volume. • Fuel storage, including secondary containment, shall be kept free and clear of collected precipitation. Accumulated water in the containment shall be removed regularly to not to diminish the capacity of the containment. If the water is contaminated, it will be removed from site and not discharged to the local environment. • While refueling, the operator will stay with the fuel nozzle. • Vehicles and equipment will be shut off while refueling.
Environmentally Sensitive Oil	• Where possible, environmentally sensitive (e.g., biodegradable/food-grade/ environmentally friendly) oils, hydraulic fluids, and lubricants that are non-toxic to aquatic life and that are readily or inherently biodegradable will be used in equipment and machines.

5.9 Archaeological and Heritage Resource Protection

No archaeological or heritage sites are recorded within the Project footprint and the area is considered to have low archaeological potential (Appendix C – Archeological Desktop Review). However, the archaeological standards and practices (including implementation of a chance find protocol) in place for private and Crown Lands remain applicable to the Project.

Evidence of what is thought to be a heritage resource may include the following:

- Artefacts of stone or other material
- Shell deposits
- Rock paintings
- Old-looking pits in the ground (large or small, circular, or rectangular)
- Old industrial, ranching, and other remains of possible heritage significance
- Human remains

If an archaeological or heritage resource is encountered during construction, the work must be stopped near the find and the EM will notify the District. From there, the District or their delegate will contact the BC Archaeological Branch and/or a professional archaeologist immediately.

5.10 Emergency Response

An Emergency Response Plan allows for the rapid response of emergency services and/or containment and clean-up of environmental emergencies. The following section provides an outline of the Emergency Response Plan for the Project.

Efficient and concise communication reduces potential risk to crews, the public, property, and the environment during emergencies. Release of dangerous goods (as defined by the BC Spill Reporting Regulation) to water or to land that is over the volume for the listed schedule of BC Spill Reporting Regulations[2] must be reported to the District and the Provincial Emergency Program (1-800-663-3456) or nearest RCMP detachment. An initial Spill Report Template is provided in Section 6.3. The Phone numbers of emergency contacts are listed in Table 11.

Table 11 Emergency Contacts

Authority/Company Name	Phone Number
District of Sooke	TBD
Emergency services	911
District of Sooke non-emergency police	250-642-5241
District of Sooke non-emergency fire	250-642-5422
BC Provincial Emergency Program	1-800-885-6655 / 604-586-4390
BC Emergency Program – 24h Spill Reporting	1-800-663-3456
Victoria General Hospital	250-727-4212
WorkSafe BC – Worksite Emergency	1-888-621-7233
TBD = District of Sooke emergency contact to be determined	

[2] *Environmental Management Act* Spill Reporting Regulation, B.C. Reg. 187/2017. Schedule

5.10.1 SPILL RESPONSE PLAN

In the event of a spill, the mitigation measures presented in Table 12 should be implemented.

Table 12 Spill Response and Reporting Mitigation Measures

Category	Mitigation Measures
Spill Response Materials	• Spill response materials are required to be readily available when working on the Project. These materials include, but are not limited to: – Spill kits – Containment booms – Personal protective equipment (e.g., nitrile gloves, safety glasses, suits) – Fire extinguishers – Shovels • The Contractor will provide an appropriate number of spill kits on site. The suggested contents of a spill kit working on or near water are as follows: – 100 sorbent pads (oil, gas, and diesel) – 100 universal sorbent pads suitable for water-based fluids (e.g., coolant) – 25 kg of dry oil sorbent – 4 x 4’ (~1.2 m) sorbent linkable socks (oil, gas, and diesel) – 4 x 4’ (~1.2 m) universal sorbent linkable socks (e.g., coolant) – 4 x 10’ (3 m) sorbent linkable floating booms – 1 roll of 25 x 4 m polyethylene sheeting (for underlay) – 10 heavy-duty plastic garbage bags – Personal protective gear as required – Spill kits will be inspected on a regular basis and refilled immediately after use • In addition to the spill kits on site, each piece of mobile equipment (e.g., excavator) should have a spill kit. The suggested contents of the spill kit are as follows: – Round-nose shovel or equivalent – 2 x 4’ (~1.2 m) sorbent sock/roll – 20 sorbent pads (oil, gas, and diesel) – Heavy-duty plastic garbage bags – Personal protective gear as required • Spill kits will be inspected on a regular basis and refilled immediately after use
Backup Supplies	• The Contractor will have adequate spill response supplies to maintain their spill kits

Table 12 Spill Response and Reporting Mitigation Measures

Category	Mitigation Measures
Response	The initial response to the spill may include the following: • Stop work • Maintain your own safety and the safety of others • Wear personal protective equipment, such as nitrile gloves and safety glasses • Identify the spilled materials and refer to the material data safety sheet to determine if human health or ignition hazards exist • If possible and safe to do so, contain the spill by any safe means possible (e.g., plug leak, close/isolate leaking valve) • Obtain assistance of others • Begin containment of the spill and stop it from spreading • Clean up the spilled substance using available supplies from the on-site spill kits • If the spill is to water, use measures such as installing sorbent rolls as floating booms to contain the spill and sorbent pads to soak up the material • Report the spill to Environmental Manager who will notify the District • The District will determine if notification to regulatory agencies is required.
Reporting	• The EM and Environmental Manager are responsible for notifying the District of all hazardous spills and to work with the District to confirm that the spill reporting meets provincial and federal requirements. • The Spill Reporting Regulation under the British Columbia *Environmental Management Act* identifies externally reportable quantities for certain substances • See Section 6.3 for an Initial Spill Report template
Environmental Incident/Non-Compliance Reporting	• The EM will prepare an Environmental Incident/Non-Compliance Report in the event of a spill • The following information should be collected as it may be required when reporting a spill to regulatory agencies and should be included in the Environmental Incident/Non-Compliance Report: – Reporting person's name and telephone number – Name and phone number of the owner of the product that spilled or leaked – Name and phone number of the person who caused the spill or leak – Date and time of the spill or leak – Description of the spill or leak – Location of the spill or leak – Receiving environment description – Type of material spilled and quantity – Source of spill or leak – If the spill or leaked product is contained, and if not, where is it flowing – Description of the response and when it occurred – Percent of material recovered – Details of further action required – Recommendations for preventative/mitigation measures – Names of other persons or agencies advised concerning the spill or leak

6 Monitoring and Reporting Requirements

Monitoring frequency will be determined by the District and the Project Environmental Lead and will consider the schedule of construction activities and potential of the activities to affect the environment. Based on site conditions, a reasonable monitoring schedule can consist of one visit a week during wet season (Oct 15 to May 15) and one visit every two weeks during the dry season (May 16 to Oct 15).

Environmental reporting is an integral part of the environmental monitoring process. Monitoring and reporting will be used to facilitate the transfer of information between the Contractor, the EM, the District, and regulatory agencies as required.

The following activities and reports are anticipated:

- Environmental monitoring reports (frequency and number of reports to be determine) – these reports will provide monitoring results, observations, and photographs.
- Environmental incident and corrective action reports for environmental incidents.
- Environmental summary reports (at the end of the Project)
- Issuance of stop work orders.

Non-compliances and incidents must be reported to the District. Non-compliances include non-compliance with this CEMP, project-specific mitigation plans, or Project permits/authorizations/legislation (e.g., spills). Incidents include workplace incidents such as spills, hazards, injuries etc.

6.1 Construction Monitoring

Once the development plan has been finalized, environmental monitoring will be conducted to support the implementation of recommendations outlined in Section 5. Additionally, the mitigation “Measures” to protect the SPEA from encroachment as outlined the RAPR report.

6.2 Post-construction Monitoring

A post-development report must be prepared by the EM, documenting the measures taken to protect the environment as described above. The post-development report will also describe the effectiveness of the mitigation measures, detail steps taken to correct problems during development, and verify compliance with the establishment and protection of habitat and the SPEA.

6.3 Initial Spill Report Template

As per the BC Spill Reporting Regulation, spills to water or to land that is over the volume for the listed schedule of BC Spill Reporting Regulations[3] must be reported to the District and the Provincial Emergency Program (1-800-663-3456) or nearest RCMP detachment. An initial Spill Report should include, to the extent practical, the following information:

Initial Spill Report		
Facility		Facility Location
Name and contact information of the individual making the report	Name	Contact Information
Name and contact information of the responsible person in relation to the spill	Name	Contact Information
Date and time of the spill (dd/mmm/yy); 24-hour clock		
Description of the spill site and the surrounding area including location coordinates (specify UTM or latitude longitude)		
Description of the source of the spill		
The type and quantity of the substance spilled Include CAS number(s) and Safety Data Sheet (SDS) information		
A description of the circumstances, cause, and adverse effects of the spill		

[3] *Environmental Management Act* Spill Reporting Regulation, B.C. Reg. 187/2017. Schedule

Initial Spill Report		
Details of action taken or proposed to comply with section 91.2 (2) of the *Environmental Management Act* including:	Assess, monitor, and prevent, or prevent the continuation of, the threat or hazard caused by the spill	
	Stabilize, contain, remove, and clean up the spill	
	Identify and evaluate the immediate risks to and impacts on the environment, human health, or infrastructure and, as necessary	
	Advise persons to take protective action in relation to the spill	
	Protect infrastructure	
	Protect, recover, and restore the environment	
	Identify and assess the long-term effects of the spill	
	Steps to resolve or mitigate immediate and long-term effects	
The names of the government, federal government, local government and First Nation government agencies at the spill site		
The names of other persons or government, federal government, local government or First Nation government agencies advised about the spill		
SOURCE: BC *Environmental Management Act* and Spill Reporting Regulation		

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APPENDICES

Appendix A Basis of Design Report

BASIS OF DESIGN
Sooke Wastewater Treatment Plant
Expansion – 2022
90% Design Submission

June 6, 2022

Prepared for:
District of Sooke

Prepared by:
GS Spencer, P.Eng.

Project Number
111720131

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date
Rev.1	Issued for Review	Stan Spencer	2/9/2022				
Rev.2	90% Design Submittal	Stan Spencer	6/6/2022				

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Shaun Swarbrick

1.0 CONTENTS

Executive Summary

The detailed engineering for the plant expansion project is approximately 90% completed. During the development of the detailed design, various options for additional treatment processes and replacement of existing equipment that is near the end of useful service life were evaluated. These options were grouped in packages of new treatment process and replacement of existing equipment in priority order based on the judgement of the Design EOR. Detailed Class B cost estimates were developed for each Option. Table 1 below summarizes the OPC estimates for the Options and shows which processes (additional to the Base Project of constructing SBR train #3) and which items are included in the Option OPC estimate. These data are displayed in a graphical format in Figure 1 on the following page.

Table 1 - Option OPCs for the WWTP Expansion Project

Options	Digester #3	Sludge Thickener	Tertiary Disk Filter	New UV System	Mechanical Bar Screen	Generator	Engineering	Construction	Contingency	Project OPC
Base Case	✓	✗	✗	✗	✗	✓	$333,148	$2,512,287	$274,152	$3,119,588
Option 1	✗	✓	✗	✗	✗	✗	$339,646	$2,411,113	$264,168	$3,014,927
Option 2	✗	✓	✓	✗	✗	✗	$365,578	$3,418,526	$368,650	$4,152,754
Option 3	✗	✓	✓	✓	✗	✗	$389,429	$3,699,414	$398,692	$4,487,535
Option 4	✗	✓	✓	✓	✓	✗	$400,010	$3,948,233	$424,682	$4,772,924
Include all	✗	✓	✓	✓	✓	✓	$400,010	$4,329,433	$463,797	$5,193,239

The OPC for the Base Case (SBR3 + Digester 3) that was developed in 2020 for the grant application was $4,198,370 which included a 40% Contingency. The 2022 OPC estimates are based on most current commodity pricing and detailed quotes from major equipment vendors. More detailed quantity takeoffs were calculated for these 2022 OPC estimates, and the confidence level of these estimates is Class B. A 10% continency is included in the 2022 estimates.

Based on these estimates, Stantec recommends that the District proceed to tender with Option 2 which includes SBR #3, a sludge thickener, replacement UV equipment in a new UV channel, and a tertiary disk filter. Items not included are Digester #3 which is not needed if a thickener is installed, a new standby generator which the electrical EOR has confirmed is not required for the new additional electrical loads, the replacement mechanical fine screen in the headworks that the operators have requested. There is ~$368K of Contingency in this estimate. Currently, there is a lot turbulence in the construction tender prices and it is impossible to predict the market in 3 months when the District would like to close the General Construction tender.

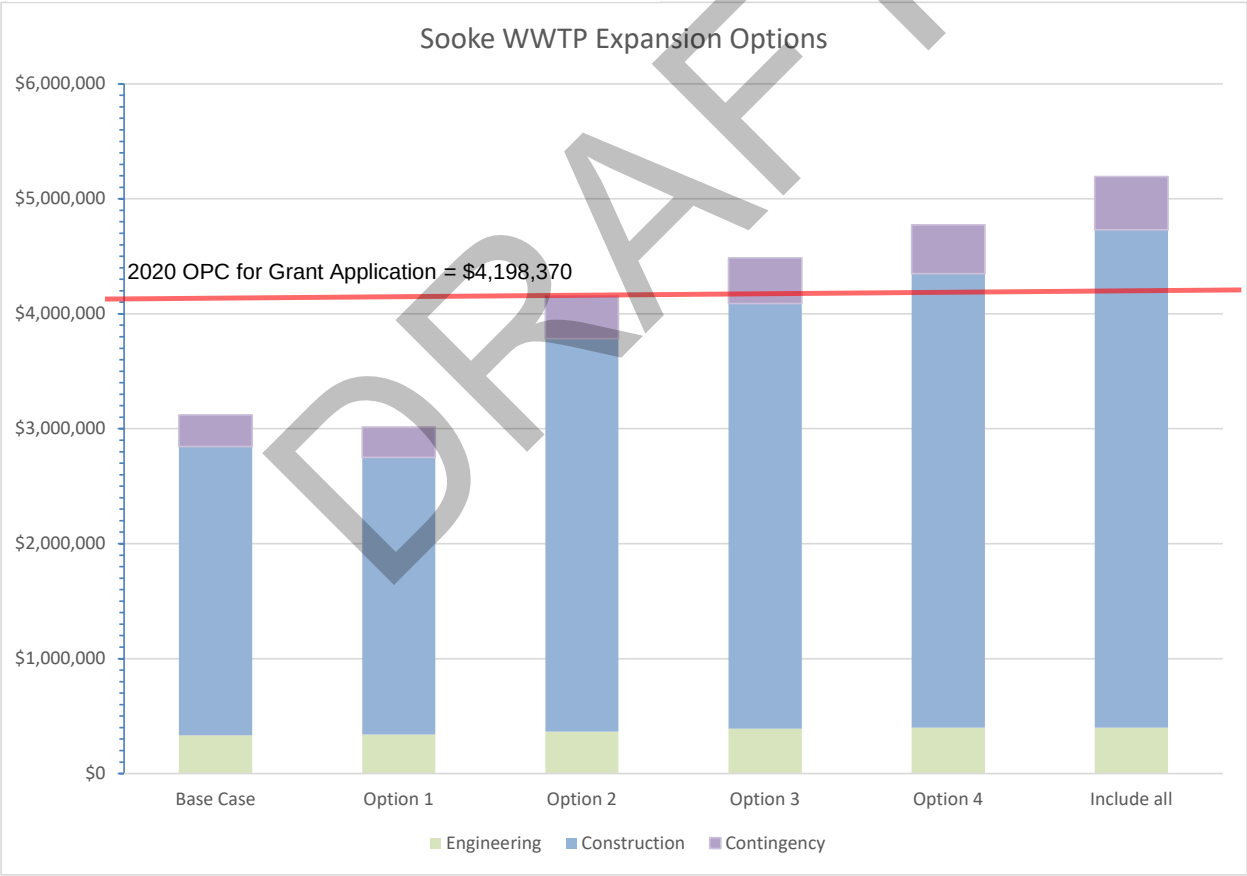
To avoid cost escalation on the major equipment, the District authorized Prepurchase Tenders for the following major equipment

1. SBR decanter, aeration diffuser, WAS pumps, blower, and PLC (may have to be sole sourced to Sanitaire to match existing equipment)
2. Rotary Drum Thickener, WAS feed pump, polymer system and PLC panel

The District may wish to consider including the disk filters as a provisional item in the general construction tender package. If the tender prices are within the available budget of $4,198,700, the District could elect to include this provisional item in the construction contract. If the tenders exceed the available budget, the provisional item could be declined.

If the District accepts this recommendation to proceed with Option 2, Stantec will proceed with completion of the design for this Option and preparation of General Construction tender for issuance on July 4 and closing on August 5.

Figure 1 - WWTP Expansion Options OPCs



ACRONYMS / ABBREVIATIONS

ABBREVIATION	FULL NAME
ADWF	Average Dry Weather Flow
BOD	Biochemical Oxygen Demand
CBOD	Carbonaceous Biochemical Oxygen Demand
CFU/I00 mL	Colony Forming Units per 100 milliliters
COD	Chemical Oxygen Demand
CRD	Capital Regional District
DBO	Design Build Operate
District	District of Sooke
FC	Fecal Coliforms
Kg	kilogram
m^3/day	cubic meters per day
mg/L	milligrams per litre
MDL	Method Detection Limit
MLD	megalitres per day
MLSS	Mixed Liquor Suspended Solids
MWR	Municipal Wastewater Regulation
NH_3	ammonia
Q_x	Yearly Quarter
RDT	Rotary Drum Thickener
RTF	Residual Treatment Facility
SBR	Sequencing Batch Reactor
SCADA	Supervisory Control and Data Acquisition
SRT	Solids Retention Time

Stantec	Stantec Consulting Ltd.
TP	Total Phosphorous
TSS	Total Suspended Solids
UV	Ultraviolet
UVT	Ultraviolet Transmittance
VFD	Variable Frequency Drive
WSER	Wastewater System Effluent Regulations
WWTP	Wastewater Treatment Plant

1.0 BACKGROUND

The District of Sooke, located on the Juan De Fuca Straight, is situated in a region of particular environmental value, including Sooke Harbour, Sooke Basin, and the Sooke River. To ensure a sustainable balance between commercial / residential development and the natural environment, the District constructed a sewer collection system and treatment plant.

The District's existing wastewater infrastructure was completed and commissioned in 2005 for a defined Sewer Specified Area (SSA) that accommodated an initial population of 5,500 or 1350 homes.

The sewer system is an integral part of the environmental remediation and protection of Sooke Harbour and Basin. Prior to the development of the system, residents in the core area were served by more than 1,000 individual septic systems. Leakage from these systems was seeping into the Sooke Harbour and Basin, creating environmental concerns for the marine ecosystems. One of the goals of the project was replacing septic fields in the core area, whose runoff accumulates into local waterways, and would provide for rehabilitation of the Sooke Harbour and Basin and protect the area's freshwater systems.

The current Single-Family Equivalent (SFE) count within the SSA is 4,062 plus 636 pre-bought parcels for a total of 4,698 SFE's accommodating a population of over 13,000 (2016 census). Projected population growth for the District of Sooke is expected to reach 23,000 by 2035 (p. 47 Official Community Plan, 2010). The 2016 Stantec Consulting report "Sooke Sewers Conceptual Design" recommends that when the Average Dry Weather Flows (ADWF's) plus pre-bought SFE's reach 70% capacity, the District should start planning and implementing the upgrades identified in the report including the WWTP expansion and the West Coast Road forcemain upgrade. These thresholds have been met.

In recent years, the Annual Average Daily Flows (AADF) received at the plant are 2,200m^3/day or 73.4% of the current design capacity and the remaining pre-bought capacity will add another 16% to that total. To accommodate inclusion of Whiffin Spit, Kaltasin, IR-1 & IR-2 and future development the sewer system, expansion and upgrades are needed. Peak Wet Weather Flows (PWWF's) are also encroaching on the WWTP wet weather capacity of 6.9 MLD occasionally exceeding this mark during extreme events. The District has and is undertaking work to mitigate these occurrences by working to repair known inflow and infiltration issues (I&I). As the wastewater system approaches capacity, compliance issues are of concern to the District as they become liable for damages and face potential fines from provincial and federal agencies. The T'Sou-ke Nation has been in discussions with the District (for 10+ years) to expand its services to both reserve lands in an effort to improve water quality by eliminating septic systems within the reserves thus preventing sewage from escaping into the Sooke Basin. The T'Sou-ke Nation is highly motivated as it has been notified twice this past year, of contamination advisories for the Sooke Basin, by Environment Canada. Although the advisory letters did not definitively confirm the source of the fecal coliform contamination, it did site potential pollution sources that included urban pollution, which potentially prohibits the harvest of shellfish. The District is aware that areas outside the SSA have the potential for failing septic systems (particularly in the areas of Kaltasin, Whiffin Spit, T'Sou-ke Nation IR-1, and IR-2). This results in the release of sewage into the Sooke Basin causing significant environmental concerns that impact the water quality and best use of the Basin by both the District and the T'Sou-ke Nation. To that end both parties are working toward including IR-1 & IR-2 into the SSA and are already in the process of signing a servicing agreement in anticipation of this service delivery. The key, however, to servicing these areas and the additional wastewater flows is to initially expand the WWTP and upsize the West Coast Road forcemain to accommodate additional SFE's outside the SSA.

2.0 OVERVIEW

2.1 General

The wastewater treatment plant located at 7113 West Coast Road, District of Sooke is part of Lot 8, Sections 1, 2 and 3 of the District of Sooke, Plan 2318, southwest of the West Coast Road. The plant

discharges treated effluent through a 2,400 metre long and 30 metre deep marine outfall to the Juan de Fuca Straight via a 4 port diffuser. Sewage is conveyed from the collection system to the treatment plant via a 375 mm diameter trunk sewer main.

Key considerations in the design of the treatment facility are:

- Energy efficient systems.
- B.C. Municipal Wastewater Regulation (MSR/MWR) compliance.
- Environmental Leadership.

Energy efficiency has been incorporated into the design through the use of fine bubble diffusers in the aerobic treatment processes, use of variable speed pumps and blowers and the use of a supervisory control and data acquisition (SCADA) system for process monitoring and control.

The effluent requirements outlined in the BC MSR/MWR for a plant with flow greater than 50 m^3/d are 45 mg/L for TSS / BOD_5. The District of Sooke Wastewater plant is designed to meet an effluent goal of 20 mg/L for TSS/BOD_5. In addition, if nitrification is a requirement, the treatment process can readily achieve < 5 mg/L NH_4-N with sufficient raw wastewater alkalinity.

Environmental leadership and stewardship are critical to the overall project design and success. Public and regulatory interest related to environmental protection is very high, for this reason the location of the outfall diffuser was selected to avoid several sensitive marine environments and the quality of the treated water is to be higher than required by regulations.

Sequencing Batch Reactor (SBR) technology was selected for the biological treatment process in 2005. Two parallel batch tanks were constructed to provide continuous treatment and a level of redundancy. The biologically treated wastewater is disinfected using ultraviolet light prior to ocean disposal. UV provides a high quality effluent while avoiding the application of chlorination and dechlorination chemicals. Sludge is stabilized in an aerobic digester and dewatered prior to disposal. In the future, if the District desires, on-site composting could be considered which would provide the capability to produce biosolids meeting the Class 'A' requirements for land disposal as outlined in the BC OMRR.

3.0 DESIGN CRITERIA

3.1 General

This section presents the process design information for the District of Sooke Wastewater Plant. Criteria including, population growth and per capita consumption have been used to develop the wastewater flow projections and influent and effluent water qualities. The design has been based on the expansion of a 3rd SBR train with consideration of the addition of the 4th SBR train which is expected within 10 years.

3.2 Population

The 1999 population equivalent in the catchment area was previously estimated to be 5,200. The population equivalent value incorporates a commercial equivalence factor to account for the higher sewage generation by commercial establishments. A growth rate between 2% and 2.5% was estimated in previous reports. The 2005 estimated total population equivalent for the year 2020 was 10,000 people during the initial design of the wastewater plant. Current population data show that growth assumption has been exceeded.

3.3 Wastewater Flow Rates

Historic wastewater flow information was not available for the District of Sooke in 2005. To estimate the future flows, values typical of Capital Regional District were selected. These values were then adjusted for

direct discharge to the sewer. Based on the CRD flow review, a per capita flow of 300 L/c/d was used to determine the Annual Average Daily Flow rate (AADF). This value incorporates some inflow and infiltration (I&I); however, this was expected to be lower than typical as the system was new. The predicted flow rates used as the Basis of Design for the treatment plant are presented in Figure 2. No reduction in the 300 L/c/d flow rate were incorporated in the flow assessment.

Based on other treatment facilities in the Capital Regional District, a relatively low peak wet weather factor of 2.3 was selected (typically 2.3 - 3.5). It was assumed that there would be minimal I&I in the new collection system. The actual peak weather factor has been 3.6 for the years 2018 through 2020. The District has and is undertaking work to mitigate these occurrences by working to repair known inflow and infiltration issues (l&I).

Population growth and key flow factors from 2005 are summarized in Table 2. From Table 3, the Maximum Day flow (~=PWWF) in 2020 was 6,289 m3/day which is 91% of the maximum hydraulic design capacity of 6,900 m3/day for 2 SBR trains. Additional treatment capacity is immediately needed.

The SBR facility was designed to accommodate expansion. Each SBR tank is designed to handle 1500 m^3/d AADF. Hence, expansion beyond the original 2 train AADF of 3,000 m^3/d can be achieved by adding tanks in 1,500 m^3/d capacity increments.

Table 2 – 2005 Influent Flow Assumptions

Year	1999	2020
Population	5,200	10,000
Per capita flow (L/c-d)	300	300
Peak Day Factor	1.25	1.25
Peak Wet Weather Factor	2.3	2.3
Average Dry Weather Flow (ADWF)	1,500	3,000
Peak Dry Weather Flow (m^3/d)	1,900	3,800
Peak Wet Weather Flow (m^3/d)	3,600	6,900

Table 3 - Influent Flows (2018-2020)

Flow Condition	2018	2019	2020	Peaking Factor
Minimum Day	1,398	1,506	1,682	0.9
Minimum Month	1,564	1,612	1,760	1
Annual Average Daily Flow	2,107	2,007	2,390	1.3
Maximum Month	3,137	2,885	3,739	2
Maximum Day	5,421	5,766	6,289	3.6

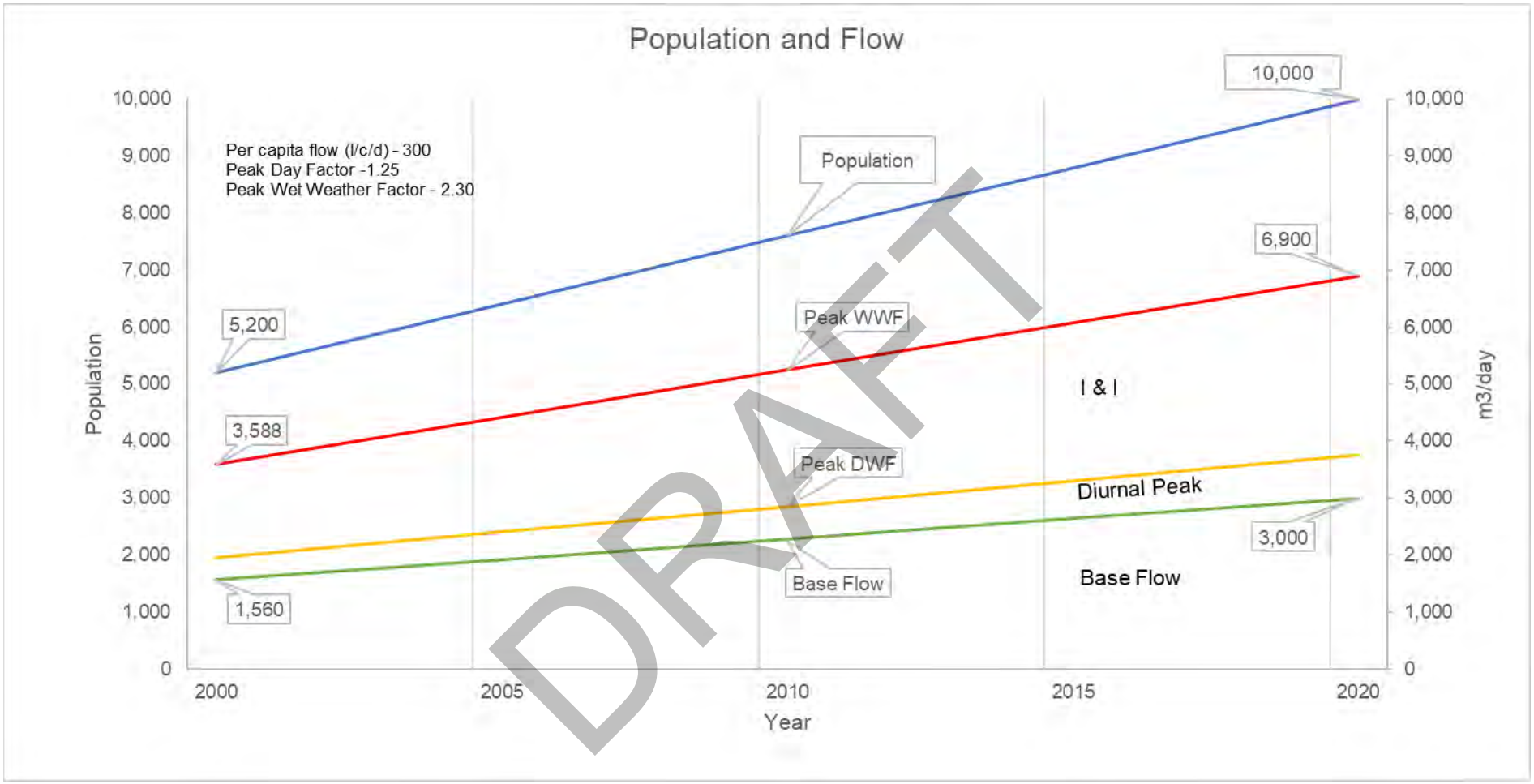


Figure 2 - Population and Flow Forecast (2005)

The projected population growth for the District of Sooke is expected to reach 23,000 by 2035 (p. 47 Official Community Plan, 2010). Data provided by the District and summarized in Table 4, was used to estimate the 2020 population of 11,240.

Table 4 - SFE and Population Data

	SFE	Population	People/SFE
2020	4062	11,240	
Pre-bought	636	1,760	
Total	4698	13,000	2.767

The growth rate to reach 23,000 by 2035 is 4.889%. Using this growth factor, the 2035 AADF will be increased by $(1.04889)^{\wedge 15} = 2.0463$. For 2040, the 2020 AADF will be increased by $(1.04889)^{\wedge 20} = 2.5979$.

The District has provided data on influent flows from 2007 through 2020. Table 5 summarizes this data. The growth during the 2007-2009 period (47.4%) was significantly higher than the growth during the 2009-2020 period (3.22%), The higher growth rate during the early years of plant operation corresponds to the build out of the collection system and connection of houses in the first 2 years following start of the WWTP.

Table 5 - Annual Average Daily Flow (AADF)

Year	AADF (m^3/day)
2007	775
2008	1,295
2009	1,685
2010	1,727
2011	1,837
2012	1,903
2013	1,818
2014	1,990
2015	2,032
2016	2,122
2017	2,172
2018	2,107
2019	2,007
2020	2,390
2035	4,891
2040	6,209

Assuming that 2020 population estimate of 11,240 is accurate, the per capita wastewater generation rate is 212.6 L/capita/day. Although much lower than the 2005 assumption of 300 L/capita/day, the value is not inconsistent with national trends.

If the current wet weather peaking factor of 3.6 persists (compared to ADWF, not AADF), the Maximum Day flow for 2035 and 2040 are estimated to be 13,540 m3/day and 17,190 m3/day, respectively. The peak hydraulic capacity for all 4 SBR trains is 13,800 m3/day which will be reached by 2035 if the I&I cannot be reduced. The wet weather hydraulic capacity of the SBR Train 3 (10,400 m3/day) will be

reached by 2029 if the population growth forecast is accurate and the high wet weather peaking factor persists. In 2020, the Influent Flow rates was < 4,500 m³/day approximately 98% of the time (Figure 4).

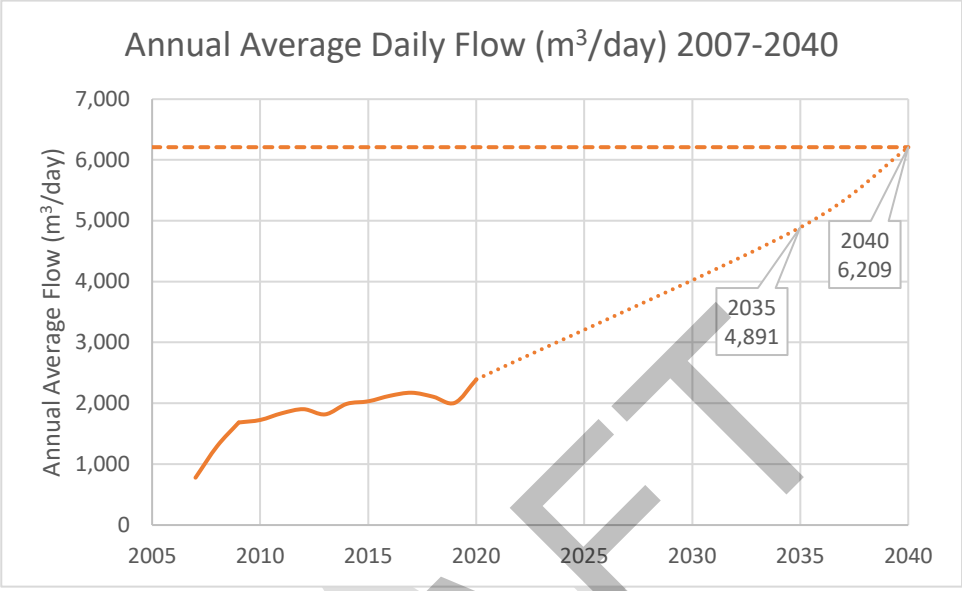


Figure 3 - AADF Actual and Forecast (2007-2040)

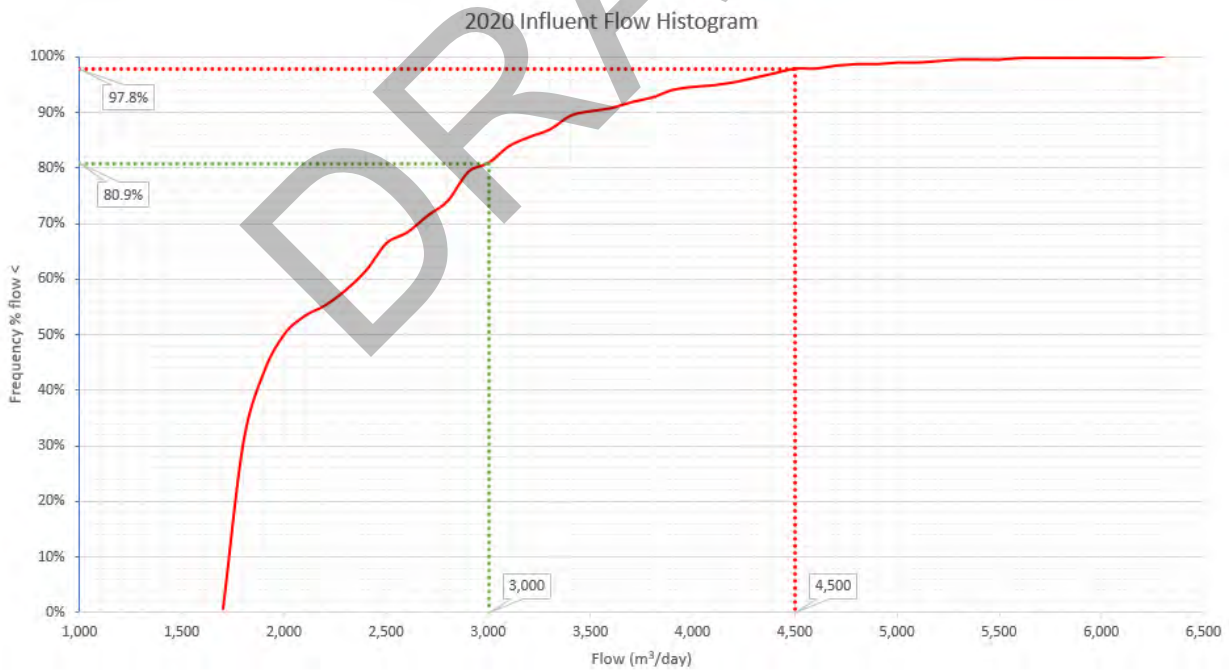


Figure 4 - 2020 Influent Flow Histogram

3.4 Influent Wastewater Characteristics

In 2005, influent wastewater quality was estimated through a review of CRD WWTPs and typical wastewater characteristics. The design values that were selected are slightly higher than typical domestic

waste, but include no major commercial, industrial or septage waste. The selected values for the wastewater influent characteristics is given in Table 6.

Table 6 - SBR Design Criteria (2005 Basis of Design)

Characteristic	Value
BOD_5	250 mg/L
Total Suspended Solids	250 mg/L
NH_3^+	25 mg/L
TKN	45 mg/L
Temperature	14 °C

Table 7 on page 7 shows the actual influent quality as recorded in the District of Sooke 2020 Annual Laboratory Report. These data show that the annual average CBOD is 215 mg/l. CBOD is carbonaceous BOD. CBOD concentrations are less than Total BOD_5 measurements by ~ 85%. Applying this factor to the recorded measurements, the annual average Total BOD5 is estimated to be 252 mg/l which is consistent with the SBR Design Criteria shown in Table 6. The annual average TSS is 187 mg/l which is less than the Table 6 value of 250 mg/l. This lower value is not surprising considering the higher than expected I&I flows.

Table 7 - 2020 Influent Data

2020	Influent					
Parameter	Influent flow	pH	CBOD	*TSS*	*NH_3-N*	TP
	m^3/d		mg/L	mg/L	mg/L	mg/L
Minimum	1,682	7.2	110	83	23.0	3.7
Maximum	5,927	8.2	420	300	70.0	20.0
Average	2,172	7.7	215	187	44.9	9.3

3.5 Discharge Criteria

The Federal (WSER) and Provincial Governments (MWR) have established treatment objectives (see Table 8 below) for marine discharge of treated wastewater from municipal wastewater treatment plants for discharge to embayed marine waters. When the District of Sooke applied for the MSR Operating Certificate in 2005, the District established treatment objectives which are greater than federal/provincial regulations and are displayed in Table 9

Table 8 - Effluent Criteria-Marine Discharge

MWR Criteria – Embayed Marine Waters		WSER	
Parameter	Criteria	Parameter	Criteria
Toxicity		Toxicity[1]	Effluent is not acutely lethal[1]
BOD_5	< 45 mg/L (maximum)	$cBOD_5$	< 25 mg/L (average)
TSS	< 45 mg/L (maximum)	TSS	< 25 mg/L (average)
pH			
Total phosphorus (P)			
Ortho-phosphate as (P)			

Ammonia Nitrogen		Un-Ionized Ammonia (as Nitrogen)	1.25 mg/L (maximum at 15˚C ± 1˚C)
Fecal Coliforms	Based on receiving water usage		
Total Residual Chlorine	<0.02 mg/L (maximum)	Total Residual Chlorine	<0.02 mg/L (average)

Table 9 - District of Sooke Treatment Objectives for MSR/MWR Registration

Parameter	Objective	Units	Standard
BOD_5	20	mg/l	30-day average
TSS	20	mg/l	30-day average
NH_3-N	5	mg/l	30-day average
Fecal Coliforms	200	MPN - Fecal Coliforms (FC) per 100 ml	30 Day Average, grab sample
pH	6.0 to 9.0		

Table 10 shows the Final Effluent quality data for 2020. Although these annual average data show that the
Final Effluent quality was achieved for CBOD, TSS and FC, there were TSS and FC monthly average exceedances of the Table 9 permit limits in the summer months. These excursions are discussed in the Technical Memorandum on UV Treatment Options included in Appendix D.

Table 10 - 2020 Final Effluent Laboratory Results

2020		Combined Effluent						
Parameter	Effluent flow	pH	UVT	CBOD	TSS	NH_3-N	TP	FC
	m^3/d		%L	mg/L	mg/L	mg/L	mg/L	CFU /100 mL
Minimum	1,682	6.0	25	6	2	0.3	0.3	1
Maximum	5,927	7.5	71	9	2	38.0	6.2	1,100
Average	2,172	6.7	53	8	8	10.3	2.9	146

4.0 SITEWORKS

4.1 General

The wastewater treatment plant is built on the site located southwest of the West Coast Road as part of Lot 8, Sections 1, 2 and 3 of the District of Sooke, Plan 2318. A 320 metre access road is provided from West Coast Road. The natural site slopes from a high of 9 metres to a low on the west side of 4.5 to 5.5 metres. The proposed site layout is presented in the appended drawing set. The site layout indicates the location of 2 additional SBR tanks which would bring the plant capacity to a total of 6000 m^3/d AAF.

4.2 Water Service And Fire Protection

Water service is connected to West Coast Road watermain. All buildings are with fire protection according to the District of Sooke's By-Laws. Sprinklers were not provided for buildings.

4.3 Roadways, Parking And Drainage

A gravel access road was constructed from West Coast road, including parking space, access to the lab and maintenance building. Access roads to the process units are gravel. The gravel road alignment will be adjusted to suit the plant expansion beyond the two basin SBR system.

The site currently has a drainage ditch adjacent the administration building to provide site drainage.

4.4 Security

A fence has been constructed around the site and across the roadway. Security lighting has been provided.

4.5 Site Piping

Piping on the site is buried PVC. Sewage from the collection system flows adjacent to the access road and collected in a 1050 mm diameter manhole. The treated wastewater flows by gravity through a 655 metre long 500 mm diameter DR41 PVC pipeline to the start of the 500 mm HDPE submerged ocean outfall.

5.0 GEOTECHNICAL

5.1 General

Based on the review of site conditions, the results of the geotechnical subsurface exploration and subsequent laboratory testing, the proposed WWTP expansion can be supported on a raft foundation founded on stiff to very stiff native clay and clayey sand soils. Additional details regarding recommendations for the proposed expansion are provided below.

5.2 Site Preparation

We envision site preparation activities to include stripping organics, removing soil backfill from the south wall of SBR #2 and excavation of the expansion footprints to achieve design subgrade elevation. Excavations 2.8 to 2.9 m deep (approx.) are anticipated to reach design subgrade for the new SBR's and digester. The anticipated soil conditions at design subgrade elevation at boreholes BH21-01 and BH21-04 consist of stiff to very stiff clay and consist of stiff clayey sand in borehole BH21-03. Borehole BH21-02 encountered auger refusal on a very dense silty sand layer at 1.5 m depth before reaching design subgrade elevation; however, similar soils consisting of stiff to very stiff clay or clayey sand are anticipated.

The clay subgrade is sensitive to moisture and mechanical disturbance. Any soft or loose soils detected within the exposed subgrade, including those disturbed by construction or other site activities, should be sub-excavated to the discretion of the Stantec geotechnical engineer and replaced with structural fill as described in Section 5.3. The subgrade and any over-excavation, backfilling and compaction should be reviewed by the geotechnical engineer.

5.3 Structural Fill

Structural fill for backfilling should be clean free-draining granular soil, consisting of 75 mm (3 in.) minus pit-run sand and gravel, with less than 5% passing the Standard US #200 sieve. The backfill should be

placed in maximum 300 mm thick loose lifts and compacted to at least 95% of the Modified Proctor maximum dry density (MPMDD).

Any proposed alternative fill material should be tested and approved by the Geotechnical Engineer prior to delivery to the site. Review of structural fill placement and compaction must be carried out by the Geotechnical Engineer to ensure that all fill used is suitable and is placed and compacted to the above specifications.

5.4 Seismic Design Parameters

Site-specific seismic design parameters were obtained from the interactive website maintained by the Geological Survey of Canada in accordance with the provisions of BCBC (2018). The parameters 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 and Peak Ground Acceleration (PGA) are determined for very dense soil or soft bedrock, taken as the reference ground condition corresponding to Site Class "C". The $S_a(T)$ values would have to be adjusted to account for local site conditions and to obtain design spectral values S(T).

The Peak Ground Acceleration (PGA) and $S_a(T)$ values for the 475, 975 and 2475-year return periods at Site Class C conditions, obtained as per BCBC (2018) are summarized in Table 3.

Table 11 Seismic Hazard Parameters for 5% Damping – Site class C - BCBC (2018)

Period, T (s)	$S_a(T)$ – 2475-year return period (g)	$S_a(T)$ – 975-year return period (g)	$S_a(T)$ – 475-year return period (g)
0.05	0.71	0.5	0.35
0.1	1.11	0.78	0.55
0.2	1.35	0.95	0.67
0.3	1.38	0.96	0.68
0.5	1.24	0.85	0.58
1.0	0.76	0.48	0.31
2.0	0.46	0.28	0.17
5.0	0.15	0.08	0.04
PGA	0.61	0.42	0.29
Note: 'g' is gravitational acceleration, 9.81 m/s^2			

5.5 Liquefaction Assessment And Site Class

Groundwater was encountered at approximately 1.2 and 1.4 m below ground surface in two of the boreholes. The soils above the water table, including upper sand and gravel and silt to silt with sand soils, are considered not susceptible to liquefaction. The clay deposit had measured PI values greater than 12 and was generally stiff to very stiff. The lower gravel and sand layer was generally dense to very dense. Based on Idriss and Boulanger (2008), the site soils are considered not susceptible to liquefaction.

The soil conditions at the site are defined as Site Class C as per BCBC (2018).

Post-seismic lateral soil spreading, and settlement are estimated to be negligible.

5.6 Foundation Design

The proposed SBR and digester expansions can be supported on reinforced concrete raft foundation at a minimum 2.8 m depth below the existing ground surface. Below the raft foundation, a minimum 150 mm thick layer of 19 mm (3/4 in.) clear, angular gravel placed and compacted is recommended. The prepared sub-grade, placement of the gravel layer and compaction should be reviewed by the Geotechnical Engineer prior to rebar or concrete placement.

The proposed raft foundation, constructed about 3 m depth below the existing ground surface founded on stiff to very stiff clay or clayey sand, can be designed using an ultimate bearing resistance of 300 kPa for Ultimate Limit State (ULS) condition and resistance factor of 0.5 (resulting in a factored bearing resistance of 150 kPa). Under Serviceability Limit States (SLS), the raft foundation can be designed using a bearing resistance of 100 kPa, which corresponds to an estimated settlement of less than 25 mm.

A friction coefficient of 0.7 can be used between the raft or slab-on-grade foundation and the subgrade soils. A modulus of subgrade reaction of 40 MN/m^2/m can be used for structural design.

5.7 Temporary Excavation

All excavations should be carried out in accordance with Part 20 of the current WorkSafeBC regulations (WorkSafeBC, 2013) and be safe for worker entry. Sloped cuts or shoring of the excavations will be required given that excavations are expected to remain open for several days.

Excavations up to about 3 m deep are expected. For excavations within the dense silty sand and stiff to very stiff clay, unsupported excavations should be cut at no steeper than 1H:1V (horizontal to vertical) to a maximum depth of 3 m.

Excavation side slopes should be covered with polyethylene sheets secured to the ground with nails immediately after the cut. This is 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 will 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.

Excavated material should be stockpiled at a horizontal distance greater than the depth of the excavation, measured from the crest. Construction equipment and vehicles should be kept a minimum of 2 m from the crest of all excavations. The Contractor should inspect excavations regularly for signs of instability, and slopes should be flattened if required.

5.8 Groundwater Control During Construction

The bottom of the proposed foundations can be below the ground water table. Conventional sumps and pumps can be considered to control the groundwater. If a more robust dewatering method is required, such as well points, the proposed groundwater control method should be reviewed by the Geotechnical Engineer prior to implementation.

The contractor is responsible for ground water control.

5.9 Earth Pressure Coefficients

Recommended lateral earth pressure parameters are provided in Table 3. The calculated earth pressures should be multiplied by the load factors specified in BCBC (2018) for structural design.

Table 12 - Lateral Earth Pressure Parameters

Parameter	Value
Internal friction angle of granular backfill	35°
Interface friction angle between concrete and soil	17°
Unit weight of compacted granular backfill (kN/m^3)	20
Coefficient of at-rest pressure K_o	0.45
Coefficient of active earth pressure K_a	0.27
Coefficient of passive earth pressure K_p	6.4
Coefficient of incremental seismic earth pressure ΔK_E (In addition to static earth pressure)	0.2 (for PGA = 0.29g) 0.36 (for PGA = 0.42g) 0.81 (for PGA = 0.61g)

A compaction induced lateral pressure with an inverted triangular distribution with 20 kPa at the adjacent ground surface, decreasing to zero at 4 m depth can be used to consider soil compaction during construction.

Under seismic loading conditions, seismic earth pressure should be considered in addition to static pressure. Incremental seismic pressure with inverted triangular pressure distribution with zero pressure at the bottom of the wall and maximum pressure at the top can be used as per Metro Vancouver (2017).

5.10 Perimeter And Site Drainage

It is recommended that a perimeter drainage system, consisting of at least 150 mm diameter perforated rigid wall pipe, be placed around the perimeter of the expansion. The perimeter drains should be established at an elevation below the underside of raft slab and be connected to a pumped sump or to a suitable gravity outlet.

The drainage pipes should be surrounded by a minimum of 150 mm of 19 mm drain rock or 19 mm clear crush gravel. The invert elevation of the drainpipes should be at least 150 mm below the underside of the slabs. Final ground surfaces around the buildings should be graded to direct surface runoff away from building areas.

5.11 Access Road

Realignment of the existing gravel access road is anticipated to facilitate construction of the proposed SBR and digester expansions. Site preparation for parking areas and the gravel access road should include stripping of organics and excavation to achieve design subgrade elevation. The native subgrade should be proof rolled using a large smooth drum roller and inspected by the Geotechnical Engineer.

Areas exhibiting deflection should be over-excavated as necessary and replaced with compacted granular fill. Backfill for the over-excavated areas should be structural fill. Material specifications, placement method and compaction requirements for the structural fill are as specified in Section 5.3.

5.11.1 SUBBASE COURSE

The subbase course should be compacted to 300 mm above the approved subgrade and compacted to at least 95% MPMDD.

5.11.2 BASE COURSE

The base course over should be compacted to 200 mm above the subbase in access roads and to 150 mm thickness at parking areas and compacted to at least 95% MPMDD.

6.0 ARCHAEOLOGICAL

An archaeological desktop review of the proposed Sooke Wastewater Treatment Plant (WWTP) Expansion project (the Project) at 7113 West Coast Road, Sooke, British Columbia was undertaken by Stantec archaeologists. The review was undertaken with the following key objectives:

- Determine the location, nature, and distribution of recorded archaeological resources near the Project area.
- Identify and assess archaeological resource potential or sensitivity within the Project area.
- Assess potential impacts to archaeological sites
- Provide recommendations on the appropriate methods and scope for subsequent archaeological studies, if needed

A Technical Memorandum on the archaeological desktop review is included in **Error! Reference source not found.**.

No further archaeological assessment is recommended for the Project. However, although an attempt was made to evaluate the potential for the Project to impact archaeological resources, as with all archaeological studies, the possibility exists that unidentified archaeological resources are present. In the unlikely event that suspected archaeological resources are encountered during proposed Project activities, all work in the immediate vicinity of the find(s) must cease and the Archaeology Branch contacted for appropriate guidance and direction.

7.0 PROCESS ELEMENTS

7.1 Headworks

The plant influent passes through a WAM Inc. GCP 300 model fine screen that was installed in 2005. The unit consists of a 3 mm punch press screen inclined at 35° from the horizontal in a channel approximately 350 mm wide by 800 mm deep. The capacity of the screening system is 6,900 m^3/d for an influent TSS of 250 mg/L. The fine screen is complete with a spiral assembly, screen basket, pivot stand, screen washing, grit washing, compacting and controls. A bypass channel equipped with a 25 mm bar screen is designed to be used during maintenance on the fine screen.

The wastewater enters the grit removal system following the fine screen. A John Meunier Metcan© vortex grit removal system, JMD/1-20 IS XH model complete with a SAM© grit dewatering screw, model GDS/9-10-25A XAOA system was installed during the 2005 construction contract. The grit removal system consists of an influent channel approximately 300-350 mm wide entering a 2000 mm diameter conical grit chamber with a 600 mm effluent channel. The grit chamber will be an open tank vortex type design with both inlet and outlet points located at the top of the tank. The flow pattern will cause natural vortex and gravity forces for separation of grit from organic solids in the wastewater stream. A set of two rotating stainless steel paddles maintain constant movement of wastewater within the chamber and help to direct the grit towards the bottom of the collecting well. The collected grit is removed periodically through a transfer air lift pump to the grit washing / dewatering system which utilizes a screw type classifier. The collected grit is washed and dewatered as it is being transported in the screw conveyor to the grit bagging system. The bagging system and grit holding dolly is similar to the one used for handling screenings. The wash water is returned to the upstream of the screen. Similar to the screens, the channel leading to the grit removal system has been designed for isolating the grit system for maintenance purposes. Following the grit removal, wastewater is directed by gravity via a 250 mm diameter PVC pipe to the SBR.

During recent site visits, the plant operators have expressed concern with the condition and performance of the WAM Inc. GCP 300 model fine screen. The screen has been in service for ~ 17 years which is beyond the normal service life of 15 years for fine screens. The plant operators would prefer a 6mm mechanical bar screen vs. the existing perforated plate screen. Stantec has obtained design and cost information for a 6 mm mechanical bar screen as illustrated in Figure 5 below. The quote for the bar screen was $115,250. The companion WTP Equipment Corp. CPW20 Screenings Washing Dewatering Press (Compactor) is $37,875

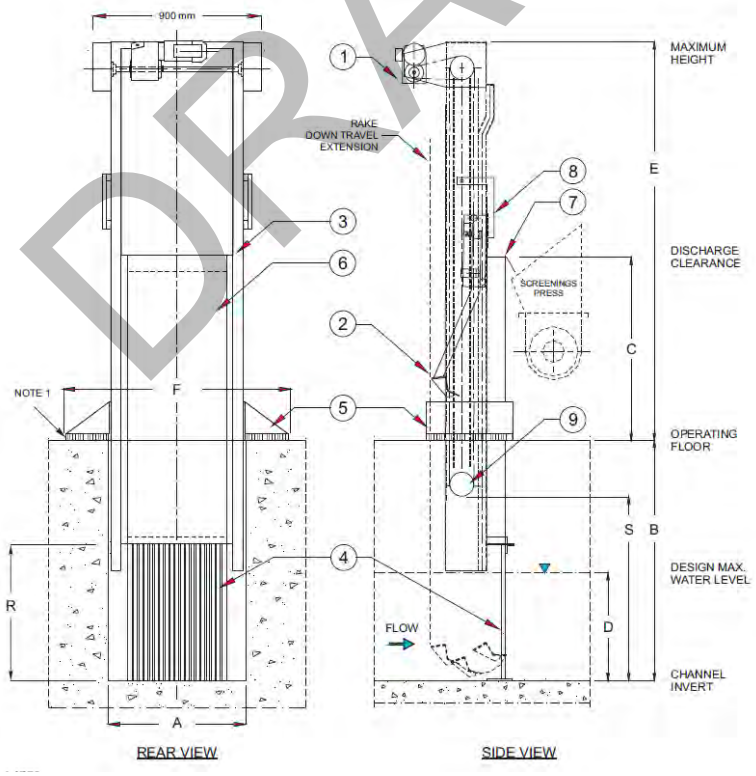


Figure 5 - WTP Equipment Corp. SL100 Bar Screen

8.0 SECONDARY TREATMENT

8.1.1 SEQUENCING BATCH REACTOR

The existing secondary treatment consists of two basin ABJ Intermittent Cycle Extended Aeration System (ICEAS©) Sequencing Batch Reactor (SBR). The wastewater flows by gravity from the headworks to the SBR system. SBR treatment is a fill-and-draw, non-steady state activated sludge type treatment system, where the biological reaction and sedimentation occur in the same tank. The bioreactor tanks are operated in a timed sequence to achieve the desired level of treatment. The size of the SBR tanks are 29 x 10 metres with a 3.9 metre minimum and 5 metre maximum side wall depth (SWD). The SBR is designed to achieve an effluent quality of 20 mg/L BOD_5, 20 mg/L of TSS and $\leq$ 5 mg/L of NH_3-N on a monthly average basis. The plant is also designed to pass the LT_{50} effluent toxicity test.

To achieve this, the SBR system operates on a "Continuous feed – intermittent decant" type strategy. An influent splitter box with control weir gates will be provided to distribute screened and degritted wastewater continuously to the two SBR cells.

The SBRs are designed to handle a hydraulic flow variation of 3000 m^3/d (AADF) to 6900 m^3/d (PWWF). The typical hydraulic retention time (HRT) of the system under average conditions is estimated to be 21 hours with a sludge age of 25 days. Under these conditions the proposed system will provide effective removal of BOD_5, TSS and ammonia-nitrogen (via nitrification). A minimum mixed liquor operating temperature of 10°C will be required for complete nitrification. The SBR treatment cycles are key to overall process operation. The mode of operation is as follows:

Table 13 - SBR Cycle Times

Cycle	Aeration	Settle	Decant	Total
Normal	120 min	60 min	60 min	4 hours
Storm[1]	90 min	45 min	45 min	3 hours

[1]Note: A storm cycle is initiated during the peak wet weather flow conditions

Aeration is provided by a Sanitaire® fine bubble 230 mm Silver Series II membrane grid diffusers and by utilizing two (one duty, one standby) positive displacement blowers to meet the air requirements. A dissolved oxygen (DO) feedback control system with DO probes was provided to optimize plant efficiency and to match blower output to process oxygen demand. Blower output is adjusted with variable speed drives. This arrangement provides greater flexibility in power savings during periods of low organic loading. Treated effluent from the SBR is collected by a decanting system in each of the SBR basins. Two decanters were provided, each 4.6 meters long with a stainless steel trough, scum exclusion float, downcomer pipes, collection pipe and 0.75 HP decanter drive. The effluent is discharged into an effluent box where flows by gravity to the ultraviolet disinfection (UV) system.

Table 14 shows the design flow criteria for the 4 SBR trains that was established in the 2005 Basis of Design.

Table 15 shows the design and performance criteria recently provided by Sanitaire, the original SBR equipment supplier. These data show the criteria for the ultimate build out of 4 SBR trains.

Table 16 show the tank dimensions and equipment specifications for the SBR reactors.

Table 14 - SBR Hydraulic Capacity Criteria (2005)

		Number of Operating Trains						
		1	2	3	4	Cycle Time	Fill Time	Decant Time
		Flow (m^3/day)						
Average Dry Weather Flow	ADWF	1,500	3,000	4,500	6,000	240	180	60
Peak Dry Weather Flow	PDWF	1,900	3,800	5,600	7,500	240	180	60
Peak Wet Weather Flow	PWWF	3,450	6,900	10,400	13,800	180	135	45

Table 15 - SBR Design Criteria

SBR Design Criteria		
Max Month*	m^3/day	6,000
Peak Dry Weather Flow	m^3/day	7,500
Peak Wet Weather Flow	m^3/day	13,800
*** - Maximum 30 day period mass flow**		
	mg/l	kg/day
BOD_5 (20°C)	250	1,499
Suspended Solids	250	1,499
TKN	45	270
Total Phosphorus	5	30
Max Wastewater Temperature	°C	23
Min Wastewater Temperature	°C	10
Ambient Air Temperature	°C	-6/+32
Site Elevation	m	8
Table B: ICEAS® EFFLUENT QUALITY (MONTHLY AVERAGE)		
BOD_5 (20°C)	mg/l	20
Suspended Solids	mg/l	20
NH_3-N	mg/l	5
Total Phosphorus	mg/l	0.0
Table C: ICEAS PROCESS DESIGN CRITERIA		
Operating Basins		4
Operating Top Water Level	m	5.00
F/M ratio	BOD_5/day/MLSS	0.060
SVI (after 30 minutes settling)	ml/g	150
MLSS at Bottom Water Level	mg/l	5,504
Waste Sludge Produced (Approx.)	kg/day	1,155
Volume of Sludge Produced		
(Approximately 0.85% solids)	m^3/day	136
Max Month Decant Rate	m^3/min	6.71
Max 4.0hr Cycle Flow Decant Rate	m^3/min	9.58
Hydraulic Retention Time	days	0.88
Sludge Age	days	20.4
Sufficient Alkalinity must be provided to maintain basin pH of 6.8		

Table 16 - SBR Tank Dimensions and Equipment Specifications

Table D: KEY ICEAS DESIGN DETAILS							
Basin Length (Inside)	m	29.3					
Basin Width (Inside)	m	10.0					
Top Water Level	m	5.00					
Bottom Water Level	m	3.88					
ICEAS EQUIPMENT (Base Design)						Motor HP	# required
Decanter Mechanism weir length	m	4.57					4
Decanter Drive Unit						½	4
ICEAS Blower	m³/hour	1,190	52.4		kpa	50	3
ICEAS Fine Bubble Aeration System	#	720	Disc Diffusers/Basin				4
Air Control Valve	mm	200					4
Waste Sludge Pump	L/min	416				2.4	4
Submersible Mixer						15	8
ICEAS Controls							1
ICEAS POWER REQUIREMENTS	(At Average Aeration Depth)						kWhr/Day
Decant Drive Unit	BHP	0.4	4	@	6	hours/day	7.2
ICEAS Air Blowers*	BHP	32.3	2	@	24	hours/day	1,156.6
Waste Sludge Pump	BHP	1.9	4	@	1.4	hours/day	7.9
						kWhr/Day	1,171.7
					Average	kWhr/Hour	48.82

* Shared ICEAS Blowers

Figure 6 through Figure 9 on the following page illustrates the SBR cycle times for the current 2 SBR train operation and proposed SBR cycle times for 3 SBR train operation.

2 SBR Trains

Normal

Time,hours	1				2				3				4			
Time, minutes	0-15	15-30	30-45	45-60	60-75	75-90	90-105	105-120	120-135	135-150	150-165	165-180	180-195	195-210	210-225	225-240
SBR1	Aeration								Settle				Decant			
SBR2	Settle				Decant				Aeration							

Figure 6 - Normal Cycle for 2 SBR Trains

Storm

Time,hours	1				2				3			
Time, minutes	0-15	15-30	30-45	45-60	60-75	75-90	90-105	105-120	120-135	135-150	150-165	165-180
SBR1	Aeration						Settle			Decant		
SBR2	Settle			Decant			Aeration					

Figure 7 - Storm Cycle for 2 SBR Trains

3 SBR Trains

Normal

Time,hours	1			2			3			4			5				6			7			8		
Time, minutes	0-20	20-40	40-60	60-80	80-100	100-120	120-140	140-160	160-180	180-200	200-220	220-240	240-260	260-280	280-300	300-320	320-340	340-360	360-380	380-400	400-420	420-440	440-460	460-480
SBR1	Aeration						Settle			Decant			Aeration						Settle			Decant		
SBR2	Settle	Decant		Aeration						Settle			Decant			Aeration								Settle
SBR3	Aeration			Settle			Decant			Aeration						Settle			Decant			Aeration		

Figure 8 - Normal Cycle for 3 SBR Trains

Storm

Time,hours	1				2				3				4				5				6			
Time, minutes	0-15	15-30	30-45	45-60	60-75	75-90	90-105	105-120	120-135	135-150	150-165	165-180	180-195	195-210	210-225	225-240	240-255	255-270	270-285	285-300	300-315	315-330	330-345	345-360
SBR1	Aeration						Settle			Decant			Aeration						Settle			Decant		
SBR2	Settle	Decant		Aeration						Settle			Decant			Aeration								Settle
SBR3	Aeration			Settle			Decant			Aeration						Settle			Decant			Aeration		

Figure 9 - Storm Cycle for 3 SBR Trains

8.1.2 TERTIARY FILTRATION

The UV Final Effluent UV Disinfection Technical Memorandum in Appendix D provides data from 2020 that shows that the design UVT of 60% is achieved only during winter months and for the majority of 2020, this value was well below the design value reaching as low as 30% and less during summer months. Also, final effluent TSS showed high variability often exceeding design value of 20 mg/L. In general, the final effluent fecal coliform values exceeded 200 MPN/100 mL target about 20% of the time.

The most effective method of reducing the TSS exceedances and improving the UVT to meet the design value of 60% is to install tertiary treatment between the SBRs and the UV disinfection process.

Appendix C contains a Technical Memorandum that discusses options for tertiary filtration of the effluent. The recommendation in the Technical Memorandum recommended to consider the surface filtration technologies only, such as disc filters for the Sooke WWTP expansion project. This technology offers generally similar footprint to the depth filtration but at smaller headloss, less backwash water volume and shorter backwash duration. Frequently, the individual filter panels can be cleaned while the filter continues to operate without interruption to the flow. Media replacement is also easier with filter panels that can be replaced individually as needed.

Stantec had numerous discussions with disk filter suppliers. Based on budgetary pricing provided by these technology providers it was concluded that the cost to install a single disk filter to treat the ultimate flow of 13,800 m^3/day would be very costly and exempt any other improvements from being implement within the available project budget. The recommendation from the equipment suppliers was to stage the installation of the tertiary filtration equipment in two stages. Each filter would be sized for 50% of the ultimate peak flow rate of 13,800 m^3/day. The individual filters will have a rated capacity of 6,900 m^3/day. The long term advantage of this strategy is that it will provide redundancy to allow for periodic offline maintenance activities.

Table 17 provides a summary of the daily decant time for 2, 3 and 4 SBRs in service. It is noted that the actual time when the decant is flowing from the SBR will be less than 60 minutes when the plant influent flow is less than the design capacity of the SBR. This is due to the SBR tank not fully filling between decant cycles and the decanter travelling for a period of time before the downspouts contact the water surface. The calculation of instantaneous decant flow rate vs influent flow rate is a somewhat complex. The rate of discharge from the decanter travel is constant depending on whether the SBR is in normal or storm mode.

Table 17 - SBR Decant Cycle Times

		Aeration	Settle	Decant	Total	Cycles/day	Decant time /train/day	Total Decant time/day
Number of SBR Trains		Minutes						
2	Normal	120	60	60	240	6	360	720
	Storm	90	45	45	180	8	360	720
3	Normal	120	60	60	240	6	360	1080
	Storm	90	45	45	180	8	360	1080
4	Normal	120	60	60	240	6	360	1440
	Storm	90	45	45	180	8	360	1440

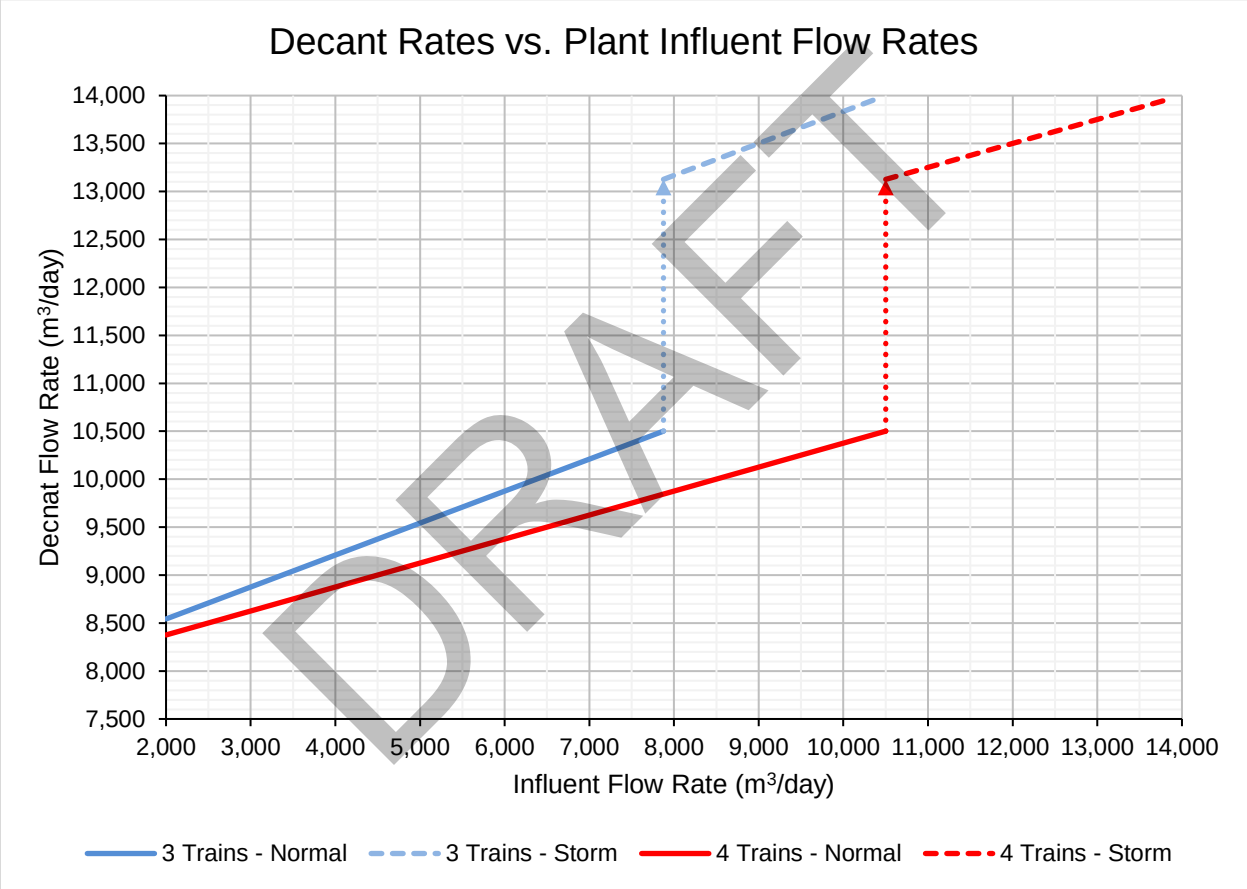
Table 18 shows the instantaneous flow rate from the decanter when submerged. These values are constant and do not change with addition SBR trains in service.

Table 18 - Flow Rates from Decanter travel time

	Normal	Storm	Units
Decanter	7,876	10,501	m^3/day
Travel rate	0.0183	0.0244	m/min

In addition to the decanter flow rate from decanter travel, the influent flow rate into the SBR basin must be added to the decanter travel flow. Figure 10 shows the instantaneous decant flow rates for a range of influent flow conditions for 3 and 4 SBR trains.

Figure 10 – Instantaneous Decant Rate vs Influent Flow Rate with 3 & 4 Operating SBR Trains



From the 2020 Influent Flow Histogram shown in Figure 11, the influent flow into the plant was less than 5,175 m^3/day 99.5% of the time. For the 2018-2020 period, the maximum daily flow into the plant was >5,175 m^3/day on 2 day in 2018 and 2019 and 3 days in 2020. The decant rate corresponding to this influent flow rate is 9,590 m^3/day which greater than the capacity of a single disk filer. To address this issue, it is proposed to construct an effluent equalization tant and effluent pumping system to equal the effluent flow to the influent flow. In addition to improve the performance of the disk filter, the equal pumping rate will also improve the performance of the UV equipment and resolve the hydraulic grade line problem with the UV channel described later in this section.

Figure 12 - 2020 Influent Flow Histogram

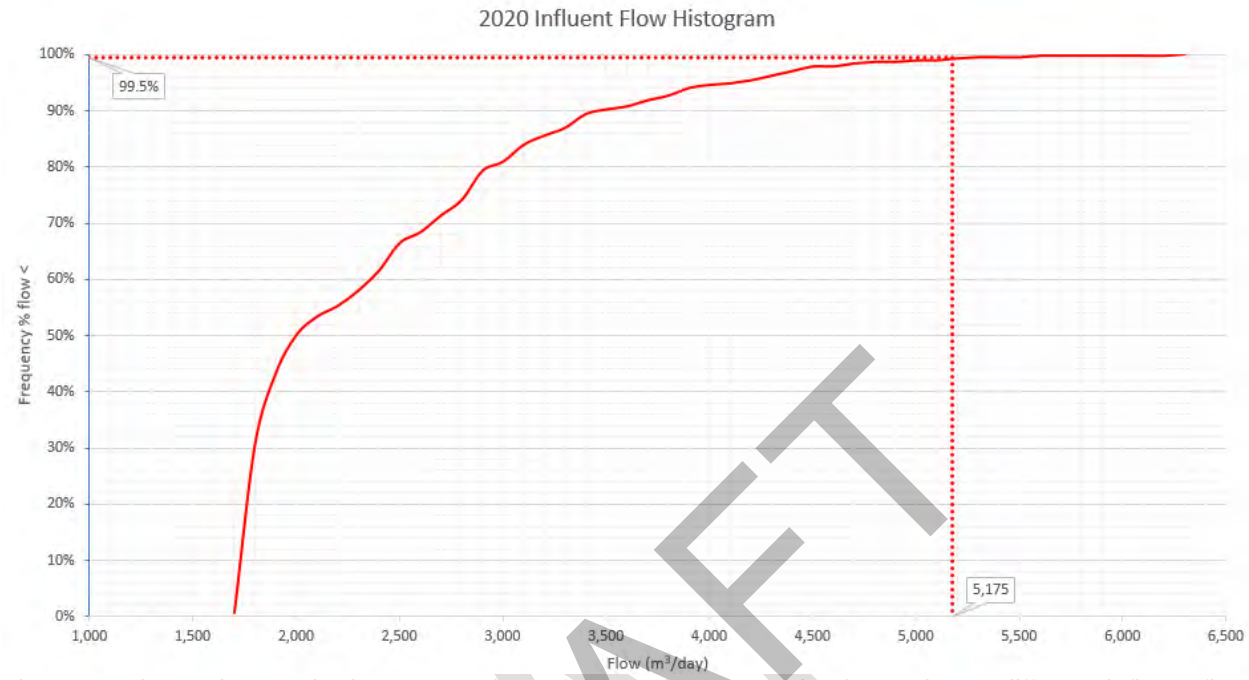
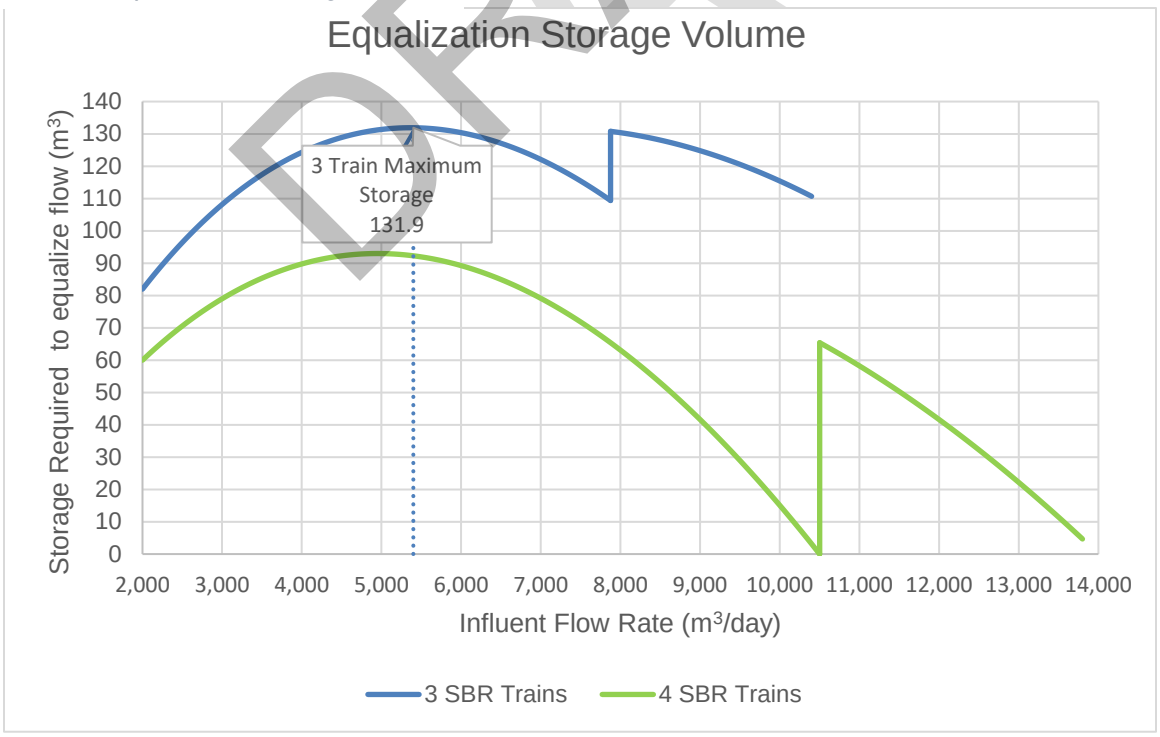


Figure 11 shows the required storage volume for 3 and 4 SBR trains in service at different influent flow rates. This graph shows that the maximum storage volume for 3 trains in service is 131.9 m³.

Figure 11 - Equalization Storage Volume



Based on discussion with equipment suppliers, the design parameters shown in Table 19 and Table 20 were used to obtain quotes for the tertiary filter equipment. Nexom has provided a quote of $390.000 for an infini-D™ cloth disk filter model 6/30 which will meet the performance specifications shown in Table 19 and Table 20

Table 19 - Disk Filter Design Loads and Effluent Objectives

	Units	Filter Influent	Filter Effluent
Design Flow (ADF)	m^3/d	3,000	
Peak Day Flow (PDF)	m^3/d	3,800	
Peak Hour Flow (PHF)	m^3/d	6,900	
Alkalinity	mg/L	50 - 150	
pH	S.U.	6 - 7.5	
TSS	mg/L	25	<10
Average filtrate expected to be < 5 mg/L.			

Table 20 - Filtration Design Parameters

Configuration	Units	Design Parameter
Total number of filters, duty		1x100%
Filter model		6/30
Number of disks per filter		6
Nominal area per disk	m^2	5
Filtration area per filter	m^2	30
Filter headloss	mm	400
Hydraulic loading	$m^3/h/m^2$	< 9.6
Surface solids loading rate (SSLR)	g/m^2h	< 200

The headloss create by the tertiary filters and the higher HGL in the outfall presents a design challenge that will require pumping of the effluent to raise the HGL upstream of the disk fillers and to equalize the flow rate. Calculating back from the UV channel, the HGL at the outlet of the tertiary filters is calculated in Table 21.

Table 21 – Headloss Calculations between Disk Filters and UV Channel

UV Channel to Disk Filter Outlet				
Effluent Flow Rate		13,800	m^3/day	
		9.583	m^3/min	
	Q =	0.160	m^3/sec	
	C =	140		
500 mm Schedule 40 steel pipe	d =	0.478	m	
pipe $h_f = (10.67*Q^{1.852})/(C^{1.852}*d^{4.8704})*L$	g =	9.80665	m/sec^2	
				HGL

			Headloss		m
HGL at upstream end of UV channel					9.323
500 mm Schedule 40 steel pipe	9	m	0.012	m	9.335
Minor losses					
500 mm Schedule 40 steel pipe	#		K		
Entrance loss	1	0.5	0.5		
90º LR elbow	1	0.19	0.19		
Coupling	1	0.04	0.04		
Gate Valve (Fully Open)	1	0.10	0.1		
Exit loss	1	1	1		
		Total K	1.83		
Velocity	0.890	m/sec			
$v^2/2g$	0.040	m			
Minor losses 500 mm Schedule 40 steel pipe		= K * $v^2/2g$	0.074	m	**9.409**
			Headloss		0.086
Q=	0.160	m^3/sec			
C_d =	0.6				
L =	5	m			
g =	9.80665	m/sec^2			
Depth of flow over disk filter weir - h =	0.068766	m			
=	2.707	inches			
TWL in outlet box = TWL above Disk Filter Weir =	9.41	m			
Disk Filter Top of Weir =	9.34	m			
Disk Filter Weir Wall Top of Concrete =	9.29	m			
Disk Filter Outlet Box Bottom Slab Top of Concrete =	8.88	m			
Centerline of 500 mm outlet pipe =	9.19	m			
HGL at Inlet Box Side of Disk Filters =	9.69	m			

$$h = \left(\frac{Q}{\frac{2}{3} * C_d * L * \sqrt{2g}} \right)^{\frac{1}{1.5}}$$

Table 22 - Headloss calculations through UV channel

UV Channel					
Channel Elements	Channel Floor Elevation	Channel Width	Depth Upstream	Depth Downstream	Upstream Water Level Elevation
	(m)	(in)	(m)	(m)	(m)
Fixed Weir	9.02	48.1	0.414	0.293	9.286
Expansion - Square Edged - 1:1< Tapered <1:4	8.87	48.1	0.416	0.414	9.288
UV Bank	8.87	24	0.434	0.416	9.306
UV Bank	8.87	24	0.451	0.434	9.323
free fall downstream of control weir =	0.100	m			
Q=	13,800	m^3/day			

Q=	9.583	m^3/min	$h = \left(\frac{Q}{\frac{2}{3} * C_d * L * \sqrt{2g}} \right)^{\frac{1}{1.5}}$
Q=	0.1597	m^3/sec	
C_d =	0.6		
L =	13.4	m	
g =	9.80665	m/sec^2	
Depth of flow over disk filter weir - h =	0.036	m	
=	1.417	inches	
Top of Weir =	9.250	m	
Weir Height =	0.2278	8.97	inches

8.1.3 ULTRAVIOLET DISINFECTION

Flow from the SBRs is passed through the UV system to meet the bacteriological effluent quality requirements of ≤ 200 fecal coliforms per 100 mL (monthly geometric mean) as required by the MSR Operating Permit.

A Technical Memorandum on the UV disinfection is included in Appendix D

The existing UV equipment is a Trojan UV3000™B low pressure, low intensity lamp technology. Low-pressure low-intensity (LPLI) lamps were selected to reduce the overall capital and O&M costs compared to low-pressure high-intensity lamps (LPHI). The lamps are oriented in a horizontal configuration parallel to the flow and require manual cleaning. The system consist of 2 banks, 8 modules per bank with each module consisting of 8 lamps for a total of 128 lamps. Following UV disinfection, the effluent is discharged via the 500 mm diameter PVC and HDPE outfall pipe to the Juan de Fuca Straight.

Trojan have proposed to replace the existing UV reactors with the current generation of the same model reactor, TrojanUV3000Plus™ (see Figure 12 on page 25). The system consist of 2 banks, 4 modules per bank with each module consisting of 6 lamps for a total of 48 lamps. The advantage of using new Trojan equipment is that it will fit in the existing UV channel whereas other competitor's equipment will not fit. However, if the District selects to include tertiary filtration as part of the expansion project, a new lower elevation channel will be required to improve the hydraulic profile for the filtration equipment. The quotation received for the replacement TrojanUV3000Plus™ UV reactors was $198,500.

Figure 13 - TrojanUV3000Plus™ Lamp Module – 8 Lamp per Module Configuration

The design parameters for the TrojanUV3000Plus™ UV reactors are shown in Table 21and Table 22

Table 23 - TrojanUV3000Plus™ UV Reactor Specification

UV PERFORMANCE SPECIFICATION	
Peak Design Flow:	13,800 m3/day
UV Transmittance:	60% (minimum)
Total Suspended Solids:	30 mg/l (30 Day Average, grab sample)
Disinfection Limit:	200 Fecal Coliform per 100 ml, based on a day 30 of consecutive daily grab samples
Design Dose:	30 mJ/cm^2 (bioassay validated)
Validation Factors:	0.98 end of lamp life factor (Low-Pressure Amalgam Lamps) 0.95 fouling factor

Table 24 - Channel and Design Parameters for TrojanUV3000Plus™ UV Reactor

CHANNEL	
Number of Channels:	1
Approximate Channel Length (existing)	7 m
Channel Width Based on Number of UV Modules:	610 mm (Existing channel is 610 mm)
Channel Depth Recommendation for UV Module to Flush with Top of Wall:	906 mm (Exising channel is 1050 mm)
UV MODULES	
Total Number of Banks:	2
Number of Modules per Bank:	4

Number of Lamps per Module:	6
Total Number of UV Lamps:	48
Maximum Power Draw:	12 kW
UV PANELS	
Power Distribution Center Quantity:	2
System Control Center Quantity:	1
MISCELLANEOUS EQUIPMENT	
Level Controller Quantity:	1
Type of Level Controller:	Existing weir to be modified to lower top of weir elevation by 0.35 m
Automatic Chemical / Mechanical Cleaning:	Included
UV Photometer Kit:	Included
Standard Spare Parts / Safety Equipment:	Included
ELECTRICAL REQUIREMENTS	
1. Each Power Distribution Center requires an electrical supply of one (1) 208V 60Hz, 3 Phase, 4 Wire + Ground, 6.2 kVA **2.** The Hydraulic System Center requires an electrical supply of one (1), 208V 60Hz, 2.5 kVA. **3.** The System Control Center requires an electrical supply of one (1) 120V 60Hz , 15 Amps. **4.** Electrical disconnects required per local code are not included in this proposal.	

Wedeco is also a leading UV technology provider for wastewater treatment plants. Table 23 and Table 24 show the design parameter for the Wedeco equipment. This equipment would require a new channel since the dimensions are different than the Trojan equipment. If the District elect to install tertiary filtration, this will not be an addition cost since a new channel will be required at a lower elevation for the additional headloss of the disk filters. The quotation receive from Wedeco for their equipment (see Figure 13) is $98,542.

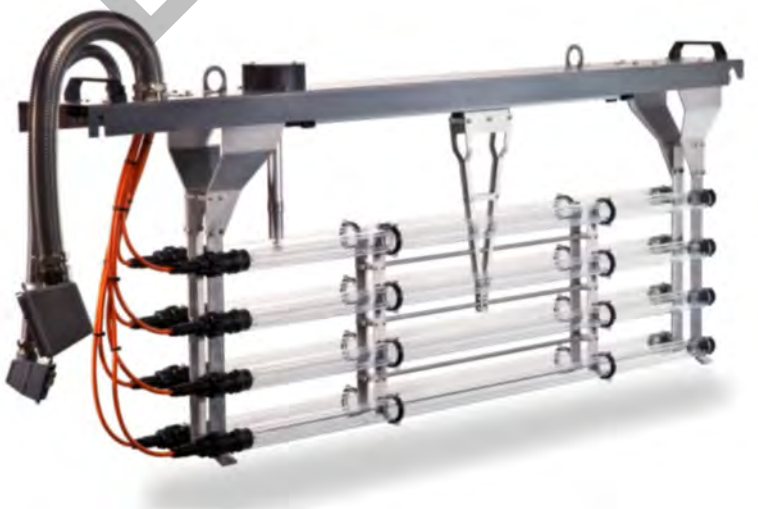


Figure 14 - Wedeco TAK SMART 4-3X1i1 Lamp Module

Table 25 – Wedeco TAK SMART 4-3X1i1 Design Parameters

Design Flows		
AADF	250	m³/h
PDWF	313	m³/h
PWWF	575	m³/h
Total Suspended Solids (Maximum)	20	mg/l
Allowable Effluent Temperature Range	5-30	°C
UV Transmittance at 253.7 nm	60 (minimum)	%
UV Dose		
Minimum Design UV Dose[1]	15	mJ/cm²
[1](based on IUVA/UVDGM (T1) bioassay)		

Table 26 – Wedeco TAK Smart 4-3x1i1 Configuration

Lamp Configuration		#
Total Number of lamps		24
Number of channels		1
Number of banks per channel		1
Number of modules per bank		3
Number of lamps per module		8
Channel Dimensions		
Width along UV banks	mm	715
Width along weir		As shown in drawing
Design water depth @ influent	mm	507
Overall channel height & length		As shown in drawing
Headloss (at design flow):		
Across baffle plate	mm	50
Across UV system	mm	3
Across level control	mm	15
Allowable freefall	mm	100
Total Headloss	mm	168
Power Consumption		
Total Connected System Power	kW	9.29

8.1.4 SLUDGE TREATMENT

Waste Activated Sludge (WAS) will be discharged to the aerobic digesters for stabilization. The purpose of the aerobic digester is to stabilize the WAS produced in the SBR system. The stabilization process is designed to reduce pathogens, reduce, or eliminate the potential for putrefaction and make the sludge less odourous for downstream processing and final disposal. The aerobic digester consists of two (2) cells to provide flexibility of operation and maintenance. The total digester volume is 1000 m^3 (10 m by 10 m), with a 5 metre maximum water level. The digester will reduce the VSS by 40% and meet the BC requirement for a Class B sludge. Aerobic conditions (minimum dissolved oxygen of 1 mg/L) are maintained through an aeration system consisting of fixed grid fine bubble diffusers. The air supply is provided by two dedicated

blowers. The contents of the aerobic digester are periodically allowed to settle after switching off the aeration system. It is expected that the sludge will be thickened to about 8,000 - 10,000 mg/L via gravity settling, which will leave a partially clarified supernatant on top of the sludge blanket. A portion of the supernatant will be decanted and returned back to the supernatant pump station and pumped back to the SBR splitter box. Provisions were incorporated in the design to accommodate mechanical dewatering of the SBR sludge prior to digestion for subsequent expansion phases.

Settled sludge from the digesters is periodically pumped by progressive cavity pumps to the centrifuge for dewatering. The centrifuge is housed in a building adjacent to the SBRs. The dewatered liquid known as centrate is returned to the SBR influent.

In 2020, the District installed a new Alfa Laval centrifuge with 30 m3/hour capacity and additional screw conveyors.

The dewatered sludge cake is transported via a conveyor (Spaans bulk handling system classifying conveyor) to an adjacent sludge metal storage bin, which will be either trucked to the landfill or to a future on-site composting facility. In 2020, the dewatered cake bin was moved outdoor onto a covered work pad.

The sludge storage bin has a storage capacity of 15m^3 (width 2m, length 4m, height m), it has a retractable cover for use when stored sludge is in the bin and during transport. The bin is wheel mounted for skidding on to a vehicle, the bin floor level will be a tailgate height.

The dewatered sludge is Class “B” which limits the disposal options, a further 30 days in compost or other sludge stabilization operation would raise the sludge to Class “A” for general disposal or reuse. The site has sufficient capacity to allow for the construction and placement of a composting system, should the District wish to do so in the future.

In lieu of constructing additional digestion capacity with the addition of SBR#3, Stantec recommends that the District install sludge thickening equipment as recommended in the 2005 Basis of Design Report.

Appendix A contains a Sludge Thickening Technical Memorandum that outline options and recommendations for sludge thickening prior to digestion. The conclusion of this Tech Memo was that a Rotary Drum thicken or Screw Press or suitable technology for thickening the WAS. It is further recommended that the WAS be pumped to an equalization tank to allow continuous dewatering the average daily rate and reduce the size of the equipment.

8.1.5 OUTFALL

To accommodate the potential installation of tertiary filtration equipment between the SBRs and the UV channels, it is necessary to review the hydraulics of the outfall pipe and confirm the most probable HGL at the outlet box of the UV channel under future flow conditions. Since the original design was completed in 2004, the issue of sea level rise due to climate change and storm surge are now considered when estimating the maximum HGL at the outlet of the UV change. From the calculations shown in Table 26 and Table 27, the predicted HGL at the 10,400 m^3/day flow rate is 7.514 m and for the 13,800 m^3/day flow rate, the HGL is calculated to be 9.186 m. The 2004 design had estimated the HGL to be 8.46 m @13,800 m^3/day flow rate. When the UV equipment is replaced, a new channel at a higher elevation will be required. The current UV channel is not at risk of flooding at flows up to 10,400 m^3/day.

Table 27 - Marine Outfall Hydraulic Losses @ 10,400 m^3/day flow

Outfall

Effluent Flow Rate		10,400	m^3/day		
		7.222	m^3/min		
	Q =	0.120	m^3/sec		
	C =	140			
500 mm Schedule 40 steel pipe	d =	0.478	m		
500 mm OD DR21 HDPE pipe	d =	0.457	m		
500 mm OD DR41 PVC pipe	d =	0.483	m		
	g =	9.80665	m/sec^2		
Outfall					**HGL**
			Headloss (m)		m
HHWL				1.7	1.700
Sea Level Rise @ 2050				0.35	2.050
Storm Surge 1:500 years				1.00	3.050
Depth of Diffuser		31.9	m		
Density of seawater		1,031	kg/m^3		
Density of water		1,000	kg/m^3		
Density Head		1.083	m		4.133
Diffusers			0.960	m	5.093
Friction losses $h_f = (10.67*Q^{1.85})/(C^{1.85}*d^{4.87})*L$					
500 mm OD DR21 HDPE pipe	1,750	m	1.803	m	6.896
500 mm OD DR41 PVC pipe	655	m	0.515	m	7.411
500 mm Schedule 40 steel pipe	7.1	m	0.006	m	7.417
Minor losses					
500 mm OD DR41 PVC pipe		K			
45º elbow (standard)	4	0.19	0.76		
Exit loss at high point MH	1	1.00	1		
Entrance loss at high point MH	1	0.50	0.5		
11.5º elbow (standard)	4	0.10	0.40		
		Total K	2.66		
Velocity =	0.657	m/sec			
$v^2/2g$ =	0.022	m			
Minor losses 500 mm OD DR41 PVC pipe =		$K * v^2/2g$ =	0.059	m	7.476
500 mm Schedule 40 steel pipe	#	K	K		
Entrance loss	1	0.5	0.5		
90º LR elbow	1	0.19	0.19		
45º elbow (standard)	2	0.19	0.38		
Coupling	2	0.04	0.08		
Mag meter	1	0.5	0.5		
		Total K	1.65		
Velocity =	0.671	m/sec			

$v^2/2g$ =	0.023	m			
Minor losses 500 mm Schedule 40 steel pipe =		K * $v^2/2g$ =	0.038	m	**7.514[1]**

[1] Estimated HGL at the UV channel outlet box for flow of 10,400 m^3/day (3 SBR trains maximum hydraulic capacity)

Table 28 - Marine Outfall Hydraulic Losses @ 13,800 m^3/day flow

Outfall					
Effluent Flow Rate		13,800	m^3/day		
		9.583	m^3/min		
	Q =	0.160	m^3/sec		
	C =	140			
500 mm Schedule 40 steel pipe	d =	0.478	m		
500 mm OD DR21 HDPE pipe	d =	0.457	m		
500 mm OD DR41 PVC pipe	d =	0.483	m		
	g =	9.80665	m/sec^2		
Outfall					**HGL**
			Headloss (m)		m
HHWL				1.7	1.700
Sea Level Rise @ 2050				0.35	2.050
Storm Surge 1:500 years				1.00	3.050
Depth of Diffuser	31.9		m		
Density of seawater	1,031		kg/m^3		
Density of water	1,000		kg/m^3		
Density Head	1.083		m		4.133
Diffusers			0.960	m	5.093
Friction losses $h_f = (10.67*Q^{1.85})/(C^{1.85}*d^{4.87})*L$					
500 mm OD DR21 HDPE pipe	1,750	m	3.043	m	8.136
500 mm OD DR41 PVC pipe	655	m	0.87	m	9.006
500 mm Schedule 40 steel pipe	7.1	m	0.01	m	9.016
Minor losses					
500 mm OD DR41 PVC pipe		K			
45º elbow (standard)	4	0.19	0.76		
Exit loss at high point MH	1	1.00	1		
Entrance loss at high point MH	1	0.50	0.5		
11.5º elbow (standard)	4	0.10	0.40		
		Total K	2.66		
Velocity =	0.872	m/sec			
$v^2/2g$ =	0.039	m			
Minor losses 500 mm OD DR41 PVC pipe =		K * $v^2/2g$ =	0.103	m	9.119
500 mm Schedule 40 steel pipe	#	K	K		
Entrance loss	1	0.5	0.5		

90º LR elbow	1	0.19	0.19		
45º elbow (standard)	2	0.19	0.38		
Coupling	2	0.04	0.08		
Mag meter	1	0.5	0.5		
		Total K	1.65		
Velocity =	0.890	m/sec			
$v^2/2g$ =	0.040	m			
Minor losses 500 mm Schedule 40 steel pipe =		K * $v^2/2g$ =	0.067	m	**9.186[1]**

[1] Estimated HGL at the UV channel outlet box for flow of 13,800 m^3/day (4 SBR trains maximum hydraulic capacity)

8.2 Operations

The Sooke Wastewater treatment plant is designed to be operated as an unattended plant. The headworks (screen and grit removal) and UV system operate continuously based on influent flow quantity and quality. The SBR system operates according to the pre-programmed schedule outlined above. Manual operation is required for the remaining process equipment.

9.0 STRUCTURAL DESIGN

The new structures for Sooke WWTP expansion must be designed to meet the many unique challenges that are associated with the processes involved as well as with the particular site. The following sections describe the proposed design criteria that will be used and summarize the proposed structural concepts for each major component of the facility.

9.1 Existing Structures

The original Sooke wastewater treatment plant structures were designed in 2004 to the 1998 British Columbia Building Code (BCBC). The existing tank structure consists of two digester tanks and two SBR tanks with construction consisting of a reinforced concrete foundation slab and reinforced concrete walls. The existing slab foundation is 400mm and 500mm in the digester tank and SBR tank respectively. The existing exterior tank walls vary from 400mm to 450mm thick. The existing tanks are open topped and there are concrete catwalks with guard rails for access to the tanks and the headworks building located on the north-west wall of the SBR tanks.

Due to the growing population in Sooke, a new digester and SBR tank are proposed to be constructed on the south wall of the existing structure. The existing concrete structure was designed to include provisions for future expansion. The existing record drawings include details showing keyway joints and threaded rebar couplers at the future south wall intersections as shown in Figure 1, as well as rebar couplers for the top row of reinforcing in the foundation slab. The record drawings also show that the south reinforced concrete wall was designed to resist loading from both sides, as opposed to the north wall which is only designed to resist loading from the inside face.

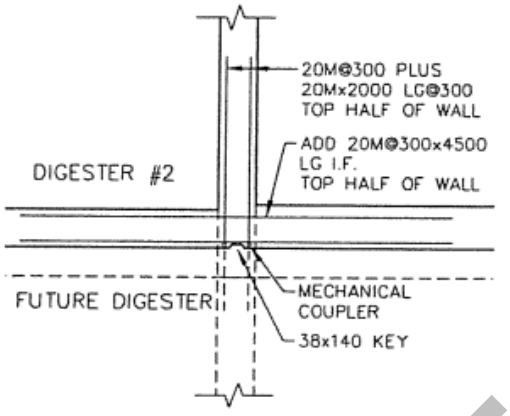


Figure 15 - - Expansion provisions including construction joint keyway and rebar couplers (Lockerbie Stanley Inc. Structural Drawings, 2004)

9.2 Applicable Codes and Standards

Applicable systems for the proposed expansion of the wastewater treatment plant will be designed in accordance with the following codes and standards adopted by the Authorities Having Jurisdiction (Sooke) at the time of the detailed design, anticipated to be the following:

- British Columbia Building Code (BCBC) 2018.
- CSA A23.3: Design of Concrete Structures.
- CSA S900.2.21: Structural Design of Wastewater Treatment Plants
- ACI 350: Code Requirements for Environmental Engineering Concrete Structures (used as a reference, superseded by CSA S900.2:21)
- ACI 350.3: Seismic Design of Liquid-Containing Concrete Structures and Commentary (used as a reference, superseded by CSA S900.2:21)

9.3 Design Criteria

In accordance with the BCBC 2018, the design criteria to be used for the expansion are as follows:

Importance Factors:

- As per the BCBC 2018 a wastewater treatment facility is considered a “post-disaster” building and therefore as shown in Table 27 - Importance Factors for Structural Design, the following importance factors apply to the structural design.

Table 29 - Importance Factors for Structural Design

	Ultimate Limit States (ULS)	Serviceability Limit States (SLS)
I_s (snow load)	1.25	0.90
I_w (wind load)	1.25	0.75
I_e (seismic load)	1.50	N/A

Snow loading:

- Ss = 1.3 kPa, Sr = 0.3 kPa (1/50 years) plus snow drifts
- One day rain = 130 mm

Reference wind pressure:

- 1/10 years for cladding = 0.37 kPa
- 1/50 years for structure = 0.48 kPa

Live load:

- Concrete Walls = Hydrostatic Pressure
- Concrete catwalks = 4.8 kPa

Seismic criteria:

- PGA = 0.605
- Sa(0.2) = 1.34, Sa(0.5) = 1.24, Sa(1.0) = 0.752, Sa(2.0) = 0.456
- Site Class C (Now Confirmed by Stantec Geotechnical)

9.4 Design Discussion

The existing reinforced concrete tank was designed in 2004 to the 1998 British Columbia Building Code (BCBC). The record drawings include design criteria stating that the structure was designed to be post-disaster using a seismic importance factor, IE = 1.5. However, the record drawings do not indicate the design methodology used to determine seismic loads on the structure.

9.4.1 ACI 350.3-06 SEISMIC DESIGN OF LIQUID-CONTAINING CONCRETE STRUCTURES

Until recently, the ACI 350.3-06 Seismic Design of Liquid-Containing Concrete Structures has been generally accepted as the industry standard code to determine lateral forces imposed on concrete liquid-containing structures during an earthquake. For the basis of design submission, Stantec Structural analyzed the existing structure using this code, to determine the feasibility of expanding the facility by constructing additional reinforced concrete tanks on the south wall. The existing tank walls were analyzed for hydrostatic forces imposed by the contained liquid, as well as hydrodynamic forces imposed on the structure due to the motion of the contained liquid during a seismic event. It was found that the existing reinforced concrete walls have a maximum demand-over-capacity ratio of approximately 105% under hydrostatic and hydrodynamic loading. During the analysis, it was found that the worst-case loading condition occurs for exterior tank walls or interior walls where only one side of the wall is under load. This condition would occur if one tank is full of liquid while the adjacent tank is empty. Therefore, it was found that constructing an additional tank on the south wall of the existing is feasible because the demand on the existing wall will be decreased.

The ACI 350.3 also includes guidelines for concrete tanks containing hazardous materials, stating that provisions should be made to accommodate the maximum wave height due to the contained liquid sloshing during a seismic event. The existing structure has 500mm of freeboard from the high-water line to the top of the concrete tank walls. During the assessment of the existing structure, it was found that the height of the wave due to sloshing would overtop the tank walls. The ACI 350.3 does not include requirements for existing structures to be retrofitted to comply with guidelines to accommodate sloshing. However, the design of the new tank structure should include higher tank walls to accommodate the sloshing of the liquid and avoid overtopping. To increase the height of the new tank, the existing south wall of the tank will need to be retrofitted by increasing the height of the wall by 700mm to match the height of the new walls. As a

result, during a seismic event the liquid in the new tank will be contained and will not overtop into the existing tanks or into the surrounding environment.

Soil conditions used for the preliminary design of the proposed expansion were assumed using the limited information indicated on the record drawings. The record drawings indicate a seismic foundation factor, f= 1.0, which corresponds to rock, dense and very dense coarse-grained soils, or very stiff and hard fine-grained soils. The drawings also indicate foundations for liquid containing structures are designed for an allowable bearing capacity of 200 kPa. Considering these parameters, Stantec assumed a seismic site class of "C" corresponding to very dense soil or soft rock. Stantec Geotechnical completed a site investigation in late 2021 – early 2022 and has confirmed these assumptions.

9.4.2 NEXT STEPS - CSA S900.2.21: STRUCTURAL DESIGN OF WASTEWATER TREATMENT PLANTS

In 2021 CSA released the Standard S900.2.21: Structural Design of Wastewater Treatment Plants. Stantec was part of the code committee that developed this standard. The standard is Canadian specific and is generally less conservative than the ACI 350.3 standard. As the next step in the structural design, Stantec will check the conceptual design using this standard and look for any locations where the structure can be reduced to reduce the overall cost of the project.

10.0 ELECTRICAL AND INSTRUMENTATION SYSTEMS

10.1 General

This section addresses modifications, additions and upgrades to the Electrical Distribution Systems, Motor Control (MCC), SCADA, Networks, Instrumentation and Control systems for the upgraded processes within the WWTP.

10.2 Electrical System Modifications

10.2.1 MAIN SERVICE

The WWTP is connected to the BC Hydro utility with a 3 phase 3 wire 600 VAC service, supplied from an adjacent BC Hydro substation. The incoming electrical service is sized at 600A and is understood to have sufficient capacity to provide for the additional power requirements of the upgraded plant. The existing Motor Control Center (MCC) is considered to be full and would not have sufficient space to provide room for additional motor starters or Variable Frequency Drives (VFD's). With this in mind additional MCC sections will need to be added and drawings indicate that there is sufficient space to the south of the existing MCC to install the required additional sections.

10.2.2 POWER DISTRIBUTION

120/208 volt electrical power is distributed throughout the facility from a 42 circuit board that is integral to the MCC. It is anticipated that the installation of additional treatment systems and general plant spaces will result in a requirement for 120/208 volt electrical power greater that what can be fed from this single panel. As a result, a new 45 kVA, 600V:120/208 volt dry type transformer will feed a new power distribution panel

board located in the electrical room to provide for new lighting, receptacles, small motors, miscellaneous 120 volt loads, etc.

Additional conduit and cable tray systems will be provided as required to allow for the installation of new systems wiring.

10.3 Lighting

10.3.1 GENERAL

It is not anticipated that there will be any new indoor lighting requirements for the existing buildings, and as a result building lighting systems will remain unchanged. The new outdoor treatment spaces will be illuminated to ensure that safe access and egress to equipment and treatment areas is automatically available when required. All new exterior lighting will be controlled by the existing photo electric cells. In locations that are classified as hazardous locations, lighting will consist of suitably rated luminaires.

10.3.2 EMERGENCY LIGHTING

Emergency lighting systems will be augmented to ensure that all points of egress throughout the plant are appropriately illuminated in event of a power outages that effects the regular facility lighting circuits.

10.3.3 HEATING

It is not anticipated that there will be any new building heating requirements and as a result plant heating systems will remain unchanged. In event that new piping heat trace requirements are identified, these new loads will be feed from the expanded 120/208V power distribution system.

10.4 Emergency Power

Initial review of the sizing of the existing 300kW standby generator indicates that this unit will be undersized to feed all of the existing plant loads and the new loads that will be added to the facility as part of this upgrade project. At this point two alternatives are being considered in order to address the issue of generator sizing for the upgraded plant.

Alternative A) would see the existing generator replaced with a new 500kW standby generator. The new unit would be a self-contained diesel generator enclosed in a weatherproof sound attenuated enclosure installed outdoors adjacent to the existing electrical / generator room. The unit would be provided complete with all support systems such as battery charging, block heaters, and a subbase fuel tank sized to provide 48hours worth of fuel reserve. The new generator would be connected to the existing automatic transfer switch as this transfer switch is sufficiently sized to accommodate the new larger standby generator.

Alternative B) would see the existing generator remain in place and revisions would be made to the plant control system and the MCC to implement a load management strategy. The generator load management system will ensure that the existing generator is not powering non-essential loads during a utility power outage. The load management system will monitor both the available capacity of the existing generator and the required plant electrical demand. If the plant demand approaches or exceeds the available capacity, nonessential loads will be shed in a pre-determined order of priority.

As the project design advances Stantec will develop and completely detail the preferred alternative to be included in the finalized design documentation.

10.5 Miscellaneous Electrical

Power will be provided to single point connections for each of the vendor treatment equipment packages. 600V 3phase feeds will originate in the new MCC sections and 120 or 208 volt feeds will originate at the new distribution panel.

Each new vendor treatment package connections will be provided with a dedicated lock off means at the vendor control panel connection point.

The installation of all new vendor packaged treatment equipment will comply with the requirements for installations in hazardous locations as determined by the NFPA 820 (2020) and the Canadian Electrical Code. Where the above codes dictate these treatment areas are hazardous locations all aspects of the electrical and control systems are to be installed using appropriate materials and methods for these locations.

10.6 Uninterruptible Power Supplies

The existing Uninterruptible Power Supplies (UPS) will be evaluated to confirm that they of sufficient size and in acceptable service condition to feed the new Instrumentation and Control loads. New UPS units will be provided as part of the scope of supply for all new control systems provided as part of vendor packaged treatment equipment.

10.7 Instrumentation And Control

10.7.1 SCADA SYSTEM

10.7.2 SBR MONITORING AND CONTROL SYSTEM

The SBR system control components are monitored and controlled from a dedicated programmable logic controller (PLC) housed in the SBR system control panel. The existing SBR PLC is an Allen Bradley model SLC 5/05. This PLC is no longer supported by the manufacturer and is to be replaced as part of this project.

The existing SBR control panel utilizes the Allen Bradley model SLC 5/05 to provide control of the two SBR trains currently installed. The design approach of the upgrade and replacement of the existing SBR PLC will have the SBR system provider manufacture a new control panel sized to control four SBR trains (2 existing, 1 new, and 1 future train). The design intent is to have the new SBR PLC be and an Allen Bradley Control Logix. This PLC is both current technology, and matches the currently installed balance of plant PLC. The new SBR panel will be provided with its own dedicated HMI operator interface panel. The new panel will be installed, wired, and commissioned to operate the new third treatment train and then one at a time the existing treatment trains will be migrated over to the new control panel. Once the migration for each train is complete, the migrated train will be re-commissioned to ensure that it is functioning properly.

Upon the completion of the migration and commissioning of all three treatment trains the existing PLC and panel can be removed from service.

10.7.3 PLC AND HMI PROGRAMMING

Individual PLC's supplied with treatment equipment packages will be configured with the vendors PLC programs which will be tailored to suit this particular installation as required. Vendors will be responsible for providing programming support services during commissioning and start-up and will also be required to

turn over copies of the installed PLC logic programs as part of their operations and maintenance close out documentation. Equipment vendors will also make available all required communications protocols and data tables required for programming of the plant wide SCADA system. This will allow operations staff to visualize the and interact with the control of each package from the centralized SCADA location

Upgrades and expansion of the existing balance of plant PLC will be undertaken to ensure that new measurement and control parameters not included in equipment vendor packages are brought into the central control system. The programming of this PLC will also be updated to address the additional connected variables and accommodate the new network connections to vendor supplied PLC's. Once the balance of plant PLC changes have been made, the plant wide SCADA programming will also be updated to include the new connected points and vendor systems.

11.0 OPINION OF PROBABLE COSTS

The OPC for the Base Case (SBR3 + Digester 3) that was developed in 2020 for the grant application was $4,198,370 which included a 40% Contingency. The 2022 OPC estimates are based on most current commodity pricing and detailed quotes from major equipment vendors. More detailed quantity takeoffs were calculated for these 2022 OPC estimates, and the confidence level of these estimates is Class B. A 10% continency is included in the 2022 estimates.

Based on these estimates, Stantec recommends that the District proceed to tender with Option 2 which includes SBR #3, a sludge thickener, replacement UV equipment in a new UV channel, and a tertiary disk filter. Items not included are Digester #3 which is not needed if a thickener is installed, a new standby generator which the electrical EOR has confirmed is not required for the new additional electrical loads, the replacement mechanical fine screen in the headworks that the operators have requested. There is ~$368K of Contingency in this estimate. Currently, there is a lot turbulence in the construction tender prices, and it is impossible to predict the market in 3 months when the District would like to close the General Construction tender.

Since the 50% Design submission, Stantec has completed 2 prepurchase tenders for major equipment. Table 30 and Table 31 summarize the results of these 2 tenders.

A detailed OPC estimate for the recommended Option 2 is included in Appendix A of this submittal.

Table 30 - Tender Prices for Sludge Thickener and ancillary equipment

				JWC Environmental	
Item	**Description**	**Qty**	**Unit**	**Unit Price ($)**	**Total Price ($)**
1	Supply and delivery of Rotary Drum Thickener summarized in Section 44 43 26 and drawings as part of this Tender package.	1	LS	$78,390.00	$78,390.00
2	Supply and delivery of Rotary Drum Thickener Feed Pump summarized in Section 43 25 13 and drawings as part of this Tender package.	1	LS	$24,490.00	$24,490.00
3	Supply and delivery of Polymer System package summarized in Section 44 44 36 and drawings as part of this Tender package.	1	LS	$23,490.00	$23,490.00
4	Supply and delivery of Control Panel package summarized in Section 44 43 26 and drawings as part of this Tender package.	1	LS	$113,480.00	$113,480.00
			Subtotal	$239,850.00	
			GST (5%)	$11,992.50	
			Total	$251,842.50	

Table 31 - Tender Prices for SBR and ancillary equipment

Item	Description	Qty	Unit	Unit Price ($)	Total Price ($)
1	decanter mechanism	1	LS	$56,618.00	$56,618.00
2	waste sludge pump complete with rails	1	LS	$6,438.00	$6,438.00
3	air diffusion equipment	1	LS	$33,785.00	$33,785.00
4	aeration blower	1	LS	$64,859.25	$64,859.25
5	4-train system control panel and Ethernet based software connection to the plant wide SCADA system	1	LS	$183,539.00	$183,539.00
6	instruments	1	LS	$33,040.00	$33,040.00
7	air control valve with actuator	1	LS	$7,387.00	$7,387.00
8	Shipping	1	LS	$61,325.00	$61,325.00
9	Startup and Commissioning	1	LS	$35,497.00	$35,497.00
				Subtotal	$482,488.25
				GST	$24,124.41
				Total	$506,612.66

APPENDICIES

APPENDIX A OPINION OF PROBABLE COST

District of Sooke

Opinion of Probable Costs for Sooke WWTP Expansion

Sooke WWTP - Plant Expansion 2022 — Prepared by: Stan Spencer, P. Eng.

Option 2 — 6/6/2022

Item No.	Description	Unit	Quantity	Material or Equipment Costs		Installation & Overhead		Total Costs
				Unit Price	Total Price	% Markup	Installation	
1.0	General Requirements - Division 1							
1.1	Mobilization/Demobilization	%	1		2%			$68,400
1.2	Bonding	%	1		1.5%			$51,300
1.3	Insurance	%	1		1.5%			$51,300
1.4	Startup and Commissioning	%	1		3%			$102,600
1.5	General Conditions - other	%	1		7%			$239,300
						Subtotal General Requirements - Division 1		$512,900
2.0	Site Work - Division 2							
2.1	Roadway Realignment							
2.1.1	Excavation	m^3	103.5	$30	$3,105		Included	$3,105
2.1.2	Road Base (150 mm - 19mm crush)	m^3	68	$65	$4,397		Included	$4,397
2.1.3	Road Base (150 mm - reuse existing roadway 19mm crush)	m^3	36	$30	$1,076		Included	$1,076
							Subtotal Roadway Realignment	$8,578
2.2	SBR Tank #3							
2.2.1	Excavation	m^3	1,300	$30	$39,000		Included	$39,000
2.2.2	Backfill (including slab prep)	m^3	270	$65	$17,550		Included	$17,550
							Subtotal SBR Tank #3	$56,550
2.3	Equalization Tank / Disk Filter Tank / Effluent Pump Station / WAS Equalization Tank							
2.3.1	Excavation	m^3	400	$30	$12,000		Included	$12,000
2.3.2	Backfill (including slab prep)	m^3	93	$65	$6,045		Included	$6,045
						Subtotal Equalization Tank / Disk Filter Tank / Effluent Pump Station / WAS Equalization Tank		$18,045
2.4	Yard Piping							
2.4.1	100 mm DR35 sewer pipe from thickener and disk filters to MH1	m	56.7	$150	$8,505		Included	$8,505
2.4.2	Fittings	LS	1	$0	$0	50%	$0	$0
							Subtotal Yard Piping	$8,505
2.5	UV Channel						Provisional item included	**No**
2.5.1	Excavation							
2.5.2	Backfill (including slab prep)							
3.0	Concrete - Division 3							
3.1	SBR Tank #3							
3.1.1	Foundation Slabs (500mm thick)	m^3	160	$1,200	$191,862		Included	$191,862
3.1.2	Reinforced Concrete Walls (450mm thick W1/W2)	m^3	144	$1,750	$252,000		Included	$252,000
3.1.3	Reinforced Concrete Baffle Walls (300mm thick)	m^3	19	$1,750	$32,550		Included	$32,550
3.1.4	Existing Wall Extension	m^3	9	$2,000	$18,900		Included	$18,900
3.1.5	Reinforced Concrete Walkway (250mm thick)	m^3	17	$2,000	$33,000		Included	$33,000
3.1.6	Expose Existing Couplers and Prepare for new Dowels	m	52	$120	$6,240		Included	$6,240
3.1.7	Dowels for New Foundation Slab	m	40	$200	$8,000		Included	$8,000
3.1.8	Supply and Install New Couplers for Future Tanks	m	52	$100	$5,200		Included	$5,200
3.1.9	Core holes through 450 mm concrete wall in SBR and 250 mm splitter box for new 400 mm transfer pipe	each	2	$1,500	$3,000		Included	$3,000
3.1.10	Supply and Install pipe supports for 400 mm influent transfer pipe from exiting splitter box to new splitter box	each	7	$500	$3,500		Included	$3,500
							Subtotal SBR Tank #3	$554,252
3.2	Thickener Deck							**Yes**
3.2.1	Reinforced Concrete Suspended Slab (300 mm thick)	m^3	6.25	$2,000	$12,504		Included	$12,504
					Subtotal Thickener Deck	Engineering	10%	$1,250.40	$12,504
	WAS Equalization Tank							**Yes**
3.2	Foundation Slabs (400mm thick)	m^3	1.11	$1,200	$1,332		Included	$1,332
	Reinforced Concrete Walls (350mm thick)	m^3	2.73	$1,750	$4,778		Included	$4,778
3.2	Reinforced Concrete Walls (300mm thick)	m^3	4.21	$1,750	$7,371		Included	$7,371
					Subtotal WAS Equalization Tank	Engineering	10%	$1,348.05	$13,481
	Equalization Tank							**Yes**
3.17	Foundation Slabs (400mm thick)	m^3	20.36	$1,200	$24,436		Included	$24,436
3.18	Reinforced Concrete Walls (300mm thick)	m^3	9.79	$1,750	$17,133		Included	$17,133
4.18	Reinforced Concrete Walls (250mm thick)	m^3	0.00	$1,750	$0		Included	$0
3.18	Reinforced Concrete Walls (350mm thick)	m^3	11.26	$1,750	$19,707		Included	$19,707
					Subtotal Equalization Tank	Engineering	10%	$6,127.53	$61,275
	Chemical Storage Room							**Yes**
3.17	Foundation Slabs (400mm thick)	m^3	11.02	$1,200	$13,218		Included	$13,218
	Reinforced Concrete Walls (350 mm thick)	m^3	5.55	$1,750	$9,714		Included	$9,714
3.18	Reinforced Concrete Walls (300 mm thick)	m^3	15.37	$1,750	$26,891		Included	$26,891
3.18	Reinforced Concrete Roof deck (300 mm thick)	m^3	6.25	$2,000	$12,504		Included	$12,504
					Subtotal Chemical Storage Room	Engineering	10%	$6,232.68	$62,327
	Disk Filter							**Yes**
3.17	Foundation Slabs (400 mm thick)	m^3	13.78	$1,200	$16,531		Included	$16,531
3.18	Reinforced Concrete Walls (300 mm thick)	m^3	14.8	$1,750	$25,905		Included	$25,905
3.18	Reinforced Concrete Walls (250 mm thick)	m^3	3.1	$1,750	$5,469		Included	$5,469
3.18	Reinforced Concrete Walls (200 mm thick)	m^3	1.3	$1,750	$2,188		Included	$2,188
					Subtotal Disk Filter	Engineering	10%	$5,009.28	$50,093

District of Sooke

Opinion of Probable Costs for Sooke WWTP Expansion

Sooke WWTP - Plant Expansion 2022 — Prepared by: Stan Spencer, P. Eng.

Option 2 — 6/6/2022

Item No.	Description	Unit	Quantity	Material or Equipment Costs		Installation & Overhead		Total Costs
				Unit Price	Total Price	% Markup	Installation	
3.0	Concrete - Division 3 (Provisional)							
	Digester #3					Provisional item included		No
3.11	Foundation Slabs (500mm thick)							
3.12	Reinforced Concrete Walls (400mm thick)							
	UV Channel					Provisional item included		No
3.15	Foundation Slabs (300mm thick)							
3.16	Reinforced Concrete Walls (300mm thick)							
						Subtotal Concrete - Division 3		$753,931
4.0	Metals - Division 5							
4.1	New Galvanized Steel Stair	LS	1	$10,000	$10,000		Included	$10,000
4.2	New Galvanized Steel Guardrails	m	62	$420	$26,040		Included	$26,040
4.2	New Galvanized Steel Guardrails - Thickener Platform on Effluent Equalization Tank	m	10	$420	$4,200		Included	$4,200
4.3	Galvanized Steel Grating	m^2	7.4	$315	$2,344		Included	$2,344
						Subtotal Metals - Division 5		$42,584
5.0	Process Mechanical - Division 11							
5.1	SBR Decanters and Control							
5.1.1	Decanter Mechanism	each	1	$56,618	$56,618	35%	$19,816	$76,434
5.1.2	ICEAS Fine Bubble Aeration System	each	1	$33,785	$33,785	35%	$11,825	$45,610
5.1.3	Air Control Valve	each	1	$7,387	$7,387	35%	$2,585	$9,972
5.1.4	Waste Sludge Pump	each	1	$6,438	$6,438	35%	$2,253	$8,691
5.1.5	ICEAS Blower	each	1	$50,716	$50,716	35%	$17,751	$68,467
5.1.6	ICEAS Controls - 4 train control panel	each	1	$183,539	$183,539	35%	$64,239	$247,778
5.1.7	400 mm Ø ID Schedule 10 SS pipe to connect existing splitter box to new splitter box	m	20	$395.34	$7,907	50%	$3,953	$11,860
5.1.8	400 mm Ø ID Schedule 10 SS 90° LR elbow	each	2	$1,500	$3,000	50%	$1,500	$4,500
5.1.9	Downward opening weir gate for 1000 X 800 mm opening in new inlet splitter box	each	2	$15,500	$31,000	35%	$10,850	$41,850
5.1.10	200 mm Schedule 10 SS air header piping	m	20	$200	$4,000	50%	$2,000	$6,000
5.1.11	150 mm Schedule 10 SS air drop piping	m	10	$150	$1,500	50%	$750	$2,250
5.1.11	200 X200 X 150 mm tee Schedule 10 SS air header piping	each	2	$500	$1,000	50%	$500	$1,500
5.1.12	150 mm actuated butterfly valve	each	1	$8,000	$8,000	50%	$4,000	$12,000
5.1.13	Pipe supports for 200 mm SS air header piping	each	4	$1,000	$4,000	50%	$2,000	$6,000
5.1.14	100 X 100 X100 mm tee - Schedule 40 PVC	each	3	$200	$600	50%	$300	$900
5.1.15	100 mm 90° SR elbow Schedule 40 PVC	each	2	$50	$100	50%	$50	$150
5.1.16	100 mm Schedule 40 PVC pipe	m	20	$38	$760	50%	$380	$1,140
5.1.17	100 mm PVC ball valves	m	6	$150	$900	50%	$450	$1,350
5.1.18	Shipping	LS	1	$65,618	$65,618	0%	Included	$65,618
5.1.19	Startup and Commissioning	LS	1	$35,497	$35,497	0%	Included	$35,497
						Subtotal SBR Decanters and Control		$647,567
5.3	Drum Thickener					Provisional item included		Yes
5.3.1	JWCE - IPEC Monster Drum Thickener Model IFT 3648 Internally Fed,	each	1	$78,390	$78,390	35%	$27,437	$105,827
5.3.2	TWAS Tank							
5.3.3	JWCE - IPEC PLC Control panel	each	1	$113,480	$113,480	25%	$28,370	$141,850
5.3.4	Supply and install WAS Equalization Tank pump	each	1	$24,490	$24,490	35%	$8,572	$33,062
5.3.5	WAS Equalization Tank pump PLC Control panel	each	1	$113,480	$113,480	50%	$56,740	$170,220
5.3.6	Install existing Sydex progressive cavity thickened sludge pump	each	2	$0	$0		$5,000	$5,000
5.3.7	100 mm 90° SR elbow Schedule 40 PVC	each	6	$50	$300	50%	$150	$450
5.3.8	100 mm Schedule 40 PVC pipe	m	20	$38	$760	50%	$380	$1,140
5.3.11	100 mm PVC ball valves	m	8	$150	$1,200	50%	$600	$1,800
					Subtotal Drum Thickener	Engineering	5%	$22,967.40	$459,348
5.3	Effluent Pump Station					Provisional item included		Yes
5.3.1	Flygt NT3153 pump	each	2	$35,199	$70,398	50%	$35,199	$105,597
5.3.2	PLC Control panel	each	1	$10,500	$10,500	50%	$5,250	$15,750
5.3.3	250 mm swing check valves	each	2	$4,573	$9,146	50%	$4,573	$13,719
5.3.4	250 mm knife gate valves	each	4	$1,880	$7,520	50%	$3,760	$11,280
5.3.5	300 mm knife gate valves	each	2	$2,909	$5,818	50%	$2,909	$8,727
5.3.6	400 X 300 X 300 flanged tee Schedule 40 PVC	each	2	$700	$1,400	50%	$700	$2,100
5.3.7	400 X 400 X 250 flanged tee Schedule 40 PVC	each	1	$700	$700	50%	$350	$1,050
5.3.8	400 X 250 flanged reducer Schedule 40 PVC	each	1	$700	$700	50%	$350	$1,050
5.3.9	400 X 600 flanged reducer Schedule 40 PVC	each	2	$700	$1,400	50%	$700	$2,100
5.3.10	250 mm 90° SR elbow Schedule 40 PVC	each	6	$350	$2,100	50%	$1,050	$3,150
5.3.11	400 mm 90° SR elbow Series 160 PVC	each	2	$400	$800	50%	$400	$1,200
5.3.12	250 mm Schedule 40 PVC flange	each	8	$100	$800	50%	$400	$1,200
5.3.13	300 mm Schedule 40 PVC flange	each	4	$150	$600	50%	$300	$900
5.3.14	400 mm Schedule 40 PVC flange	each	1	$200	$200	50%	$100	$300
5.3.15	250 mm Schedule 40 PVC pipe	m	40	$150	$6,000	50%	$3,000	$9,000
5.3.16	300 mm Schedule 40 PVC pipe	m	10	$300	$3,000	50%	$1,500	$4,500
5.3.17	400 mm Schedule 40 PVC pipe	m	5	$350	$1,750	50%	$875	$2,625
5.3.18	250 mm Robar coupler	each	4	$500	$2,000	50%	$1,000	$3,000
5.3.19	300 mm Robar coupler	each	2	$700	$1,400	50%	$700	$2,100
					Subtotal Effluent Pump Station	Engineering	5%	$9,467.40	$189,348

District of Sooke

Opinion of Probable Costs for Sooke WWTP Expansion

Sooke WWTP - Plant Expansion 2022 — Prepared by: Stan Spencer, P. Eng.

Option 2 — 6/6/2022

Item No.	Description	Unit	Quantity	Material or Equipment Costs		Installation & Overhead		Total Costs
				Unit Price	Total Price	% Markup	Installation	
5.1	Digester #3					Provisional item included		**No**
5.1.1	Fine Bubble Aeration System							
5.1.2	15 kW blowers							
5.1.3	Estimated freight to jobsite							
5.6	UV					Provisional item included		**No**
5.6.1	Wedeco TAK Smart 4-3x2i1							
5.6.2	Estimated Prepaid Freight & Handling to Sooke, BC							
5.6.1	500 mm Schedule 10 steel pipe from Disk Filter Box to UV Channel							
5.6.2	500 mm LR 90° elbow							
5.6.2	500 mm coupler							
5.4	Disk Filter					Provisional item included		**Yes**
5.4.1	infini-D™ cloth disk filter units, model 6/30	each	1					
5.4.2	Backwash pumps	each	2					
5.4.3	Cloth Media elements	each	6	$390,000	$390,000	25%	$97,500	$487,500
5.4.4	Control panels with Allen Bradley PLC, HMI, VFDs and starters	each	1					
5.4.5	SS weir plates - 2.5 m X 150 mm X 0.009 mm	each	4	$525	$2,100	35%	$735	$2,835
5.4.5	SS weir plates - 2.5 m X 300 mm X 0.009 mm	each	2	$1,050	$2,100	35%	$735	$2,835
				Subtotal Disk Filter	Engineering	3%	$14,795.10	$493,170
5.5	Mechanical Bar Screen and Washer Compactor					Provisional item included		**No**
5.5.1	WTP Equipment Corp. SL100 Bar Screen (6 mm)							
5.5.2	WTP Equipment Corp. CPW20 Screenings Washing Dewatering Press (Compactor)							
5.5.3	Estimated freight to jobsite (each shipment of 1 bar screen & 1 press).							
						Subtotal Process Mechanical - Division 11		$1,789,433
6.0	Electrical - Division 16					Include generator in estimate		**No**
6.1	Generator (500kW skin tight diesel 8hr), demo of existing							
6.2	MCC expansion, all EIC cable, associated equipment, overhead, travel	LS	1	$50,000	$50,000	50%	$25,000	$75,000
						Subtotal Electrical - Division 16		$75,000
7.0	Instrumentaion and Controls - Division 17							
7.1	Control System Upgrade (new PLC, new Programming, Commissioning of new Control System)	LS	1	$75,000	$75,000	50%	$37,500	$112,500
7.2	Instrumentation	LS	1	$27,000	$27,000	50%	$13,500	$40,500
						Subtotal Instrumentaion and Controls - Division 17		$153,000
						Total Construction Costs		$3,418,526
Direct Costs:								
	Construction Costs							$3,418,526
	Construction Contingency (% of Construction Costs)			5%				$170,900
						Total Direct Costs		$3,589,426
Indirect Costs:								
	Project Management (% of Direct Costs)			0.7%				$24,333.75
	Preliminary/Detailed Design (% of Direct Costs)			4.0%				$143,982.96
	CO #1 - Geotech (% of Direct Costs)			0.2%				$5,425.86
	CO #2 (% of Direct Costs)			0.0%				
	Engineering for Additional Items							
	Structural							
	Credit for Digester #3 (% of Direct Costs)")			-0.37%				-$13,405.68
	Thickener Deck (% of Direct Costs)			0.03%				$1,250.40
	WAS Equalization Tank (% of Direct Costs)			0.04%				$1,348.05
	Equalization Tank (% of Direct Costs)			0.17%				$6,127.53
	Disk Filter (% of Direct Costs)			0.14%				$5,009.28
	UV Channel (% of Direct Costs)			0.00%				$0.00
	Process							
	Credit for Digester #3 (% of Direct Costs)")			-0.16%				-$5,662.50
	Drum Thickener (% of Direct Costs)			0.64%				$22,967.40
	Disk Filter (% of Direct Costs)			0.41%				$14,795.10
	UV (% of Direct Costs)			0.00%				$0.00
	Mechanical Bar Screen and Washer Compactor (% of Direct Costs)			0.00%				$0.00
	Engineering (% of Direct Costs)			5.74%				$206,172.15
	Construction Services (% of Direct Costs)			4.4%				$159,405.91
						Total Indirect Costs		$365,578.06
						Subtotal (Direct + Indirect Costs)		$3,955,004
	Project Contingency (% of Subtotal)			5%				$197,750
	Total Project Costs							$4,152,754

Notes:

1 Costs are in 2022 Canadian Dollars.

2 Construction costs will vary depending on market conditions at the time of tender. The Engineer has no control over those conditions.

APPENDIX B SLUDGE THICKENING TECHNICAL MEMO

Stantec

Memo

To:	District of Sooke 2205 Otter Point Rd, Sooke, BC V9Z 1J2	From:	Bartek Puchajda Surrey
Project/File:	111720131	Date:	February 8, 2022

Reference: Wastewater Treatment Plant Expansion - Sludge Thickening Options

1 INTRODUCTION

This Technical Memorandum summarizes sludge thickening options for the Sooke WWTP expansion project. The Sooke WWTP is currently at its hydraulic capacity and the expanded plant will require additional sludge treatment capacity. Sludge thickening is an option to concentrate the volume of sludge generated in SBRs (including the future SBRs) in order to increase the retention time in the aerobic digesters. Sludge thickening is a viable alternative to constructing additional aerobic digestion capacity. Sludge thickening will also result in a higher concentration feedstock for the dewatering centrifuge and a dryer sludge cake for ultimate disposal. Dryer sludge cake = a lower volume of sludge for disposal resulting in lower transportation and disposal costs for the District.

This document will discuss the following areas:

- Sludge mass and volume estimates for sludge thickener sizing
- Sludge thickening technologies
- Recommendations for sludge thickener for the Sooke WWTP expansion project

2 2005 SBR DESIGN CRITERIA

2.1 HYDRAULIC LOADING CRITERIA

Table 1 - Hydraulic loading from 2005 Basis of Design

Flow Condition	Peaking Factors (PF)	1 Train	2 Trains	3 Trains	4 Trains
		m^3/day			
Average Dry Weather Flow (ADWF)	1.0	1,500	3,000	4,500	6,000
Peak Dry Weather Flow (PDWF)	1.25	1,900	3,800	5,600	7,500
Peak Wet Weather Flow (PWWF)	2.3	3,450	6,900	10,400	13,800

2.2 WASTEWATER CHARACTERISTICS

Table 2 - Influent Wastewater Characteristics from 2005 Basis of Design

Characteristic	Value
BOD_5	250 mg/L
Total Suspended Solids	250 mg/L

3 SLUDGE MASS AND VOLUME ESTIMATES

Sanitaire was the original SBR technology provider. Sanitaire was contacted to provide design parameters and preliminary cost estimates for the ultimate build-out of 4 SBR trains at the Sooke WWTP. Table 6 on page 3 shows that the expected sludge production for an influent flow of 6,000 m^3/day which Sanitaire has called Maximum Month. The original Basis of Design had referred to this flow as Average Dry Weather Flow (ADWF).

Table 3. Sludge mass and volumes from 4 SBR trains and estimated digester SRT.

		SBR			Digesters			
Condition	Influent	Sludge Mass	Sludge Density	Sludge Volume	Thickened Sludge Density	Thickened Sludge Volume	Digester Volume	SRT
	m3/day	*kg/d*	*%*	*m^3/d*	*%*	*m^3/d*	*m^3*	*days*
Maximum Month*	6,000	1,155	0.85%	136	5%	23	1,000	43.5
PDWF	7,500	1,444	0.85%	170	5%	29	1,000	34.5
PWWF	13,800	2,657	0.85%	313	5%	53	1,000	18.9

* Sanitaire definition of flow condition

The expected thickened sludge volume is 23 to 53 m^3/d at 5% solids. The existing aerobic digester volume is 2 (units) x 10 (L) x 10 (W) x 5 (H) = 1,000 m^3. The SRT in the existing aerobic digesters is calculated to be 43.5 days to 18.9 days. These SRTs are adequate to achieve 38% Volatile Solids reduction which is required to achieve Class B biosolids. The PWWF flow condition is short term and does not represent the performance of the digesters which are normally evaluated on a monthly flow condition.

From the 2020 Operating and Laboratory data provided the District, the following operational metrics were extracted.

Table 4. 2020 Influent Flow from District of Sooke Operations Report.

2020 Operating Data	m^3/day	Peaking Factor (PF)
Average Dry Weather Flow (ADWF)	1,778	1.0
Peak Dry Weather Flow (PDWF)	1,991	1.12
Annual Average Flow (AAF)	2,390	1.34
Maximum Month (MM)	3,739	2.10
Maximum Day (MD)	6,289	3.54

Using these 2020 flow data and prorating the sludge production estimates provided by Sanitaire, Table 5 on page 3 shows the probable digester SRT for the Annual Average Flow (AAF) and the design ADWF flow for 2 trains. It is unlikely that 38% Volatile Solids (VS) reduction is being achieved at these calculated SRT values and Class B biosolids criteria is not being met.

Reference: Wastewater Treatment Plant Expansion - Sludge Thickening Options

Table 5 - Digester SRT Calculations based on 2020 Flow Conditions

Condition	Influent	SBR			Digesters	
		Sludge Mass	Sludge Density	Sludge Volume	Digester Volume	SRT
	m3/day	*kg/d*	*%*	*m3/d*	*m3*	*days*
Annual Average Flow (AAF)	2,390	460	0.85%	54	1,000	18.5
Average Dry Weather Flow (ADWF)	3,000	578	0.85%	68	1,000	14.7

Table 6 - Sanitaire SBR Design Proposal for 4 Basins

DESIGN PROPOSAL Sooke Expansion, CA Sanitaire #A30954-21ac		
Max Month*	m³/day	6,000
Max 4.8 hr Cycle Flow	m³/day	7,600
Max 4.0 hr Cycle Flow	m³/day	13,800
*** - Maximum 30 day period mass flow**		
	mg/l	kg/day
BOD_5 (20°C)	250	1,499
Suspended Solids	250	1,499
TKN	45	270
Total Phosphorus	5	30
Max Wastewater Temperature	°C	23
Min Wastewater Temperature	°C	10
Ambient Air Temperature	°C	-6/+32
Site Elevation	m	8
Table B: ICEAS® EFFLUENT QUALITY (MONTHLY AVERAGE)		
BOD_5 (20°C)	mg/l	20
Suspended Solids	mg/l	20
NH_3-N	mg/l	5
Total Phosphorus	mg/l	0.0
Table C: ICEAS PROCESS DESIGN CRITERIA		
Operating Basins		4
Operating Top Water Level	m	5.00
F/M ratio	BOD_5/day/MLSS	0.060
SVI (after 30 minutes settling)	ml/g	150
MLSS at Bottom Water Level	mg/l	5,504
Waste Sludge Produced	kg/day	1,155
Volume of Sludge Produced @ approximately 0.85% solids)	m³/day	136
Max Month Decant Rate	m³/min	6.71
Max 4.0 hr Cycle Flow Decant Rate	m³/min	9.58
Hydraulic Retention Time	days	0.88
Sludge Age	days	20.4
Bold, italicized text indicate assumptions made by Sanitaire		

4 SLUDGE THICKENING TECHOLOGIES

This section will discuss sludge thickener technologies and their suitability for Sooke WWTP.

4.1 GRAVITY THICKENING

The gravity thickener could be considered the simplest form of thickener. Almost any tank, clarifier or vessel could be used for gravity thickening. Thickening via gravity is similar to sedimentation where the settled solids are removed via gravity toward the bottom and supernatant collects on top of the tank. This form of thickening is already applied at the Sooke WWTP in aerobic digesters via telescopic valve. The results, however, are not satisfactory and poor thickening is achieved via gravity. This method of thickening is therefore not considered further.

4.2 DISSOLVED AIR FLOTATION (DAF)

This is a common method used for thickening of mostly secondary sludge but also applied for co-thickened primary and secondary sludge. This method relies on solids flotation via dispersed air bubbles and polymer addition. This method of thickening would have to be tried in pilot scale to determine its suitability to the Sooke WWTP sludge. The desired sludge concentration of 5% would most likely not be achieved as it is an upper end for this technology. In addition, this method typically has high capital and operating costs. This method of thickening is therefore not considered further.

4.3 GRAVITY BELT THICKENING (GBT)

Thickening via gravity belt is commonly applied to both primary and secondary sludges. The equipment consists of a porous membrane belt that moves over rollers on which the polymer conditioned sludge is distributed. The water drains through the belt and the thickened sludge is removed at the end of this process as shown in Figure 1.

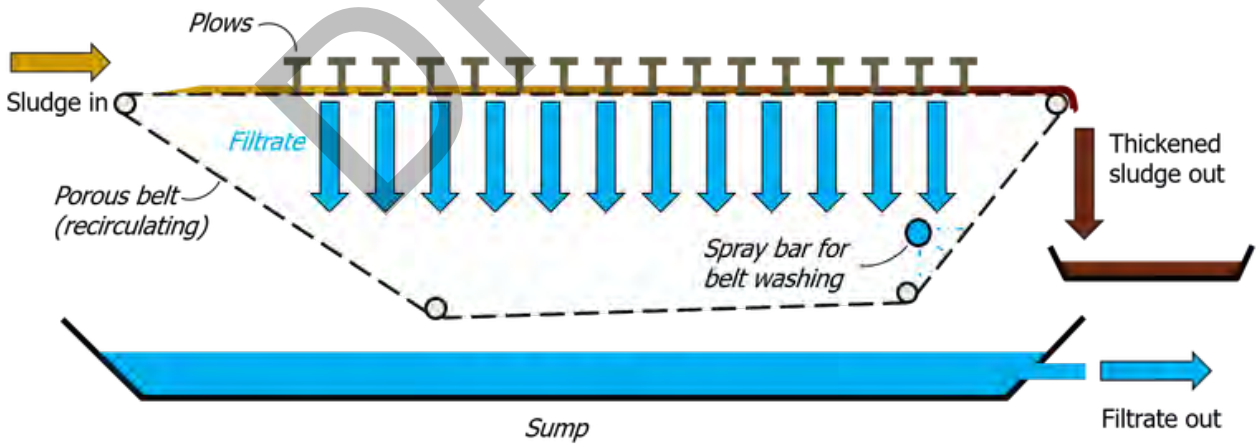


Figure 1. Example of gravity belt thickener.

The gravity belt thickener can achieve between 5 to 7% solids with solids capture rates of 92-95%. However, because of a relatively large footprint, the construction costs would make this alternative cost prohibitive. This method of thickening is therefore not considered further.

4.4 ROTARY DRUM THICKENER (RDT)

Rotary drum thickening increases the sludge solids concentration by agitating the solids in a slowly rotating vessel with porous walls though which the water (or filtrate) drains. A rotary drum thickener is based on the same principle as a gravity belt thickener (GBT), in that water drains from the sludge through a retaining porous medium as shown in Figure 2. This type of thickener can achieve from 5 to 9% solids with 93-98% solids capture rate. Due to relatively slow rotating drum which moves at speeds between 5 to 20 RPM the operating costs are relatively low (comparable to belt thickener and lower than centrifugal thickening). This method of thickening should be considered for the Sooke WWTP.

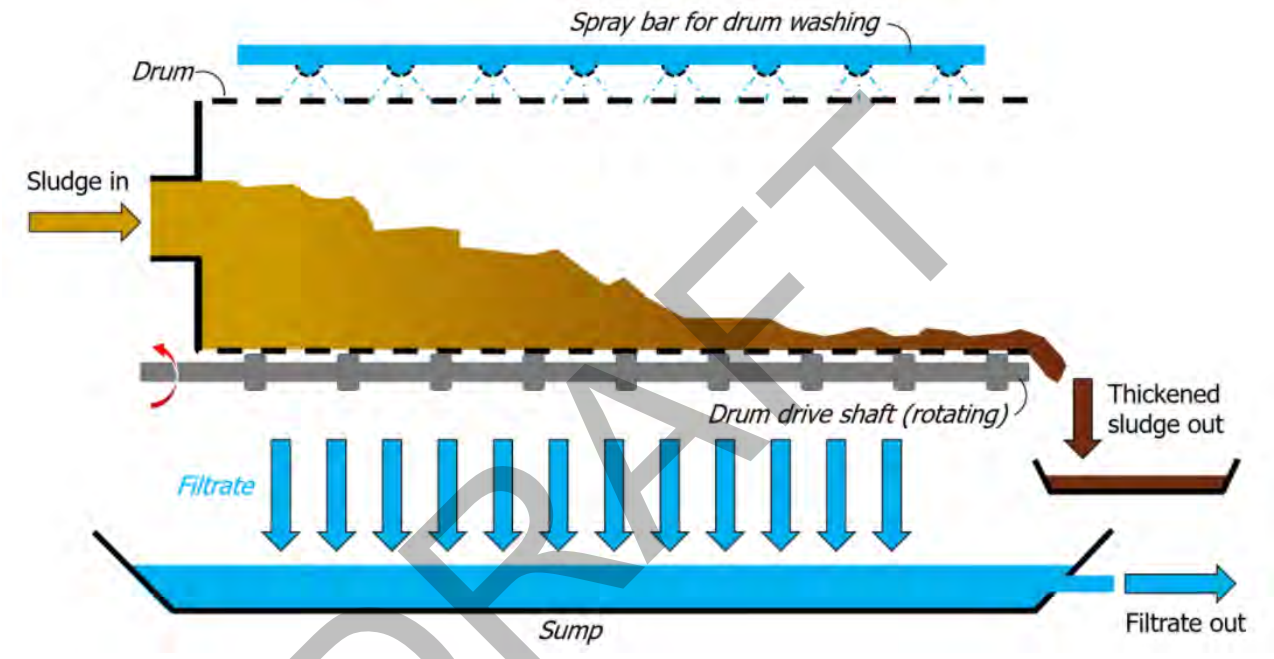


Figure 2. Example of rotary drum thickener.

4.5 SCREW THICKENING

Screw thickener is similar to drum thickener but instead of rotating shaft it has a rotating screw as shown in Figure 3. It is based on a slowly rotating (~5 RPM) Archimedean screw within a cylindrical screen (otherwise termed drum filter/screen or basket). It is normally inclined by ~20° to the horizontal to assist with the draining of water into the sump. The screen generally has an aperture rating below 0.5 mm and is based on wedge-wire or occasionally perforated metal. Additional advantage is relatively clogging free operation and low water use. The average performance and unit power consumption is similar that of drum thickener. This technology should be considered for the Sooke WWTP.

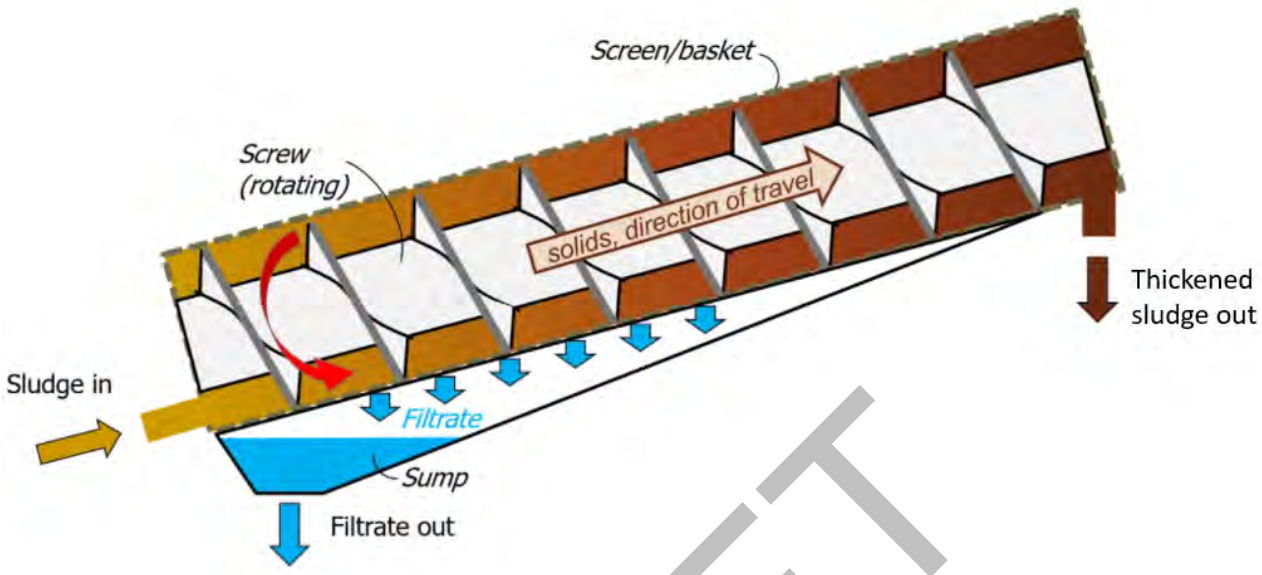


Figure 3- Example of screw thickener

4.6 CENTRIFUGAL THICKENING

Thickening by centrifuge involves the solids separation of sludge particles under the influence of centrifugal forces as shown in Figure 4. Sludge is introduced into the unit where the solids bowl moves at high speed and internal scroll spinning at a different speed moves the accumulated sludge toward the tapered end where solids concentration occurs. The advantage of this method is that thickening can be sometimes achieved without addition of polymer. There are many factors that can influence the thickening including rotational speed, depth of liquid pool in the bowl, differential speed of the screw conveyor and hydraulic loading. This type of thickening has high operating costs compared to other alternative thickening technologies.

The District of Sooke has the original Pieralisi centrifuge FP 600 RS/M. This centrifuge could potentially be used for thickening after some modifications. In the dewatering mode, this centrifuge has a capacity of 5-6 m^3/h. For thickening the capacity would be 15-20 m^3/h. Due to the age of this equipment (17 years), it is estimated that the remaining service life is about 5 to 7 years. A replacement centrifuge would have to be required at the end of its expected service life in 2030.

Due to high operating costs (order of magnitude more than drum thickener or screw thickener), centrifugal thickening is not considered a viable option for the Sooke WWTP.

Reference: Wastewater Treatment Plant Expansion - Sludge Thickening Options

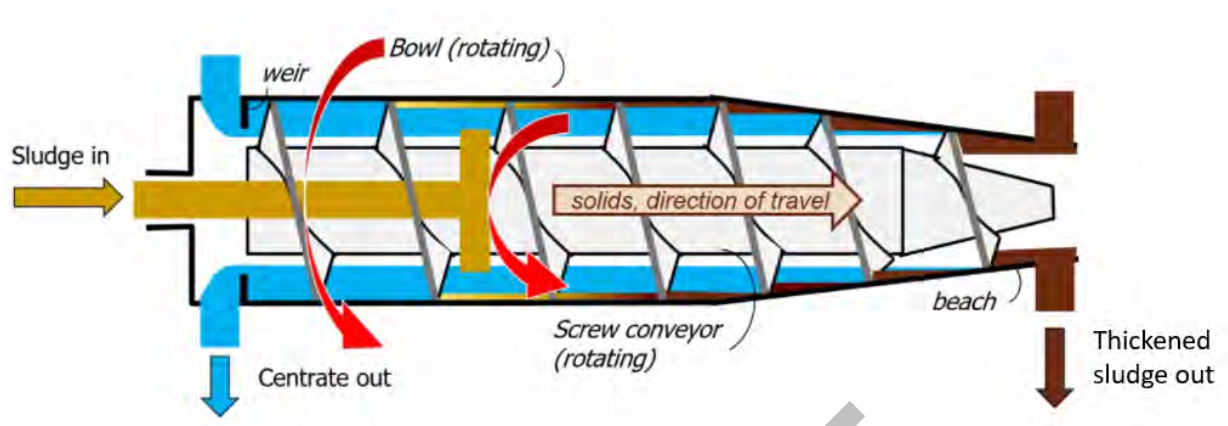


Figure 4. Example of centrifugal thickening.

5 SLUDGE THICKENER RECOMMENDATIONS

The ultimate sludge mass and volume estimates assuming future expansion to 4 SBRs are 1,155 kg/d and 136m^3/d of SBR residual solids. The following types of sludge dewatering equipment are recommended for evaluation for the Sooke WWTP expansion project:

(1) Rotary Drum Thickener, and
(2) Screw Thickening.

These technologies offer ability to thicken the sludge to 5-7% solids and have low operating costs.

Since the SBR WAS pumping cycle is high rate/short duration, it is recommendation that a WAS equalization tank be included in the design to size the thickening technology based on daily average flows rather than peak flows.

It is proposed to tender pre-purchase contracts for this equipment and incorporate the preferred option in the detailed design. This will allow to control the scope and schedule of the construction contract.

Stantec Consulting Ltd.

Bartek Puchajda Ph.D., P.Eng.
Senior Process Engineer, Water
Phone: (604) 587-8406
Mobile: (604)318-3143
bartek.puchajda@stantec.com

Attachment: [Attachment]

APPENDIX C TERTIARY FILTRATION TECHNICAL MEMO

Stantec

Memo

To:	District of Sooke 2205 Otter Point Rd, Sooke, BC V9Z 1J2	From:	Bartek Puchajda Surrey
Project/File:	111720131	Date:	December 2, 2021

Reference: Wastewater Treatment Plant Expansion – Final Effluent Tertiary Filtration

1 INTRODUCTION

This document presents option for final effluent tertiary filtration for the Sooke WWTP expansion project. The Sooke WWTP has SBR bioreactors followed by UV disinfection. Due to exceedances of TSS and UVT, fecal coliforms numbers exceed the required limit approximately 20% of the time. It is proposed to install an equalization tank followed by tertiary filtration prior to the UV disinfection at an upgraded facility in order to improve final effluent bacteriological quality.

This document will discuss the following areas:

- Tertiary filtration options
- The sizing of tertiary filter
- Final recommendation of the tertiary filter option for the upgraded Sooke WWTP

2 TERTIARY FILTRATION OPTIONS

Tertiary filtration options include:

(1) conventional filtration either through depth filters or disc filters, and
(2) membrane filtration such as microfiltration, ultrafiltration, nanofiltration and reverse osmosis.

Figure 1 shows the type of filtration equipment used in relation to particle size removal. Typical size of the settleable solids particles in wastewater is 10 μm and more. Therefore, microfiltration, ultrafiltration, nanofiltration and reverse osmosis can be eliminated leaving only conventional filtration.

There are two types of filtration technologies: surface filtration such as disc filters and depth filtration such as media filter. Typical operating parameters are shown in Table 1 and description of each technology is provided below.

Deep bed granular media filters as schematically shown in Figure 2 use depth filtration and remove suspended solids by allowing the filter influent water to pass downward under the force of gravity. They typically have mono-, dual-, or multimedia beds contained in a square or rectangular box of concrete or steel. Some filters use a dual-media filter of silica sand and anthracite at a depth of about 1 meter similar to those seen at potable water treatment facilities. Filtered water leaves the filter box via an underdrain system. As the bed retains solids, headloss increases until it reaches the head available. The filter is then removed from service and backwashed. To backwash, the filtered effluent is pumped back through the underdrains and is distributed up through the filter media from the bottom. Air scour is also typically applied to help clean the media.

Reference: Wastewater Treatment Plant Expansion – Final Effluent Tertiary Filtration

Microscreen filters shown schematically in Figure 3 use surface filtration. The microscreen fabric (typically polyester or stainless steel) is approximately 150 microns thick. The filters operate with in an either inside-out or outside-in flow path. The disks remain partially or fully submerged as the filtrate is collected in the filter tank. Solids accumulate on the media and are backwashed by counter-current flow or spray pipes and nozzles. The disks rotate continuously or only during backwash depending on the design.

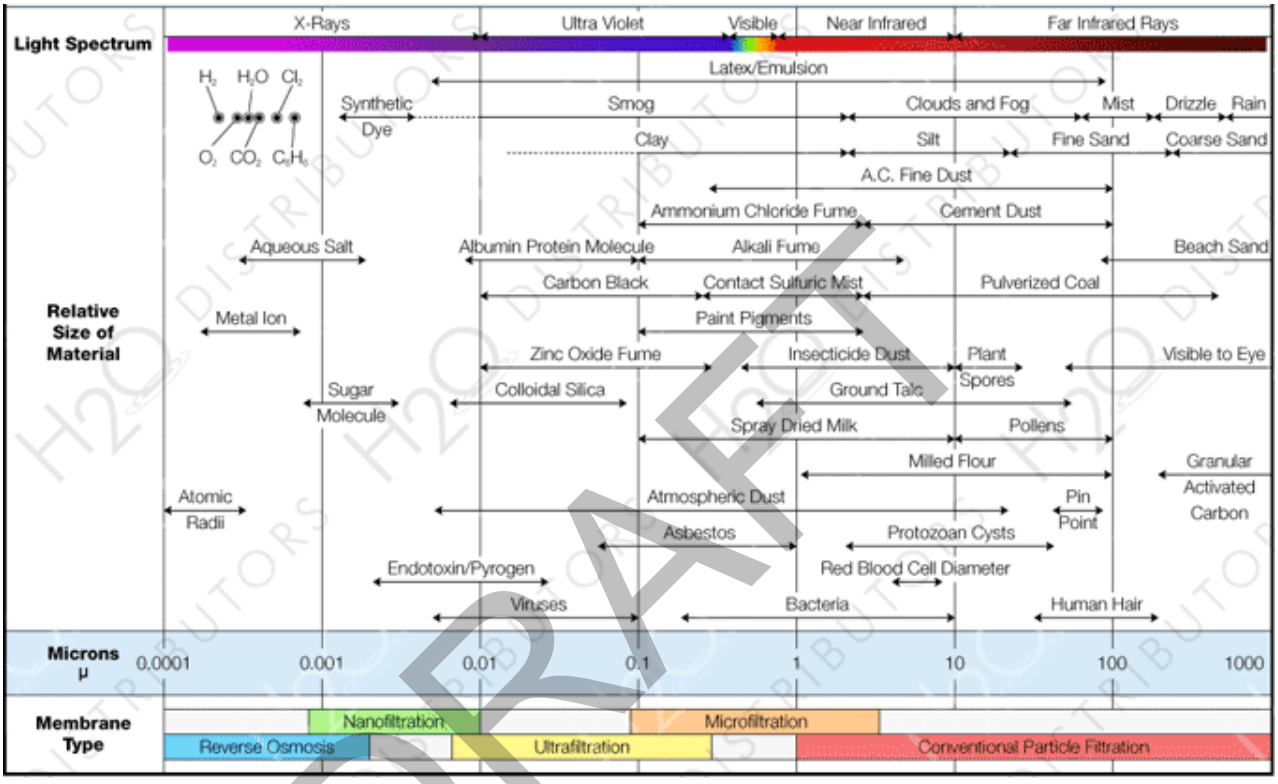


Figure 1. Filtration type and particle size comparison.

Table 1. Typical design parameters comparison between depth filtration and surface filtration technologies.

	Deep Bed Granular Media	Cloth Media Disc Filter
Media Type, Depth, Nominal Pore Size	*Granular, 1-2 m, 10 micron*	Nylon, Acrylic, Polyester, 5-13 mm, 5-10 micron
Driving Head Requirements	1-2 m	0.5 – 1.2 m
Peak Hydraulic Loading Rate	12-20 $m^3/m^2/hr$	15 - 17 $m^3/m^2/hr$
Backwash Duration	20 min	6 min
Backwash Reject Rate	2-3%	1-3%

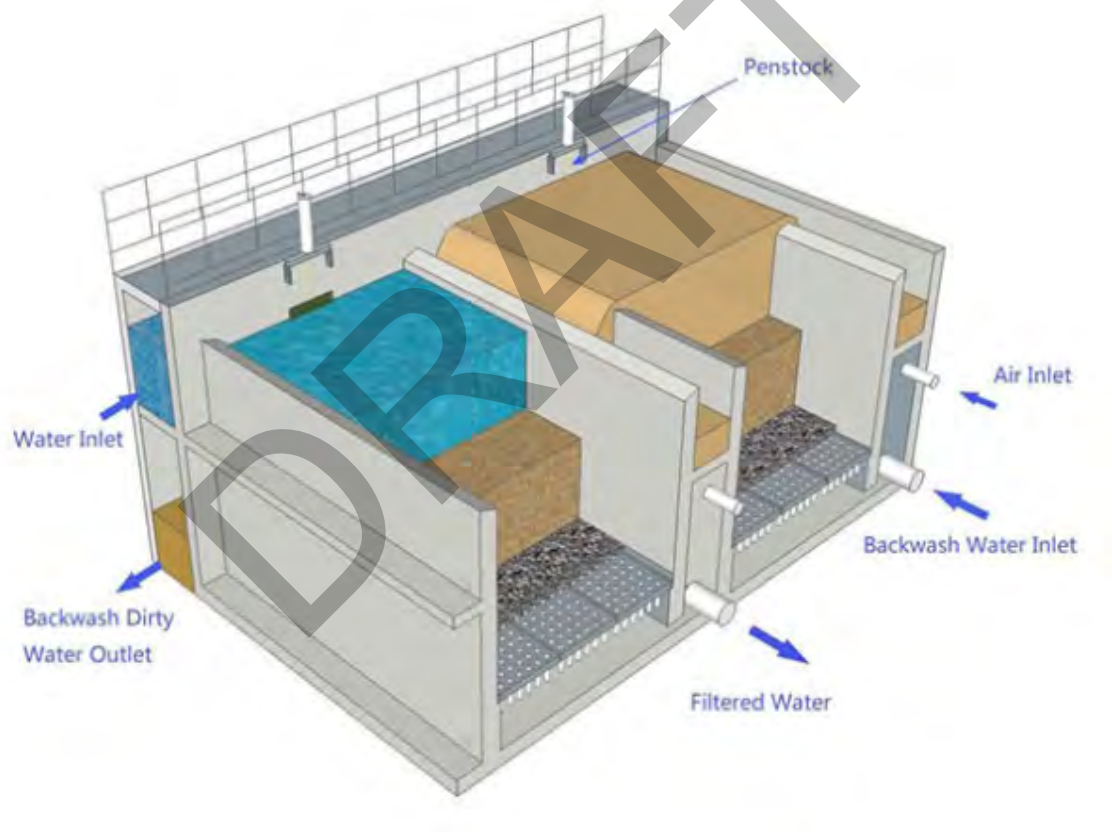


Figure 2 - Example of depth filtration technology

Reference: Wastewater Treatment Plant Expansion – Final Effluent Tertiary Filtration

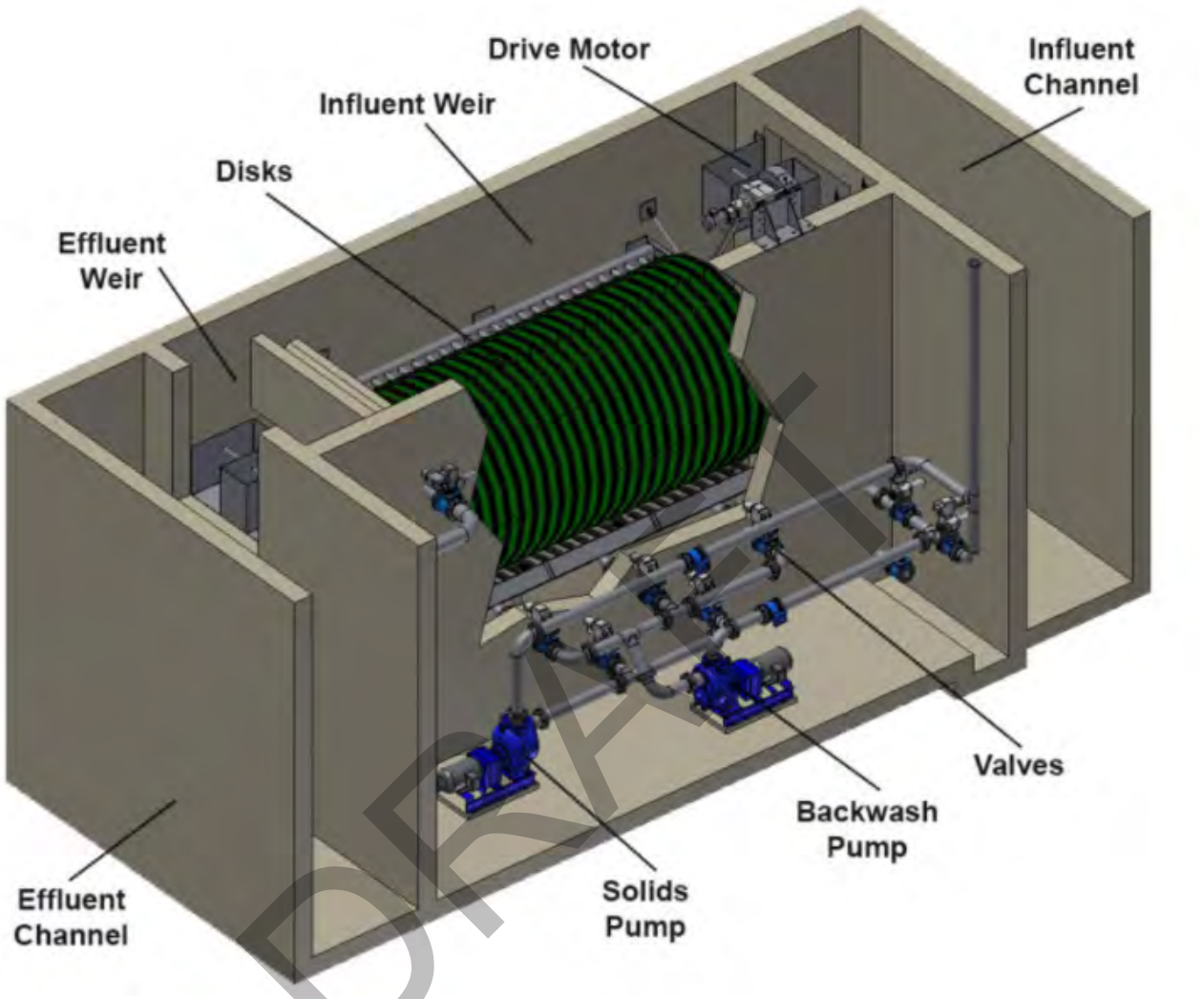


Figure 3 - Example cloth media disc filter

3 TERTIARY FILTER SIZING FOR PLANT EXPANSION

The key designed futures that are proposed to be implemented that would improve the quality of the final effluent would consist of the following:

- Possible equalization tank for the SBRs effluent to extend the discharge time so that the plant effluent flow would equal to the plant influent flow
- Installation of the tertiary filter in order to remove excess suspended solids and improve UVT
- Installation of the new UV equipment for final effluent disinfection

The description of the equalization tank sizing will be included in the Design Basis while a separate TM is be provided for the UV sizing and options. This section will focus on the tertiary filter sizing.

The proposed tertiary filter design parameters as shown in Table 2. The proposed design incorporates the hydraulic capacity for the 4th SBR train which is expected to be added within the next 10-15 years. Tertiary filter suppliers guarantee the filtered effluent TSS level. To verify the filtered effluent UVT, a bench scale studies is recommended.

Table 2. Proposed UV design parameters with equalization tank and tertiary filter installed downstream from the SBRs.

	Unit	Value
Peak design flow (PWWF)	m^3/d	13,800
Average design flow (ADWF)	m^3/d	6,000
SBR effluent TSS average	mg/L	13
SBR effluent TSS maximum	mg/L	36
SBR effluent cBOD average	mg/L	10
SBR effluent cBOD maximum	mg/L	27
SBR effluent COD average	mg/L	80
SBR effluent COD maximum	mg/L	135

4 TERTIARY FILTER RECOMMENDATION

It is recommended to consider the surface filtration technologies only, such as disc filters for the Sooke WWTP expansion project. This technology offers generally similar footprint to the depth filtration but at smaller headloss, less backwash water volume and shorter backwash duration. Frequently, the individual filter panels can be cleaned while the filter continues to operate without interruption to the flow. Media replacement is also easier with filter panels that can be replaced individually as needed.

It is proposed to tender pre-purchase contracts for this equipment and select a preferred vendor to be incorporated into the detailed design. This will allow control of the scope and schedule of the construction contract.

Reference: Wastewater Treatment Plant Expansion – Final Effluent Tertiary Filtration

Regards,

Stantec Consulting Ltd.

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Senior Process Engineer, Water
Phone: (604) 587-8406
Mobile: (604)318-3143
bartek.puchajda@stantec.com

APPENDIX D UV DISINFECTION TECHNICAL MEMO

Stantec

Memo

To:	District of Sooke 2205 Otter Point Rd, Sooke, BC V9Z 1J2	From:	Bartek Puchajda Surrey
Project/File:	111720131	Date:	February 9, 2022

Reference: Wastewater Treatment Plant Expansion– Final Effluent UV Disinfection

1 INTRODUCTION

This document presents the Final Effluent UV disinfection options for the Sooke WWTP expansion project. Flow from the SBRs passes through the UV system to meet the bacteriological effluent quality requirements of ≤ 200 fecal coliforms per 100 mL (monthly geometric mean) as required by the MSR. For the District of Sooke, a Trojan UV3000B^{TM} low pressure, low intensity lamp technology was installed. Low-pressure low-intensity (LPLI) lamps were selected to reduce the overall capital and O&M costs compared to low-pressure high-intensity lamps (LPHI). The lamps are oriented in a horizontal configuration parallel to the flow and require manual cleaning. The system consists of 2 banks, 8 modules per bank with each module consisting of 8 lamps for a total of 128 lamps.. Following UV disinfection, the effluent is discharged via the 500 mm diameter HDPE outfall pipe to the Juan de Fuca Straight.

This document will discuss the following areas:

- The current UV equipment sizing and past performance
- The sizing of the UV equipment for the plant expansion
- The types of UV disinfection options
- Final recommendation of the UV disinfection option for the Sooke WWTP Expansion project

2 CURRENT UV EQUIPMENT SIZING

The current UV equipment is sized as shown in Table 1. There are several potential issues with this sizing. As can be seen from Figure 1, the design UVT of 60% is achieved only during winter months and for the majority of 2020, this value was well below the design value reaching as low as 30% and less during summer months. Final effluent TSS as shown in Figure 2 showed high variability often exceeding design value of 20 mg/L. In general, the final effluent fecal coliform values exceeded 200 MPN/100 mL target about 20% of the time as shown in Figure 3.

Table 1. Current UV sizing parameters

	Unit	Value
Peak design flow	m^3/d	13,824
Average design flow	m^3/d	9,504
TSS	mg/L	20; Range: 6-25
BOD	mg/L	20; Range: 4-25
UVT at 253.7 nm	%	60
Finale Effluent	Fecal coliform MPN	200/100 mL
Minimum required dose at peak flow	$\mu Ws/cm^2$	33,000

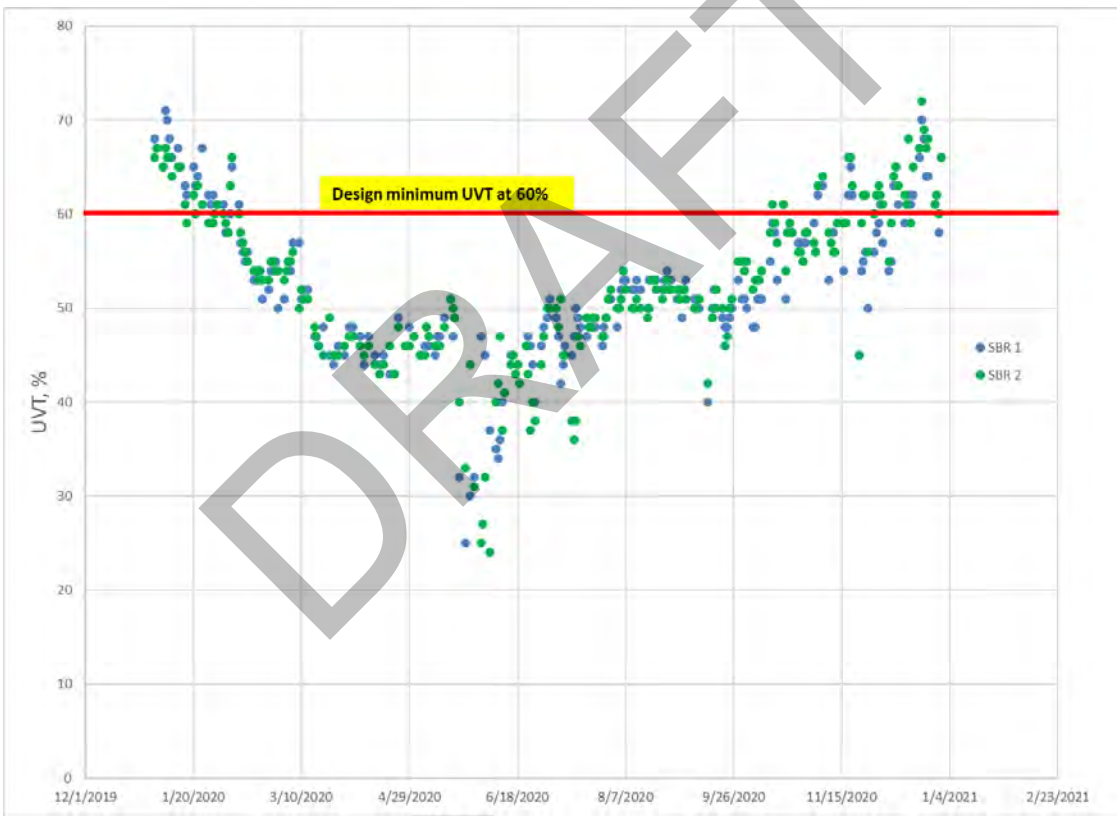

Figure 1. Final effluent UVT in 2020.

Reference: Wastewater Treatment Plant Expansion– Final Effluent UV Disinfection

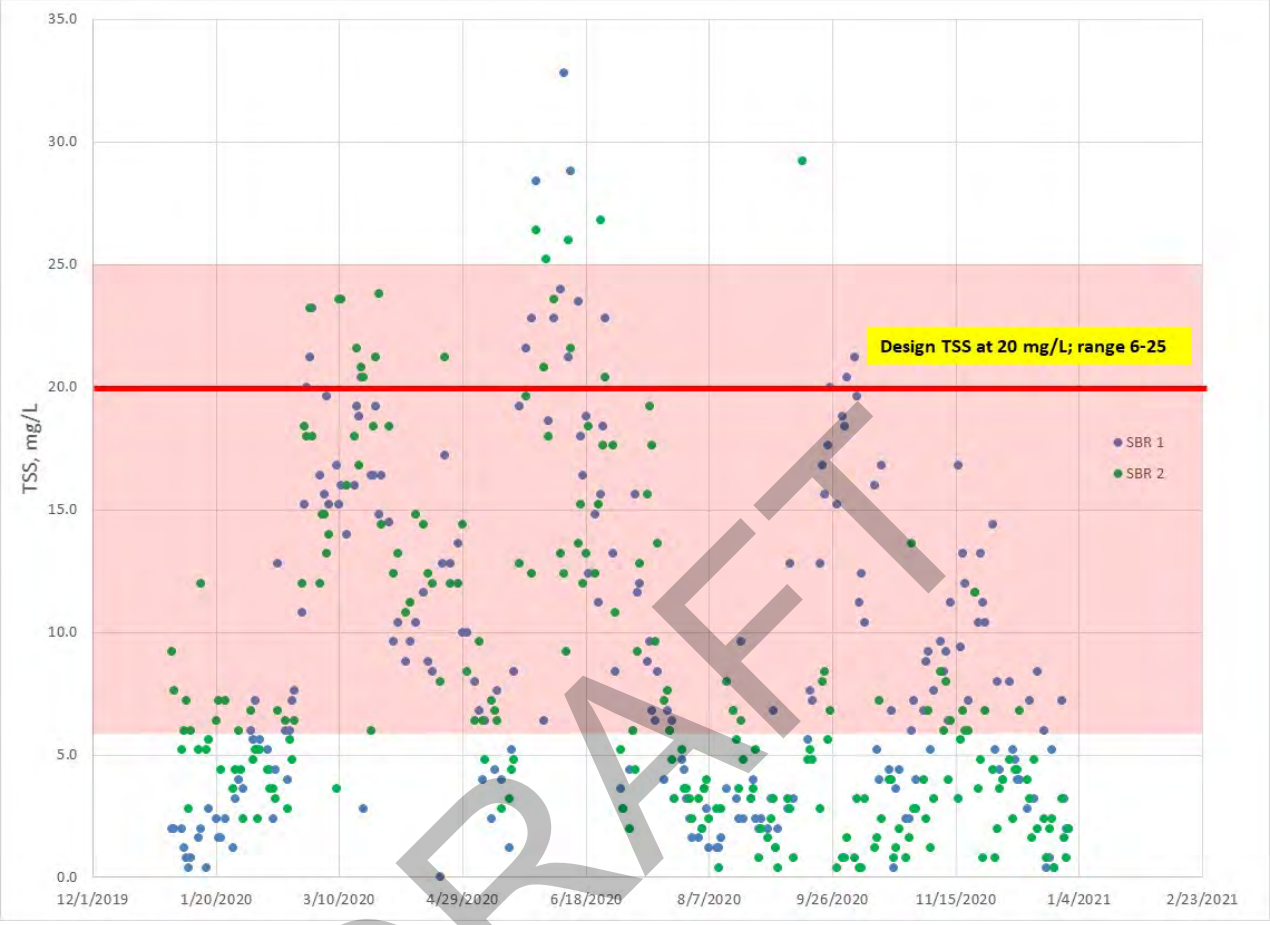

Figure 2. Final effluent TSS in 2020.

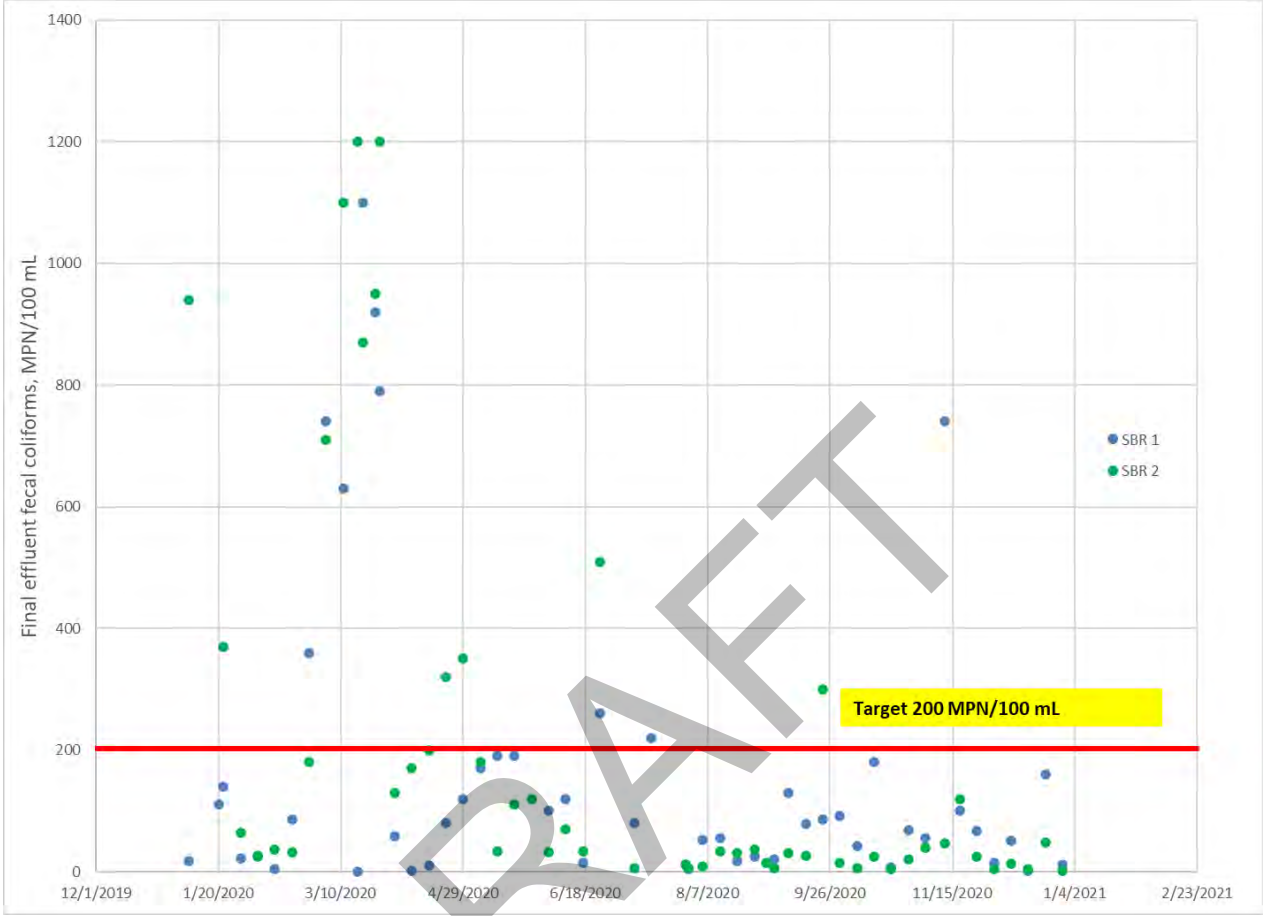

Figure 3. Final effluent decal coliforms in 2020.

3 UV EQUIPMENT SIZING FOR PLANT EXPANSION

The key designed futures that are proposed to be implemented that would improve the quality of the final effluent including bacteriological quality would consist of the following:

- Equalization tank for the SBRs effluent flow rate would equal to the plant influent flow rate and be continuous flow.
- Installation of the tertiary filter to remove excess suspended solids and improve UVT
- The replacement UV system is designed for the ultimate expansion of the 4th SBR system which is expected within 10 years

This section will focus on the UV sizing.

The proposed UV design parameters are shown in Table 2. The hydraulic capacity is similar to the current design (see Table 1) which includes accommodation of instantaneous flows from SBRs. In addition, the proposed design hydraulic capacity accommodates the 4th SBR which is anticipated within 10 years (< typical life-span for UV equipment). Tertiary filter suppliers will guarantee the filtered effluent TSS level, but in order to verify the filtered effluent UVT bench scale studies are recommended.

Table 2. Proposed UV design parameters with tertiary filter

	Units	Value
Peak design flow (PWWF)	m^3/d	13,800
Average design flow (ADWF)	m^3/d	6,000
TSS	mg/L	10
cBOD	mg/L	10
UVT at 253.7 nm	%	60
Final Effluent	Fecal coliform MPN	200/100 mL
Minimum required dose at peak flow	mJ/cm^2	30 (bioassay validated)
		0.98 end of lamp life factor 0.95 fouling factor

Note that the minimum required dose at peak flow conditions is not determined. Due to advancements in the UV technology and associated testing protocols the UV suppliers establish their own UV dose to match the required bacteriological quality in the effluent.

4 UV DISINFECTION OPTIONS

The option of constructing a new UV channel for the replacement equipment at a lower elevation to accommodate anticipated additional head losses upstream UV channel due to possible addition of flow equalization tanks and/or disk filters was examined. On review of the hydraulic profile of the marine outfall, it was concluded that the HGL at the outlet box end of the UV channel could not be lowered without causing flooding of the channel. It was concluded that the existing UV channel will be reused for installation of the new UV equipment. The following types of UV disinfection were considered:

- An in-channel UV system as shown in Figure 4
- An in-pipe UV system as shown in Figure 5

An in-channel UV system, as currently in use at the Sooke WWTP, consists of the channel structure which can be either concrete or stainless steel. The inlet portion of the channel provides uniform flow pattern (sometime with the use of orifice plates, baffles or vanes). The lamps positioned parallel to the flow path are grouped in banks. The liquid depth is controlled via automatically adjustable gate or fixed weir. The power supply and the ballast system is selected to match the power requirements of the lamps. The automatic wiping system and UV sensor are integrated with the control panel for fully automatic control.

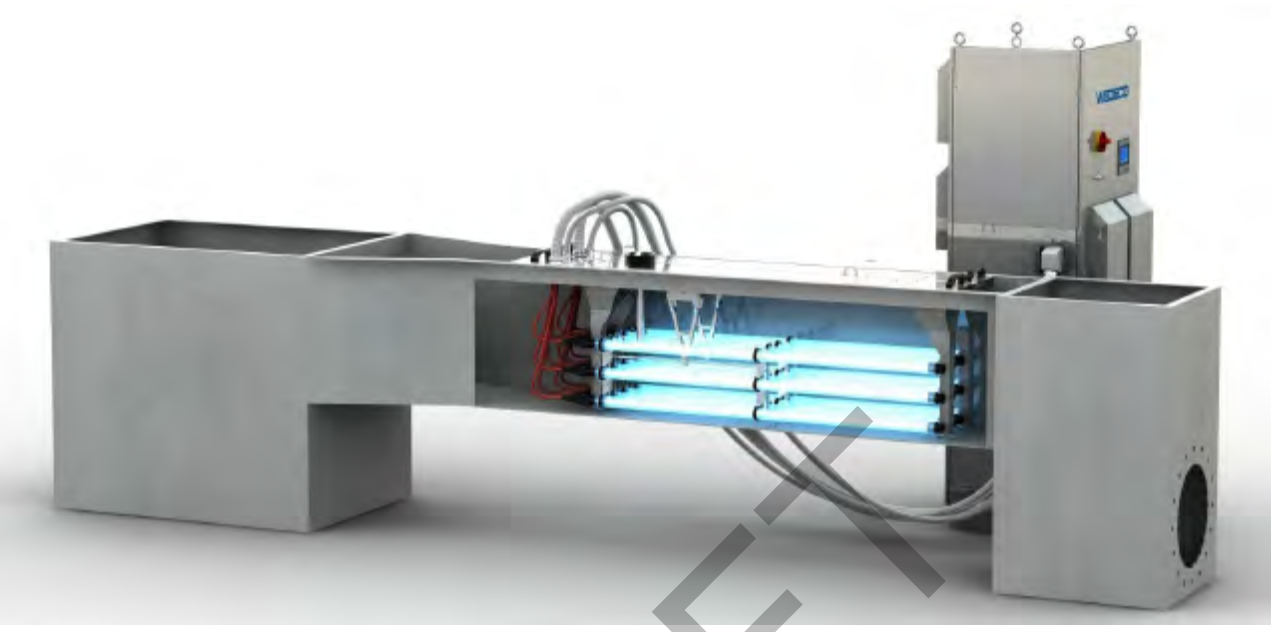

Figure 4. Example of in-channel UV system

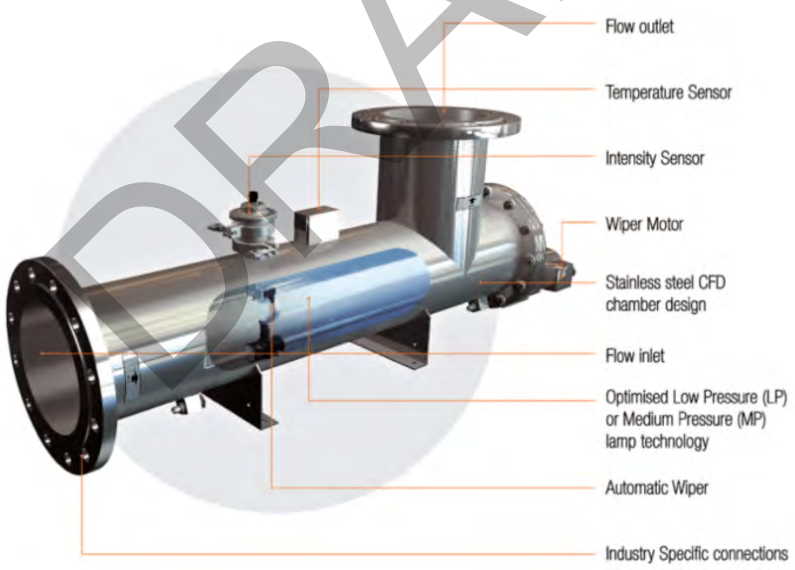

Figure 5. Example of in-pipe UV system.

The components of the in-pipe UV systems are similar to the in-channel system with the exception of the liquid level control. The in-pipe system is constructed in such a way that the pipe with UV lamps is always fully filled due to a 90-degree bend at the and of the UV reactor. In order to provide laminar flow a minimum upstream pipe length has to be maintenance as per manufacturer recommendations.

The in-pipe UV systems are typically more expensive than the in-channel systems. However, when the cost of constructing a concrete channel is factored in this may not be the case. In addition, the in-channel

Reference: Wastewater Treatment Plant Expansion– Final Effluent UV Disinfection

systems may offer somewhat lower headloss due to an open channel configuration. This may be of critical importance when there is a limited head available as is the case at the Sooke WWTP.

At this stage both UV options should be considered for the upgraded Sooke WWTP. It is proposed to tender pre-purchase contracts for this equipment and pre-select the final option to be incorporated into the detailed design. This will allow to control the scope and schedule of the construction contract.

Regards,

Stantec Consulting Ltd.

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Attachment: [Attachment]

APPENDIX E GEOTECHNICAL REPORT

Sooke Wastewater Treatment Plant Expansion

Draft Geotechnical Report – Rev A

February 7, 2022

Prepared for:

District of Sooke
2205 Otter Point Road
Sooke, BC V9Z 1J2

Prepared by:

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Revision	Date	Description
A	February 7, 2022	Issued for Review

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LIST OF APPENDICES

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) has been retained by the District of Sooke (the District) to provide consulting engineering services for the Sooke Wastewater Treatment Plant (WWTP) expansion design, contract administration and project management services (the Project). This report presents the details of the geotechnical exploration program, geotechnical analysis results, and geotechnical design recommendations for the Project.

The geotechnical work was completed in general accordance with Task A6 outlined in our proposal dated August 19, 2021, in response to District of Sooke's Request for Proposal, RFP 2021-WW002.

The geotechnical works consisted of the following:

- Review of project drawings and published information on subsurface soil and groundwater conditions at the Project area
- Execution of a geotechnical subsurface exploration program
- Laboratory testing of soil samples collected during the geotechnical exploration
- Geotechnical engineering analyses
- Geotechnical recommendations pertinent to the design and construction of the proposed expansion.

This report should be read in conjunction with the Statement of General Conditions in **Appendix A**.

1.1 PROJECT UNDERSTANDING

The District of Sooke built a wastewater collection system and wastewater treatment plant in Sooke, BC which serves a core area of 5,500 residents including the downtown commercial and industrial core. The collection system comprises over 58 km of piping and seven (7) municipally operated pump stations. The construction of the wastewater treatment plant began in December 2004 with completion in November 2005.

Growing demand for the existing system and expected increases in projected future flows has caused the need for greater capacity at the WWTP, and the existing plant was designed to allow for future expansion. The proposed expansion of the Sooke WWTP will include various unit processes/systems:

- Screened raw sewage splitter box
- Sequencing Batch Reactor (SBR)
- Aerobic Digester
- SBR blower and aeration diffusion system
- Digester blower and aeration diffusion system
- Motor Control Centre Extension
- Electrical and control systems
- Programmable Logic Controller replacement
- Generator replacement

We understand the existing WWTP includes two SBR's and two digesters. The proposed construction includes a third SBR and digester (SBR #3 and Digester #3) and will be constructed against the south wall of SBR #2 and Digester #2 (**Figure 1, Appendix B**). The new SBR and digesters will be similar in size to the existing structures (i.e., 10 m wide, 39 m long and 6 m tall). Conceptual design drawings indicate the proposed structure foundations will consist of 500 mm thick raft slabs and will be constructed to match the elevation of the existing SBR's at El. 5.16 m.

We further understand that a fourth SBR (10 m wide and 29 m long) located against the south wall of the proposed SBR #3 is being considered for future construction. If the District of Sooke opts to proceed, the foundations for SBR #4 will be constructed at the same time as the construction of SBR #3 and Digester #3.

The proposed WWTP expansion buildings will be designed using seismic design criteria for Post-Disaster structures.

1.2 REFERENCE REPORTS AND DRAWINGS

The following is a list of documents that were reviewed prior to carrying out the geotechnical scope of work. Outside references from literature are reported separately in the respective sections of the report.

- Stantec Consulting Ltd. "Sooke Wastewater Treatment Plant Expansion Conceptual Design Report", dated February 21, 2020
- Stantec Consulting Ltd. Sooke Wastewater Treatment Plant Expansion preliminary design drawings, dated February 21, 2020

1.3 DESIGN CODES AND STANDARDS

Geotechnical engineering analyses and recommendations were developed in accordance with the following design codes, standards, and guidelines:

1. British Columbia Building Code, BCBC (2018)
2. National Building Code of Canada, NBCC (2015)
3. Canadian Foundation Engineering Manual, CFEM (2006)
4. Metro Vancouver Engineering Standards – Lateral Pressure on Walls GEO-00107 (2017)

2.0 SITE DESCRIPTION AND GEOLOGY

2.1 PHYSICAL SETTING

The site address is 7113 West Coast Road, in Sooke, British Columbia. The existing WWTP buildings and proposed expansion area is located approximately 350 m southwest of West Coast Road (Highway 14) and accessible via a gravel road. There are residential houses located to the east, and undeveloped land to the north, south and west of the WWTP. The surrounding area is grass covered, with the gravel access road extending through the centre of the site.

Elevations and grade changes have been estimated using aerial imagery and contours available on the District of Sooke's online Arc GIS Maps, and from topographic survey data for the site completed by McIlvaney Riley BC Land Surveyors on February 28, 2020. Elevations are assumed to be referenced to the Geodetic Datum. The entrance to the WWTP site at West Coast Road is at an elevation of El. 18 m (approx.). The gravel access road slopes down to the site at a 3% grade (approx.) over a distance of 350 m to an elevation of El. 7.6 m (approx.). The ground surface around the WWTP buildings is at an elevation of El. 7.6 m (approx.), except against the exterior walls of the existing SBR and Digesters where the ground surface is 1 to 2 m higher; i.e., El. 8.6 m (approx.) along the south side, and El. 9.6 m (approx.) along the west side.

2.2 SURFICIAL GEOLOGY

Based on "Open file 1993025 - Surficial geology of the Sooke area" (Blyth and Rutter, 1993), the surficial geology at the site can be generally described as fluvial sediment deposited in association with glacier ice, generally consisting of gravel and sand.

3.0 GEOTECHNICAL EXPLORATION

3.1 SITE EXPLORATION

A geotechnical exploration was carried out at the project site on November 04, 2021, consisting of four solid-stem auger boreholes (BH21-01 to BH21-04). Boreholes BH21-01 and BH21-02 were completed within the proposed footprint of SBR #3 and Digester #3, and boreholes BH21-03 and BH21-04 were completed in the proposed footprint of SBR #4. A BC One Call was completed prior to mobilizing equipment and personnel to the site. Prior to drilling, the presence of existing underground utilities near the proposed boreholes were verified using ground penetrating radar (GPR) equipment. This utility clearance work was caried out by ScanPlus Locating Ltd. As a subcontractor to Stantec.

All boreholes were advanced using 140 mm outside diameter solid-stem augers. In boreholes BH21-01 and BH21-04, auger refusal due to high soil stiffness was encountered at 3.4 m and 3.8 m depth below ground surface, respectively. An inferred boulder was encountered in BH21-02 at 1.5 m depth causing termination of the borehole. Borehole BH21-03 was terminated at a target depth of 10.7 m.

The borehole coordinates were measured using a handheld GPS during the site exploration. Approximate locations of the test holes are shown in Figure 1. A summary of the boreholes is presented in Table 1.

Table 1 Summary of Geotechnical Exploration

ID	UTM Coordinates [1]		Approximate Ground Elev. (m)	Drilling Depth of Borehole Below Ground Surface (Elev.) (m)
	Easting (m)	Northing (m)		
BH21-01	444627	5357237	7.6	3.4 (4.2)
BH21-02	444601	5357226	7.6	1.5 (6.1)
BH21-03	444613	5357223	7.5	10.7 (-3.2)
BH21-04	444636	5357230	7.5	3.8 (3.7)

Note:
[1] Coordinates were collected using a handheld GPS device.
Elevations are referenced to Geodetic Datum

Dynamic Cone Penetration Tests (DCPT) were completed prior to drilling at each of the borehole locations. The purpose of the DCPT test is to assess the compactness and consistency of the subsurface soils. The DCPT utilizes a 63.5 kg hammer, free-falling from 760 mm height on top of an anvil, which is connected to 45 mm diameter AWJ steel rods. A disposable 60 mm diameter cone is connected to the bottom end of the AWJ rods. With each blow the cone penetrates the ground, and the “blow counts” are recorded for each 300 mm of penetration. The DCPT was generally terminated when the blow counts exceeded 50 blows per 300 mm of penetration. The DCPT blow counts are presented on the borehole records in **Appendix C**.

A Stantec engineer coordinated the exploration work, located the boreholes on site, classified the soils encountered within the boreholes, maintained a detailed field log of the boreholes, collected soil samples for laboratory testing, and observed and recorded pertinent site features. Soil descriptions presented on the borehole records are based on the soil samples collected in the field, and are in general accordance with the American Society for Testing and Materials (ASTM) standards D2487 and D2488 for the Unified Soil Classification System (USCS) and the information presented on the “Symbols and Terms Used in Borehole and Test Pit Records” in **Appendix C**.

3.2 LABORATORY TESTING

Geotechnical laboratory testing on representative soil samples was performed in Stantec’s laboratory and included natural moisture content, grain size distribution, and Atterberg Limits. Soil chemistry and corrosivity tests were carried out on representative soil samples at the Bureau Veritas Laboratory (BV Labs) in Burnaby, British Columbia.

The results of the laboratory testing program are summarized on the borehole logs in **Appendix C** and the detailed test reports are presented in **Appendix D**.

4.0 SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

In general, the subsurface conditions encountered consisted of sand, gravel and clay. Boreholes were drilled on the grass-covered areas adjacent to the existing gravel access road.

4.1 SUBSURFACE SOIL CONDITIONS

4.1.1 Upper Sand and Gravel (SP/GP)

Sand and gravel soils were encountered in boreholes BH21-01 and BH21-02 and extended to approximately 1.2 to 1.5 m below the existing ground surface from El. 6.1 to 6.4 m. Moisture content of samples collected from those soils ranged from 12% to 21%. Based on interpretation of the DCPT blow counts and field observation, the deposit was generally compact to dense.

4.1.2 Clayey Silt (ML/CL)

Clayey silt with Sand was encountered at borehole BH21-04 and extended to approximately 1.5 m below the existing ground surface to El. 6 m. Organics were also encountered in this deposit from approximately 0.1 to 0.3 m depth below the ground surface. Measured moisture content of the clayey silt ranged from 27% to 58%. Based on interpretation of the DCPT blow counts and field observation, this deposit was generally soft.

4.1.3 Clay (CL/CH)

Clay was encountered beneath the upper sand and gravel soils in borehole BH21-01 and beneath the clayey silt in BH21-04. The clay layer was inferred to extend beyond the termination depths of boreholes BH21-01 (3.4 m) and BH21-04 (3.8 m); i.e., below El.4.2 m and 3.7 m, respectively. In borehole BH21-03, the clay deposit was encountered at the ground surface and extended to approximately 1.2 m depth to El. 6.3 m. The clay layer was not encountered in BH21-02. Laboratory test results indicated that the plasticity index of the clay deposit varied from 24 to 31 and natural moisture content ranged from 19% to 31%. Based on interpretation of the DCPT blow counts and field observation, this clay deposit was generally stiff to very stiff.

4.1.4 Lower Gravel and Sand (SM/GP/GM)

In borehole BH21-03, gravel with sand with various amount of fines were observed underlying the clay deposit. This gravel and sand layer was inferred to extend beyond the borehole termination depth of 10.7 m below the ground surface to El. -3.2 m. Based on interpretation of the DCPT blow counts and field observation, this deposit was generally dense to very dense.

4.2 GROUNDWATER CONDITIONS

Groundwater was observed in boreholes BH21-03 and BH21-04 at approximately 1.4 and 1.2 m below ground surface (El. 6.1 and 6.3 m), respectively. No groundwater was observed in boreholes BH21-01

and BH21-02, which were completed within the footprint of the proposed SBR #3 and digester. It is anticipated that the groundwater level will vary seasonally following precipitation events and groundwater pumping activity in the vicinity of the site.

4.3 CHEMICAL TEST RESULTS

The results of the chemical testing are summarized in Table 2 and presented in **Appendix D**.

Table 2 Results of Chemical Tests

Borehole ID	BH20-01	BH21-03
Sample No.	GS-3	GS-4
Approx. Sample Depth (m)	1.2 to 1.5	1.2 to 1.5
Soil Description	Lean clay	Silt
pH	7.32	5.99
Soluble Sulphate (mg/L)	23	<20
Soluble Conductivity (µS/cm)	162	287
Calculated Resistivity (ohm-cm) *	6173	3484
Corrosivity Rating **	Moderately corrosive	Corrosive

NOTES:
* Resistivity, ρ was calculated as the inverse of soluble conductivity, σ, using the equation:
$$\rho\ (ohm-cm) = 10^6/[\sigma\ (\mu S/cm)].$$
** Based on calculated soil resistivity and Table 2.27, of the Handbook of Corrosion Engineering (Roberge, 2000).

Based on the results of the samples tested, the degree of exposure of concrete to sulphate attack is less than moderate per Table 3, CSA A23.1:19/CSA A23.2:19 (CSA Group, 2019). The corrosion potential of steel in contact with soils is rated as moderately corrosive to corrosive.

5.0 ANALYSES AND RECOMMENDATIONS

5.1 GENERAL

Based on the review of site conditions, the results of the geotechnical subsurface exploration and subsequent laboratory testing, the proposed WWTP expansion can be supported on a raft foundation founded on stiff to very stiff native clay and clayey sand soils. Additional details regarding recommendations for the proposed expansion are provided below.

5.2 SITE PREPARATION

We envision site preparation activities to include stripping organics, removing soil backfill from the south wall of SBR #2 and excavation of the expansion footprints to achieve design subgrade elevation. Excavations 2.8 to 2.9 m deep (approx.) are anticipated to reach design subgrade for the new SBR's and digester. The anticipated soil conditions at design subgrade elevation at boreholes BH21-01 and BH21-04 consist of stiff to very stiff clay, and consist of stiff clayey sand in borehole BH21-03. Borehole BH21-02 encountered auger refusal on a very dense silty sand layer at 1.5 m depth before reaching design subgrade elevation; however, similar soils consisting of stiff to very stiff clay or clayey sand are anticipated.

The clay subgrade is sensitive to moisture and mechanical disturbance. Any soft or loose soils detected within the exposed subgrade, including those disturbed by construction or other site activities, should be sub-excavated to the discretion of the Stantec geotechnical engineer and replaced with structural fill as described in Section 5.3. The subgrade and any over-excavation, backfilling and compaction should be reviewed by the geotechnical engineer.

5.3 STRUCTURAL FILL

Structural fill for backfilling should be clean free-draining granular soil, consisting of 75 mm (3 in.) minus pit-run sand and gravel, with less than 5% passing the Standard US #200 sieve. The backfill should be placed in maximum 300 mm thick loose lifts and compacted to at least 95% of the Modified Proctor maximum dry density (MPMDD).

Any proposed alternative fill material should be tested and approved by the Geotechnical Engineer prior to delivery to the site. Review of structural fill placement and compaction must be carried out by the Geotechnical Engineer to ensure that all fill used is suitable and is placed and compacted to the above specifications.

5.4 SEISMIC DESIGN PARAMETERS

Site-specific seismic design parameters were obtained from the interactive website maintained by the Geological Survey of Canada in accordance with the provisions of BCBC (2018). The parameters 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 and Peak Ground Acceleration (PGA) are determined for very dense soil or soft bedrock, taken as the reference ground condition corresponding to Site Class "C". The $S_a(T)$ values would have to be adjusted to account for local site conditions and to obtain design spectral values S(T).

The Peak Ground Acceleration (PGA) and $S_a(T)$ values for the 475, 975 and 2475-year return periods at Site Class C conditions, obtained as per BCBC (2018) are summarized in Table 3.

Table 3 Seismic Hazard Parameters for 5% Damping – Site class C - BCBC (2018)

Period, T (s)	$S_a(T)$ – 2475-year return period (g)	$S_a(T)$ – 975-year return period (g)	$S_a(T)$ – 475-year return period (g)
0.05	0.71	0.5	0.35
0.1	1.11	0.78	0.55
0.2	1.35	0.95	0.67
0.3	1.38	0.96	0.68
0.5	1.24	0.85	0.58
1.0	0.76	0.48	0.31
2.0	0.46	0.28	0.17
5.0	0.15	0.08	0.04
PGA	0.61	0.42	0.29
Note: 'g' is gravitational acceleration, 9.81 m/s^2			

5.5 LIQUEFACTION ASSESSMENT AND SITE CLASS

Groundwater was encountered at approximately 1.2 and 1.4 m below ground surface in two of the boreholes. The soils above the water table, including upper sand and gravel and silt to silt with sand soils, are considered not susceptible to liquefaction. The clay deposit had measured PI values greater than 12 and was generally stiff to very stiff. The lower gravel and sand layer was generally dense to very dense. Based on Idriss and Boulanger (2008), the site soils are considered not susceptible to liquefaction.

The soil conditions at the site are defined as Site Class C as per BCBC (2018).

Post-seismic lateral soil spreading and settlement are estimated to be negligible.

5.6 FOUNDATION DESIGN

The proposed SBR and digester expansions can be supported on reinforced concrete raft foundation at a minimum 2.8 m depth below the existing ground surface. Below the raft foundation, a minimum 150 mm thick layer of 19 mm (3/4 in.) clear, angular gravel placed and compacted is recommended. The prepared sub-grade, placement of the gravel layer and compaction should be reviewed by the Geotechnical Engineer prior to rebar or concrete placement.

The proposed raft foundation, constructed about 3 m depth below the existing ground surface founded on stiff to very stiff clay or clayey sand, can be designed using an ultimate bearing resistance of 300 kPa for

Ultimate Limit State (ULS) condition and resistance factor of 0.5 (resulting in a factored bearing resistance of 150 kPa). Under Serviceability Limit States (SLS), the raft foundation can be designed using a bearing resistance of 100 kPa, which corresponds to an estimated settlement of less than 25 mm.

A friction coefficient of 0.7 can be used between the raft or slab-on-grade foundation and the subgrade soils. A modulus of subgrade reaction of 40 MN/m^2/m can be used for structural design.

5.7 TEMPORARY EXCAVATION

All excavations should be carried out in accordance with Part 20 of the current WorkSafeBC regulations (WorkSafeBC, 2013) and be safe for worker entry. Sloped cuts or shoring of the excavations will be required given that excavations are expected to remain open for several days.

Excavations up to about 3 m deep are expected. For excavations within the dense silty sand and stiff to very stiff clay, unsupported excavations should be cut at no steeper than 1H:1V (horizontal to vertical) to a maximum depth of 3 m.

Excavation side slopes should be covered with polyethylene sheets secured to the ground with nails immediately after the cut. This is 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 will 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.

Excavated material should be stockpiled at a horizontal distance greater than the depth of the excavation, measured from the crest. Construction equipment and vehicles should be kept a minimum of 2 m from the crest of all excavations. The Contractor should inspect excavations regularly for signs of instability, and slopes should be flattened if required.

5.8 GROUNDWATER CONTROL DURING CONSTRUCTION

The bottom of the proposed foundations can be below the ground water table. Conventional sumps and pumps can be considered to control the groundwater. If a more robust dewatering method is required, such as well points, the proposed groundwater control method should be reviewed by the Geotechnical Engineer prior to implementation.

The contractor is responsible for ground water control.

5.9 EARTH PRESSURE COEFFICIENTS

Recommended lateral earth pressure parameters are provided in Table 3. The calculated earth pressures should be multiplied by the load factors specified in BCBC (2018) for structural design.

Table 4 Lateral Earth Pressure Parameters

Parameter	Value
Internal friction angle of granular backfill	35°
Interface friction angle between concrete and soil	17°
Unit weight of compacted granular backfill (kN/m^3)	20
Coefficient of at-rest pressure K_o	0.45
Coefficient of active earth pressure K_a	0.27
Coefficient of passive earth pressure K_p	6.4
Coefficient of incremental seismic earth pressure ΔK_E (In addition to static earth pressure)	0.2 (for PGA = 0.29g) 0.36 (for PGA = 0.42g) 0.81 (for PGA = 0.61g)

A compaction induced lateral pressure with an inverted triangular distribution with 20 kPa at the adjacent ground surface, decreasing to zero at 4 m depth can be used to consider soil compaction during construction.

Under seismic loading conditions, seismic earth pressure should be considered in addition to static pressure. Incremental seismic pressure with inverted triangular pressure distribution with zero pressure at the bottom of the wall and maximum pressure at the top can be used as per Metro Vancouver (2017).

5.10 PERIMETER AND SITE DRAINAGE

It is recommended that a perimeter drainage system, consisting of at least 150 mm diameter perforated rigid wall pipe, be placed around the perimeter of the expansion. The perimeter drains should be established at an elevation below the underside of raft slab and be connected to a pumped sump or to a suitable gravity outlet.

The drainage pipes should be surrounded by a minimum of 150 mm of 19 mm drain rock or 19 mm clear crush gravel. The invert elevation of the drain pipes should be at least 150 mm below the underside of the slabs. Final ground surfaces around the buildings should be graded to direct surface runoff away from building areas.

5.11 ACCESS ROAD

Realignment of the existing gravel access road is anticipated to facilitate construction of the proposed SBR and digester expansions. Site preparation for parking areas and the gravel access road should include stripping of organics and excavation to achieve design subgrade elevation. The native subgrade should be proof rolled using a large smooth drum roller and inspected by the Geotechnical Engineer.

Areas exhibiting deflection should be over-excavated as necessary and replaced with compacted granular fill. Backfill for the over-excavated areas should be structural fill. Material specifications, placement method and compaction requirements for the structural fill are as specified in Section 5.3.

5.11.1 Subbase Course

The subbase course should be compacted to 300 mm above the approved subgrade and compacted to at least 95% MPMDD.

5.11.2 Base Course

The base course over should be compacted to 200 mm above the subbase in access roads and to 150 mm thickness at parking areas and compacted to at least 95% MPMDD.

6.0 FIELD REVIEW

The Geotechnical Engineer of Record should be retained to provide geotechnical engineering field review services during construction to verify that the soil conditions encountered are consistent with our design assumptions, and that the intent of our recommendations are satisfied. Geotechnical field reviews would be carried out for the items listed below:

- Shoring construction (if applicable) and excavation
- Review of subgrade preparation and compaction of structure fill
- Backfill placement and compaction for foundation bearing surface
- Backfill placement and compaction for subgrade walls
- Proof rolling of subgrade for new access roads and parking areas
- Review of structure fill density test results

7.0 CLOSURE

This report was prepared for the exclusive use of the District of Sooke and its agents for specific application to the geotechnical scope of work for the Sooke Wastewater Treatment Plant Expansion. 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 Statement of General Conditions included in Appendix A. It is the responsibility of the District of Sooke, 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. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying or unexpected site conditions
- Planning, design, or construction

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.

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APPENDICES

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 FIGURES

LEGEND

- LOT LINE
- EXISTING BUILDING
- PROPOSED PLANT EXPANSION AREA
- BOREHOLE LOCATION

SCALE IN METRES
0 5 10 15 20 25
1:500

Stantec

ORIGINAL SHEET - ANSI B

Sources
- AERIAL IMAGERY FROM MICROSOFT BING WEB MAPPING SERVICE (WMS)

Project Information

Project No.:	111720131
Scale:	1:500
Date:	2021-DEC-01
Drawn by:	G. HUYNH
Checked by:	V. TRAN

Project Location
SOOKE WASTEWATER TREATMENT PLANT
SOOKE, BC

Client/Project
DISTRICT OF SOOKE

SOOKE WASTEWATER TREATMENT PLANT EXPANSION

TITLE
BOREHOLE LOCATION PLAN

Figure No.
1

Appendix C BOREHOLE RECORDS

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 2. 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

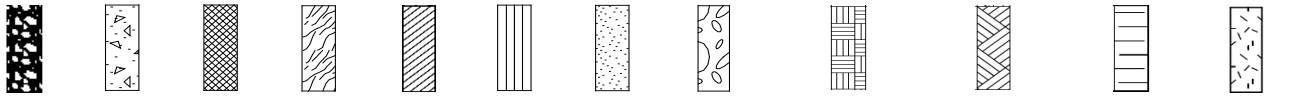
Terminology describing consistency of cohesive soils

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
	kg/cm^2 or 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

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.



Asphalt | Concrete | Fill | Organics | Clay | Silt | Sand | Gravel Cobbles Boulders | Undifferentiated Bedrock | Sedimentary Bedrock | Metamorphic Bedrock | Igneous Bedrock

SAMPLE TYPE

AS, BS, GS	Auger sample; bulk sample; grab sample
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
SO	Sonic tube
SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby Tube or thin wall tube
SV	Shear vane
RC *HQ, NQ, BQ, etc.*	Rock Core; samples obtained with the use of standard size diamond coring bits.

WATER LEVEL

Measured: in standpipe, piezometer, or well

Inferred: seepage noted, or; measured during or at completion of drilling

RECOVERY FOR SOIL SAMPLES

The recovery is recorded as the length of the soil sample recovered in the direct push, split spoon sampler, Shelby Tube, or sonic tube.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test (SPT): 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 for 75 mm or 50/75 mm). 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

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"

Total Core Recovery (TCR) denotes the sum of all measurable rock core recovered in one drill run. The value is noted as a percentage of recovered rock core based on the total length of the drill run.

Solid Core Recovery (SCR) is defined as total length of solid core divided by the total drilled length, presented as a percentage. Solid core is defined as core with one full diameter.

Rock Quality Designation (RQD) is a modified core recovery that incorporates only pieces of solid core that are equal to or greater than 10 cm (4") along the core axis. It is calculated as the total cumulative length of solid core (> 10 cm) as measured along the centerline of the core divided by the total length of borehole drilled for each drill run or geotechnical interval, presented as a percentage. RQD is determined in accordance with ASTM D6032.

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 quality

Rock Mass Quality	Rock Quality Designation Number (RQD)	Alternate (Colloquial) Rock Mass Quality	
Very Poor Quality	0-25	*Very Severely Fractured*	*Crushed*
Poor Quality	25-50	*Severely Fractured*	*Shattered or Very Blocky*
Fair Quality	50-75	*Fractured*	*Blocky*
Good Quality	75-90	*Moderately Jointed*	*Sound*
Excellent Quality	90-100	*Intact*	*Very Sound*

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.

Terminology describing rock with respect to discontinuity and bedding spacing

Spacing (mm)	Discontinuities Spacing	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*

BOREHOLE RECORD

BH21-01

CLIENT: **District of Sooke**
PROJECT: **Sooke Waste Water Treatment Plant Expansion**
LOCATION: **7113 West Coast Road**
DATE BORED: **November 4, 2021**

BH COORDINATES [UTM 10U] 5357237.0N 444627.0E
WATER LEVEL: **N/A**

PROJECT NO. : **111720131**
BH ELEVATION: **7.6m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	7.6	Dark brown, poorly graded SAND with gravel (SP), moist, trace organics, trace roots/wood debris, trace silt		GS	1		13	
							63	
1	6.4			GS	2		65	
	6.1	Yellowish brown, sandy lean CLAY (CL) with gravel, moist		GS	3		100	
		Very stiff, greyish, fat CLAY (CH), moist		GS	4			Percent Passing #200: 57%
2								
3	4.6			GS	5			
	4.3	Stiff, grey, sandy lean CLAY (CL), moist, trace to few gravel		GS	6			
		End of borehole BH21-01 at 3.35m -Auger refusal encountered -No ground water observed						
4								
5								
6								
7								
8								
9								
10								
11								
12								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT/DCPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 7 6 5 4 3 2 1 0 -1 -2 -3 -4

BACKFILL SYMBOL
BENTONITE ASPHALT DRILL CUTTINGS GROUT SAND CONCRETE SLOUGH

Drilling Contractor: Grassroots Drilling Ltd.
Drilling Method: Solid Stem Auger
Completion Depth: 3.35 m

Logged By: NP
Reviewed By: BH
Page 1 of 1

BOREHOLE RECORD

BH21-02

CLIENT: **District of Sooke**
PROJECT: **Sooke Waste Water Treatment Plant Expansion**
LOCATION: **7113 West Coast Road**
DATE BORED: **November 4, 2021**

BH COORDINATES [UTM 10U] 5357226.0N 444601.0E
WATER LEVEL: **N/A**

PROJECT NO. : **111720131**
BH ELEVATION: **7.6m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	7.6							
		Greyish brown, silty GRAVEL with sand (GM), wet		GS	1		16	Percent Passing #200: 17%
	6.8						53	
1		Grey, silty SAND with gravel (SM), moist		GS	2			Percent Passing #200: 18%
	6.1							
2		End of borehole BH21-02 at 1.51m -Auger refusal encountred on inferred boulder						

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT/DCPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 7 6 5 4 3 2 1 0 -1 -2 -3 -4

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: Grassroots Drilling Ltd.
Drilling Method: Solid Stem Auger
Completion Depth: 1.51 m

Logged By: NP
Reviewed By: BH
Page 1 of 1

BOREHOLE RECORD

BH21-03

CLIENT: **District of Sooke**
PROJECT: **Sooke Waste Water Treatment Plant Expansion**
LOCATION: **7113 West Coast Road**
DATE BORED: **November 4, 2021**

BH COORDINATES [UTM 10U] 5357223.0N 444613.0E
PROJECT NO. : **111720131**
BH ELEVATION: **7.5m**
DATUM: **Geodetic**
WATER LEVEL: **1.4 m on November 4, 2021**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	7.5							
	7.1	Dark brown, silty lean CLAY (CL/ML), moist, trace to few sand, trace gravel, trace organics, trace rootlets,		GS	1		6	
		Medium to very stiff, brown, lean CLAY (CL), moist, mottled		GS	2		2	
1	6.3						8	
		Grey, silty clayey SAND with gravel (SC/SM), moist		GS	3		17	
							31	
2				GS	4		33	
							100	
	4.7			GS	5			
3		Greyish brown, silty GRAVEL with sand (GM), wet		GS	6			Sieve at 3.0 m G S Fines 55% 30% 14%
	3.8							
4		Greyish brown, poorly graded GRAVEL with clay and sand (GP-GC), wet		GS	7			
				GS	8			
5								
	1.5			GS	9			
6		Grey, silty SAND with gravel (SM), moist		GS	10			
7								
				GS	11			Percent Passing #200: 34%
8								
				GS	12			
9				GS	13			Percent Passing #200: 33%
10								
	-3.2			GS	14			
11		End of borehole BH21-03 at 10.7m -Ground water observed in open borehole at 1.4m						
12								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT/DCPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)
7 6 5 4 3 2 1 0 -1 -2 -3 -4

▽ Water Level Observed During Drilling

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Grassroots Drilling Ltd.
Drilling Method: Solid Stem Auger
Completion Depth: 10.7 m

Logged By: NP
Reviewed By: BH

BOREHOLE RECORD

BH21-04

CLIENT: **District of Sooke**
PROJECT: **Sooke Waste Water Treatment Plant Expansion**
LOCATION: **7113 West Coast Road**
DATE BORED: **November 4, 2021**

BH COORDINATES [UTM 10U] 5357230.0N 444636.0E
PROJECT NO. : **111720131**
BH ELEVATION: **7.5m**
DATUM: **Geodetic**
WATER LEVEL: **1.2 m on November 4, 2021**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	7.5							
0 to 1.5		Soft, dark brown, clayey SILT (ML/CL), moist, trace sand, trace gravel, trace organics, trace rootlets		GS	1			
				GS	2		2	Percent Passing #200: 79%
				GS	3		2	
							3	
1 ▽				GS	4		6	
1.5 to 3.7	6.0	Stiff to very stiff, greyish brown, lean CLAY (CL), moist, trace to few sand, trace gravel, trace rootlets		GS	5		9	Percent Passing #200: 77%
							13	
2		-Hard below 2.4m					29	
							46	
3				GS	6		39	
							43	
							55	
	3.7			GS	7		60	
4		End of borehole BH21-04 at 3.8m -Auger refusal encountered -Ground water observed in open borehole at 1.2m						50/88mm >>

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 7 6 5 4 3 2 1 0 -1 -2 -3 -4

▽ Water Level Observed During Drilling

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: Grassroots Drilling Ltd.
Drilling Method: Solid Stem Auger
Completion Depth: 3.8 m

Logged By: NP
Reviewed By: BH
Page 1 of 1

Appendix D LABORATORY TEST RESULTS

Stantec

Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client:	District of Sooke
Project Name:	WWTP Expansion
	-
Project No:	111720131.200.006
Date Received:	November 5, 2021
Date Tested:	November 15, 2021
Tested By:	WdC

OFFICE
4515 Central Blvd.
Suite 500
Burnaby, BC
Canada V5H 0C6
Tel: (604) 436-3014

LABORATORY
3711 North Fraser Way
Suite 400
Burnaby, BC
Canada V5J 5J2
Tel: (604) 436-3014

Sample : BH21-01, BS-4, 1.50m. - 1.80m.

LIQUID LIMIT

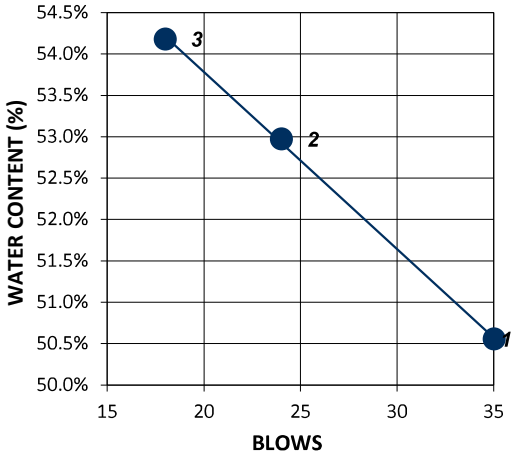
Trial	1	2	3
No. of Blows	35	24	18
Tare No.	14A	A6	H13
Wt. Sa. (wet+tare)(g)	8.04	7.49	10.08
Wt. Sa. (dry+tare)(g)	5.77	5.35	6.98
Wt. Tare (g)	1.28	1.29	1.27
Wt. Dry Soil (g)	4.5	4.1	5.7
Wt. Water (g)	2.3	2.1	3.1
Water Content (%)	50.6%	53.0%	54.2%

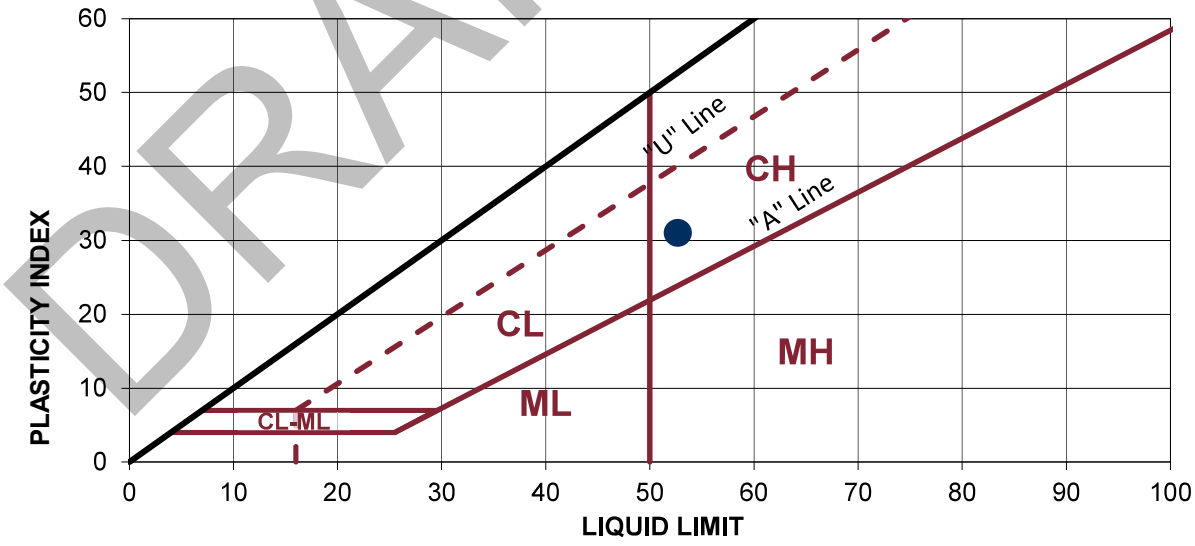
PLASTIC LIMIT

Trial	1	2
Tare No.	2	5
Wt. Sa. (wet+tare)(g)	30.42	27.02
Wt. Sa. (dry+tare)(g)	28.69	25.92
Wt. Tare (g)	20.86	21.05
Wt. Dry Soil (g)	7.8	4.9
Wt. Water (g)	1.7	1.1
Water Content (%)	22.1%	22.6%

RESULTS

LL	**53**
PL	**22**
PI	**31**
Natural MC (%)	
24.5%	





Comments:

Reviewed By: Wil de Castro, AScT
Digitally signed by Wil de Castro, AScT
Date: 2021.11.18 08:02:18 -08'00'

Stantec

Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client:	District of Sooke
Project Name:	WWTP Expansion
	-
Project No:	111720131.200.006
Date Received:	November 5, 2021
Date Tested:	November 15, 2021
Tested By:	WdC

OFFICE
4515 Central Blvd.
Suite 500
Burnaby, BC
Canada V5H 0C6
Tel: (604) 436-3014

LABORATORY
3711 North Fraser Way
Suite 400
Burnaby, BC
Canada V5J 5J2
Tel: (604) 436-3014

Sample : BH21-03, BS-3, 1.20m. - 1.50m.

LIQUID LIMIT

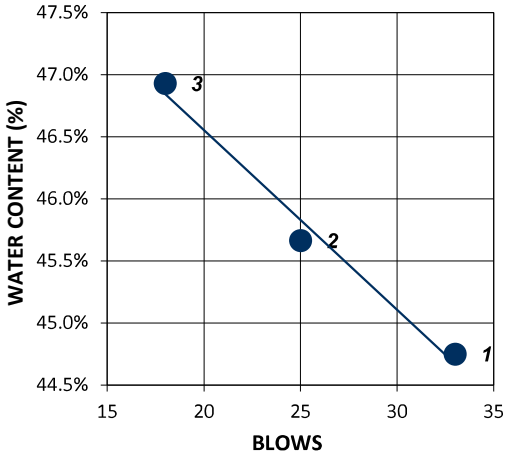
Trial	1	2	3
No. of Blows	33	25	18
Tare No.	A226	KK7	2C
Wt. Sa. (wet+tare)(g)	9.37	9.17	9.99
Wt. Sa. (dry+tare)(g)	6.87	6.70	7.20
Wt. Tare (g)	1.28	1.28	1.27
Wt. Dry Soil (g)	5.6	5.4	5.9
Wt. Water (g)	2.5	2.5	2.8
Water Content (%)	44.8%	45.7%	46.9%

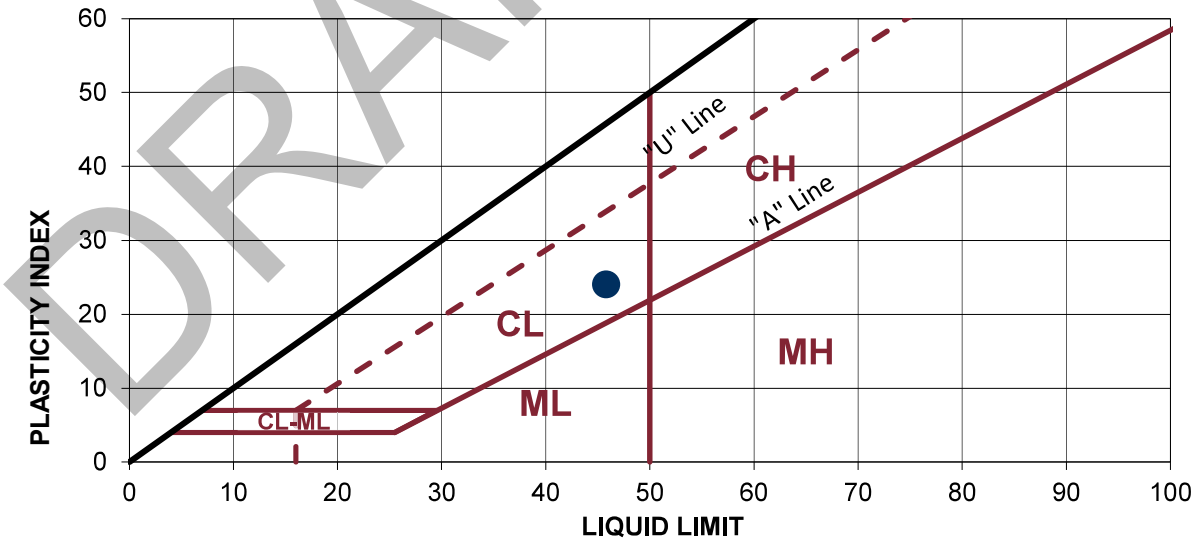
PLASTIC LIMIT

Trial	1	2
Tare No.	3	8
Wt. Sa. (wet+tare)(g)	28.83	29.93
Wt. Sa. (dry+tare)(g)	27.44	28.32
Wt. Tare (g)	21.03	21.00
Wt. Dry Soil (g)	6.4	7.3
Wt. Water (g)	1.4	1.6
Water Content (%)	21.8%	22.0%

RESULTS

LL	**46**
PL	**22**
PI	**24**
Natural MC (%)	
24.8%	





Comments:

Reviewed By: Wil de Castro, AScT

Digitally signed by Wil de Castro, AScT
Date: 2021.11.18 08:02:37 -08'00'

Stantec

Grain Size Analysis

ASTM D6913

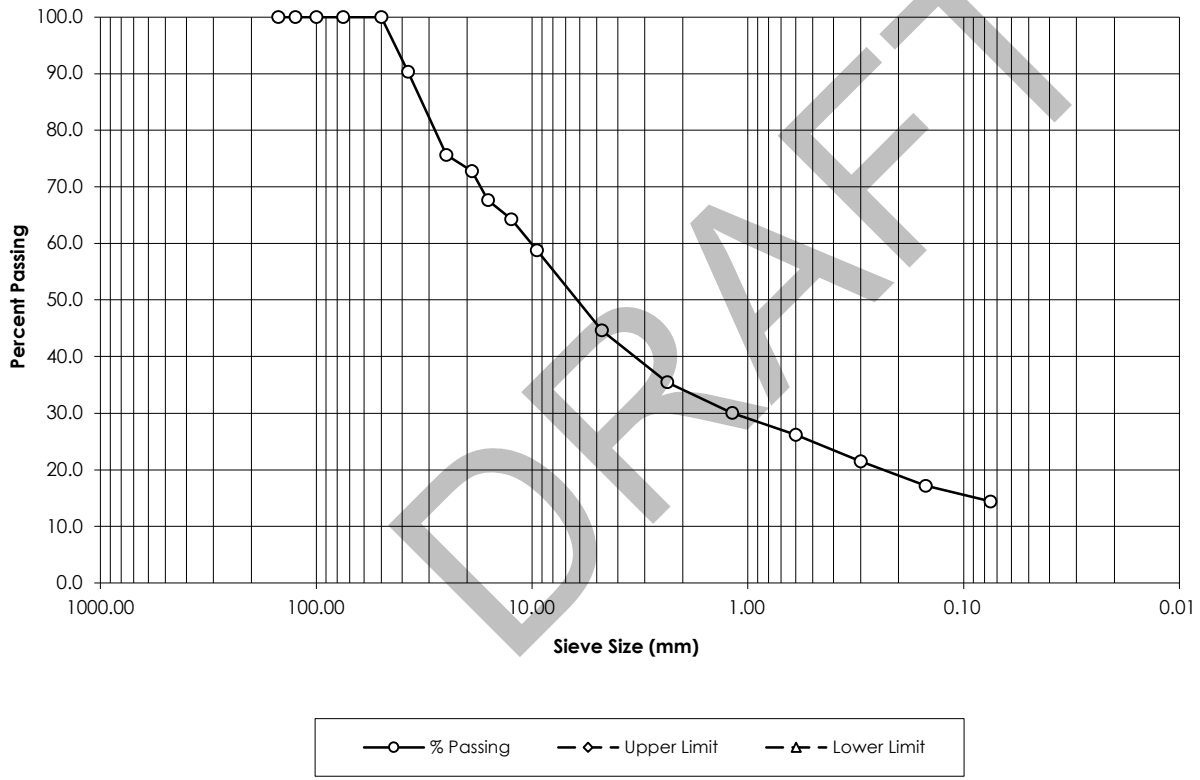
Client: District of Sooke
Project Name: WWTP Expansion
-
Project No: 111720131.200.006

OFFICE
4515 Central Blvd.
Suite 500
Burnaby, BC
Canada V5H 0C6
Tel: (604) 436-3014

LABORATORY
3711 North Fraser Way
Suite 400
Burnaby, BC
Canada V5J 5J2
Tel: (604) 436-3014

SAMPLE No.: BH21-03, BS-6, 3.00m-3.30m
SOURCE: -
TESTED BY: WdC

DATE RECEIVED: November 5, 2021
DATE TESTED: November 16, 2021
SAMPLE DESCRIPTION: silty GRAVEL with sand, (GM)



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	**100.0**	-	-
125.0	**100.0**	-	-
100.0	**100.0**	-	-
75.0	**100.0**	-	-
50.0	**100.0**	-	-
37.5	**90.3**	-	-
25.0	**75.6**	-	-
19.0	**72.8**	-	-
16.0	**67.6**	-	-
12.5	**64.3**	-	-
9.5	**58.8**	-	-
4.75	**44.6**	-	-
2.36	**35.5**	-	-
1.18	**30.0**	-	-
0.600	**26.1**	-	-
0.300	**21.5**	-	-
0.150	**17.2**	-	-
0.075	**14.4**	-	-

Cobble:	-	D_{10}:	-
Gravel:	55.4%	D_{30}:	1.18
Sand:	30.2%	D_{60}:	10.19
Fines:	14.4%	C_U:	-
		C_c:	-

Comments:

Reviewed by:
Wil de Castro, AScT
Digitally signed by Wil de Castro, AScT
Date: 2021.11.18 08:03:01 -08'00'

Your P.O. #: 111720131.200.006
Your Project #: 111720131
Site Location: Sooke
Your C.O.C. #: 43719

Attention: Ben Huynh

STANTEC CONSULTING LTD
Metrotower III
Suite 500, 4730 Kingsway
BURNABY, BC
CANADA V5H 4M1

Report Date: 2021/11/16
Report #: R3099905
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C187403
Received: 2021/11/12, 15:40

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Conductivity (Soluble)	2	2021/11/15	2021/11/15	BBY6SOP-00029	SM 23 2510 B m
pH (2:1 DI Water Extract)	2	2021/11/16	2021/11/16	BBY6SOP-00028	BCMOE BCLM Mar2005 m
Saturated Paste	2	2021/11/15	2021/11/15	BBY6SOP-00030	BC Lab Manual 2015 m
Sulphate (soluble) (soil)	2	2021/11/15	2021/11/15	BBY6SOP-00017	SM 23 4500-SO42- E m
Soluble Sulphate (SO4) Ion Calc. (mg/kg)	2	N/A	2021/11/15	BBY WI-00033	Auto Calc

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Your P.O. #: 111720131.200.006
Your Project #: 111720131
Site Location: Sooke
Your C.O.C. #: 43719

Attention: Ben Huynh

STANTEC CONSULTING LTD
Metrotower III
Suite 500, 4730 Kingsway
BURNABY, BC
CANADA V5H 4M1

Report Date: 2021/11/16
Report #: R3099905
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C187403
Received: 2021/11/12, 15:40

Encryption Key

Bureau Veritas
16 Nov 2021 15:07:09

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Geraldlyn Gouthro, Key Account Specialist
Email: geraldlyn.gouthro@bureauveritas.com
Phone# (780)577-7173
==========
This report has been generated and distributed using a secure automated process.
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Job #: C187403
Report Date: 2021/11/16

STANTEC CONSULTING LTD
Client Project #: 111720131
Site Location: Sooke
Your P.O. #: 111720131.200.006
Sampler Initials: PN

RESULTS OF CHEMICAL ANALYSES OF SOIL

Bureau Veritas ID		AKM747		AKM748		
Sampling Date		2021/11/04		2021/11/04		
COC Number		43719		43719		
	UNITS	BH21-01, BS-3, 1.21m - 1.51m	RDL	BH21-04, BS-4, 1.20m- 1.50m	RDL	QC Batch
ANIONS						
Soluble Sulphate (SO4)	mg/L	23	20	<20	20	A425936
Calculated Parameters						
Soluble Sulphate (SO4)	mg/kg	14	12	<10	10	A424005
Physical Properties						
Soluble (2:1) pH	pH	7.32	N/A	5.99	N/A	A426915
Soluble Parameters						
Soluble Conductivity	uS/cm	162	5.0	287	5.0	A426362
Saturation %	%	60.8	N/A	52.2	N/A	A425289

RDL = Reportable Detection Limit
N/A = Not Applicable

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

GENERAL COMMENTS

Results relate only to the items tested.

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Bureau Veritas Job #: C187403
Report Date: 2021/11/16

QUALITY ASSURANCE REPORT

STANTEC CONSULTING LTD
Client Project #: 111720131
Site Location: Sooke
Your P.O. #: 111720131.200.006
Sampler Initials: PN

			Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
A425289	Saturation %	2021/11/15			0	%	0	30	104	75 - 125
A425936	Soluble Sulphate (SO4)	2021/11/15	94	80 - 120	<20	mg/L			91	75 - 125
A426362	Soluble Conductivity	2021/11/15	102	70 - 130	<5.0	uS/cm			88	75 - 125
A426915	Soluble (2:1) pH	2021/11/16	100	97 - 103			0.22	N/A		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Bureau Veritas Job #: C187403
Report Date: 2021/11/16

STANTEC CONSULTING LTD
Client Project #: 111720131
Site Location: Sooke
Your P.O. #: 111720131.200.006
Sampler Initials: PN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Custody Tracking Form

W43719

Please use this form for custody tracking when submitting the work instructions via eCOC (electronic Chain of Custody). Please ensure your form has a barcode or a Bureau Veritas eCOC confirmation number in the top right hand side. This number links your electronic submission to your samples. This form should be placed in the cooler with your samples.

First Sample: BH21-01, BS-3, 1.21m - 1.51m
Last Sample: BH21-04, BS-4, 1.20m-1.50m
Sample Count: 2

Relinquished By				Received By			
NANTHINEE PORCHELVAM	P. Nanthinee	Date	2021/11/12	ALFRED NGAI		Date	2021/11/12
		Time (24 HR)	15:30			Time (24 HR)	15:40
		Date				Date	
		Time (24 HR)				Time (24 HR)	
		Date				Date	
		Time (24 HR)				Time (24 HR)	

Unless otherwise agreed to, submissions and use of services are governed by Bureau Veritas' standard terms and conditions which can be found at www.bvna.com.

Triage Information

Sampled By (Print): P. Nanthinee

# of Coolers/Pkgs:

Rush ☐ Immediate Test ☐ Food Residue ☐

Micro ☐ Food Chemistry ☐

***** LABORATORY USE ONLY *****

Received At: Lab Comm

Labeled By:

Verified By:

C187403_COC

Custody Seal		Cooling Media	Temperature °C		
Present (Y/N)	Intact (Y/N)	Present (Y/N)	1	2	3
N	N/A	N	20	20	20
Drinking Water Metals Preservation Check Done (Circle)				YES	NO

COR FCD-00383/3

Page 1 of 1

eCOC: W43719

Project Information:	C187403
Job Received:	2021/11/12 15:40
Results Required By:	2021/11/17
Expected Arrival:	2021/11/12 15:30
Submitted By:	Wil Decastro
Submitted To:	Burnaby ENV: 4606 Canada Way

Invoice Information

Attn: ACCOUNTS PAYABLE
STANTEC CONSULTING LTD
Metrotower III
Suite 500, 4730 Kingsway
BURNABY , BC , V5H 4M1
Email to:
sapinvoices@stantec.com

Report Information

Attn: Ben Huynh
STANTEC CONSULTING LTD
Metrotower III
Suite 500, 4730 Kingsway
BURNABY , BC , V5H 4M1
Email to:
ben.huynh@stantec.com

Project Information

Quote #:	C00413
PO/AFE#:	111720131.200.006
Project #:	111720131
Site Location:	Sooke
Task Order:	200.006

Analytical Summary

A: Due On 2021/11/17

Client Sample ID	Clnt Ref	Sampling Date/Time	Matrix	#Cont	Conductivity (Soluble)	PH (2:1 DI Water Extract)	Saturated Paste	Soluble Sulphate (SO4) Ion Calc. (mg/kg)
BH21-01, BS-3, 1.21m - 1.51m	1	2021/11/04	SOIL	1	A	A	A	A
BH21-04, BS-4, 1.20m- 1.50m	2	2021/11/04	SOIL	1	A	A	A	A

Deadlines are estimates only and are subject to change. Please refer to your Job Confirmation report for final due dates.

Submission Information

# of Samples: 2

APPENDIX F ARCHEOLOGICAL INVESTIGATIONS

Stantec Consulting Ltd.
11-2042 Mills Road, Sidney BC V8L 5X4

February 8, 2022
File: 111720131

District of Sooke
2205 Otter Point Rd
Sooke, BC
V9Z 1J2

Reference: Archaeological Desktop Review –– Sooke Wastewater Treatment Plant Expansion Project, Sooke, British Columbia

INTRODUCTION

Stantec Consulting Ltd. (Stantec) conducted an archaeological desktop review of the proposed Sooke Wastewater Treatment Plant (WWTP) Expansion project (the Project) at 7113 West Coast Road, Sooke, British Columbia. The archaeological desktop review was undertaken with the following key objectives:

- Identify the Indigenous group traditional territories within which the Project is located.
- Determine the location, nature, and distribution of recorded archaeological resources near the Project area.
- Identify and assess archaeological resource potential or sensitivity within the Project area.
- Assess potential impacts to archaeological sites
- Provide recommendations on the appropriate methods and scope for subsequent archaeological studies, if needed

Archaeological sites and objects on private and Provincial Crown land in British Columbia are protected under the *Heritage Conservation Act* (*HCA*), which is administered by the Archaeology Branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Heritage resources specifically protected by the *HCA* include Provincial heritage sites, burial places with historical or archaeological value, aboriginal rock paintings or carvings, sites with evidence of human habitation or use before AD 1846 and heritage wrecks. The Lieutenant Governor in Council may also make regulations to define the extent of types of sites protected by the *HCA*. Sites that postdate AD 1846 can be protected under the HCA if they area of special historical interest.

Reference: Archaeological Desktop Review — Sooke Wastewater Treatment Plant Expansion Project, Sooke, British Columbia

METHODS

The archaeological desktop review included a review of the Province's Consultative Areas Database (CAD), the Remote Access to Archaeological Data (RAAD) application and Provincial Archaeological Report Library (PARL) maintained by the Archaeology Branch, publicly available ethnographic and historical information, and satellite imagery.

The evaluation of archaeological potential was based on consideration of the Project setting in relation to archaeological sites recorded in RAAD and the presence/absence of terrain characteristics typically associated with archaeological sites (e.g., level, well-drained landforms close to hydrological features).

This desktop review is intended to provide a preliminary evaluation of potential impacts to archaeological resources and did not involve input from Indigenous groups with the understanding that the District will engage them on the Project. Indigenous groups may possess other knowledge or be aware of other information sources relevant to the assessment of archaeological or traditional use site impacts and evaluation of potential.

RESULTS

The Project area is adjacent to the north boundary of T'Sou-ke Nation Reserve 2, approximately 500 m east of the Sooke Bay shoreline, and falls within the traditional territories of Sc'ianew First Nation and T'sou-ke First Nation (Figure 1). A small drainage feature is mapped as intersecting the southeast portion of the Project area.

The Project area is predominantly characterized by developed land associated with the existing WWTP and related infrastructure and lacks any prominent landforms. Within the Project area, the small drainage feature is not visible on satellite imagery nor associated with any distinct terracing or other landform development. It is likely that the natural drainage channel has been obscured due to past disturbance associated with the development of the existing WWTP.

There are no archaeological sites recorded in the Project area. The nearest site, DcRw-41, is a subsurface shell midden site on the shoreline of Sooke Bay, approximately 475 m west-southwest of the Project area (Figure 1). There are no other archaeological sites recorded within 1 km.

The Capital Regional District archaeological potential model (APM) identifies an area of high archaeological potential associated with the small drainage feature which intersects the southeast portion of the Project area (Figure 1).

According to Provincial records, an archaeological impact assessment (AIA) of the Sooke Wastewater Service Project was undertaken in 2004 under *HCA* Permit 2004-0387. The AIA included surface inspection and subsurface shovel testing of a section of a proposed sewer outfall right-of-way at 7117 West Coast Road and resulted in the identification of DcRw-41 (Nicholls 2004). No other archaeological sites were

identified during this study which included both surface and subsurface inspection to the north, northwest, west and southwest of the Project area. No other archaeological field studies have been carried out in or near the Project area.

It is our understanding that ground disturbing activities for the Project will be confined to areas impacted by previous WWTP development (i.e., existing surface and subsurface infrastructure, paved surfaces, etc.).

Based on the results of the 2004 AIA, the lack of any prominent landforms in the Project area, the level of past disturbance associated with initial WWTP development, and the nature of proposed Project development plans, there is low potential for archaeological deposits to be present in the Project area.

RECOMMENDATIONS

No further archaeological assessment is recommended for the Project. However, it is recommended that the District engage the Sc'ianew First Nation and T'sou-ke First Nation to request their input they may want to provide.

Although an attempt was made to evaluate the potential for the Project to impact archaeological resources, as with all archaeological studies, the possibility exists that unidentified archaeological resources are present. In the unlikely event that suspected archaeological resources are encountered during proposed Project activities, all work in the immediate vicinity of the find(s) must cease and the Archaeology Branch contacted for appropriate guidance and direction.

Regards,

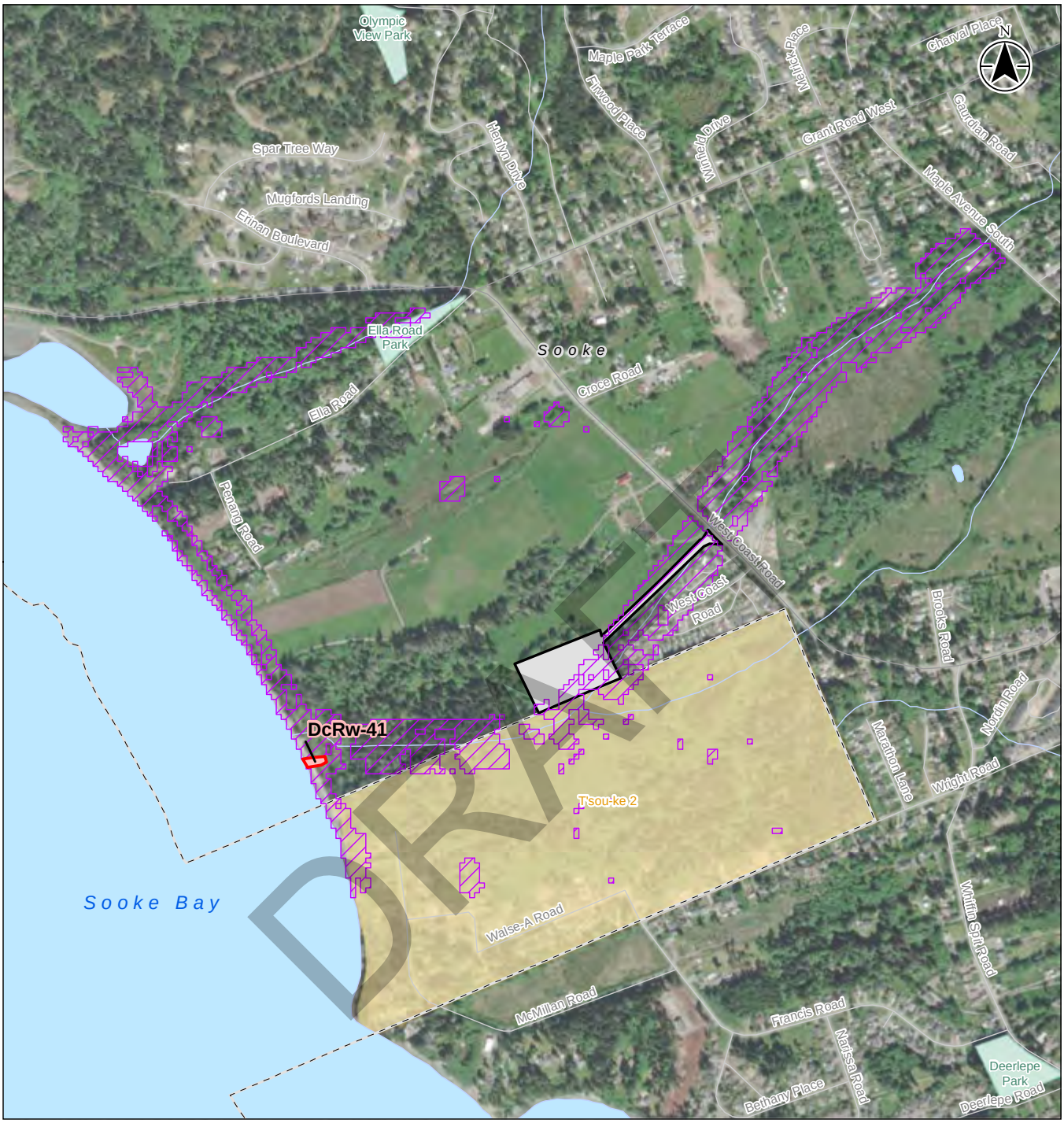
Stantec Consulting Ltd.

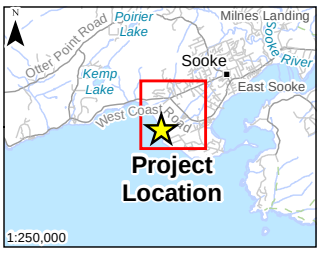
Ryan Spady BA, RPCA
Associate, Senior Archaeologist
Phone: 250-896-6657
Ryan.Spady@stantec.com

Jonathan (Jonny) Hall MA, RPCA
Senior Associate
Phone: 250-655-6067
Jonny.Hall@stantec.com

REFERENCES

Nicholls, Nicole. 2004. Archaeological Impact Assessment for the Sooke Wastewater Service Project, Sooke, BC. *Heritage Conservation Act Permit* 2004-0387. Report on file with the Archaeology Branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Victoria, BC.





- Road
- Local Street
- Watercourse
- Waterbody
- First Nations Reserve
- Local Greenspace
- Municipal Boundary
- Archaeological Site
- High Potential - CRD Archaeological Potential Model
- Project

0 100 200 300 400 500

Meters

1:12,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

Stantec

Project Location: Sooke, British Columbia

Project Number: 111720131
Prepared by PKASIANCHUK on 20220208
Requested by RSPADY on 20220208
Checked by TCARDINAL on 20220208

Client/Project/Report

District of Sooke
F+WWTP Expansion

Figure No.

1

Title

Archaeological Review Results

DRAFT

S:\1232\projects\111720131\figures\fig1_111720131_archaeological_review.mxd Revised: 2022-02-08 By: pkasianchuk

Appendix B Geotechnical Report

Sooke Wastewater Treatment Plant Expansion

Draft Geotechnical Report – Rev A

February 7, 2022

Prepared for:

District of Sooke
2205 Otter Point Road
Sooke, BC V9Z 1J2

Prepared by:

Stantec Consulting Ltd.,
500 – 4515 Central Boulevard
Burnaby, BC V5H 0C6

Revision	Date	Description
A	February 7, 2022	Issued for Review

Table of Contents

LIST OF APPENDICES

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) has been retained by the District of Sooke (the District) to provide consulting engineering services for the Sooke Wastewater Treatment Plant (WWTP) expansion design, contract administration and project management services (the Project). This report presents the details of the geotechnical exploration program, geotechnical analysis results, and geotechnical design recommendations for the Project.

The geotechnical work was completed in general accordance with Task A6 outlined in our proposal dated August 19, 2021, in response to District of Sooke's Request for Proposal, RFP 2021-WW002.

The geotechnical works consisted of the following:

- Review of project drawings and published information on subsurface soil and groundwater conditions at the Project area
- Execution of a geotechnical subsurface exploration program
- Laboratory testing of soil samples collected during the geotechnical exploration
- Geotechnical engineering analyses
- Geotechnical recommendations pertinent to the design and construction of the proposed expansion.

This report should be read in conjunction with the Statement of General Conditions in **Appendix A**.

1.1 PROJECT UNDERSTANDING

The District of Sooke built a wastewater collection system and wastewater treatment plant in Sooke, BC which serves a core area of 5,500 residents including the downtown commercial and industrial core. The collection system comprises over 58 km of piping and seven (7) municipally operated pump stations. The construction of the wastewater treatment plant began in December 2004 with completion in November 2005.

Growing demand for the existing system and expected increases in projected future flows has caused the need for greater capacity at the WWTP, and the existing plant was designed to allow for future expansion. The proposed expansion of the Sooke WWTP will include various unit processes/systems:

- Screened raw sewage splitter box
- Sequencing Batch Reactor (SBR)
- Aerobic Digester
- SBR blower and aeration diffusion system
- Digester blower and aeration diffusion system
- Motor Control Centre Extension
- Electrical and control systems
- Programmable Logic Controller replacement
- Generator replacement

We understand the existing WWTP includes two SBR's and two digesters. The proposed construction includes a third SBR and digester (SBR #3 and Digester #3) and will be constructed against the south wall of SBR #2 and Digester #2 (**Figure 1, Appendix B**). The new SBR and digesters will be similar in size to the existing structures (i.e., 10 m wide, 39 m long and 6 m tall). Conceptual design drawings indicate the proposed structure foundations will consist of 500 mm thick raft slabs and will be constructed to match the elevation of the existing SBR's at El. 5.16 m.

We further understand that a fourth SBR (10 m wide and 29 m long) located against the south wall of the proposed SBR #3 is being considered for future construction. If the District of Sooke opts to proceed, the foundations for SBR #4 will be constructed at the same time as the construction of SBR #3 and Digester #3.

The proposed WWTP expansion buildings will be designed using seismic design criteria for Post-Disaster structures.

1.2 REFERENCE REPORTS AND DRAWINGS

The following is a list of documents that were reviewed prior to carrying out the geotechnical scope of work. Outside references from literature are reported separately in the respective sections of the report.

- Stantec Consulting Ltd. "Sooke Wastewater Treatment Plant Expansion Conceptual Design Report", dated February 21, 2020
- Stantec Consulting Ltd. Sooke Wastewater Treatment Plant Expansion preliminary design drawings, dated February 21, 2020

1.3 DESIGN CODES AND STANDARDS

Geotechnical engineering analyses and recommendations were developed in accordance with the following design codes, standards, and guidelines:

1. British Columbia Building Code, BCBC (2018)
2. National Building Code of Canada, NBCC (2015)
3. Canadian Foundation Engineering Manual, CFEM (2006)
4. Metro Vancouver Engineering Standards – Lateral Pressure on Walls GEO-00107 (2017)

2.0 SITE DESCRIPTION AND GEOLOGY

2.1 PHYSICAL SETTING

The site address is 7113 West Coast Road, in Sooke, British Columbia. The existing WWTP buildings and proposed expansion area is located approximately 350 m southwest of West Coast Road (Highway 14) and accessible via a gravel road. There are residential houses located to the east, and undeveloped land to the north, south and west of the WWTP. The surrounding area is grass covered, with the gravel access road extending through the centre of the site.

Elevations and grade changes have been estimated using aerial imagery and contours available on the District of Sooke's online Arc GIS Maps, and from topographic survey data for the site completed by McIlvaney Riley BC Land Surveyors on February 28, 2020. Elevations are assumed to be referenced to the Geodetic Datum. The entrance to the WWTP site at West Coast Road is at an elevation of El. 18 m (approx.). The gravel access road slopes down to the site at a 3% grade (approx.) over a distance of 350 m to an elevation of El. 7.6 m (approx.). The ground surface around the WWTP buildings is at an elevation of El. 7.6 m (approx.), except against the exterior walls of the existing SBR and Digesters where the ground surface is 1 to 2 m higher; i.e., El. 8.6 m (approx.) along the south side, and El. 9.6 m (approx.) along the west side.

2.2 SURFICIAL GEOLOGY

Based on "Open file 1993025 - Surficial geology of the Sooke area" (Blyth and Rutter, 1993), the surficial geology at the site can be generally described as fluvial sediment deposited in association with glacier ice, generally consisting of gravel and sand.

3.0 GEOTECHNICAL EXPLORATION

3.1 SITE EXPLORATION

A geotechnical exploration was carried out at the project site on November 04, 2021, consisting of four solid-stem auger boreholes (BH21-01 to BH21-04). Boreholes BH21-01 and BH21-02 were completed within the proposed footprint of SBR #3 and Digester #3, and boreholes BH21-03 and BH21-04 were completed in the proposed footprint of SBR #4. A BC One Call was completed prior to mobilizing equipment and personnel to the site. Prior to drilling, the presence of existing underground utilities near the proposed boreholes were verified using ground penetrating radar (GPR) equipment. This utility clearance work was caried out by ScanPlus Locating Ltd. As a subcontractor to Stantec.

All boreholes were advanced using 140 mm outside diameter solid-stem augers. In boreholes BH21-01 and BH21-04, auger refusal due to high soil stiffness was encountered at 3.4 m and 3.8 m depth below ground surface, respectively. An inferred boulder was encountered in BH21-02 at 1.5 m depth causing termination of the borehole. Borehole BH21-03 was terminated at a target depth of 10.7 m.

The borehole coordinates were measured using a handheld GPS during the site exploration. Approximate locations of the test holes are shown in Figure 1. A summary of the boreholes is presented in Table 1.

Table 1 Summary of Geotechnical Exploration

ID	UTM Coordinates [1]		Approximate Ground Elev. (m)	Drilling Depth of Borehole Below Ground Surface (Elev.) (m)
	Easting (m)	Northing (m)		
BH21-01	444627	5357237	7.6	3.4 (4.2)
BH21-02	444601	5357226	7.6	1.5 (6.1)
BH21-03	444613	5357223	7.5	10.7 (-3.2)
BH21-04	444636	5357230	7.5	3.8 (3.7)

Note:
[1] Coordinates were collected using a handheld GPS device.
Elevations are referenced to Geodetic Datum

Dynamic Cone Penetration Tests (DCPT) were completed prior to drilling at each of the borehole locations. The purpose of the DCPT test is to assess the compactness and consistency of the subsurface soils. The DCPT utilizes a 63.5 kg hammer, free-falling from 760 mm height on top of an anvil, which is connected to 45 mm diameter AWJ steel rods. A disposable 60 mm diameter cone is connected to the bottom end of the AWJ rods. With each blow the cone penetrates the ground, and the “blow counts” are recorded for each 300 mm of penetration. The DCPT was generally terminated when the blow counts exceeded 50 blows per 300 mm of penetration. The DCPT blow counts are presented on the borehole records in **Appendix C**.

A Stantec engineer coordinated the exploration work, located the boreholes on site, classified the soils encountered within the boreholes, maintained a detailed field log of the boreholes, collected soil samples for laboratory testing, and observed and recorded pertinent site features. Soil descriptions presented on the borehole records are based on the soil samples collected in the field, and are in general accordance with the American Society for Testing and Materials (ASTM) standards D2487 and D2488 for the Unified Soil Classification System (USCS) and the information presented on the “Symbols and Terms Used in Borehole and Test Pit Records” in **Appendix C**.

3.2 LABORATORY TESTING

Geotechnical laboratory testing on representative soil samples was performed in Stantec’s laboratory and included natural moisture content, grain size distribution, and Atterberg Limits. Soil chemistry and corrosivity tests were carried out on representative soil samples at the Bureau Veritas Laboratory (BV Labs) in Burnaby, British Columbia.

The results of the laboratory testing program are summarized on the borehole logs in **Appendix C** and the detailed test reports are presented in **Appendix D**.

4.0 SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

In general, the subsurface conditions encountered consisted of sand, gravel and clay. Boreholes were drilled on the grass-covered areas adjacent to the existing gravel access road.

4.1 SUBSURFACE SOIL CONDITIONS

4.1.1 Upper Sand and Gravel (SP/GP)

Sand and gravel soils were encountered in boreholes BH21-01 and BH21-02 and extended to approximately 1.2 to 1.5 m below the existing ground surface from El. 6.1 to 6.4 m. Moisture content of samples collected from those soils ranged from 12% to 21%. Based on interpretation of the DCPT blow counts and field observation, the deposit was generally compact to dense.

4.1.2 Clayey Silt (ML/CL)

Clayey silt with Sand was encountered at borehole BH21-04 and extended to approximately 1.5 m below the existing ground surface to El. 6 m. Organics were also encountered in this deposit from approximately 0.1 to 0.3 m depth below the ground surface. Measured moisture content of the clayey silt ranged from 27% to 58%. Based on interpretation of the DCPT blow counts and field observation, this deposit was generally soft.

4.1.3 Clay (CL/CH)

Clay was encountered beneath the upper sand and gravel soils in borehole BH21-01 and beneath the clayey silt in BH21-04. The clay layer was inferred to extend beyond the termination depths of boreholes BH21-01 (3.4 m) and BH21-04 (3.8 m); i.e., below El.4.2 m and 3.7 m, respectively. In borehole BH21-03, the clay deposit was encountered at the ground surface and extended to approximately 1.2 m depth to El. 6.3 m. The clay layer was not encountered in BH21-02. Laboratory test results indicated that the plasticity index of the clay deposit varied from 24 to 31 and natural moisture content ranged from 19% to 31%. Based on interpretation of the DCPT blow counts and field observation, this clay deposit was generally stiff to very stiff.

4.1.4 Lower Gravel and Sand (SM/GP/GM)

In borehole BH21-03, gravel with sand with various amount of fines were observed underlying the clay deposit. This gravel and sand layer was inferred to extend beyond the borehole termination depth of 10.7 m below the ground surface to El. -3.2 m. Based on interpretation of the DCPT blow counts and field observation, this deposit was generally dense to very dense.

4.2 GROUNDWATER CONDITIONS

Groundwater was observed in boreholes BH21-03 and BH21-04 at approximately 1.4 and 1.2 m below ground surface (El. 6.1 and 6.3 m), respectively. No groundwater was observed in boreholes BH21-01

and BH21-02, which were completed within the footprint of the proposed SBR #3 and digester. It is anticipated that the groundwater level will vary seasonally following precipitation events and groundwater pumping activity in the vicinity of the site.

4.3 CHEMICAL TEST RESULTS

The results of the chemical testing are summarized in Table 2 and presented in **Appendix D**.

Table 2 Results of Chemical Tests

Borehole ID	BH20-01	BH21-03
Sample No.	GS-3	GS-4
Approx. Sample Depth (m)	1.2 to 1.5	1.2 to 1.5
Soil Description	Lean clay	Silt
pH	7.32	5.99
Soluble Sulphate (mg/L)	23	<20
Soluble Conductivity (µS/cm)	162	287
Calculated Resistivity (ohm-cm) *	6173	3484
Corrosivity Rating **	Moderately corrosive	Corrosive

NOTES:
* Resistivity, ρ was calculated as the inverse of soluble conductivity, σ, using the equation:
$$\rho\ (ohm-cm) = 10^6/[\sigma\ (\mu S/cm)].$$
** Based on calculated soil resistivity and Table 2.27, of the Handbook of Corrosion Engineering (Roberge, 2000).

Based on the results of the samples tested, the degree of exposure of concrete to sulphate attack is less than moderate per Table 3, CSA A23.1:19/CSA A23.2:19 (CSA Group, 2019). The corrosion potential of steel in contact with soils is rated as moderately corrosive to corrosive.

5.0 ANALYSES AND RECOMMENDATIONS

5.1 GENERAL

Based on the review of site conditions, the results of the geotechnical subsurface exploration and subsequent laboratory testing, the proposed WWTP expansion can be supported on a raft foundation founded on stiff to very stiff native clay and clayey sand soils. Additional details regarding recommendations for the proposed expansion are provided below.

5.2 SITE PREPARATION

We envision site preparation activities to include stripping organics, removing soil backfill from the south wall of SBR #2 and excavation of the expansion footprints to achieve design subgrade elevation. Excavations 2.8 to 2.9 m deep (approx.) are anticipated to reach design subgrade for the new SBR's and digester. The anticipated soil conditions at design subgrade elevation at boreholes BH21-01 and BH21-04 consist of stiff to very stiff clay, and consist of stiff clayey sand in borehole BH21-03. Borehole BH21-02 encountered auger refusal on a very dense silty sand layer at 1.5 m depth before reaching design subgrade elevation; however, similar soils consisting of stiff to very stiff clay or clayey sand are anticipated.

The clay subgrade is sensitive to moisture and mechanical disturbance. Any soft or loose soils detected within the exposed subgrade, including those disturbed by construction or other site activities, should be sub-excavated to the discretion of the Stantec geotechnical engineer and replaced with structural fill as described in Section 5.3. The subgrade and any over-excavation, backfilling and compaction should be reviewed by the geotechnical engineer.

5.3 STRUCTURAL FILL

Structural fill for backfilling should be clean free-draining granular soil, consisting of 75 mm (3 in.) minus pit-run sand and gravel, with less than 5% passing the Standard US #200 sieve. The backfill should be placed in maximum 300 mm thick loose lifts and compacted to at least 95% of the Modified Proctor maximum dry density (MPMDD).

Any proposed alternative fill material should be tested and approved by the Geotechnical Engineer prior to delivery to the site. Review of structural fill placement and compaction must be carried out by the Geotechnical Engineer to ensure that all fill used is suitable and is placed and compacted to the above specifications.

5.4 SEISMIC DESIGN PARAMETERS

Site-specific seismic design parameters were obtained from the interactive website maintained by the Geological Survey of Canada in accordance with the provisions of BCBC (2018). The parameters 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 and Peak Ground Acceleration (PGA) are determined for very dense soil or soft bedrock, taken as the reference ground condition corresponding to Site Class "C". The $S_a(T)$ values would have to be adjusted to account for local site conditions and to obtain design spectral values S(T).

The Peak Ground Acceleration (PGA) and $S_a(T)$ values for the 475, 975 and 2475-year return periods at Site Class C conditions, obtained as per BCBC (2018) are summarized in Table 3.

Table 3 Seismic Hazard Parameters for 5% Damping – Site class C - BCBC (2018)

Period, T (s)	$S_a(T)$ – 2475-year return period (g)	$S_a(T)$ – 975-year return period (g)	$S_a(T)$ – 475-year return period (g)
0.05	0.71	0.5	0.35
0.1	1.11	0.78	0.55
0.2	1.35	0.95	0.67
0.3	1.38	0.96	0.68
0.5	1.24	0.85	0.58
1.0	0.76	0.48	0.31
2.0	0.46	0.28	0.17
5.0	0.15	0.08	0.04
PGA	0.61	0.42	0.29
Note: 'g' is gravitational acceleration, 9.81 m/s^2			

5.5 LIQUEFACTION ASSESSMENT AND SITE CLASS

Groundwater was encountered at approximately 1.2 and 1.4 m below ground surface in two of the boreholes. The soils above the water table, including upper sand and gravel and silt to silt with sand soils, are considered not susceptible to liquefaction. The clay deposit had measured PI values greater than 12 and was generally stiff to very stiff. The lower gravel and sand layer was generally dense to very dense. Based on Idriss and Boulanger (2008), the site soils are considered not susceptible to liquefaction.

The soil conditions at the site are defined as Site Class C as per BCBC (2018).

Post-seismic lateral soil spreading and settlement are estimated to be negligible.

5.6 FOUNDATION DESIGN

The proposed SBR and digester expansions can be supported on reinforced concrete raft foundation at a minimum 2.8 m depth below the existing ground surface. Below the raft foundation, a minimum 150 mm thick layer of 19 mm (3/4 in.) clear, angular gravel placed and compacted is recommended. The prepared sub-grade, placement of the gravel layer and compaction should be reviewed by the Geotechnical Engineer prior to rebar or concrete placement.

The proposed raft foundation, constructed about 3 m depth below the existing ground surface founded on stiff to very stiff clay or clayey sand, can be designed using an ultimate bearing resistance of 300 kPa for

Ultimate Limit State (ULS) condition and resistance factor of 0.5 (resulting in a factored bearing resistance of 150 kPa). Under Serviceability Limit States (SLS), the raft foundation can be designed using a bearing resistance of 100 kPa, which corresponds to an estimated settlement of less than 25 mm.

A friction coefficient of 0.7 can be used between the raft or slab-on-grade foundation and the subgrade soils. A modulus of subgrade reaction of 40 MN/m^2/m can be used for structural design.

5.7 TEMPORARY EXCAVATION

All excavations should be carried out in accordance with Part 20 of the current WorkSafeBC regulations (WorkSafeBC, 2013) and be safe for worker entry. Sloped cuts or shoring of the excavations will be required given that excavations are expected to remain open for several days.

Excavations up to about 3 m deep are expected. For excavations within the dense silty sand and stiff to very stiff clay, unsupported excavations should be cut at no steeper than 1H:1V (horizontal to vertical) to a maximum depth of 3 m.

Excavation side slopes should be covered with polyethylene sheets secured to the ground with nails immediately after the cut. This is 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 will 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.

Excavated material should be stockpiled at a horizontal distance greater than the depth of the excavation, measured from the crest. Construction equipment and vehicles should be kept a minimum of 2 m from the crest of all excavations. The Contractor should inspect excavations regularly for signs of instability, and slopes should be flattened if required.

5.8 GROUNDWATER CONTROL DURING CONSTRUCTION

The bottom of the proposed foundations can be below the ground water table. Conventional sumps and pumps can be considered to control the groundwater. If a more robust dewatering method is required, such as well points, the proposed groundwater control method should be reviewed by the Geotechnical Engineer prior to implementation.

The contractor is responsible for ground water control.

5.9 EARTH PRESSURE COEFFICIENTS

Recommended lateral earth pressure parameters are provided in Table 3. The calculated earth pressures should be multiplied by the load factors specified in BCBC (2018) for structural design.

Table 4 Lateral Earth Pressure Parameters

Parameter	Value
Internal friction angle of granular backfill	35°
Interface friction angle between concrete and soil	17°
Unit weight of compacted granular backfill (kN/m^3)	20
Coefficient of at-rest pressure K_o	0.45
Coefficient of active earth pressure K_a	0.27
Coefficient of passive earth pressure K_p	6.4
Coefficient of incremental seismic earth pressure ΔK_E (In addition to static earth pressure)	0.2 (for PGA = 0.29g) 0.36 (for PGA = 0.42g) 0.81 (for PGA = 0.61g)

A compaction induced lateral pressure with an inverted triangular distribution with 20 kPa at the adjacent ground surface, decreasing to zero at 4 m depth can be used to consider soil compaction during construction.

Under seismic loading conditions, seismic earth pressure should be considered in addition to static pressure. Incremental seismic pressure with inverted triangular pressure distribution with zero pressure at the bottom of the wall and maximum pressure at the top can be used as per Metro Vancouver (2017).

5.10 PERIMETER AND SITE DRAINAGE

It is recommended that a perimeter drainage system, consisting of at least 150 mm diameter perforated rigid wall pipe, be placed around the perimeter of the expansion. The perimeter drains should be established at an elevation below the underside of raft slab and be connected to a pumped sump or to a suitable gravity outlet.

The drainage pipes should be surrounded by a minimum of 150 mm of 19 mm drain rock or 19 mm clear crush gravel. The invert elevation of the drain pipes should be at least 150 mm below the underside of the slabs. Final ground surfaces around the buildings should be graded to direct surface runoff away from building areas.

5.11 ACCESS ROAD

Realignment of the existing gravel access road is anticipated to facilitate construction of the proposed SBR and digester expansions. Site preparation for parking areas and the gravel access road should include stripping of organics and excavation to achieve design subgrade elevation. The native subgrade should be proof rolled using a large smooth drum roller and inspected by the Geotechnical Engineer.

Areas exhibiting deflection should be over-excavated as necessary and replaced with compacted granular fill. Backfill for the over-excavated areas should be structural fill. Material specifications, placement method and compaction requirements for the structural fill are as specified in Section 5.3.

5.11.1 Subbase Course

The subbase course should be compacted to 300 mm above the approved subgrade and compacted to at least 95% MPMDD.

5.11.2 Base Course

The base course over should be compacted to 200 mm above the subbase in access roads and to 150 mm thickness at parking areas and compacted to at least 95% MPMDD.

6.0 FIELD REVIEW

The Geotechnical Engineer of Record should be retained to provide geotechnical engineering field review services during construction to verify that the soil conditions encountered are consistent with our design assumptions, and that the intent of our recommendations are satisfied. Geotechnical field reviews would be carried out for the items listed below:

- Shoring construction (if applicable) and excavation
- Review of subgrade preparation and compaction of structure fill
- Backfill placement and compaction for foundation bearing surface
- Backfill placement and compaction for subgrade walls
- Proof rolling of subgrade for new access roads and parking areas
- Review of structure fill density test results

7.0 CLOSURE

This report was prepared for the exclusive use of the District of Sooke and its agents for specific application to the geotechnical scope of work for the Sooke Wastewater Treatment Plant Expansion. 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 Statement of General Conditions included in Appendix A. It is the responsibility of the District of Sooke, 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. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying or unexpected site conditions
- Planning, design, or construction

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,

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APPENDICES

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 FIGURES

LEGEND

- LOT LINE
- EXISTING BUILDING
- PROPOSED PLANT EXPANSION AREA
- BOREHOLE LOCATION

SCALE IN METRES
0 5 10 15 20 25
1:500

Stantec

ORIGINAL SHEET - ANSI B

Sources
- AERIAL IMAGERY FROM MICROSOFT BING WEB MAPPING SERVICE (WMS)

Project Information

Project No.:	111720131
Scale:	1:500
Date:	2021-DEC-01
Drawn by:	G. HUYNH
Checked by:	V. TRAN

Project Location
SOOKE WASTEWATER TREATMENT PLANT
SOOKE, BC

Client/Project
DISTRICT OF SOOKE

SOOKE WASTEWATER TREATMENT PLANT EXPANSION

TITLE
BOREHOLE LOCATION PLAN

Figure No.
1

Appendix C BOREHOLE RECORDS

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 2. 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

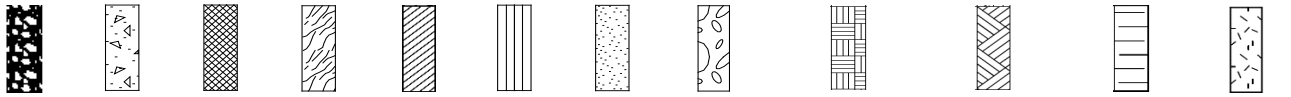
Terminology describing consistency of cohesive soils

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
	kg/cm^2 or 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

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.



Asphalt | Concrete | Fill | Organics | Clay | Silt | Sand | Gravel Cobbles Boulders | Undifferentiated Bedrock | Sedimentary Bedrock | Metamorphic Bedrock | Igneous Bedrock

SAMPLE TYPE

AS, BS, GS	Auger sample; bulk sample; grab sample
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
SO	Sonic tube
SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby Tube or thin wall tube
SV	Shear vane
RC *HQ, NQ, BQ, etc.*	Rock Core; samples obtained with the use of standard size diamond coring bits.

WATER LEVEL

Measured: in standpipe, piezometer, or well

Inferred: seepage noted, or; measured during or at completion of drilling

RECOVERY FOR SOIL SAMPLES

The recovery is recorded as the length of the soil sample recovered in the direct push, split spoon sampler, Shelby Tube, or sonic tube.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test (SPT): 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 for 75 mm or 50/75 mm). 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

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"

Total Core Recovery (TCR) denotes the sum of all measurable rock core recovered in one drill run. The value is noted as a percentage of recovered rock core based on the total length of the drill run.

Solid Core Recovery (SCR) is defined as total length of solid core divided by the total drilled length, presented as a percentage. Solid core is defined as core with one full diameter.

Rock Quality Designation (RQD) is a modified core recovery that incorporates only pieces of solid core that are equal to or greater than 10 cm (4") along the core axis. It is calculated as the total cumulative length of solid core (> 10 cm) as measured along the centerline of the core divided by the total length of borehole drilled for each drill run or geotechnical interval, presented as a percentage. RQD is determined in accordance with ASTM D6032.

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 quality

Rock Mass Quality	Rock Quality Designation Number (RQD)	Alternate (Colloquial) Rock Mass Quality	
Very Poor Quality	0-25	*Very Severely Fractured*	*Crushed*
Poor Quality	25-50	*Severely Fractured*	*Shattered or Very Blocky*
Fair Quality	50-75	*Fractured*	*Blocky*
Good Quality	75-90	*Moderately Jointed*	*Sound*
Excellent Quality	90-100	*Intact*	*Very Sound*

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.

Terminology describing rock with respect to discontinuity and bedding spacing

Spacing (mm)	Discontinuities Spacing	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*

BOREHOLE RECORD

BH21-01

CLIENT: **District of Sooke**
PROJECT: **Sooke Waste Water Treatment Plant Expansion**
LOCATION: **7113 West Coast Road**
DATE BORED: **November 4, 2021**

BH COORDINATES [UTM 10U] 5357237.0N 444627.0E
WATER LEVEL: **N/A**

PROJECT NO. : **111720131**
BH ELEVATION: **7.6m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	7.6	Dark brown, poorly graded SAND with gravel (SP), moist, trace organics, trace roots/wood debris, trace silt		GS	1		13	
							63	
1	6.4			GS	2		65	
	6.1	Yellowish brown, sandy lean CLAY (CL) with gravel, moist		GS	3		100	
		Very stiff, greyish, fat CLAY (CH), moist		GS	4			Percent Passing #200: 57%
2								
3	4.6			GS	5			
	4.3	Stiff, grey, sandy lean CLAY (CL), moist, trace to few gravel		GS	6			
		End of borehole BH21-01 at 3.35m -Auger refusal encountered -No ground water observed						
4								
5								
6								
7								
8								
9								
10								
11								
12								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT/DCPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 7 6 5 4 3 2 1 0 -1 -2 -3 -4

BACKFILL SYMBOL
BENTONITE ASPHALT DRILL CUTTINGS GROUT SAND CONCRETE SLOUGH

Drilling Contractor: Grassroots Drilling Ltd.
Drilling Method: Solid Stem Auger
Completion Depth: 3.35 m

Logged By: NP
Reviewed By: BH
Page 1 of 1

BOREHOLE RECORD

BH21-02

CLIENT: **District of Sooke**
PROJECT: **Sooke Waste Water Treatment Plant Expansion**
LOCATION: **7113 West Coast Road**
DATE BORED: **November 4, 2021**

BH COORDINATES [UTM 10U] 5357226.0N 444601.0E
WATER LEVEL: **N/A**

PROJECT NO. : **111720131**
BH ELEVATION: **7.6m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	7.6							
		Greyish brown, silty GRAVEL with sand (GM), wet		GS	1		16	Percent Passing #200: 17%
	6.8						53	
1		Grey, silty SAND with gravel (SM), moist		GS	2			Percent Passing #200: 18%
	6.1							
2		End of borehole BH21-02 at 1.51m -Auger refusal encountred on inferred boulder						

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT/DCPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 7 6 5 4 3 2 1 0 -1 -2 -3 -4

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: Grassroots Drilling Ltd.
Drilling Method: Solid Stem Auger
Completion Depth: 1.51 m

Logged By: NP
Reviewed By: BH
Page 1 of 1

BOREHOLE RECORD

BH21-03

CLIENT: **District of Sooke**
PROJECT: **Sooke Waste Water Treatment Plant Expansion**
LOCATION: **7113 West Coast Road**
DATE BORED: **November 4, 2021**

BH COORDINATES [UTM 10U] 5357223.0N 444613.0E
PROJECT NO. : **111720131**
BH ELEVATION: **7.5m**
DATUM: **Geodetic**
WATER LEVEL: **1.4 m on November 4, 2021**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	7.5							
	7.1	Dark brown, silty lean CLAY (CL/ML), moist, trace to few sand, trace gravel, trace organics, trace rootlets,		GS	1		6	
		Medium to very stiff, brown, lean CLAY (CL), moist, mottled		GS	2		2	
1	6.3						8	
		Grey, silty clayey SAND with gravel (SC/SM), moist		GS	3		17	
							31	
2				GS	4		33	
							100	
	4.7			GS	5			
3		Greyish brown, silty GRAVEL with sand (GM), wet		GS	6			Sieve at 3.0 m G S Fines 55% 30% 14%
	3.8							
4		Greyish brown, poorly graded GRAVEL with clay and sand (GP-GC), wet		GS	7			
				GS	8			
5								
	1.5			GS	9			
6		Grey, silty SAND with gravel (SM), moist		GS	10			
7								
				GS	11			Percent Passing #200: 34%
8								
				GS	12			
9				GS	13			Percent Passing #200: 33%
10								
	-3.2			GS	14			
11		End of borehole BH21-03 at 10.7m -Ground water observed in open borehole at 1.4m						
12								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT/DCPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)
7 6 5 4 3 2 1 0 -1 -2 -3 -4

▽ Water Level Observed During Drilling

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Grassroots Drilling Ltd.
Drilling Method: Solid Stem Auger
Completion Depth: 10.7 m

Logged By: NP
Reviewed By: BH

BOREHOLE RECORD

BH21-04

CLIENT: **District of Sooke**
PROJECT: **Sooke Waste Water Treatment Plant Expansion**
LOCATION: **7113 West Coast Road**
DATE BORED: **November 4, 2021**

BH COORDINATES [UTM 10U] 5357230.0N 444636.0E
PROJECT NO. : **111720131**
BH ELEVATION: **7.5m**
DATUM: **Geodetic**
WATER LEVEL: **1.2 m on November 4, 2021**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	7.5							
0 to 1.5		Soft, dark brown, clayey SILT (ML/CL), moist, trace sand, trace gravel, trace organics, trace rootlets		GS	1			
				GS	2		2	Percent Passing #200: 79%
				GS	3		2	
							3	
1 ▽				GS	4		6	
1.5 to 3.7	6.0	Stiff to very stiff, greyish brown, lean CLAY (CL), moist, trace to few sand, trace gravel, trace rootlets		GS	5		9	Percent Passing #200: 77%
							13	
2		-Hard below 2.4m					29	
							46	
3				GS	6		39	
							43	
							55	
	3.7			GS	7		60	
4		End of borehole BH21-04 at 3.8m -Auger refusal encountered -Ground water observed in open borehole at 1.2m						50/88mm >>

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 7 6 5 4 3 2 1 0 -1 -2 -3 -4

▽ Water Level Observed During Drilling

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: Grassroots Drilling Ltd.
Drilling Method: Solid Stem Auger
Completion Depth: 3.8 m

Logged By: NP
Reviewed By: BH
Page 1 of 1

Appendix D LABORATORY TEST RESULTS

Stantec

Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client:	District of Sooke
Project Name:	WWTP Expansion
	-
Project No:	111720131.200.006
Date Received:	November 5, 2021
Date Tested:	November 15, 2021
Tested By:	WdC

OFFICE
4515 Central Blvd.
Suite 500
Burnaby, BC
Canada V5H 0C6
Tel: (604) 436-3014

LABORATORY
3711 North Fraser Way
Suite 400
Burnaby, BC
Canada V5J 5J2
Tel: (604) 436-3014

Sample : BH21-01, BS-4, 1.50m. - 1.80m.

LIQUID LIMIT

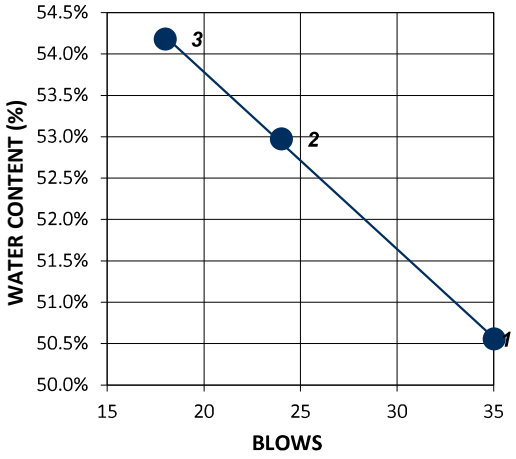
Trial	1	2	3
No. of Blows	35	24	18
Tare No.	14A	A6	H13
Wt. Sa. (wet+tare)(g)	8.04	7.49	10.08
Wt. Sa. (dry+tare)(g)	5.77	5.35	6.98
Wt. Tare (g)	1.28	1.29	1.27
Wt. Dry Soil (g)	4.5	4.1	5.7
Wt. Water (g)	2.3	2.1	3.1
Water Content (%)	50.6%	53.0%	54.2%

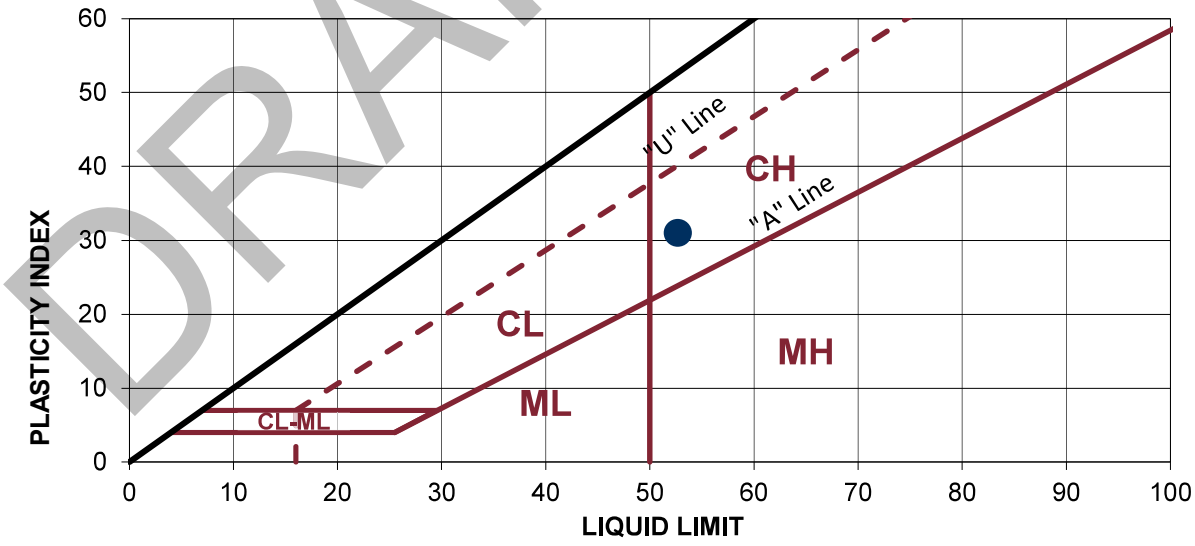
PLASTIC LIMIT

Trial	1	2
Tare No.	2	5
Wt. Sa. (wet+tare)(g)	30.42	27.02
Wt. Sa. (dry+tare)(g)	28.69	25.92
Wt. Tare (g)	20.86	21.05
Wt. Dry Soil (g)	7.8	4.9
Wt. Water (g)	1.7	1.1
Water Content (%)	22.1%	22.6%

RESULTS

LL	**53**
PL	**22**
PI	**31**
Natural MC (%)	
24.5%	





Comments:

Reviewed By: Wil de Castro, AScT
Digitally signed by Wil de Castro, AScT
Date: 2021.11.18 08:02:18 -08'00'

Stantec

Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client:	District of Sooke
Project Name:	WWTP Expansion
	-
Project No:	111720131.200.006
Date Received:	November 5, 2021
Date Tested:	November 15, 2021
Tested By:	WdC

OFFICE
4515 Central Blvd.
Suite 500
Burnaby, BC
Canada V5H 0C6
Tel: (604) 436-3014

LABORATORY
3711 North Fraser Way
Suite 400
Burnaby, BC
Canada V5J 5J2
Tel: (604) 436-3014

Sample : BH21-03, BS-3, 1.20m. - 1.50m.

LIQUID LIMIT

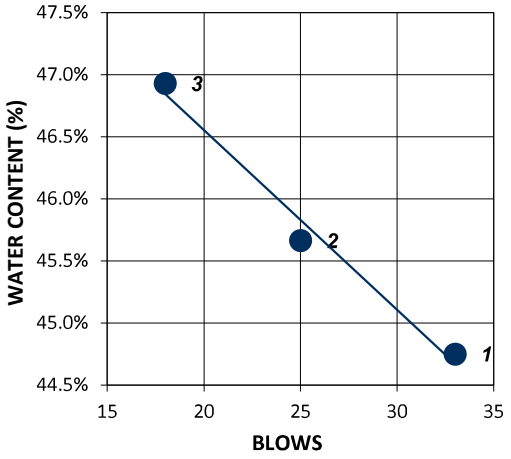
Trial	1	2	3
No. of Blows	33	25	18
Tare No.	A226	KK7	2C
Wt. Sa. (wet+tare)(g)	9.37	9.17	9.99
Wt. Sa. (dry+tare)(g)	6.87	6.70	7.20
Wt. Tare (g)	1.28	1.28	1.27
Wt. Dry Soil (g)	5.6	5.4	5.9
Wt. Water (g)	2.5	2.5	2.8
Water Content (%)	44.8%	45.7%	46.9%

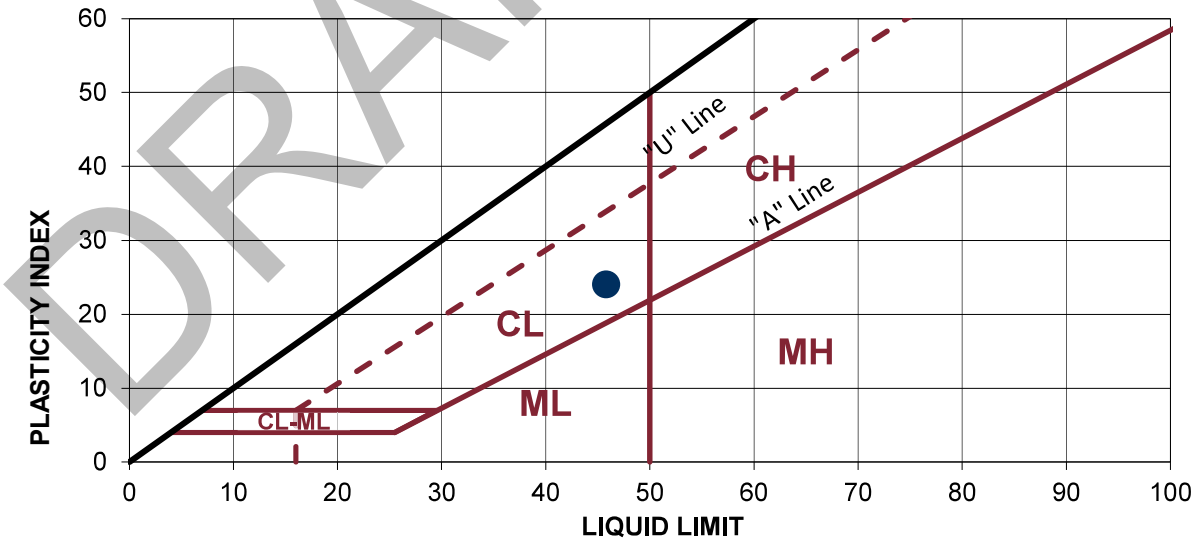
PLASTIC LIMIT

Trial	1	2
Tare No.	3	8
Wt. Sa. (wet+tare)(g)	28.83	29.93
Wt. Sa. (dry+tare)(g)	27.44	28.32
Wt. Tare (g)	21.03	21.00
Wt. Dry Soil (g)	6.4	7.3
Wt. Water (g)	1.4	1.6
Water Content (%)	21.8%	22.0%

RESULTS

LL	**46**
PL	**22**
PI	**24**
Natural MC (%)	
24.8%	





Comments:

Reviewed By: Wil de Castro, AScT

Digitally signed by Wil de Castro, AScT
Date: 2021.11.18 08:02:37 -08'00'

Stantec

Grain Size Analysis

ASTM D6913

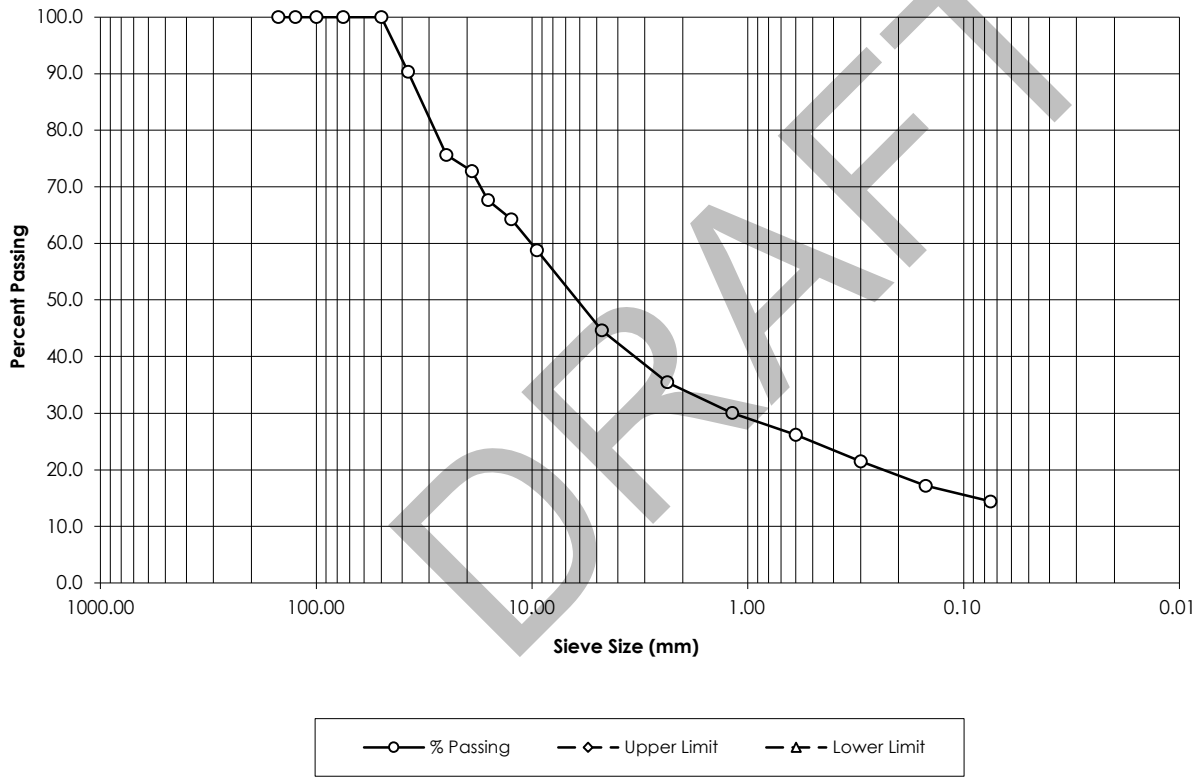
Client: District of Sooke
Project Name: WWTP Expansion
-
Project No: 111720131.200.006

OFFICE
4515 Central Blvd.
Suite 500
Burnaby, BC
Canada V5H 0C6
Tel: (604) 436-3014

LABORATORY
3711 North Fraser Way
Suite 400
Burnaby, BC
Canada V5J 5J2
Tel: (604) 436-3014

SAMPLE No.: BH21-03, BS-6, 3.00m-3.30m
SOURCE: -
TESTED BY: WdC

DATE RECEIVED: November 5, 2021
DATE TESTED: November 16, 2021
SAMPLE DESCRIPTION: silty GRAVEL with sand, (GM)



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	**100.0**	-	-
125.0	**100.0**	-	-
100.0	**100.0**	-	-
75.0	**100.0**	-	-
50.0	**100.0**	-	-
37.5	**90.3**	-	-
25.0	**75.6**	-	-
19.0	**72.8**	-	-
16.0	**67.6**	-	-
12.5	**64.3**	-	-
9.5	**58.8**	-	-
4.75	**44.6**	-	-
2.36	**35.5**	-	-
1.18	**30.0**	-	-
0.600	**26.1**	-	-
0.300	**21.5**	-	-
0.150	**17.2**	-	-
0.075	**14.4**	-	-

Cobble:	-	D_{10}:	-
Gravel:	55.4%	D_{30}:	1.18
Sand:	30.2%	D_{60}:	10.19
Fines:	14.4%	C_U:	-
		C_c:	-

Comments:

Reviewed by:
Wil de Castro, AScT
Digitally signed by Wil de Castro, AScT
Date: 2021.11.18 08:03:01 -08'00'

Your P.O. #: 111720131.200.006
Your Project #: 111720131
Site Location: Sooke
Your C.O.C. #: 43719

Attention: Ben Huynh

STANTEC CONSULTING LTD
Metrotower III
Suite 500, 4730 Kingsway
BURNABY, BC
CANADA V5H 4M1

Report Date: 2021/11/16
Report #: R3099905
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C187403
Received: 2021/11/12, 15:40

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Conductivity (Soluble)	2	2021/11/15	2021/11/15	BBY6SOP-00029	SM 23 2510 B m
pH (2:1 DI Water Extract)	2	2021/11/16	2021/11/16	BBY6SOP-00028	BCMOE BCLM Mar2005 m
Saturated Paste	2	2021/11/15	2021/11/15	BBY6SOP-00030	BC Lab Manual 2015 m
Sulphate (soluble) (soil)	2	2021/11/15	2021/11/15	BBY6SOP-00017	SM 23 4500-SO42- E m
Soluble Sulphate (SO4) Ion Calc. (mg/kg)	2	N/A	2021/11/15	BBY WI-00033	Auto Calc

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Your P.O. #: 111720131.200.006
Your Project #: 111720131
Site Location: Sooke
Your C.O.C. #: 43719

Attention: Ben Huynh

STANTEC CONSULTING LTD
Metrotower III
Suite 500, 4730 Kingsway
BURNABY, BC
CANADA V5H 4M1

Report Date: 2021/11/16
Report #: R3099905
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C187403
Received: 2021/11/12, 15:40

Encryption Key

Bureau Veritas
16 Nov 2021 15:07:09

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Geraldlyn Gouthro, Key Account Specialist
Email: geraldlyn.gouthro@bureauveritas.com
Phone# (780)577-7173
==========
This report has been generated and distributed using a secure automated process.
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Job #: C187403
Report Date: 2021/11/16

STANTEC CONSULTING LTD
Client Project #: 111720131
Site Location: Sooke
Your P.O. #: 111720131.200.006
Sampler Initials: PN

RESULTS OF CHEMICAL ANALYSES OF SOIL

Bureau Veritas ID		AKM747		AKM748		
Sampling Date		2021/11/04		2021/11/04		
COC Number		43719		43719		
	UNITS	BH21-01, BS-3, 1.21m - 1.51m	RDL	BH21-04, BS-4, 1.20m- 1.50m	RDL	QC Batch
ANIONS						
Soluble Sulphate (SO4)	mg/L	23	20	<20	20	A425936
Calculated Parameters						
Soluble Sulphate (SO4)	mg/kg	14	12	<10	10	A424005
Physical Properties						
Soluble (2:1) pH	pH	7.32	N/A	5.99	N/A	A426915
Soluble Parameters						
Soluble Conductivity	uS/cm	162	5.0	287	5.0	A426362
Saturation %	%	60.8	N/A	52.2	N/A	A425289

RDL = Reportable Detection Limit
N/A = Not Applicable

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

GENERAL COMMENTS

Results relate only to the items tested.

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Bureau Veritas Job #: C187403
Report Date: 2021/11/16

QUALITY ASSURANCE REPORT

STANTEC CONSULTING LTD
Client Project #: 111720131
Site Location: Sooke
Your P.O. #: 111720131.200.006
Sampler Initials: PN

			Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
A425289	Saturation %	2021/11/15			0	%	0	30	104	75 - 125
A425936	Soluble Sulphate (SO4)	2021/11/15	94	80 - 120	<20	mg/L			91	75 - 125
A426362	Soluble Conductivity	2021/11/15	102	70 - 130	<5.0	uS/cm			88	75 - 125
A426915	Soluble (2:1) pH	2021/11/16	100	97 - 103			0.22	N/A		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Bureau Veritas Job #: C187403
Report Date: 2021/11/16

STANTEC CONSULTING LTD
Client Project #: 111720131
Site Location: Sooke
Your P.O. #: 111720131.200.006
Sampler Initials: PN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Custody Tracking Form

W43719

Please use this form for custody tracking when submitting the work instructions via eCOC (electronic Chain of Custody). Please ensure your form has a barcode or a Bureau Veritas eCOC confirmation number in the top right hand side. This number links your electronic submission to your samples. This form should be placed in the cooler with your samples.

First Sample: BH21-01, BS-3, 1.21m - 1.51m
Last Sample: BH21-04, BS-4, 1.20m-1.50m
Sample Count: 2

Relinquished By				Received By			
NANTHINEE PORCHELVAM	P. Nanthinee	Date	2021/11/12	ALFRED NGAI		Date	2021/11/12
		Time (24 HR)	15:30			Time (24 HR)	15:40
		Date				Date	
		Time (24 HR)				Time (24 HR)	
		Date				Date	
		Time (24 HR)				Time (24 HR)	

Unless otherwise agreed to, submissions and use of services are governed by Bureau Veritas' standard terms and conditions which can be found at www.bvna.com.

Triage Information

Sampled By (Print): P. Nanthinee

# of Coolers/Pkgs:

Rush ☐ Immediate Test ☐ Food Residue ☐

Micro ☐ Food Chemistry ☐

***** LABORATORY USE ONLY *****

Received At: Lab Comm

Labeled By:

Verified By:

C187403_COC

Custody Seal		Cooling Media	Temperature °C		
Present (Y/N)	Intact (Y/N)	Present (Y/N)	1	2	3
N	N/A	N	20	20	20
Drinking Water Metals Preservation Check Done (Circle)				YES	NO

COR FCD-00383/3

Page 1 of 1

eCOC: W43719

Project Information:	C187403
Job Received:	2021/11/12 15:40
Results Required By:	2021/11/17
Expected Arrival:	2021/11/12 15:30
Submitted By:	Wil Decastro
Submitted To:	Burnaby ENV: 4606 Canada Way

Invoice Information

Attn: ACCOUNTS PAYABLE
STANTEC CONSULTING LTD
Metrotower III
Suite 500, 4730 Kingsway
BURNABY , BC , V5H 4M1
Email to:
sapinvoices@stantec.com

Report Information

Attn: Ben Huynh
STANTEC CONSULTING LTD
Metrotower III
Suite 500, 4730 Kingsway
BURNABY , BC , V5H 4M1
Email to:
ben.huynh@stantec.com

Project Information

Quote #:	C00413
PO/AFE#:	111720131.200.006
Project #:	111720131
Site Location:	Sooke
Task Order:	200.006

Analytical Summary

A: Due On 2021/11/17

Client Sample ID	Clnt Ref	Sampling Date/Time	Matrix	#Cont	Conductivity (Soluble)	PH (2:1 DI Water Extract)	Saturated Paste	Soluble Sulphate (SO4) Ion Calc. (mg/kg)
BH21-01, BS-3, 1.21m - 1.51m	1	2021/11/04	SOIL	1	A	A	A	A
BH21-04, BS-4, 1.20m- 1.50m	2	2021/11/04	SOIL	1	A	A	A	A

Deadlines are estimates only and are subject to change. Please refer to your Job Confirmation report for final due dates.

Submission Information

# of Samples: 2

Appendix C Archeological Desktop Review

Stantec Consulting Ltd.
11-2042 Mills Road, Sidney BC V8L 5X4

February 8, 2022
File: 111720131

District of Sooke
2205 Otter Point Rd
Sooke, BC
V9Z 1J2

Reference: Archaeological Desktop Review — Sooke Wastewater Treatment Plant Expansion Project, Sooke, British Columbia

INTRODUCTION

Stantec Consulting Ltd. (Stantec) conducted an archaeological desktop review of the proposed Sooke Wastewater Treatment Plant (WWTP) Expansion project (the Project) at 7113 West Coast Road, Sooke, British Columbia. The archaeological desktop review was undertaken with the following key objectives:

- Identify the Indigenous group traditional territories within which the Project is located.
- Determine the location, nature, and distribution of recorded archaeological resources near the Project area.
- Identify and assess archaeological resource potential or sensitivity within the Project area.
- Assess potential impacts to archaeological sites
- Provide recommendations on the appropriate methods and scope for subsequent archaeological studies, if needed

Archaeological sites and objects on private and Provincial Crown land in British Columbia are protected under the *Heritage Conservation Act* (*HCA*), which is administered by the Archaeology Branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Heritage resources specifically protected by the *HCA* include Provincial heritage sites, burial places with historical or archaeological value, aboriginal rock paintings or carvings, sites with evidence of human habitation or use before AD 1846 and heritage wrecks. The Lieutenant Governor in Council may also make regulations to define the extent of types of sites protected by the *HCA*. Sites that postdate AD 1846 can be protected under the HCA if they area of special historical interest.

Reference: **Archaeological Desktop Review — Sooke Wastewater Treatment Plant Expansion Project, Sooke, British Columbia**

METHODS

The archaeological desktop review included a review of the Province's Consultative Areas Database (CAD), the Remote Access to Archaeological Data (RAAD) application and Provincial Archaeological Report Library (PARL) maintained by the Archaeology Branch, publicly available ethnographic and historical information, and satellite imagery.

The evaluation of archaeological potential was based on consideration of the Project setting in relation to archaeological sites recorded in RAAD and the presence/absence of terrain characteristics typically associated with archaeological sites (e.g., level, well-drained landforms close to hydrological features).

This desktop review is intended to provide a preliminary evaluation of potential impacts to archaeological resources and did not involve input from Indigenous groups with the understanding that the District will engage them on the Project. Indigenous groups may possess other knowledge or be aware of other information sources relevant to the assessment of archaeological or traditional use site impacts and evaluation of potential.

RESULTS

The Project area is adjacent to the north boundary of T'Sou-ke Nation Reserve 2, approximately 500 m east of the Sooke Bay shoreline, and falls within the traditional territories of Sc'ianew First Nation and T'sou-ke First Nation (Figure 1). A small drainage feature is mapped as intersecting the southeast portion of the Project area.

The Project area is predominantly characterized by developed land associated with the existing WWTP and related infrastructure and lacks any prominent landforms. Within the Project area, the small drainage feature is not visible on satellite imagery nor associated with any distinct terracing or other landform development. It is likely that the natural drainage channel has been obscured due to past disturbance associated with the development of the existing WWTP.

There are no archaeological sites recorded in the Project area. The nearest site, DcRw-41, is a subsurface shell midden site on the shoreline of Sooke Bay, approximately 475 m west-southwest of the Project area (Figure 1). There are no other archaeological sites recorded within 1 km.

The Capital Regional District archaeological potential model (APM) identifies an area of high archaeological potential associated with the small drainage feature which intersects the southeast portion of the Project area (Figure 1).

According to Provincial records, an archaeological impact assessment (AIA) of the Sooke Wastewater Service Project was undertaken in 2004 under *HCA* Permit 2004-0387. The AIA included surface inspection and subsurface shovel testing of a section of a proposed sewer outfall right-of-way at 7117 West Coast Road and resulted in the identification of DcRw-41 (Nicholls 2004). No other archaeological sites were

identified during this study which included both surface and subsurface inspection to the north, northwest, west and southwest of the Project area. No other archaeological field studies have been carried out in or near the Project area.

It is our understanding that ground disturbing activities for the Project will be confined to areas impacted by previous WWTP development (i.e., existing surface and subsurface infrastructure, paved surfaces, etc.).

Based on the results of the 2004 AIA, the lack of any prominent landforms in the Project area, the level of past disturbance associated with initial WWTP development, and the nature of proposed Project development plans, there is low potential for archaeological deposits to be present in the Project area.

RECOMMENDATIONS

No further archaeological assessment is recommended for the Project. However, it is recommended that the District engage the Sc'ianew First Nation and T'sou-ke First Nation to request their input they may want to provide.

Although an attempt was made to evaluate the potential for the Project to impact archaeological resources, as with all archaeological studies, the possibility exists that unidentified archaeological resources are present. In the unlikely event that suspected archaeological resources are encountered during proposed Project activities, all work in the immediate vicinity of the find(s) must cease and the Archaeology Branch contacted for appropriate guidance and direction.

Regards,

Stantec Consulting Ltd.

Spady, Ryan — Digitally signed by Spady, Ryan Date: 2022.02.08 17:21:26 -08'00'

Ryan Spady BA, RPCA
Associate, Senior Archaeologist
Phone: 250-896-6657
Ryan.Spady@stantec.com

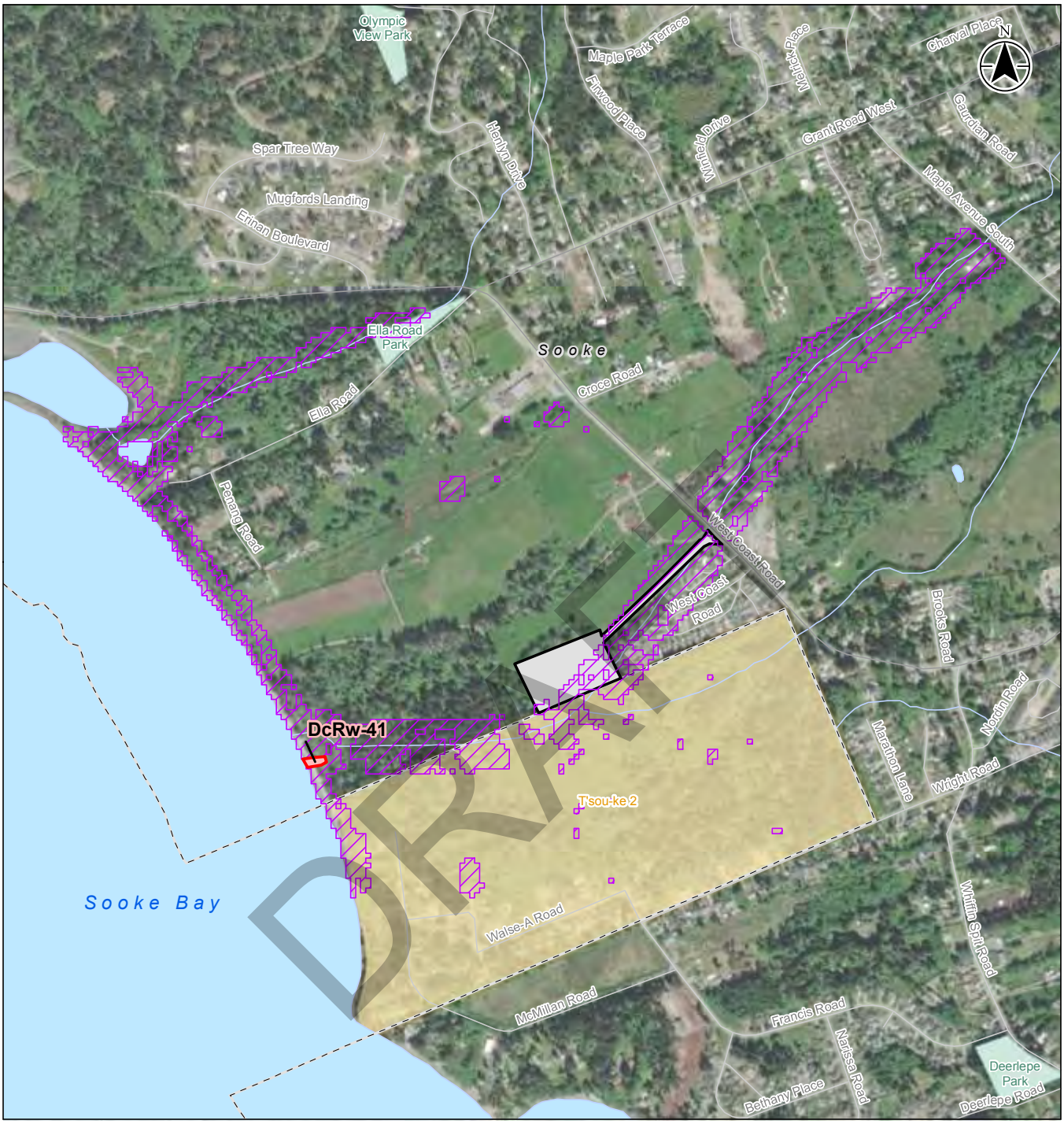
Jonathan Hall — Digitally signed by Jonathan Hall Date: 2022.02.08 16:52:16 -08'00'

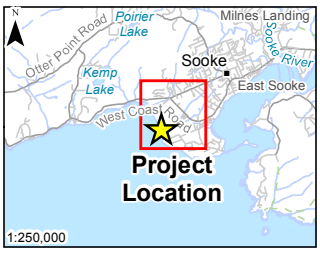
Jonathan (Jonny) Hall MA, RPCA
Senior Associate
Phone: 250-655-6067
Jonny.Hall@stantec.com

Reference: **Archaeological Desktop Review — Sooke Wastewater Treatment Plant Expansion Project, Sooke, British Columbia**

REFERENCES

Nicholls, Nicole. 2004. Archaeological Impact Assessment for the Sooke Wastewater Service Project, Sooke, BC. *Heritage Conservation Act Permit* 2004-0387. Report on file with the Archaeology Branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Victoria, BC.





- Road
- Local Street
- Watercourse
- Waterbody
- First Nations Reserve
- Local Greenspace
- Municipal Boundary
- Archaeological Site
- High Potential - CRD Archaeological Potential Model
- Project

0 100 200 300 400 500

Meters

1:12,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

Stantec

Project Location: Sooke, British Columbia

Project Number: 111720131
Prepared by PKASIANCHUK on 20220208
Requested by RSPADY on 20220208
Checked by TCARDINAL on 20220208

Client/Project/Report

District of Sooke
F+WWTP Expansion

Figure No.

1

Title

Archaeological Review Results

S:\1232\projects\111720131\figures\fig1_111720131_archaeologicalReview.mxd Revised: 2022-02-08 By: pkasianchuk

DRAFT

Part 1 General

1.1 DESCRIPTION

.1 This section specifies the General Provisions for the supply, delivery, installation, calibration and commissioning of the process control and instrumentation system, including all control and graphic panels.

.2 It is the intention of these specifications and drawings, to provide for a complete and fully operating control and instrumentation system, with facilities and services to meet the requirements described herein, and in complete accord with applicable codes and ordinances. The specifications do not purport to cover details entering the design of the system which shall be the responsibility of the Contractor.

.3 The work to be done shall include the provision of all labour, materials, tools and equipment as well as the application of a competent knowledge of construction, whether or not directly specified or shown on the plans, required for the installation testing and placing into service the complete control and instrumentation system, except when it is specifically mentioned that certain materials and/or labour are not part of the contract.

.4 These specifications shall apply to and govern all trades doing control and instrumentation work and shall be read in conjunction with and form a part of the general specifications of the project.

.5 The Control and Instrumentation work includes but is not limited to the following:

- .1 Control panels (vendor panels and existing site PLC panel).
- .2 Primary Elements for flow, level, pressure, temperature, etc.
- .3 Control Wiring and conduit.
- .4 Starters and controllers.
- .5 Indicators, annunciators, interfaces, HMIs, and PLCs.
- .6 Installation and commissioning of SBR System (new).
- .7 Installation and commissioning of Disk Filter System (new).
- .8 Installation and commissioning of Thickener/Polymer System (new).
- .9 Re-commissioning of existing SBR System on new Vendor PLC.

.6 The plant PLC and SCADA programming and commissioning is the responsibility of the Contractor.

.7 Refer to Section 4 of this specification for high level guidance in providing programming services.

1.2 EQUIPMENT MANUFACTURERS

.1 All equipment shall be manufactured by experienced manufacturers who can demonstrate experience for all equipment offered in similar facilities and processes.

.2 Requests for approval of alternative suppliers shall be submitted for approval. Refer to Section 26 05 01 - Common Work Results for Electrical.

.3 Most of the equipment shall be supplied by a single manufacturer, particularly where aesthetics are of concern, such as in panels.

1.3 CODES, PERMITS & FEES

.1 The work shall comply with the requirements of the current edition of the Canadian Electrical Code, Part 1, and the regulations of the Province of British Columbia.

.2 Obtain the required construction permits, arrange for inspections, and supply the Prime Contractor, District and Engineer with approval certificates pertaining thereto including a certificate of final inspection

1.4 REFERENCE STANDARDS

.1 Unless otherwise specified, equipment shall conform to appropriate standards and recommendations of:

.1 The Instrument Society of America, hereinafter referred to as ISA.

.2 The Canadian Standards Association, hereinafter referred to as CSA.

.3 The American Society of Mechanical Engineers, hereinafter referred to as ASME Standards.

.2 All equipment shall be metric - SI Standard.

1.5 OPERATION MANUALS

.1 Submit operation manuals in accordance with Section 26 05 01 - Common Work Results - Electrical.

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with 01 33 00 – Submittal Procedures and the specifications.

.2 Shop drawings to indicate (where applicable):

.1 Completed instrument data sheets by Vendors.

.2 Instrument tag number(s).

.3 Available range.

.4 Materials of construction.

.5 Wetted materials.

.6 Accuracy.

.7 Rating of enclosure.

.8 Other details listed on the Instrument Specification Sheet(s).

.3 Shop drawings for control panels shall include all the information described in Section 01 33 00 – Submittal Procedures.

.4 Attach a copy of the Instrument Specification Sheet to each shop drawing for field instruments.

.5 Clearly indicate on the shop drawing which model, features, materials, etc. are being provided, when more than one is shown.

1.7 RECORD DRAWINGS AND OPERATION AND MAINTENANCE MANUALS

.1 Record Drawings in accordance with the requirements of Section 01 78 00 – Closeout Submittals.

.2 Mark up engineering drawings with construction details and submit to Engineer two (2) sets of drawings for plan of record.

.3 Operation and Maintenance Manuals in accordance with Section 01 78 00 – Closeout Submittals.

1.8 INSTRUMENTATION SUB-CONTRACTORS

.1 The work as specified in this Section to be performed by a qualified control and instrumentation contractor.

Part 2 PRODUCTS

2.1 PROCESS PIPING CONNECTIONS

.1 Connections to be in accordance with instrument details shown on the drawings or attached to the instrument specification sheets and manufacturer recommended installation procedures.

.2 Pipe or tubing fittings and valves for process leads to instruments to be of the type, material and pressure standard as called for on the process piping standard of the line pressure being sensed.

.3 Process leads to be sloped, vented, and sized in accordance with accepted instrument practices in the industry. Provide necessary unions in the pipe or tubing to allow removal of instruments for service.

.4 Piping and capillary tubing lines between instruments and points of connection to be supported and located to be protected from damage and deflection.

2.2 MATERIALS

.1 All materials shall be new and in new condition.

.2 All materials shall bear the approval of the Canadian Standards Association (CSA).

.3 All materials shall be suitable for full operation within specified environments.

2.3 POWER SUPPLIES

.1 Provide all necessary power supplies for controls and instruments.

.2 Power wiring to field devices shall be minimum #12 AWG.

2.4 CONTROL WIRING

.1 Unless specified otherwise, all conductors for control wiring shall be copper with RW90, X-link insulation, 300 Volts. For any control wiring run with power cabling, conductors shall be rated 600 Volts.

.2 Neutral conductors shall be white, grounding conductors shall be green, DC conductors shall be red and AC conductors shall be black.

.3 Instrumentation wiring for analog signals shall be individually shielded - multipair cable #16 AWG (7x16) tinned copper.

.4 Control wiring for level and pressure switches shall be #14 THHN black.

.5 Provide armor for wiring as required when installed near wiring of other systems or other voltages.

.6 Provide shielding for signal and communication wiring.

.7 Where dimensional details are required, work with the applicable structural and architectural drawings.

.8 The Contractor is responsible for correcting any work completed contrary to the intent of the drawings and specification and shall bear all costs for correcting same.

2.5 CONDUIT, WIRING AND CABLE

.1 Supply and install all conduit, wiring, control and instrumentation cables for the control, instrumentation and low voltage and line voltage control for building

services, including those systems not specifically detailed in the drawings. This could include control of HVAC systems, etc.

.2 Conduit and wiring for power, lighting, miscellaneous electrical systems, and power supplies to control instrumentation and building service panels including other components requiring line voltage power supply shall be supplied and installed as specified here and in Division 26.

2.6 JUNCTION BOXES AND ENCLOSURES

.1 All junction boxes and enclosures shall be rated NEMA 4X unless otherwise specified.

.2 All wiring shall be terminated on terminal blocks as specified in Section 26 05 20 – Wire and Box Connectors.

.3 120VAC and 24VDC wiring shall be isolated from each other and terminated on separate terminal strips.

Part 3 Execution

3.1 INSTALLATION

.1 Install and interconnect all process control system equipment.

.2 Install all equipment in accordance with the manufacturer’s recommendations and in a manner that will ensure satisfactory operation upon completion.

.3 Provide all labour and all necessary equipment including timbers, scaffolding, tools, and rigging materials for installation of the equipment.

.4 Contractor shall be responsible for coordinating all mechanical, electrical, and other works for the equipment being installed.

.5 Installation shall meet the minimum standards set forth by Standards and Practices for Instrumentation.

.6 Use trained personnel to install systems and controls as per approved shop drawings and in accordance with manufacturer's recommendations.

.7 Follow building lines with all piping and electrical wiring runs. Utilize proper separation and wiring techniques.

3.2 INSTRUMENT TAGGING

.1 General

.1 Provide each instrument with a tag in accordance with Section 01 18 00 – Identification Systems.

.2 Tags to be stainless steel and supplied by the instrument manufacturer wherever possible.

.3 Affix tags to instruments with nylon tie-wraps or adhesive. Do not use adhesive on curved surfaces.

.2 The Contractor shall tag each instrumentation and control cable conductor with unique identification as given on drawings. The tag at the end of a cable or conductor will identify where the opposite end of the cable or conductor is terminated.

.3 The Contractor shall maintain accurate records during cable, conductor, and conduit installation as to the tags which are to be installed. The Contractor's records shall be turned over to the Engineer for periodic review when requested.

.4 In the event the Contractor must develop a conduit or cable identification not given on drawings the strategy to label all conduit, cable and conductors uniquely by incrementing a numeral behind a C (Control), I (Instrumentation), E (Element) or P (Power) prefix. Where a unique tag number cannot be developed, the Contractor shall advise the Engineer for clarification.

.5 No two wires or cables shall have an identical tag.

3.3 COORDINATION OF WORK

.1 Cooperate and coordinate with other trades on the project.

.2 Check drawings and specifications of other trades for conflict and coordination with the control and instrumentation trade. If any conflicts are found, obtain a ruling from the District and Engineer before proceeding.

3.4 MOUNTING OF INSTRUMENTS, CONTROLS AND ACCESSORIES

.1 Instruments to be installed in accordance with the drawings or as detailed in the installation manual for the equipment. Instruments shall be rigidly supported, level and plumb, and in such a manner as to provide accessibility, protection from damage, isolation from heat, shock and vibration, and freedom from interference with other equipment, piping, and electrical work.

.2 Do not install Instruments until heavy construction work adjacent to the instruments has been completed.

.3 Locate instrument devices including accessories where they will be accessible from structural platforms, permanent ladders, or grade. Mount local indicating instruments facing toward, in line or sight and within reading distance of a normal operating area.

.4 Sufficient clearance to be allowed for removal of equipment such as level displacers and floats, rotameter floats, control valve diaphragms and plugs.

.5 Field located items of instrumentation to be mounted on building columns and walls where such building columns or walls are accessible. Pipe stands and/or other means of support to be provided where the mounting on columns or walls is not practical.

.6 Manifolding for pressure sensing devices to be in accordance with installation detail drawings and as required to provide a functional system that allows maintenance of equipment without shutdown of main process equipment. Manifold details generally show a gauge as the pressure device; however, this will apply to pressure switches, recorders, transmitters, and other pressure instruments.

.7 Where a pressure gauge or other pressure device is supported by a manifold, and conditions of pulsating pressure or mechanical vibration exist, the manifold to be fastened so that no stress is exerted on the pressure connection from a vessel or line.

.8 Pressure gauges which have a safety blowout feature in case of Bourdon tubes to be mounted so that the proper functioning of the blowout is not hindered in any way by mounting plates, insulation, etc.

.9 Instrument housings to be capped, closed, or covered with polyethylene when work is not in progress.

.10 Panels, control stations, and other equipment to be protected against the entrance of dust, dirt, and moisture, and protected against mechanical injury while rough, dirty, wet, or dusty work is in progress. Damage to equipment, including marring of painted surfaces caused by failure to properly protect the equipment, to be promptly repaired by the Contractor to the satisfaction of the Engineer.

3.5 PAINTING

.1 Painted surfaces on material supplied or installed under this contract which are damaged in any way, i.e. by welding, scraping, cutting, etc., to be thoroughly cleaned, primed with a rust inhibiting primer, and repainted to the original colour. The finished job to meet or exceed the original painting specification.

3.6 INSTRUMENTATION WIRING CHECKS

.1 Prior to the installation of the remote I/O, the Contractor shall check each instrument wiring loop between the field instrument and the Control Panel. Verify and check off each wiring loop and correct termination address by initialing each loop on the drawings. Submit verification to Engineer for review. Contractor to supply all necessary power supply and instruments for testing.

.2 Prior to startup, and after all field instruments and the PLC(s) are powered up, complete an Instrument Wiring Check Sheet (see end of Specification) for each PLC module and submit the sheets to the Engineer.

.3 For each signal indicate the Rack, Slot, and Point to which the signal is connected. Indicate whether the signal is an Input to the PLC from a field device or an Output from the PLC to a field device, and briefly detail the signal (e.g. SBR #3 Blower Valve BFV-303, Full Open Status ZSO-303, 1=Open).

.4 Test discrete input signals by jumpering the field instrument's output contact and noting whether the appropriate indicator light on the PLC input module operates.

.5 Test discrete output signals by jumpering the PLC output at the module's terminals and noting the action of the field device (e.g. valve opens).

.6 Test analog input signals by noting the reading on the field device and measuring the mA signal into the PLC. Check that the mA reading is appropriate for the process variable and the span of the instrument.

3.7 SYSTEMS PROGRAMMING

.1 The Contractor is to retain the services of the District of Sooke's preferred Systems Programmer for the programming of the Plant PLC and the facility SCADA system.

.2 The preferred System Programmer is

Zane Spencer, P.Tech.(Eng.)
Automation & Controls Project Manager
Tel. (403) 317-3635
Cel. (403) 382-8246
Fax. (403) 329-9354
Email. zspencer@mpe.ca

.3 Systems programming is to be completed based on control narrative documents provided by the project engineer and by the packaged equipment vendors. Control narrative documents will be provided after the receipt of all finalized packaged equipment Shop Drawings.

.4 Systems programming time is to be allotted based on the table below:

Task #	Task Description	Allotted hours
1	Plant PLC programming (New I/O)	12
2	New Standby Power management logic	24
3	Communications interfaces (Ethernet /Devicenet)	40
4	SCADA data Import/Export for new networked systems	80
5	New SCADA Process Mimics for HMI's	80
6	New trend and alarm data management	64
	Total	300

* Pricing based on this table is not to include programmer costs such as hardware, software, travel, meals etc.

3.8 WELDING

.1 Fabricate and install all brackets, hangers, etc., necessary to complete this contract. All welding and welding materials to conform to the requirements of the Owner, Engineer, and local authorities.

3.9 CALIBRATION

.1 Prior to start-up, submit to Engineer calibration sheets for each instrument which is adjustable, indicating the setpoint(s), and by whom the calibration was performed.

.2 For microprocessor-based instruments in which parameters must be entered as part of configuring or calibration, list all the values entered.

.3 List the settings of all DIP-switches, jumpers, etc.

.4 Contractor is to supply all test equipment to calibrate and test equipment and devices.

3.10 TESTING

.1 Thoroughly test all control equipment, components, and systems for proper operation and report in writing to the satisfaction of the Contract Administrator.

.2 Tests shall include:

.1 Complete operational test including interlocks, functions, features, options, etc., for all instrumentation, PLC, and computer system control operations.

.2 Operation of alarm initiating devices.

.3 Calibration of all instruments.

.3 Supply all necessary test equipment and personnel to completely test the entire instrumentation and process control system.

3.11 START-UP AND COMMISSIONING

.1 Perform all panel start-up and commissioning in accordance with Section 26 05 01.

.2 Upon completion of the installation, the Contractor shall be responsible for testing to determine correct system operation and sequences as intended in the Contract Documents. Process Instruments such as flow, level, pressure transmitters, etc., shall be checked for operation prior to process start-up, by manipulating operating controls like set points, auto-manual selectors, etc. Status and alarm contacts to be checked by manipulation or jumpering at the sensing element.

.3 Results of tests are to be logged by the Contractor and submitted to the District and Engineer. Any apparent defects shall be reported and corrected.

.4 When preliminary checks have been completed and process equipment is operating or ready to operate, individual systems shall be calibrated in accordance with the latest ISA recommendation. After calibrations, the system shall be placed in operation in conjunction with the Contractor, District, Engineer, and designated operating personnel.

INSTRUMENTATION WIRING CHECK SHEET

PLC DISCRETE INPUTS AND OUTPUTS

In/Out	Rack	Slot	Channel	Description	Signal Action	Check

Client: _____ Project: _____

Date of Test: _____ Test conducted by: _____

Signature: _____ (Signed): _____

INSTRUMENTATION WIRING CHECK SHEET

PLC ANALOG INPUTS AND OUTPUTS

In/Out	Rack	Slot	Channel	Description	Instrument Reading	mA Signal

Client: _____ Project: _____

Date of Test: _____ Test conducted by: _____

Signature: _____ (Signed): _____

Part 4 Process Philosophy

4.1 GENERAL

.1 All equipment will operate automatically and shut down automatically in the event of a downstream system fault.

.2 All control of the main elements of the system will be available at the facility SCADA.

.3 Vendor supply packages will be integrated into the facility control system and control network as able.

4.2 SBR

.1 The SBR supplier will provide the narrative to detail the operation of the system. The finalized equipment has not yet been received.

4.3 DISK FILTER

.1 The Disk Filter supplier will provide the narrative to detail the operation of the system. The finalized equipment has not yet been received.

4.4 THICKENER / POLYMER SYSTEM

.1 The Thickener / Polymer supplier will provide the narrative to detail the operation of the system. The finalized equipment has not yet been received.

Operate all equipment in accordance with the manufacturer's recommendations

END OF SECTION

Part 1 General

1.1 QUALITY ASSURANCE

.1 CAN/CSA 22.1-2015, Canadian Electrical Code.

.2 C22.2 No.14-95, Industrial Control Equipment.

.3 C22.2 No.40-M1989 (R1994), Conduit, Junction and Pull Boxes.

.4 C22.2 No.94-M91 (R1997), Special Purpose Enclosures.

.5 NEMA 1-10-1979, Indoor enclosures, outdoor enclosures, ventilated enclosures, knock out and oil resistant gaskets.

1.2 SCOPE OF WORK

.1 It is not the intent of this specification to completely specify all details of control panel design and construction.

.2 The selection of all accessories, materials and methods of fabrication not specifically covered by these specifications, but which are necessary to complete the fabrication of the panels, shall be the responsibility of the Fabricator and shall be carried out in accordance with good engineering practices.

.3 In case of conflict within this specification or between the specification, drawings, purchase order, the accompanying data sheets and any other supplemental specifications, the Contractor shall immediately submit the matter in writing to the Engineer who shall make a determination and written clarification.

.4 Contractor shall have full responsibility for adhering to all local Codes and local inspector's requirements such that there shall be no impact to project schedule.

.5 The scope of work will include the replacement of the existing SBR control panel and additions to existing panels as required. The Contractor will be provided vendor drawings for all new panels, including PLC layouts and Card layouts with minimal Loop Drawings. The Contractor shall field verify all back pan and equipment dimensions prior to fabrication.

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures. Include:

.1 Bill of Materials showing item reference, tag, quantity, description, manufacturer, model number, and whether the item is shipped loose or installed.

.2 Separate shop drawings for the terminals, DC power supply, relays, control panel breakers, disconnects, motor starters, panel lighting, panel power bars etc.

.3 Loop drawings or schematics showing all internal and field wiring along with terminal numbers, equipment tags, wire tags, settings (for example timer relays) and calibrated ranges (if applicable).

.4 Internal elevation of all back panels and equipment.

.5 External elevation including enclosure rating and dimensions.

.6 List of Lamicoid labels.

.7 Drawings showing wire tags.

.8 Component shop drawings.

.2 Include control panel literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results for Electrical.

1.4 CLOSEOUT SUBMITTALS

.1 All submittals to be in accordance with Section 01 33 00.

.2 Detailed instructions as required permitting effective operation, maintenance, and repair.

.3 Technical data:

.1 Schematic diagrams of components, controls, and relays.

.2 Illustrated parts lists with parts catalogue numbers.

.3 Certified copy of factory test results.

Part 2 Products

2.1 GENERAL

.1 Supply the control panels in accordance with the general arrangement and dimensions indicated on the appropriate drawings. Panels must be complete with all instruments, meters, switches, indication lights, relays, etc., as specified herein or as indicated.

.2 Provide removable lamacoid nameplates having letters not smaller than 6 mm to identify equipment.

2.2 OPERATOR CONTROL STATIONS

.1 All enclosures and devices shall be rated NEMA 12 in ordinary environments or NEMA 3R outdoor environments, NEMA 4X in corrosive environments, unless otherwise noted.

.2 A replacement SBR control panel will be deployed in the Electrical Room in place of the existing panel, and contain equipment detailed in the vendor drawings. This equipment will operate the SBRs (new and existing) and be contained in a steel enclosure suitable for the environment.

2.3 PUSHBUTTONS

.1 Heavy-duty oil tight, operator flush, black, with 1-NO and 1-NC contacts rated at 10 A, 120 VAC, labels as indicated. Stop pushbuttons coloured red

.2 Acceptable manufacturer shall be Telmecanique, Allen-Bradley.

2.4 INDICATING LIGHTS

.1 Heavy duty, push to test LED type

.2 Lens colours: Red for running, Green for off, Amber for alarm

.3 Supply voltage: 120 V (AC)

.4 Labels as specified in Section 26 05 01 – Common Work Results for Electrical

.5 Acceptable manufacturer shall be Telmecanique, Allen-Bradley.

2.5 SELECTOR SWITCHES

.1 2 or 3 position as required, labelled as indicated heavy duty oiltight, operators as indicated, contact arrangement as indicated, rated 120 V (ac), 10 A.

.2 Acceptable manufacturer shall be Telemecanique, Allen-Bradley

2.6 PROGRAMMABLE LOGIC CONTROLLER

.1 The plant programmable logic controller (PLC) is a Logix5000 based controller and will require software to program.

.2 All systems to be programmed for required functionality, including remote start/stop from the main PLC over hardwire (and if decided during shop drawing reviews, Ethernet/IP). PLC programming, Factory Acceptance Testing (FAT), Site Acceptance Testing (SAT) and commissioning is the responsibility of the Contractor.

.3 Acceptable programmers will be MPE:

Zane Spencer, P.Tech.(Eng.)
Automation & Controls Project Manager
Tel. (403) 317-3635
Cel. (403) 382-8246
Fax. (403) 329-9354
Email. zspencer@mpe.ca

2.7 HUMAN MACHINE INTERFACE

.1 A SCADA terminal (iFIX) is required for updates to showcase the additional centrifuge, additional conveyors, replacement polymer system, modification to the sludge pump starters, and modification to the existing centrifuge.

.2 Acceptable programmers will be the PLC programmers selected for the work. Support by the Engineer can be provided for integrators not familiar with the iFIX platform. Graphics shall use 'high performance HMI graphic programming techniques (shades of grey, etc.) where possible, with input from the District.

.3 HMI to be programmed to support local control of primary building process functions, including the following:

- .1 Equipment mode (e.g. Hand, Off, Auto, Remote, etc.).
- .2 Equipment status (Running, Fault, etc.)
- .3 Equipment manual control.
- .4 Duty assignments for redundant equipment.
- .5 Instrument readings in engineering units.
- .6 Process control setpoints and modes.
- .7 PID controller setpoint, control variable, and process variable (read-only).
- .8 Equipment and plant operating limits, adjacent to real time variables and readings.
- .9 Adjustable alarm setpoints.
- .10 Overall process screen.
- .11 Individual process, equipment, and building system detail screens.
- .12 Screen titles.
- .13 Screen navigation buttons.
- .14 Date and time.
- .15 Currently logged-in user.
- .16 Mathematical constants page.
- .17 Communication heartbeat and status.

2.8 SURGE PROTECTION DEVICE (SPD) – CONTROL POWER

.1 UL1449 2nd Edition rated using metal oxide varisters.

.2 120 V, 15 A, 2 wire grounded input.

.3 MCOV: 150 V.

.4 Surge Current: 45 kA per phase.

.5 3 modes of protection.

.6 Filtering Bandwidth: 10 kHz to 100 MHz.

.7 Noise Attenuation: Normal Mode 75 dB at 100 kHz, Common mode 50 dB at 5 Mhz.

.8 Let Through voltage: 6 V A3 ringwave, 9.6 V B3 Ringwave, 70 V, B3/C1 impulse.

.9 Manufacturer: Cutler Hammer Aegis or approved equal in accordance with B7.

2.9 GENERAL PURPOSE RELAYS

.1 DIN rail mounted.

.2 Coil voltage as required.

.3 Contacts rated 5A, 120/240 V AC inductive, with two (2) N/O and (2) N/C contacts minimum.

.4 Operating time to be 20 ms maximum or AC coil and 30 ms maximum for DC coil.

.5 Rated for 100 000 operations at 5A, 120/240 VAC.

.6 With socket, built in LED or neon lamp operation indicator and push to test push button.

.7 Manufacturers: Allen-Bradley relays shall be type 700-HAX2Z24-1-4 with 700-HN125 relay base for 24 VDC coil voltages, and type 700-HAX2A1-1-4 with 700-HN125 relay base for 120 VAC coil voltage.

2.10 INTRINSICALLY SAFE RELAYS

.1 DIN rail mounted.

.2 Coil Voltage as required.

.3 Div 1, hazardous area classification required.

.4 250V:5A:500W resistive loads; reactive loads must be suppressed

.5 ‘No-Fail’ earth fault protection

.6 LED indicator: on when relay energized.

.7 Manufacturers: MTL model MTL2211 switch operated relay or similar.

2.11 DC POWER SUPPLY

.1 DIN rail mounted.

.2 Switched mode type.

.3 Input voltage 85-230 VAC.

.4 Output voltage 24 VDC output adjustable to + 10%.

.5 Power output as required with 25% spare capacity.

.6 Built-in overload protection.

.7 0.5% voltage regulation Minimum-Maximum input voltage.

.8 1.0% voltage regulation 10% to 100% load.

2.12 ETHERNET PATCH CABINETS, COMMUNICATIONS AND SWITCHES.

.1 Contractor is responsible for all Ethernet / communications cabling and terminations. Contractor to provide all wall plates, patch panels and all other required equipment to provide a clean installation.

.2 All Ethernet patch cables are to be of type 6 with properly terminated ends to ANSI/TIA/EIA 568A wiring standards to support gigabit Ethernet.

.3 Termination equipment design based on Panduit

.4 All Armoured Ethernet cable to follow applicable ANSI/TIA/AIA 568A wiring standards.

.5 The main plant PLC cabinet requires a second ethernet switch. The contractor will supply one additional switch, minimum of 8 ethernet ports, and install within the PLC enclosure on the left side-pan beside the existing 708TX switch.

2.13 WIRING

.1 Internal Control Panel Wiring for 120 VAC Power Distribution Circuits

.1 Rated No. 14 AWG, 600V PVC type insulation rated for minus 40 deg. C. to +105 deg. C., CSA rating TR-32, UL Style 1015, tinned, stranded copper conductor, as manufactured by Atlas Wire, Copper Field, Noma Cables, or other approved manufacturers.

.2 Internal Control Panel Wiring for PLC 120 VAC Discrete Signals and for PLC 24 VDC Discrete Signals.

.1 Maximum 8 A circuit protection: Rated No. 16 AWG, 600V PVC type insulation rated for minus 40 deg. C. to +105 deg. C., CSA rating TR-32, UL Style 1015, tinned, stranded copper conductor, as manufactured by Atlas Wire, Copper Field, Noma Cables, or other approved manufacturers.

.2 Maximum 15 A circuit protection: Rated No. 14 AWG, 600V PVC type insulation rated for minus 40 deg. C. to +105 deg. C., CSA rating TR-32,

UL Style 1015, tinned, stranded copper conductor, as manufactured by Atlas Wire, Copper Field, Noma Cables, or other approved manufacturers.

.3 Internal Control Panel Wiring for 24VDC Analog Signals.

.1 Stranded No.18 AWG tinned copper conductors, 300V with individual shielded twisted pairs. Use Belden Type 9318 for cables requiring 1 pair of individually shielded twisted pairs, Belden 9368 for cables requiring 2 pairs of individually shielded twisted pairs, and Belden 9388 for cables requiring 4 pairs of individually shielded twisted pairs.

.2 Manufacturers: Belden, Atlas Wire, Copper Field, Noma Cables, or other approved manufacturers.

.4 All wiring shall be color coded as follows:

.1 Analog signal pairs.

.1 White: DC positive.

.2 Black: Signal common.

.2 Analog signal triads:

.1 Red: DC supply to device.

.2 White: Analog signal from device.

.3 Black: Signal common.

.3 DC POWER WIRES

.1 Blue: DC positive.

.2 Brown: DC negative/common.

.3 Green: Grounding.

.4 AC POWER WIRES

.1 Black: AC supply/hot.

.2 White: AC neutral.

.3 Green: Grounding.

.5 PLC DISCRETE I/O (AC VOLTS)

.1 Red: AC Input

.2 Orange: AC Output

.6 PLC DISCRETE I/O (DC VOLTS)

.1 Violet: DC Input

.2 Grey: DC Output

2.14 GROUNDING

.1 Provided grounding lug, suitable for termination of #2 AWG to #2/0 AWG copper grounding cable.

.2 Separate grounding bars are to be provided for power grounds and instrument control system grounds (signal cable grounding, etc.).

2.15 SPARE PARTS

.1 Provide in accordance with Section 01 78 00 Closeout Submittals, the following spare parts:

.2 30 fuses of each type and rating used.

.3 2 control relays of each type used.

2.16 TERMINAL BLOCKS

.1 Screw connection terminals to be mounted on 35 mm DIN rails.

.1 Fused, 24 V DC shall be CSA approved for 300 V, accepting #12 - #16 AWG wire with blown-fuse indicator lamp. Weidmuller ASK-1 22276-0000 or similar.

.2 Unfused, 24 V DC shall be CSA approved for 300 V, accepting #12 - #16 AWG wire. Terminals shall be Weidmuller SAK 4 feed through type or similar.

.3 Fused, 120 V AC shall be CSA approved for 300 V, accepting #12 - #16 AWG wires, with blown-fuse indicator lamp. Weidmuller ASK-1 22556-0000 or similar.

.4 Unfused, 120 V AC devices shall be CSA approved for 300 V, accepting #12 - #16 AWG wires. Weidmuller SAK 4 feed through type or similar.

.2 Terminals colors shall be as follows:

.1	Ground	GREEN
.2	120V Line	BLACK
.3	120 V Neutral	WHITE
.4	+24 V DC	BLUE
.5	-24 V DC	BROWN

2.17 CONTROLS CIRCUIT PROTECTION

.1 Fuses: size as required, to match terminal blocks.

.2 Internal Control Panel Breakers:

.1 DIN rail mounted.

.2 CSA certified as a branch breaker protecting No.16 wire on load side of breaker.

.3 Size as required, maximum rating to be 80% of load side wire rating.

2.18 WIREWAYS

.1 Plastic wiring raceway with removable covers.

.2 Separate raceways shall be provided as follows:

.1	DC (24 V)	White
.2	AC	Black
.3	IS	Blue

.4 Raceway shall be sized for 40% wire fill.

2.19 CONSTRUCTION

.1 Minimum NEMA 12 construction for all panels unless otherwise specified.

.2 Unless otherwise specified fabricate floor mounted panels, indicated, of high grade, cold rolled smooth sheet metal steel no thinner than 3 mm thick with all doors and edges neatly turned and finished smoothly. Visible welding seams will not be accepted.

.3 Construct rigid panels and racks with an angle iron or channel supporting frame, suitably braced, and stiffened to prevent any deformation during shipping or installation, and provide a surface free from dents, warping or other deformation. Provide a four-sided channel iron mounting base with front recess.

.4 Provide flush fitting, gasketted doors hung on piano type hinges with three-point latches and locking-type handles (CSA Type 12 construction).

.5 Provide pans and rails for mounting terminal blocks, relays, wiring and other necessary devices.

.6 Use rear connected fittings to hold equipment and instrument cases on the panel, but where not possible; any front fixing required shall be only by means of chrome-plated, brass, or stainless-steel machine screws.

.7 Panel surfaces shall be thoroughly cleaned and degreased before painting. One primer coat shall be covered by two finished paint coats.

.8 The surface finish shall be free of runs, drops, ridges, waves, and laps. The paints shall be applied in such manner as to provide an even film covering corners and crevices. The interior finish shall be white, and the exterior finished will be selected after award of the contract.

.9 Panel Accessories: a metal pocket, 250 mm wide x 150 mm high x 25 mm deep, to hold pertinent drawings and manuals on the lower half of the inside door.

2.20 INTERNAL WORKS

.1 Provide an individual switch for disconnection and a fuse for isolation of all panel mounted instruments requiring a 120-volt supply.

.2 Make all wiring connections in the shop from the equipment mounted on the panel to numbered terminal blocks conveniently located in the panel, including the power supply for all instruments. Conductors shall be extra flexible stranded

copper of gauges sufficient to carry the required currents and shall in no case be smaller than #16 AWG extra flexible.

.3 Wire connections to all relays and instruments shall be made using easily removable good quality mechanical clips.

.4 Identify all wiring by means of plastic slip-on type markers. Install all wiring neatly and laced or bunched into cable form using plastic wire clips, and where practical, contained in plastic wiring channels with covers.

.5 Provide Weidmuller terminal blocks #SAK 2.5, T7 Carrier & EK 2.5N Grounding, tubular clamp, 300 V, complete with track. Each terminal shall be clearly indelibly marked with the wire number connection to it. Each field connecting conductor shall be served by one terminal. Provide 20% spare unit terminals, with a minimum of two spare terminals. Provide all necessary terminal block accessories such as manufactured jumpers and marking tape.

.6 Mount all internally mounted equipment on a hinged sub-chassis or mount on a rack and arrange for ease of access and removal when necessary.

.7 Arrange all terminal blocks in the panel in groups such that all low level signals such as 4-20 mA DC are located in one area, followed by contact closure type signals (limit switches, etc.), that do not subsequently energize starters, etc. but are for status indication, and the remainder that contain powered circuits, 120 volt, 60 Hz, are to be arranged in such a manner and location so as to prevent interference into the low level signal.

.8 Submit proposed terminal block layout and identification scheme for review prior to manufacture.

.9 Provide suitable spaces around the terminal blocks for incoming and outgoing conductors or cable assemblies.

.10 Provide plastic cable troughs equal to Panduit complete with snap-on covers for containing the cables. Cables are not to be bunched and tied, but laid in. Wire fill not to exceed 40%.

2.21 LABELLING

.1 Panel terminal labels to be black writing on white background.

.2 Wire labels to be PVC material with black writing on white background, securely fastened to prevent movement on wire or cable. Wieland type Z5 or Weidmuller type Z or similar.

.3 Each major component inside and on the face of the control panel to be labeled with a Lamicoid label, white lettering on black background, minimum text size to be 5mm high.

.4 Terminals shall be grouped for clarity and a Lamicoid label or DIN-rail mounted label block provided for each group. For example: Terminals for slot 2 discrete input PLC card may be grouped together with label as follows; TB1 (DI).

.5 Each terminal block in each group should be numbered with individual snap-in labels such as Weidmuller Dekterm markers or similar.

.6 Label the front of the control panel with engraved Lamicoid nameplates, 20 mm x 75 mm, white lettering on black background.

.7 WRITE ON LABELS ARE NOT ACCEPTABLE.

2.22 PANEL MANUFACTURER

.1 Panel assembly, subcomponents and all internal components shall be CSA approved. Cabinet construction shall be performed by an established panel manufacturer who shall comply with all building codes, factory, and Department of Labour regulations and has CSA approval as manufacturer for all components of the work including control panels. Local approvals for panel construction including CSA will not be accepted.

.2 Panel manufacturer shall have successfully completed a minimum of five (5) water and / or sewage treatment plant projects of a similar scope and complexity in the past 24 months.

.3 Panel manufacturer shall have full CSA approval as manufacturer for all components of the work.

.4 Acceptable panel manufacturer shall be in British Columbia and showcase experience with Allen Bradley Compact Logix PLCs.

Part 3 Execution

3.1 INSTALLATION

.1 Install pushbutton stations, control and relay panels, control devices as indicated, and interconnect as indicated.

3.2 CONTROL SYSTEM DISRUPTION

.1 All shutdowns shall be coordinated with operations and maintenance.

3.3 GENERAL

.1 Field measure all back pans and equipment to be relocated. Advise Engineer of changes and submit shop drawings. Modify panel layout to suit.

.2 Install Ethernet taps cabling.

.3 All AC, DC and intrinsically safe wiring shall be run in separate raceways.

.4 Install a maximum of one wire per terminal.

.5 Install terminal cross connects where required. Do not install jumper wires.

.6 Label all terminals and devices.

.7 Label all wire and cables as defined in related sections.

.8 Mount Lamicoids using self-tapping Stainless-Steel screws. Do not mount on removable covers.

.9 All devices to be protected with either fuses or breakers.

.10 All I/O to be protected with fuses including relay coils and contacts, discrete inputs and outputs and analog inputs and outputs.

.11 Control panel junctions shall be made using terminal blocks. Wire splices shall not be allowed.

.12 Communication and signal circuits shall not be installed in the same conduit with power and lighting circuits.

.13 Only commercially prepared wire-pulling compounds approved by cable manufacturers will be used. The use of soaps, soap flakes, detergents or similar preparations will not be allowed.

.14 Each wire entering a box shall be left with at least 200 mm of wire clear of the box after splicing to facilitate future alterations. Through wires in a box shall be 150 mm between the box and bottom of loop.

.15 Each terminal shall be uniquely identified and labeled.

.16 Each wire shall be tagged at both ends. The tag shall correspond with labels provided on engineering design drawings. Mark up one set of drawings with added/modified tags for review by the Engineer.

3.4 INSPECTION AND TESTING

.1 The Owner and Engineer reserves the right to inspect and witness test the control panels.

.2 Inspection:

.1 The Engineer shall be notified at least one (1) day prior to the completion of the panel layout so that arrangements can be made to inspect the panel before commencement of wiring. Provide progress photographs

(digital format) to the Engineer at this stage. Progress photographs shall be sent via e-mail.

.2 The Engineer shall be notified at least seven (7) days prior to the completion of the panel so that arrangements can be made for final inspection and testing. Provide progress photographs (digital format) to the Engineer at this stage. Progress photographs shall be sent via e-mail.

.3 The inspection of the panel shall include but not be limited to the following:

.1 General workmanship (including physical dimensions).

.2 Panel painting.

.3 Arrangement of the panel.

.4 Nameplates and tagging of all panel components, instruments, control switches, indicating lights, wires, terminals, relays, and auxiliary equipment.

.3 Testing:

.1 Prior to the arrival of the Engineer, the panel shall have been completely tested by the Panel Fabricator as follows:

.1 All electrical circuits checked for continuity, and compliance with the specification.

.2 All symbols and nameplates checked for correct spelling and size of letters.

.3 All lamps tested.

.4 Mechanical features (doors, hinges, latches, etc.) shall be free from defects.

.5 Finished surfaces shall be free from defects.

.6 The Panel Fabricator shall perform all other tests as required to place the panel in operating condition. Completion of these tests shall be submitted to the Engineer in writing.

.2 The Contractor shall allocate adequate space, facilities, and assistance to permit inspection and testing to the satisfaction of the Engineer. Test instruments and equipment, test leads, temporary wiring, tools, etc., shall be made available, by the Contractor, as required. All the above items are to remain the property of the Contractor.

.3 Provide a technician for two (2) eight (8) hour days to assist the Engineer in testing the panel.

.4 All calibration/test equipment shall have a current certification of calibration. All the facilities, assistance, equipment, materials, and arrangements shall be provided at no additional charge to the Engineer.

.5 During functional test, the Engineer shall develop a deficiency list of items to be completed before the panel is accepted and shipped.

.6 The test of the panel shall include but not be limited to the following:

.1 All circuits with timing relays.

.2 All interconnecting circuits with sequencing functions.

.3 AC and DC power distribution.

.4 All auxiliary equipment.

.5 All control switches and indicating lights.

3.5 PACKAGING AND SHIPPING

.1 In accordance with Section 01 33 00 – Submittal Procedures.

.2 The panels shall be prepared for shipment to protect it from physical damage. Assemblies shall be packaged in generously padded cartons or containers. Partial shipment shall only be allowed by written approval of the Engineer.

.3 All shelf-mounted instrumentation shall be removed from the panel before shipment and re-packaged in its original containers for shipment to the job site.

.4 Any other "loose" components shall be taped or tied down, and/or supported with polyurethane foam to provide a tight, vibration free shipping unit.

.5 In addition to the District's company name and the shipping destination, the outside of each crate or carton shall be marked with the Purchase Order and Item Number(s). A label listing the contents and a duplicate listing shall be included inside the package.

3.6 TESTS

.1 Thorough testing of the communications system shall be done prior to completion of field installation of equipment. The Contractor shall demonstrate that PLC components are operational and meet the specifications by means of tests carried out at different points of time.

.2 The complete testing process shall follow this sequence:

.1 Contractor Testing of I/O back to PLC

.2 Contractor will support testing of control system

.3 Site Acceptance Test (SAT)

.4 14-Day Acceptance Period after Commissioning

.3 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at a time and check out operation of section.

.4 Upon completion of sectional test, undertake group testing.

.5 Check out complete system for operational sequencing.

.6 Record Network/Segment measurements on commissioning test forms and include in commissioning manuals.

.7 Submit one copy of test results to the Engineer.

3.7 COMMISSIONING

.1 The Contractor shall be responsible for the commissioning support of the systems during the project.

.2 The Contractor shall perform all panel start-up and commissioning.

.3 PLC and HMI programming is the responsibility of the Contractor. Programming will be based on the work package and operation requirements of the District.

.4 Site Acceptance Test (SAT)

.1 System Test

.1 Test communication links for specified performance

.2 Test all wiring made to existing control panels

.3 Test all manual and automatic controls for complete operation

.4 Test all alarms to PLC for proper operation - contacts to open on alarm

.5 Test PLC-imitated callout system on alarms

.6 Test all discrete PLC inputs for proper operation

.7 Test all analog PLC inputs for proper operation

.8 Force all discrete outputs to test for correct wiring and operation

.9 Test all automated sequences

.5 14-Day Acceptance Period After Commissioning

.1 A 14-Day Acceptance Period after Commissioning shall commence at the discretion of the Engineer and after successful completion of SAT. During this period, the system will be monitored for proper operation and to ensure compliance with the availability criteria.

.2 In the event of a malfunction or a failure to meet the reliability criteria, the Client will terminate the Site Acceptance Period until the Contractor remedies the deficiency. The Site Acceptance Period shall then begin again and continue for a period of fourteen (14) days. This process shall continue until the system performs satisfactorily for fourteen (14) consecutive days in complete compliance with the specifications.

END OF SECTION

Part 1 General

1.1 UNIFORMITY OF INSTRUMENTS

.1 Instruments of one manufacturer to be used throughout the installation to the extent practical. Instruments of similar make and model to existing site equipment to be used throughout the installation to the extent practical. Variations will be permitted only where the major supplier cannot supply an instrument as specified in the instrument specifications.

.2 Note that where specifications specify a variety of instrument manufacturers, these are to establish standards of quality.

1.2 SCOPE

.1 This section specifies the supply installation, field testing, and placing into operation of flow, pressure, temperature, level turbidity, and other instruments of control and instrumentation.

1.3 RELATED WORK

.1 Section 26 05 01 – Common Work Results – Electrical.

.2 Section 25 14 00 – Control Panels.

1.4 DRAWINGS AND DESIGN

.1 The drawings are intended to show the major details of the control and instrumentation work but it is the Contractor's responsibility to examine the electrical, mechanical, structural, and architectural drawings before beginning the work and report to the Engineer any discrepancies or interferences which may occur.

.2 Control and instrumentation system layouts shown on the drawings are generally diagrammatic and the locations of equipment are approximate. Exact routing of conduits, cables, wiring, tubing, and air headers to be governed by the mechanical, structural, and architectural conditions which prevail.

.3 The Engineer reserves the right to change the location of any piece of equipment without extra payment therefore, providing only that the change is requested before installation and that the new location is within 3.0 m of the original location.

1.5 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures. Product data sheets to include:

.1 Component electrical characteristics.

.2 Performance criteria.

.3 Physical size and limitations.

.2 Include instruments literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results – Electrical. Manufacturer's Instructions to indicate special handling criteria, installation sequence, cleaning, and maintenance procedures.

Part 2 Products

2.1 INSTRUMENTS

.1 Provide each instrument with mechanisms that are corrosion resistant.

.2 Provide each instrument with mechanisms enclosed in a dustproof and a moisture proof case.

.3 Provide all indicator and gauge dials finished in permanent white with black graduations and figures.

.4 Potentiomeric signals shall have a "live" zero or positive minimum value in the signal range.

.5 Each component shall be carefully selected and designed for a long lifetime with ample margin to withstand transient and other surge voltages, which may occur in the circuits from any source in the power supply.

.6 Each component and composite instrument shall be suitable for the location and installation position at the attitude designated on the drawings, e.g., horizontal, vertical, or sloped position.

.7 The Contractor shall provide all power supplies. Provide each instrument having a 120-volt supply with a receptacle and plug assembly. Receptacles and plug to be of "twist-lok," type.

.8 Provide each instrument with a circuit breaker.

.9 All control panel mounted instruments shall be suitable for flush mounting and shall be furnished with bezel.

.10 Unless otherwise indicated or specified, all signals shall be of the 4-20 mA DC type. This applies to both transmitting and receiving instruments.

.11 All materials shall conform to the standards of the Canadian Standards Association (CSA).

.12 A minimum of one paper copy of each unique manual shall be provided.

.13 Where instruments require a hand-held programmer for setting up and calibrating, one of each unique programmer shall be provided.

.14 Instruments of one manufacturer to be used throughout the installation to the extent practical.

.15 Where indicated on P&ID drawings, provide instruments with block valves, block and bleed valves, or 3-valve manifolds.

.16 Use 316 stainless steel valves on stainless steel piping, bronze-body valves on carbon steel or copper piping, and PVC ball valves on PVC piping unless specified otherwise.

.17 All pressure gauges, transmitters and switches shall be installed with a gauge/root valve equal to Whitey SS-6NDGM12-F8 complete with bleed valve SS-BVM8 and SS-½ inch plugs as required.

.18 All instrument tubing and fittings will 316 SS. All fittings will be Swagelok compression type unless otherwise specified.

.19 Any instruments encountering potable water that carries on through to distribution will have NSF 61 / ANSI 61 certification. Alternatively, they will be rated as hygienic or sanitary and a case will be made to treat them as equivalent to NSF 61 / ANSI 61.

.20 Any instruments that are do not encounter potable water for distribution do not have to be NSF 61/ ANSI 61 certified.

2.2 MAGNETIC FLOW METERS

.1 Magnetic flow meters for applications where there is at least three diameters of straight pipe upstream and two diameters of straight pipe downstream of the flow meter shall be complete with signal converters and shall be one of the following series or an approved alternative.

.1	ABB	FXE4000 (COPA-XE/MAG-XE)
.2	Endress+Hauser	PROline Promag 50 W
.3	Rosemount	8700
.4	Siemens/Sitrans	MAG 5000/MAG 5100
.5	Toshiba	LF430
.6	Krohne	Optiflux

.2 Magnetic flow meters for applications where there is less than three diameters of straight pipe upstream and two diameters of straight pipe downstream of the flow meter shall be complete with signal converters and shall be the following series or an approved alternative.

.1	Toshiba	LF430

.2 Krohne Waterflux (316SS body only)

.3 Flow meters shall have the following features:

.1 Continuous zero stability.

.2 Interchangeability with signal converters without calibration performance.

.3 End connections shall be compatible with process piping specifications and drawings.

.4 Grounding as specified by the flow meter manufacturer.

.4 Flow meters shall have the following features:

.1 Signal converters shall have the following features:

.1 CSA Zone 2 Groups A, B, C & D certified and F.M. approved

.2 Flanges: Carbon steel, flanged each end

.3 Liner: Polyurethane

.4 Electrodes: 316 stainless steel

.5 Enclosure: NEMA 4X

.6 Product temperature: -10 to 50°C

.7 Ambient temperature: 10 to 50°C

.8 Continuous zero stability.

.9 Solid state electronics.

.10 Direct reading range adjustment permitting precise manual selecting of maximum flow rate.

.11 A local indicator that simultaneously displays instantaneous flow and totalized flow.

.12 Output analog signal proportion to the instantaneous flow, 4-20mA.

.13 Interchangeability with any flow meter without affecting calibration performance.

.14 Local display: instantaneous flow in litres per minute and totalizer in cubic metres

.15 Field mounting design.

.16 The combined accuracy off the flow meter and converter shall be within 0.5% of the actual flow rate, when the actual flow rate is between 10% and 100% of the maximum flow setting.

.5 Provide pipe spool pieces for the in-line replacement of each flow meter. Spool piece tube and end connections shall conform to the process piping specifications and drawings.

.6 The in-line mechanical installation of magnetic flow meters and turbine meters is specified under process mechanical specifications and scope. Install per manufacturers installation instructions and process mechanical specifications.

2.3 LEVEL MONITORING SYSTEMS

.1 Ultrasonic Level Transmitter

.1 Level monitoring Transmitters

.2 The level system shall be the following or equivalent product:

.1 Siemens (Milltronics) model Sitrans Echomax XPS-15 w/ Sitrans MultiRanger 100,

.2 Endress and Hauser Prosonic M series

.3 Siemens Sitrans Probe LU

.3 Controller shall have local display, analog output and adjustable high- and low-level alarm setpoints.

.4 Each alarm output shall be a Form C contact driven by a relay that de-energizes on the alarm condition.

.5 The reservoir Ultrasonic level transmitter shall have the transducer mounted separately from the controller (transmitter).

.6 Output analog signal will be linearly proportional to the level.

.7 Indicator will have linear scale in units of mm.

.2 Point Level Control Systems

.1 Point Level Transmitters

.2 The level system shall be the following or equivalent:

.1 Siemens Pointek ULS200 (point level, LSC-116 only)

.2 Siemens (Milltronics) model Sitrans Echomax XPS-15 w/ Sitrans MultiRanger 100,

.3 Endress and Hauser Prosonic M series

.4 Siemens Sitrans Probe LU

.3 Controller shall have local display for programming and adjustable latch/unlatch and high alarm setpoints.

.4 Two outputs are to be provided, both being Form C contacts providing a start/stop signal as well as a high-level signal.

.5 Power to be 24Vdc. If 24Vdc not used, 120Vac system installation shall be accounted for in price (including wiring and source)

.3 Level Switches

.1 For non-NSF 61 / ANSI 61 rated devices, level switches shall be ENM-10 Liquid Regulators, standard version, as manufactured by Flygt Canada or an approved alternative. Switches shall not contain any mercury.

.2 For NSF 61 / ANSI 61 rated devices, level switches shall be Endress and Hauser Liquiphan M FTL51 series or approved equivalent.

.3 Install as shown on Process Mechanical drawings.

.4 Suspend the bulb the appropriate distance above the bottom of the channel to obtain the desired switching point.

.5 For level switches sensing a high level, the switching point is defined by a rising water level

.6 For level switches sensing a low level, the switching point is defined by a falling water level.

.7 Protect level switches from turbulence during equipment operation.

2.4 ISOLATION VALVES

.1 Each instrument sensing line shall be complete with an isolation valve. The isolation valves shall conform to Division 40 - Process Mechanical.

2.5 PRESSURE MONITORING SYSTEM

.1 Pressure transmitters shall have the following features:

.2 Loop powered by 24 Vdc.

.3 Output analog signal shall be 4 to 20 mA and linearly proportional to the pressure.

.4 Where an Indicator is required, it shall have a linear scale in units of kPa.

.5 Pressure transmitters shall be manufactured by ABB, Endress + Hauser, Rosemount, Siemans, Toshiba or an approved alternative.

2.6 SUPPLIED EQUIPMENT

.1 Contractor responsible for confirming with all trades to ensure electrical discipline is made aware of all equipment that is to be wired and supported for commissioning. Basic drawings are provide showcasing the vendor-supplied equipment and the equipment that is required for purchase and installation.

Part 3 Execution

3.1 INSTALLATION

.1 Coordinate the work of this Section with the installation of the equipment specified in the relevant Sections and as shown on the Mechanical and Electrical drawings.

.2 Perform all work in compliance with the relevant sections of this Section.

.3 Ensure that exit light circuit breaker is locked in on position.

.4 The Contractor to be responsible for the correct installation and assembly of all items of equipment. Manufacturer's instructions to be carefully read and rigidly adhered to in the installation. Any damage resulting from failure to observe the manufacturer's instructions or because of proceeding with the work without

complete knowledge of a component will be the Contractor's responsibility. The Contractor to make good any loss or damage resulting from malpractice.

.5 Where the manufacturer recommends the use of special tools or jigs for installation or calibration, use such tools.

.6 Where the manufacturer requires to inspect the work before certifying the instrument, co-operate to permit such inspection.

3.2 CONDUIT AND CONDUCTOR INSTALLATION

.1 Refer to Division 26 for conduit and conductor installation and precautions during construction.

3.3 CABLE INSTALLATION

.1 Control and instrumentation cables shall be supported on horizontal cable trays by means of nylon cable ties at intervals not exceeding 1 m.

.2 Control and instrumentation cables shall be supported on vertical cable trays by means of cable clamps. The Contractor shall be responsible for selecting the proper size clamp for each cable.

.3 Cables leaving the cable tray system shall be supported to the building walls by means of c-channel and cable clamps or approved alternative.

.4 Wall support not to exceed an interval of 1 m. The length of the supports to be 150 mm minimum.

.5 Cable installation from the building wall to the control or instrumentation device exceeding 0.5 m shall be supported by means of c-channel, supported to the wall and at the device. Cross channel for the support of the Series M-5000 cable clamps to be bolted to the main channel. Cross channel not to be wider than is required for the cable clamp. All channels and supports painted black.

.6 Channels for cable support from building walls shall be painted the same colour as the walls. Cables and cable clamps not to be painted.

3.4 FIELD INSTRUMENT MOUNTING

.1 "Mounting" shall mean the positioning and fastening with proper brackets in the position required.

.2 All equipment shall be mounted in accordance with manufacturer's recommendations.

.3 Locations of all field instruments are subject to modification by the Engineer who reserves the right to move any item up to 3 meters from the position shown,

without change to the contract price, provided notice is given before the related work has commenced.

.4 Exact locations of all field instruments shall be site determined by the Contractor to the satisfaction of the Engineer to ensure proper operation of the device.

.5 Employ all means of trade, skill, and workmanship to install all field instruments to the satisfaction of the Engineer.

3.5 COMMISSIONING

.1 Instrument manufacturer's qualified field service representative shall be onsite as required to perform instrument calibration, testing and commissioning and to instruct Owner's representatives in all aspects of instrument operation and maintenance.

.2 Follow all commissioning requirements of these specifications.

.3 The Contractor is responsible for fully commissioning the installed equipment and providing a functional system to the Owner.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 All Sections of General Conditions form a part of this Specification. They shall be read and fully adhered to exactly as if repeated here in full.

.2 Refer to all other Sections of the Specifications and the Contract Documents to determine their effect upon the work of this Section.

1.2 SCOPE

.1 A brief but not necessarily all-inclusive list of work to be performed under this contract is given herein.

.2 The Contractor shall supply all labor, material, equipment, transportation, services, and facilities necessary to make, test and place into operation a complete electrical installation as shown on the drawings and/or as specified herein.

.3 Where the term "provide" is used herein, it shall mean "supply, install, adjust, test and place into operation".

.4 All systems shall be completely assembled, adjusted, tested, and demonstrated to be ready for operation to the satisfaction of the Engineer.

.5 The Contractor shall carefully examine the drawings and specifications and shall fully inform himself as to all existing conditions and limitations, including all laws, ordinances and regulations affecting the contract and the work and shall include in his tender all items implied or required to complete the work of this contract.

.6 The Contractor shall satisfy himself as to working space, storage space, access facilities and all other conditions pertaining to the site, relating to the conduct of his operations, by the inspection of the site and examination of the drawings.

.7 Provide all labor and materials as necessary to install, wire, connect and put into satisfactory operation the following electrical equipment, control panels and process and mechanical equipment supplied under this and other Sections of this specification:

- .1 Motor Control Centre modifications,
- .2 PLC modifications (I/O terminations, PLC programming, SCADA programming),
- .3 Installation and commissioning of all vendor-supplied equipment,
- .4 Motor starters, contactors, and interlocks where specified as components of "packaged" equipment,

.5 Electrical distribution equipment, such as 600V panel board, and

.6 Various other electrical systems, including lighting, receptacles, switches, and controls.

1.3 EXTENT OF WORK

.1 This work shall consist of furnishing of all labor, material, equipment, and all incidentals required for the District of Sooke WWTP Dewatering Area (Facility).

.2 Work at the Facility shall include, but not be limited to:

.1 Modifications to existing facilities, including:

.1 Provide all required Electrical permitting for the project.

.2 Revisions to the existing MCC to make space for connection of new loads and new MCC sections,

.3 Supply and installation of two additional MCC sections. New MCC sections are to be powered from a single cable feed to minimize MCC de-energization requirements,

.4 Connection of new MCC mounted VFD’s to field motor loads,

.5 Connection of new field mounted VFD’s to field motor loads

.6 Connection of new MCC feed breakers to new and existing 600VAC loads,

.7 Supply and installation of local motor control stations and related wiring.

.8 Supply and installation of cable tray extensions for Teck and armoured cabling,

.9 Additional distribution equipment including but not limited to: 600V panel board and wiring,

.10 Addition of MCC breakers, wiring and distribution to feed vendor packages (including Disk Filter, Thickener/Polymer System, SBR system),

.11 Installation of conduit, wiring and/or cabling for the interconnection of vendor supplied panels and vendor supplied field devices detailed in the work package and on vendor shop drawings,

.12 Supply and installation of all power, control, and instrumentation wiring for pre-purchased and contractor supplied process systems,

.13 Wiring of new mechanical equipment in the polymer room, including: water heater (electric), room heating and ventilation equipment, and related controls. Coordinate with Div 22,

.14 Supply and installation of all building electrical services to the new polymer room, including lighting, receptacles, and communications,

.15 Supply and installation of all grounding and equipment bonding systems,

.16 Revision of the existing plant Ethernet communications network including all required hardware and cabling,

.17 Revision of the existing plant Devicenet communications network including all required hardware and cabling,

.18 Supply and installation of all components related for modification of the existing Plant PLC-based control system, including programming services,

.19 Supply and installation of all wiring systems between new field instruments and control devices and the Plant PLC cabinet,

.20 Supply and installation of all contractor and vendor suppled field instruments and control devices.

.21 Programming of PLC and SCADA to accommodate new systems and communicate with new packaged equipment,

.22 Commissioning assistance to all package vendors during their respective start up and testing phases.

.23 Commissioning of all equipment to an operating state, and

.24 See contract drawings for further details.

.3 Wire to and make connections to, all electrical power and control items required, including motors, and controls.

1.4 EXAMINATION OF DRAWINGS

.1 The electrical drawings do not show all architectural, mechanical, and structural details. All electrical schematics are shown diagrammatically unless otherwise noted. The Contractor shall review the mechanical and structural drawings to obtain building dimensions and details. Verify dimensions accurately by measurements.

.2 There are many underground conduits required that are not shown on the plan drawings but are referred to in notes and listed on the cable schedule(s). Contractor shall review the underground conduit requirements and provide sketch of proposed layout for Engineer review, prior to installing.

.3 To change the location of electrical equipment, submit a request in writing to the Engineer for approval. If approved, such changes are to be made at no additional cost to the District.

.4 No extra will be allowed for any additional labor or materials required for relocation of equipment due to interference with equipment of other trades, beams, joists, walls, etc., unless the conflict has been submitted to the Engineer in accordance with these Specifications.

1.5 APPROVED DESIGN AND INSTALLATION

.1 Equipment and material to be of approved design and manufactured in accordance with all governing regulations such as "Canadian Standards

Association", "Canadian Electrical Code", "Provincial Department of Labor", "Underwriters Laboratory", etc. Equipment and material must bear applicable acceptance labels of all associations and governing bodies recognized by the municipal, provincial, and federal authorities.

.2 Install equipment in strict accordance with manufacturer's recommendations and governing rules, regulations, and codes.

.3 Where requirement conflict occurs, install all materials in accordance with the most severe requirements.

.4 Material installed under this Section to be new and of uniform construction.

.5 All installation to ensure maximum headroom, minimum interference with free use of surrounding areas, and best access to equipment.

.6 For any deviations of major service runs and/or feeder cabling from the locations shown on the drawings, Contractor shall submit to the Engineer suitable drawings showing such deviations together with reasons for deviations and obtain approval from the Engineer before proceeding with the installation.

1.6 CODES AND STANDARDS

.1 Do complete installation in accordance with the latest edition of the Canadian Electrical Code, as adopted for the province of British Columbia, and Provincial, Municipal, and other codes, rules and regulations, and requirements of the local authorities having jurisdiction.

.2 Perform all work in accordance with drawings, specifications, applicable municipal and provincial regulations, and any pertinent inspection bulletins issued by the electrical inspection authority having jurisdiction over the installation. In no instance shall the standard established by the drawings and specifications be reduced.

.3 Provide a copy of all standards referred to in this Section for use on site.

1.7 PERMITS, FEES, AND INSPECTION

.1 Submit to the District of Sooke authorities having jurisdiction, the necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Engineer of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to the Engineer.

1.8 ABBREVIATIONS

.1 Abbreviations for electrical terms shall be to CSA Z85 1983.

.2 Names used throughout these specifications are:

.1 EEMAC: Electrical & Electronic Manufacturers Association of Canada (formerly CEMA)
.2 CSA: Canadian Standards Association
.3 FM: Factory Mutual
.4 NEMA: National Electrical Manufacturers Association (U.S.)
.5 JIC: Joint Industry Conference
.6 IPCEA: Insulated Power Cable Engineers Association
.7 ISA: Instrument Society of America
.8 CEC: Canadian Electrical Code
.9 IEEE: Institute of Electrical and Electronic Engineers
.10 IES: Illuminating Engineering Society
.11 NBC: National Building Code
.12 ANSI: American National Standards Institute

1.9 SHOP DRAWINGS

.1 Submit shop drawings in accordance with these Specifications and Specification 01 33 00.

.2 Submit shop drawings for all equipment as indicated, except for conduits, standard conduit fittings and low voltage wiring.

.3 Indicate on shop drawings details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.4 Where applicable, include wiring, single line, and schematic diagrams.

.5 Wiring drawings showing interconnection with work or other sections are required.

.6 Indicate the numbered and lettered tags shown on the drawings for identification symbol(s) on submitted shop drawings and product data for panelboards, lighting fixtures and other electrical equipment.

1.10 OPERATION AND MAINTENANCE MANUALS

.1 Include in the manual’s information based on following requirements:

.1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation,

maintenance, repair, modification, extension, and expansion of any portion or feature of installation.

.2 Technical data to be in form of approved shop drawings, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists.

.3 Advertising or sales literature is not acceptable.

.4 Provide wiring and schematic diagrams and performance curves.

.5 Include names and addresses of local suppliers for all items included in the operation and maintenance manuals.

.2 Submit six (6) complete copies of manuals and "as-constructed" drawings to the Engineer for review. Revise initial manual as required by the Engineer prior to final submission.

1.11 RECORD DRAWINGS

.1 Submit record drawings in accordance with Section 01 78 00 - Closeout Submittals.

.2 The Contractor shall record all changes made during construction and provide red-lined record drawings to District upon completion of the work.

.3 At the completion of the project, the Contractor shall submit one (1) set of record drawings on disk, accurately recording all changes, deviations and relocations necessitated by job conditions and equipment approved shop drawings all done with red pen to full sized drawings. A second copy to be left at site.

.4 Include with the record drawings a list for each motor indicating motor or equipment number and name, nameplate voltage, horsepower and current, the size of overload and breaker or fuse protection provided.

1.12 DEFINITIONS

.1 The following are definitions of terms and expressions used in the specification:

.1 "Inspection Authority" means agent of any authority having jurisdiction over construction and safety standards associated with any part of electrical work on site.

.2 “Supply Authority" means electrical power company or commission responsible for delivery of electrical power to project.

.3 "Electrical Code" means latest edition of the Canadian Electrical Code C22.1 or code in force at project location.

.4 "Indicated" means as shown on contract drawings or noted in contract documents.

.2 Refer to CSA C22.2 for "Definitions and General Requirements".

1.13 COOPERATION AND COORDINATION

.1 Schedule expediting of all materials and execution of work with associated work specified in other Sections.

.2 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete shall be schedule 40 galvanized steel pipes, sized for free passage of conduit, and protruding 50 mm (2").

.3 Cables, conduits, and fittings to be embedded or plastered over neatly and close to building structure so furring can be kept to a minimum.

.4 Arrange for holes through exterior walls and roof to be flashed and made weatherproof.

1.14 SOURCE QUALITY CONTROL

.1 Arrange for a plant inspection by the Engineer where specified.

.2 Inform the Engineer of manufacturing progress and arrange inspections at appropriate times.

.3 Action required by factory inspection shall not be construed as final acceptance.

.4 Obtain a Certificate of Acceptance from the inspection authority on completion of work and hand it to the Engineer.

.5 The Engineer may carry out inspections and prepare deficiency lists for action by the Contractor, during and on completion of project.

1.15 CARE, OPERATION AND START-UP

.1 Instruct operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance, and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

1.16 APPROVAL OF ALTERNATE MATERIALS

.1 Bid Opportunity shall be based on the materials, products, and manufacturers specified.

.2 Alternates to materials, products, and manufacturers specified shall be in accordance with Section 1.

.3 Supply and install all motor power wiring and conduit, all control wiring and conduit, all local and remote-control devices, and all motor starters and contactors except where specified as components of "packaged" equipment.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT - GENERAL

.1 All materials shall be fully approved by the Canadian Standards Association (CSA) or by a Provincial Inspection Authorities approved agency, for use as installed. All materials shall meet the requirements of this specification in all respects.

.2 Where there is no alternative to supplying equipment, which does not have CSA approval, submit such equipment to Provincial Inspection Authorities for special inspection and obtain approval. Pay all associated fees.

.3 Materials and equipment shall be of Canadian manufacture except where specified otherwise or where Canadian made materials or equipment does not exist.

.4 Where two or more units of the same class or type of equipment are required, the units shall be the product of a single manufacturer, although components of equipment need not be products of the same manufacturer.

.5 Use material and equipment available from regular production of manufacturer.

.6 Control panels and component assemblies to be shop manufactured, assembled, and CSA approved.

2.2 FINISH

.1 Finish metal enclosure surfaces by removing rust and scale, cleaning, and applying rust resistant primer inside and outside with at least two coats of finish enamel.

.2 Paint all outdoor electrical equipment "equipment green" finish to EEMAC Y1-2, unless noted otherwise.

.3 Paint all indoor switchgear and distribution enclosure "light grey" to ASA 61 grey.

.4 Clean, prime and paint exposed hangers, racks, fastenings, etc., to prevent rusting.

2.3 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

2.4 WIRING

.1 Lugs, terminals, screws used for termination of wiring must be suitable for copper conductors.

2.5 ENCLOSURES

.1 Minimum enclosure type to be used is NEMA 12 for ordinary environments, NEMA 4X for corrosive environments and outdoor installations, unless otherwise specified.

2.6 MANUFACTURERS AND CSA LABELS

.1 Manufacturers' nameplates and CSA labels are to be visible and legible after equipment is installed.

2.7 WARNING SIGNS

.1 Provide warning signs with suitable background color and lettering as required to meet requirements of inspection authorities and Engineer. Use decal signs, minimum size 178 mm x 250 mm.

2.8 PLYWOOD MOUNTING BOARDS

.1 Surface wall mounted panelboards and other electrical equipment shall be installed on plywood mounting boards. Boards shall be provided under this section of the specifications, sized to suit equipment indicated and/or implied.

.2 Plywood mounting boards shall consist of 20 mm fir plywood fastened securely to wall.

.3 Plywood mounting boards, strapping and trim shall be treated with wood preservative prior to installation and painted with one coat of primer and two coats of grey enamel ASA61. Painting shall be completed before any electrical equipment is mounted on the plywood.

.4 Service entrance equipment shall be spaced from the plywood mounting boards to the satisfaction of the inspection authorities.

2.9 ELECTRIC MOTORS, EQUIPMENT, AND CONTROLS

.1 Contractor and Sub-Contractor responsibility is indicated in Equipment Schedules on mechanical drawings.

.2 Control wiring and conduit is specified in Sections 26 05 21 and 26 05 34 except for conduit, wiring and connections below 50 V which are related to control systems (HVAC equipment) and shown on mechanical drawings.

2.10 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamacoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self-tapping screws.

.2

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.3 Allow for average of twenty-five (25) letters per nameplate.

.4 Identification to be English.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, impedance, primary and secondary voltages.

2.11 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or colored plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and color coding throughout.

.3 Color code: to CSA C22.1.

.4 Use color coded wires in communication cables, matched throughout system.

2.12 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes, unless otherwise detailed in the drawing package.

.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.3 Locate light switches on latch side of doors.

2.13 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

- .1 Local switches: 1400 mm.
- .2 Wall receptacles:
  - .1 General: 300 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.
  - .3 Above top of counters or counter splash backs: 175 mm.
  - .4 In process areas, chemical rooms, and mechanical rooms: 1400 mm.
- .3 Panelboards: as required by Code or as indicated.
- .4 Voice and data communication outlets: same height as nearest receptacle.

2.14 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

2.15 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits, and fittings to be embedded or plastered over, neatly, and close to building structure so furring can be kept to minimum.

2.16 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this section to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province that the work is being constructed.

.3 Conduct and pay for following tests:

- .1 Power distribution system including phasing, voltage, grounding, and load balancing.
- .2 Circuits originating from branch distribution panels.
- .3 Interior and exterior lighting and its control.
- .4 Emergency lighting.
- .5 Motors, heaters, and associated control equipment including sequenced operation of systems where applicable.
- .6 Vendor systems power feeds
- .7 Vendor control system wiring verifications
- .8 Plant PLC wiring verification and verification of all program modifications.

.4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.5 Insulation resistance testing.

- .1 Megger circuits, feeders, and equipment up to 350 V with a 500 V instrument.
- .2 Megger 350-600 V circuits, feeders, and equipment with a 1000 V instrument.
- .3 Check resistance to ground before energizing.

.6 Provide instruments, meters, equipment, and personnel required to conduct tests during and at conclusion of project.

.7 Submit test results for Engineer's review.

2.17 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Provide a coordination study report demonstrating selective tripping and proper functionality of the power distribution system with the devices and settings as installed.

.2 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

.3 Select and adjust protective devices as required to ensure suitable coordination.

.4 Provide a coordination study report demonstrating selective tripping and proper functionality of the power distribution system with the devices and settings as installed.

2.18 ARC FLASH SAFETY LABELING

.1 Provide an arc flash study for power distribution system using devices and settings as installed.

.2 Provide arc flash safety labeling on electrical equipment in accordance with CSA - Z462.

Part 3 Execution

3.1 WORKMANSHIP

.1 All work to be carried out by qualified journeymen of the related trades.

.2 Where sheet metal enclosures are not provided with knockouts, Greenlee punches shall be used in all cases. Cutting torches shall not be used for making holes.

3.2 INSTALLATION

.1 Determine manufacturers' recommendations regarding storage and installation of equipment and adhere to these recommendations.

.2 Check all factory joints and tighten where necessary to ensure continuity.

.3 Coordinate the work of this Section with the installation of the equipment specified in the relevant Process and Mechanical Sections and shown on the Process, Mechanical and Electrical drawings.

.4 Perform all work in compliance with the relevant sections of this Section.

3.3 SPECIAL PROTECTION

.1 Accept the responsibility to protect those working on the project from any physical danger due to exposed electrically energized equipment such as panel mains, outlet wiring, etc. Shield and mark all live parts "LIVE 600 VOLTS" or with the appropriate voltage.

.2 Arrange for the installation of temporary doors, barriers, etc., for all electrical equipment. Always keep these doors locked, except when under direct supervision.

3.4 FIREPROOFING

.1 Where sleeves or openings are installed in walls, floors, roof or partitions to accommodate raceways, cables or bus duct, provide all necessary seals, fittings, barriers and fire-resistant materials to restore the installation to its original fire rating to the satisfaction of the Engineer.

3.5 TOUCH-UP PAINTING

.1 Be responsible for field touch up painting of all shop painted electrical equipment installed in this Contract.

.2 All surfaces to be painted shall be dry, clean, and free from dust, dirt, grease, frost, rust, loose crystals or extraneous matter, tool, and machine marks. Feather out edges of scratch marks to make patch inconspicuous.

.3 Apply one or more coats of paint until the damaged surface has been restored to original finish condition. Do not apply succeeding coats until preceding coat is dry and hard. Sand lightly between coats with No. 00 sandpaper.

.4 Be responsible for obtaining the necessary touch up paint of the original type and quality from the equipment manufacturer.

.5 Supervise priming and finish painting of all electrical equipment and material not shop-painted.

3.6 SLEEVES AND OPENINGS

.1 Provide sleeves and openings for exposed conduits, busways, and wireways, where they pass through walls or floors conforming to relevant fire codes where applicable.

.2 Sleeves for individual conduits shall be galvanized steel in ordinary areas or stainless steel in corrosive environments.

.3 Pack or fill sleeves and openings after the completed work is in place. Filling shall provide a waterproof seal to prevent leakage of water or other liquids through the sleeve or opening.

.4 Sleeves and openings shall not displace reinforcing steel and shall receive approval of the Engineer prior to placement.

3.7 CUTTING AND PATCHING

.1 Do all drilling, cutting, fitting, and patching necessary for the running and securing of conduits, wireways, and other electrical equipment.

.2 Provide supports necessary for same.

.3 Provide bracing and anchorage of work subject to Engineer's approval.

.4 No cutting of the structural members or of the fireproofing shall be done without the written consent of the Engineer.

.5 Caulk and flash all conduits passing through walls, roofs or other surfaces exposed to weather or as indicated on the drawings to prevent the passage of water and/or sewer gases.

3.8 HANGERS AND SUPPORTS

.1 Provide hangers, angles, channels, and other supports necessitated by field conditions to install all items of electrical equipment. Design of supports and methods of fastening to building structures shall be subject to the Engineer's approval.

.2 All local motor control devices are to be grouped and mounted on a free-standing frame of stainless-steel construction easily accessible and as close to the motor as possible.

.3 Provide weight-distribution facilities, where required, so as not to exceed the load-bearing capacities of floors or walls that bear the weight of, or support, electrical items.

.4 Paint all exposed parts of hangers and supports with an anti rust inhibiting primer.

.5 Equipment shall not be held in place by its own weight. Provide base anchor fasteners in each case.

.6 Meet seismic requirements as defined in seismic specification section 26 05 48.

3.9 PROTECTION OF EQUIPMENT

.1 Protect conduit and wireway openings against the entrance of foreign matter by means of plugs or caps.

.2 Fixtures, materials, equipment, or devices damaged prior to final acceptance of the work shall be restored to their original condition or replaced by the Contractor.

3.10 TESTING OF ELECTRICAL SYSTEMS GENERAL

.1 Prior to the Engineer's acceptance, all electrical equipment, materials, and systems installed shall be subject to an inspection and applicable performance tests supervised by the Engineer to ensure that the operation of the system and components satisfy the requirements of the Specifications. Refer also to Section 26 08 00 – Testing of Electrical Systems.

.2 Ensure that the system and its components are ready prior to the inspection and test for acceptance.

.3 All testing shall be conducted by fully qualified personnel only. Tests requiring initial power energization of a system shall not be made without notification of the Engineer. Tests, checks and the like carried out by or on behalf of the Contractor shall be documented and certified at no additional cost to the District. Submit six (6) copies of the test certificates to the Engineer. Carefully check wiring for each system and/or part of a system to ensure that the system will function properly as indicated by wiring and schematic diagrams, description of operation, etc.

.4 Carefully check wiring for each system and/or part of a system to ensure that the system will function properly as indicated by wiring and schematic diagrams, description of operation, etc.

.5 Manually operate alarms and control devices to check whether their operation during normal and abnormal operating conditions causes the proper effect.

.6 In addition to tests on purely electrical systems, supply the necessary labor and equipment for operational tests required by other Sections where electrical services are involved and make final adjustments to the electrical controls at no additional cost to the District.

.7 Perform tests on auxiliary or specialized systems with the assistance of the manufacturer's representative. Upon successful conclusion of the tests, obtain a certificate from the manufacturer stating that the system has been installed to their satisfaction and that it is in good working order.

.8 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to values and settings as indicated.

.9 Supply all instruments, meters and personnel required for the tests.

3.11 CABLE AND WIRE 1000 VOLT AND BELOW

.1 Tests on cables in this voltage range shall be limited to insulation resistance measurements using a 500V megger for systems up to 350V and a 1000V megger for 351 to 600V systems.

.2 Record all test results in a logbook and submit to the Engineer for reference. Replace or repair all circuits, which do not meet minimum requirements specified in the CEC, Table 24. Insulation resistance of the following circuits shall be measured:

.1 Power, lighting, and motor feeders (with equipment disconnected): phase to phase, phase to neutral and phase to ground.

.2 Control circuits: measure to ground only.

.3 Do not perform megger tests on control circuits containing transistorized or solid-state components.

.4 Where power factor correction equipment is installed, it may be necessary to disconnect the capacitors from the system prior to testing to avoid overvoltage.

3.12 GROUNDING SYSTEM

.1 Test the grounding system efficacy for compliance with CSA Standard C22.1 and Supply Authority requirements.

.2 Notify Engineer that they may be present to witness Contractor testing.

3.13 TRAINING

.1 Provide for the training of the Owner in the operation, maintenance and testing of all systems and equipment including the provision of qualified manufacturer's technical representatives for specialized systems.

.2 Provide these services for such period, and for as many visits as necessary to put installation in working order, and to ensure that operating personnel are conversant with all aspects of its care and operation.

3.14 DELIVERY AND STORAGE

.1 Ship and store floor mounted equipment in upright position.

.2 Ship channel bases and anchor stencils in advance of equipment.

.3 Keep equipment doors locked. Protect equipment from damage and dust.

.4 Block moving parts when necessary to prevent damage during movement and shipment of equipment. Instructions to remove blocking before putting equipment in service to be clearly and conspicuously displayed.

.5 Store all electrical equipment indoors. Temperature sensitive equipment to be stored in heated spaces.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Refer to Section 26 05 01 Common Work Results for Electrical.

.2 Furnish all labour, materials, supervision, equipment, and services specified, indicated, or requested to install a complete conduit raceway system. The raceway systems shall be comprised of the supply and installation of all conduits, fittings, supports, hangers and miscellaneous support materials and hardware required.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

.2 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.3 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.3 LOCATION OF CONDUIT

.1 The drawings do not show every specific conduit run. All wiring shall be surface and as run in the slab unless otherwise indicated in the specifications and/or shown on the drawings. All devices shall be surface mounted type except as shown.

Part 2 Products

2.1 CONDUITS

.1 Conduit in ordinary areas and humid corrosive environments shall be Rigid PVC. Minimum size to be 19 mm.

.2 Conduit in hazardous areas shall be threaded rigid aluminum epoxy coated conduit with zinc coating and corrosion resistant epoxy finish inside and outside. Minimum size to be 19 mm.

.3 Liquid-tight flexible metal conduit for motor and equipment connections.

.4 EMT conduit shall not be utilized anywhere in the installation.

2.2 CONDUIT FASTENINGS

.1 One-hole steel straps to secure surface conduits 50 mm and smaller. Two-hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

2.4 EXPANSION FITTINGS FOR CONDUIT

.1 All conduits entering outlet boxes and devices that are in walls subject to movement shall be terminated by means of liquid-tight flexible conduit, approximately 450 mm in length between the conduit and the outlet box or device which is being supplied. All conduits, bus duct, wireways, etc., passing through or across expansion joints of the building shall be installed with the use of approved expansion fittings.

2.5 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.3 Use rigid pvc conduit unless otherwise noted.

.4 Use rigid pvc conduit underground and in cast concrete.

.5 Use flexible metal conduit for connection to motors.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.7 Minimum conduit size: 19 mm.

.8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.9 Mechanically bend steel conduit over 19 mm dia.

.10 Install fish cord in empty conduits.

.11 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.12 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.

.5 Do not pass conduits through structural members except as permitted by the Contract Administrator

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS UNDERGROUND

.1 Slope conduits to building to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Cable tray to form a complete system, including straight lengths, horizontal and vertical elbows, tees, crosses, reducers, couplers, covers and accessories as detailed in this specification an as shown on drawings.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittals and Section 260501 – Common Work Results for Electrical.

Part 2 Products

2.1 TRAY

.1 Ladder type, Class D1 to CSA C22.2 No. 126.

.2 Extruded aluminum tray.

.3 Horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required. Fittings: manufactured accessories for cable tray supplied.

.4 Solid covers for cable tray system located below 2000mmm above finished floor, under platform grating, and outdoors.

.5 Barriers where different voltage systems are in the same cable tray.

.6 Cable tray width as indicated with a minimum cable loading depth of 100 mm.

2.2 SUPPORTS

.1 Provide supports, hangers, and securing devices as required for complete installation.

2.3 ACCEPTABLE MANUFACTURERS

.1 Electro-Tray.

.2 Canstrut Products

.3 Cooper B-Line

.4 Unitray Systems Inc.

.5 Unless otherwise approved by the Engineer, provide cable trays of the same manufacturer throughout the contract.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cable tray system.

.2 Support cable tray as shown on drawings and as recommended by manufacturer.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.4 Coordinate supports and tray location with work of other trades. Notify Engineer of any conflicts and obtain a ruling before proceeding with the installation. Prepare roughing-in drawings illustrating the locations and methods of supports of all components.

.5 Where terminations are indicated, provide a grommet or protective bushing to protect exiting cables.

.6 Provide cable tray covers on all trays at floor level and up to 2000 mm above floor level or finished grade, under platforms, and outdoors.

.7 Ground cable tray as required in section 260528.

3.2 CABLES IN CABLE TRAY

.1 Install cables individually.

.2 Lay cables into cable tray. Use rollers when necessary to pull cables.

.3 Secure cables in cable tray at 3 m centers, with nylon ties.

.4 Where cable trays are mounted vertically on wall, secure cables at 1.5 m intervals with P type clamp fasteners.

.5 Control and instrument cables shall be random fill with a barrier separation between power cables.

.6 Selected feeder cables shall have an air gap between them equal to 100% of the largest cable diameter. Refer to cable schedule for details.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 Refer to Section 26 05 01 Common Work Results for Electrical.

.2 Furnish all labour, materials, equipment, and services specified, indicated, or requested to install the trenches and underground conduits as specified herein and on the drawings.

1.2 SCOPE

.1 Furnish all labour, materials, supervision, equipment, and services specified, indicated of requested to provide all trenching and backfilling as necessary for the installation of all underground conduits and cables, as indicated.

.2 Direct buried cables are not expected to be required on this project and shall only be installed with approval by the Engineer.

1.3 QUALITY ASSURANCE

.1 Installation of cables in trenches and ducts shall meet the requirements of the latest edition of CSA C22.1 – Canadian Electrical Code.

Part 2 Products

2.1 TRENCHING AND BACKFILLING

.1 Trenching shall be approximately 1000 mm in depth, width to suit proper installation.

.2 Backfill for trenches for all ducts, conduits, and cables shall consist of fine sand (minimum 100 mm below and above cables, etc.) and firmly compacted

.3 All ducts, and conduits crossing over each other or over/under other types of underground service shall be separated by minimum of 150mm and surrounded by wood planks treated with pentachlorophenol.

.4 Frozen earth, large lumps or boulders shall not be used for backfilling material.

.5 Where direct buried cables are approved by the Engineer provide treated wood planks over all such cables installed under existing or future roads and sidewalks, and provide sleeves under all parking, concrete and traffic areas for cables.

2.2 CABLE PROTECTION

.1 Provide identification tape labeled as indicated showing location of direct buried cables.

Part 3 Execution

3.1 INSTALLATION OF UNDERGROUND CONDUITS AND DIRECT BURIED CABLES

.1 After specified sand bed is in place, lay conduits, or cables in trench, maintaining a 75 mm minimum clearance from each side of trench to nearest conduit or cable. Do not pull cable into trench.

.2 For cables, provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 M run, maintaining minimum cable separation and bending radius requirements.

.3 Underground cable splices are not acceptable

.4 Minimum permitted radius of conduits is 300mm. Cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

3.2 CABLE INSTALLATION IN CONDUITS

.1 Install cables and wiring as indicated in underground conduits.

.1 Do not pull spliced cables inside ducts.

.2 Install multiple cables in underground conduit simultaneously.

.3 Use CSA approved lubricants as specified as part of the cable manufactures cable pull design to reduce pulling tension.

.4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.5 After installation of cables and wiring, seal duct ends with duct sealing compound.

.6 Seal all spare conduits at entry to buildings using permanent pressure resistant long-term plugs. Plugs must be constructed with rubber gaskets that can be compressed to form a permanent seal of the conduit.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 – Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits, and grounds. Ensure resistance to ground of circuit is not less than 50 megohms.

.5 Pre-acceptance tests:

.1 After installing cable but before terminating, perform insulation resistance test with 1000V megger on each phase conductor

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Provide Engineer with list of test results showing location at which each test was made, circuit tested and result of each test.

.7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

.8 Contractor responsible for making all necessary repairs to installation resulting from improper backfilling, compactions, etc.

END OF SECTION