PROJECT TITLE	TAHSIS FLOOD PROTECTION IMPROVEMENTS PROJECT PHASES 1 AND 2
PROJECT START DATE	SPRING 2021
ESTIMATED PROJECT COMPLETION DATE	FALL 2023
PROJECT BUDGET	$1,896,920
FEDERAL AND PROVINCIAL FUNDING	$1,896,920
VILLAGE CONTRIBUTION	IN-KIND
PROJECT DESCRIPTION	The project will upgrade three existing flood mitigation works: the North Maquinna Drive Floodwall, Cook Street Dike and Boston Street Internal Drainage System. The proposed project area (North Village) has experienced repeated flooding over the last century, with significant flooding events recorded in 1975, 1989, 1990 and 2010. Recent hydrotechnical assessments have revealed that this section of the Village is highly susceptible to flooding and shows an immediate need for further protection. Once implemented, these proposed upgrades will protect residents of Tahsis and existing assets from both 1:20 and 1:200 year flooding events.

TAHSIS FLOOD PROTECTION IMPROVEMENT PROJECT PHASE 2

In 2021, the Village of Tahsis received $1.89 million in grant funding under the Investing in Canada Infrastructure Program to improve protection from flooding caused by the Tahsis River. Phase 1, which entailed improving drainage and diking, was completed in 2021. Beginning on August 14, 2023, Phase 2 construction will start. This phase will result in the height of the floodwall along the Tahsis River being raised using concrete lock blocks to protect the north area of the Village from 1:200 year flood events, as well as other related works.

Upland Contracting Ltd. is the prime contractor for this Phase. The work will require sections of the river bank being excavated and armoured with riprap to support the additional weight of the lock blocks. Pacificus Biological Services Ltd. will be onsite during the in-bank work as the environmental monitor. All work is being done in accordance with the approval of Fisheries and Oceans Canada ("DFO") and with the support of the Mowachaht/Muchalaht First Nation Council of Chiefs.

More information about the project is available on the Village website at: www.villageoftahsis.com/major-capital-projects/ or by contacting the Village Office at (250)934-6344.

CLIENT: # VILLAGE OF TAHSIS

DESCRIPTION: FLOOD MITIGATION PROJECT - PHASE 2
TAHSIS, BC

REVISION: RE-ISSUED FOR TENDER 2023
2023-06-05

Project No.: 2221-49140-00 T2026

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McElhanney

1196 Dogwood Street
Campbell River BC
Canada V9W 3A2
T 250 287 7799

PROJECT LOCATION
SCALE = 1:2000

PROJECT:
McElhanney: 2221-49140-00 T2026

DRAWING PATH: G:\PROJECTS\ACTIVE\49140-00 village of tahsis - 2018 msa\task 2026 flood protection ph 1&2\10.0 drawings\10.4 sheets\49140-COVER.dwg Tab COVER Jun 08, 2023 10:37:45am

ROAD PLAN

0 20 40 60 80 100

SCALE: 1:2000

GENERAL CONSTRUCTION NOTES:

1. ALL WORKS TO BE COMPLETED IN CONFORMANCE WITH MMCD (MOST RECENT EDITION).
2. ALL TRENCHING TO BE CARRIED OUT IN CONFORMANCE WITH WORKSAFE BC REGULATIONS FOR SIDE SLOPE AND SHORING.
3. THE LOCATIONS SHOWN FOR EXISTING UTILITIES ARE BASED ON MUNICIPAL RECORDS, 'AS BUILT' DRAWINGS AND LIMITED FIELD SURVEY. THIS INFORMATION MAY NOT BE ACCURATE OR COMPLETE. WHERE UTILITIES ARE SHOWN ON PROFILE, THE ELEVATIONS ARE ASSUMED.
4. 5 BUSINESS DAYS PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL CONFIRM THE LOCATION AND ELEVATIONS OF ALL PIPES AND UNDERGROUND UTILITIES AT CROSSINGS AND CONNECTION LOCATIONS, AND NOTIFY THE ENGINEER OF ANY DISCREPANCIES.
5. THE CONTRACTOR SHALL UTILIZE BC1 CALL SERVICE TO ASSIST LOCATING ALL EXISTING UTILITIES IN THE AREA OF CONSTRUCTION. IN ADDITION, THE CONTRACTOR SHALL EXERCISE CAUTION WHILE EXCAVATING IN ORDER TO AVOID DAMAGE TO THE EXISTING INFRASTRUCTURE.
6. UPON AWARD OF CONTRACT THE CONTRACTOR MUST CONTACT BC-HYDRO, AND TELUS WITH A CONSTRUCTION SCHEDULE. THE CONTRACTOR IS RESPONSIBLE FOR ALL WORK AT OR AROUND EXISTING UTILITY POLES AND JUNCTION BOXES, AND SHALL COORDINATE WITH THE APPROPRIATE AGENCY, AND BE RESPONSIBLE FOR THE RELOCATION OR MAINTENANCE/PROTECTION OF ALL UTILITY POLES, SERVICE BOXES, AND GUY WIRES.
7. THE CONTRACTOR SHALL ENSURE THAT ALL ENVIRONMENTAL PROTECTIONS TO ELIMINATE DOWNSTREAM SEDIMENT TRANSPORT ARE IN PLACE PRIOR TO THE START OF CONSTRUCTION AND REMAIN IN PLACE FOR THE DURATION OF THE CONTRACT. THE CONTRACTOR SHALL OBTAIN A COPY OF, AND FOLLOW THE PROCEDURES CONTAINED IN THE "PROJECTS NEAR WATER" DOCUMENT BY DEPARTMENT OF FISHERIES AND OCEANS.
8. CONTRACTOR TO VERIFY THAT SITE SAFETY FOR VEHICLE OPERATORS AND PEDESTRIANS IS MAINTAINED FROM THE END OF EACH WORK DAY THROUGH THE NIGHT UNTIL THE START OF THE NEXT WORK DAY USING FLASHING BEACONS, BARRICADES, SIGNAGE, DELINEATORS ETC. IN ACCORDANCE WITH CURRENT CONSTRUCTION ZONE SIGNAGE STANDARDS.
9. CONTRACTOR TO COMPLY WITH ALL CURRENT VILLAGE BY-LAWS REGARDING VEHICLE INSURANCE, PERMITS, LICENSING PER "PERMIT TO WORK ON VILLAGE LANDS" FORM. CONTRACTOR TO COMPLETE FORM AND SUBMIT TO VILLAGE REPRESENTATIVE PRIOR TO CONSTRUCTION ON VILLAGE PROPERTY.
10. ALL TRENCHING IS TO BE AS PER MMCD STD DWGS# G4 & G5.
11. ALL MATERIALS TO BE IN CONFORMANCE WITH THE CITY OF CAMPBELL RIVER APPROVED PRODUCTS LIST (LATEST EDITION)

STORM SEWER NOTES

1. ALL PVC STORM SEWER PIPES SHALL BE DR35 (UNLESS OTHERWISE NOTED).
2. ALL HDPE STORM SEWER PIPES SHALL BE DR17 (UNLESS OTHERWISE NOTED).
3. ALL STORM SEWER MANHOLES TO BE 1050mmØ c/w PRE-BENCHED BASE UNLESS OTHERWISE NOTED.
4. ALL STORM LAWN BASINS (LAWN DRAINS) ARE TO BE 600mmØ, TYPE 2 AS PER MMCD STANDARD DETAIL S12 (UNLESS OTHERWISE NOTED).
5. PIPE SLOPES AND LENGTHS ARE MEASURED FROM CENTRE TO CENTRE OF MANHOLES.

ROADWORKS NOTES

1. PAVEMENT STRUCTURE TO BE CONSTRUCTED AS PER DESIGN SPECIFICATIONS
2. WHERE EXISTING SIDE ROADS MEET PROPOSED WORKS, CONNECTIONS HAVE BEEN DESIGNED BUT MAY REQUIRE MINOR FIELD FIT WORK. CONTRACTOR IS TO ENSURE A SMOOTH TRANSITION FROM PROPOSED WORKS TO EXISTING ROAD.

TRAFFIC MANAGEMENT NOTES

1. THE CONTRACTOR IS WHOLLY RESPONSIBLE FOR MAINTAINING ALL TEMPORARY RUNNING SURFACES AND WILL BE REQUIRED TO RESPOND WITHIN TWO (2) HOURS SHOULD ANY TEMPORARY RUNNING SURFACES DETERIORATE BEYOND AN ACCEPTABLE LEVEL AS DETERMINED BY THE CONTRACT ADMINISTRATOR.
2. THE CONTRACTOR IS REQUIRED TO PREPARE A TRAFFIC MANAGEMENT PLAN (TMP) AS DIRECTED IN THE FORM OF TENDER AND SUBMIT FOR APPROVAL WITHIN 10 DAYS OF RECEIPT OF NOTICE OF AWARD.
3. CONTRACTOR TO NOTIFY ALL EMERGENCY SERVICE AGENCIES OF THE SUBSEQUENT WORK ZONE AREA, SPEED REDUCTIONS AND DETOURS THAT MAY AFFECT TRAFFIC FLOW.
4. CONTRACTOR IS TO ERECT ALL APPROPRIATE CONSTRUCTION ZONE SIGNAGE AND USE FLAG PERSONNEL TO MAINTAIN SAFE AND EFFICIENT TRAFFIC FLOW THROUGH AND AROUND THE WORK SITE.
5. CONTRACTOR TO VERIFY THAT SITE SAFETY FOR VEHICLE OPERATORS AND PEDESTRIANS IS MAINTAINED FROM THE END OF EACH WORK DAY THROUGH THE NIGHT UNTIL THE START OF THE NEXT WORK DAY. USING FLASHING BEACONS, BARRICADES, SIGNAGE, DELINEATORS ETC. IN ACCORDANCE WITH CURRENT CONSTRUCTION ZONE SIGNAGE STANDARDS.
6. ENSURE CONTINUOUS AND SAFE ACCESS FOR VEHICLES AND PEDESTRIANS TO ALL LOTS/PROPERTIES DURING CONSTRUCTION.
7. CONTRACTOR TO PROVIDE ALL REQUIRED VEHICLE INSURANCE, PERMITS, AND LICENSING AS PER CONTRACT DOCUMENTS.

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3	ISSUED FOR REVIEW	SS	2022-08-02	DC	2022-08-03
2	ISSUED FOR ADDENDUM 2	AC	2022-03-23	DC	2022-03-23
1	ISSUED FOR TENDER	AC	2022-03-03	DC	2022-03-03
0	ISSUED FOR APPROVALS	AC	2021-12-13	DC	2021-12-13

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C	U/G SHAW	C	D	STORM DRAIN	D	SMH / DMH	SAN. SEWER & STRM. DRAIN MANHOLES	SMH / DMH
E	U/G HYDRO	E	W	WATER MAIN	W	SIDE INLET / TOP INLET	CATCH BASIN	SIDE INLET / TOP INLET
G	NATURAL GAS	G		PAVEMENT		HYD	FIRE HYDRANT	HYD
FM	SANITARY - FORCEMAIN	FM		CURB & GUTTER		WV	WATER VALVE	WV
	LAWN DRAIN			SIDEWALK		UP	UTILITY POLE	UP
	INSPECTION CHAMBER			STREET LIGHTS		ANC	GUY LINE ANCHOR	ANC

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51236
2023-06-08

VILLAGE OF TAHSIS

KEY PLAN

FLOOD MITIGATION PROJECT - PHASE 2

TAHSIS, BC

SHEET REFERENCE: C-101
MCELHANNEY PROJECT #: 2221-49140-00 T2026
SHEET 1 OF 11
REV. 5

DRAWING PATH: G:\PROJECTS\ACTIVE\49140-00 village of tahsis - 2018 msa\task 2026 flood protection ph 1&2\10.0 drawings\10.4 sheets\49140-KEY.dwg Tab C-101 Jun 08, 2023 10:38:06am

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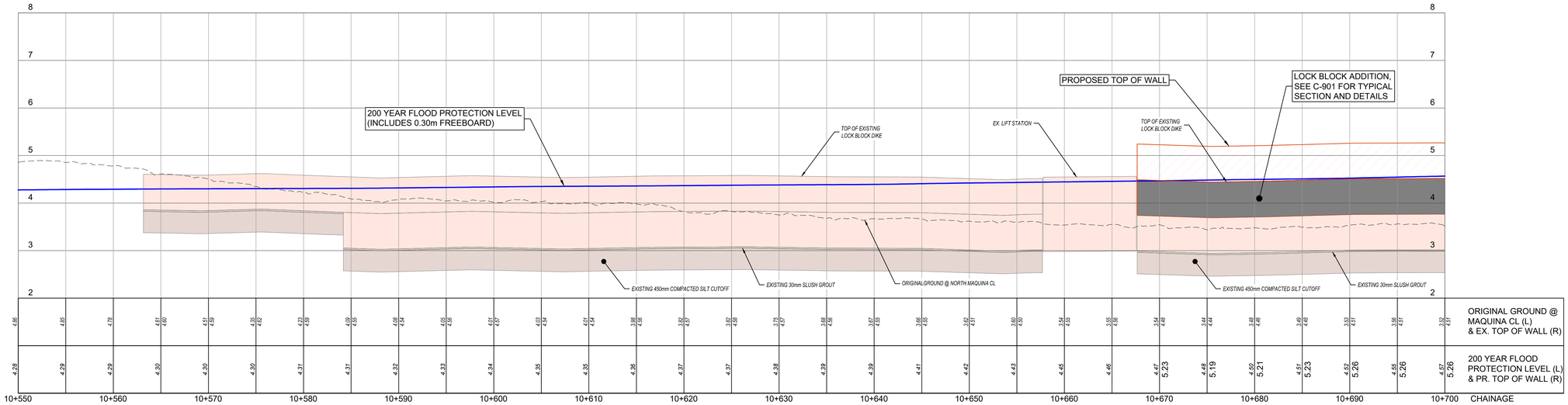
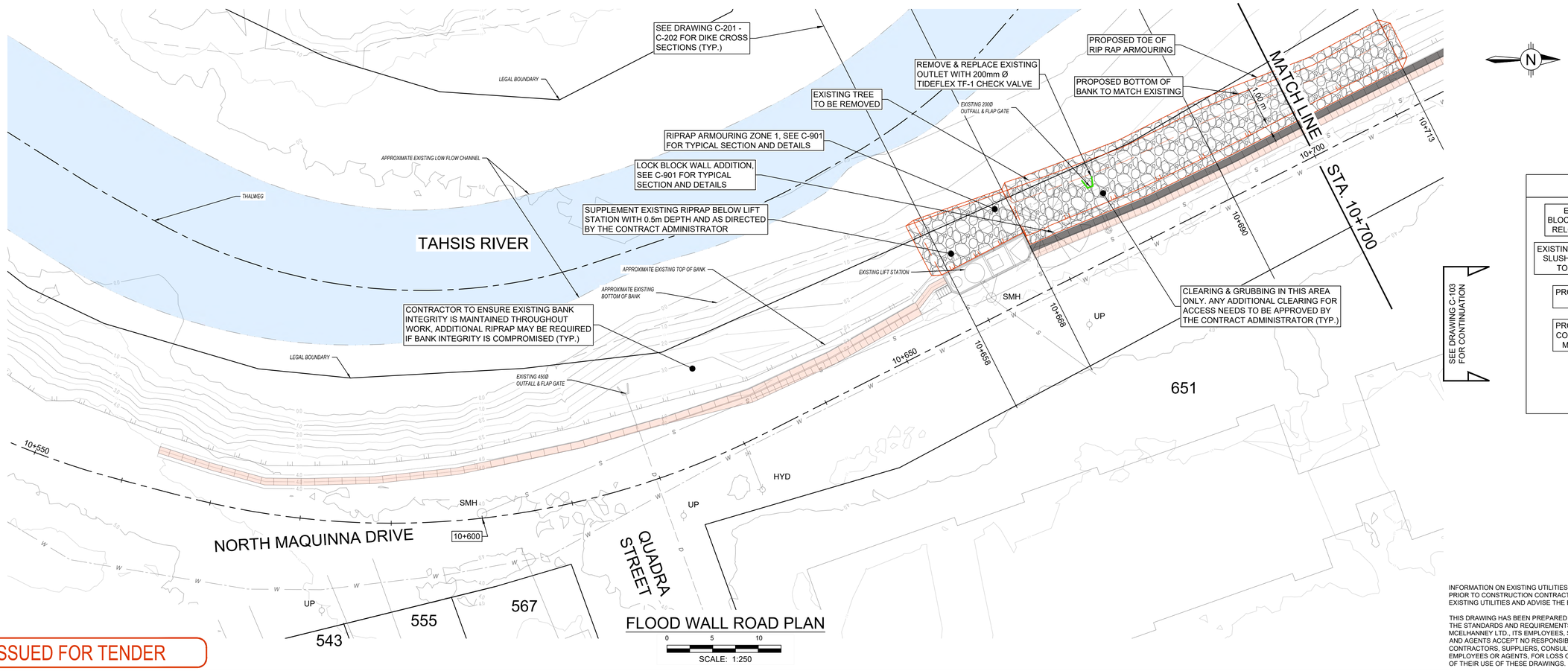


FLOOD WALL PROFILE VIEW

SCALE 1:250 H / 1:50 V

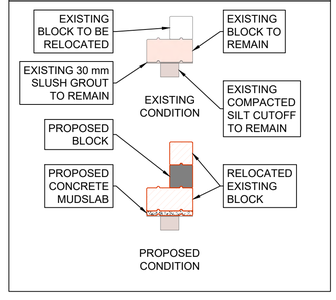


FLOOD WALL ROAD PLAN

0 5 10

SCALE: 1:250

HATCHING LEGEND



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FM	SANITARY - FORCEMAIN	FM		CURB & GUTTER		WV	WATER VALVE	WV
	LAWN DRAIN			SIDEWALK		UP	UTILITY POLE	UP
	INSPECTION CHAMBER			STREET LIGHTS		ANC	GUY LINE ANCHOR	ANC

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DATE: 2021-12-13
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2023-06-08

VILLAGE OF TAHSIS

TAHSIS DIKE PROFILE
STA. 10+550 - 10+700

FLOOD MITIGATION PROJECT - PHASE 2

TAHSIS, BC

SHEET REFERENCE: C-102
McELHANNEY PROJECT #: 2221-49140-00 T2026
SHEET 2 OF 11
REV. 5

DRAWING PATH: G:\PROJECTS\ACTIVE\49140-00 village of tahsis - 2018 msa\task 2026 flood protection ph 1&2\10.0 drawings\10.4 sheets\49140-DIKE.dwg Tab C-102 Jun 08, 2023 10:41:14am

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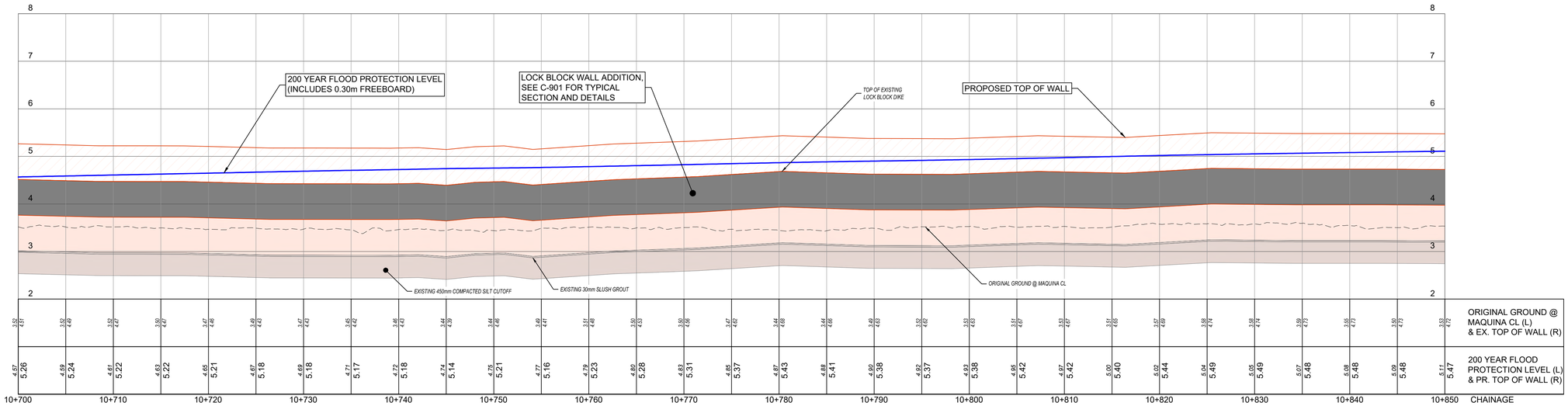
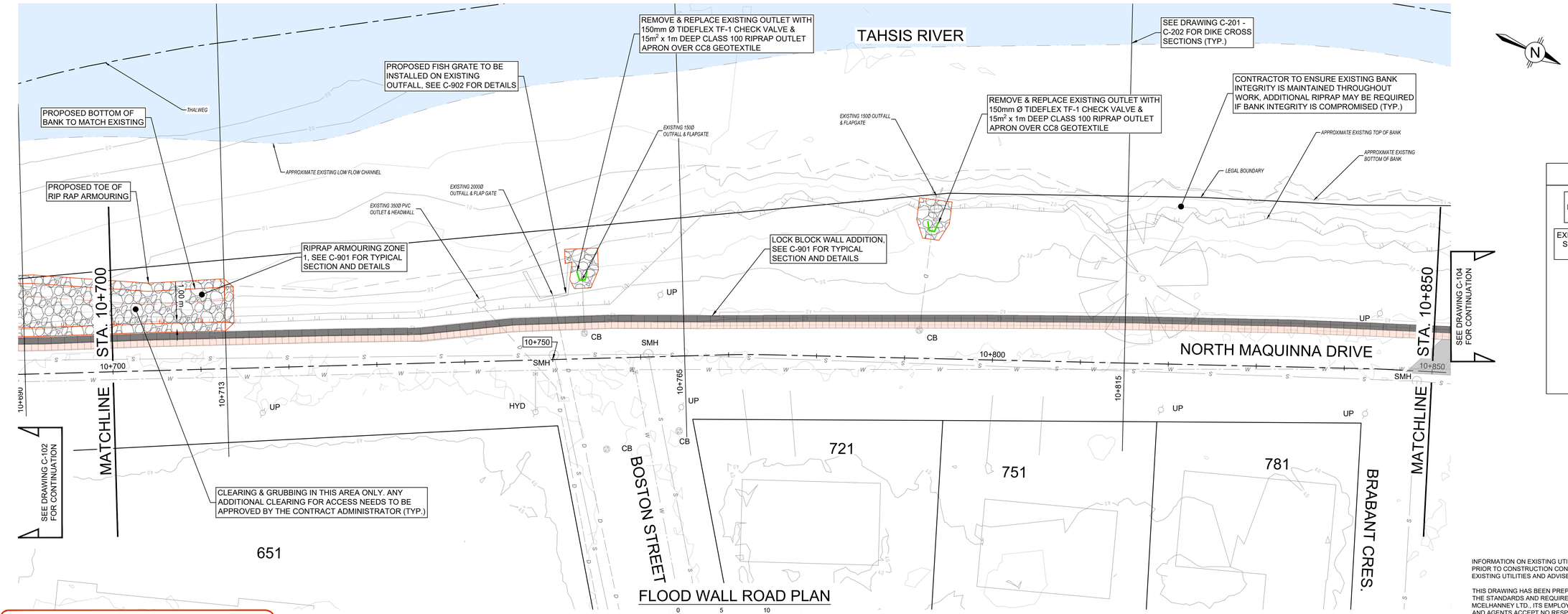


FLOOD WALL PROFILE VIEW

SCALE 1:250 H / 1:50 V



FLOOD WALL ROAD PLAN

SCALE: 1:250

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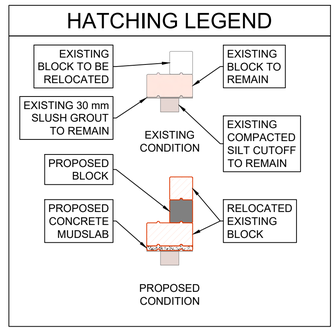

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	U/G SHAW			STORM DRAIN		SMH / DMH	SAN. SEWER & STRM. DRAIN MANHOLES	SMH / DMH
	U/G HYDRO			WATER MAIN		SIDE INLET / TOP INLET	CATCH BASIN	SIDE INLET / TOP INLET
	NATURAL GAS			PAVEMENT		HYD	FIRE HYDRANT	HYD
	SANITARY - FORCEMAIN			CURB & GUTTER		WV	WATER VALVE	WV
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	INSPECTION CHAMBER			STREET LIGHTS		ANC	GUY LINE ANCHOR	ANC

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VILLAGE OF TAHSIS

TAHSIS DIKE PROFILE
STA. 10+700 - 10+850

FLOOD MITIGATION PROJECT - PHASE 2

TAHSIS, BC

SHEET REFERENCE: C-103
McELHANNEY PROJECT #: 2221-49140-00 T2026
SHEET 3 OF 11
REV. 5

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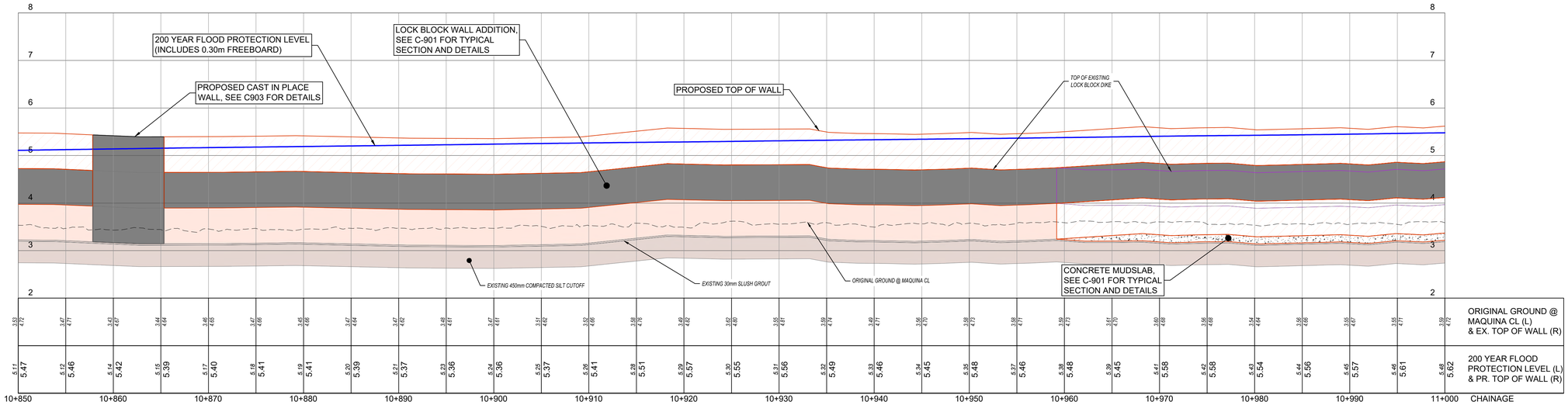
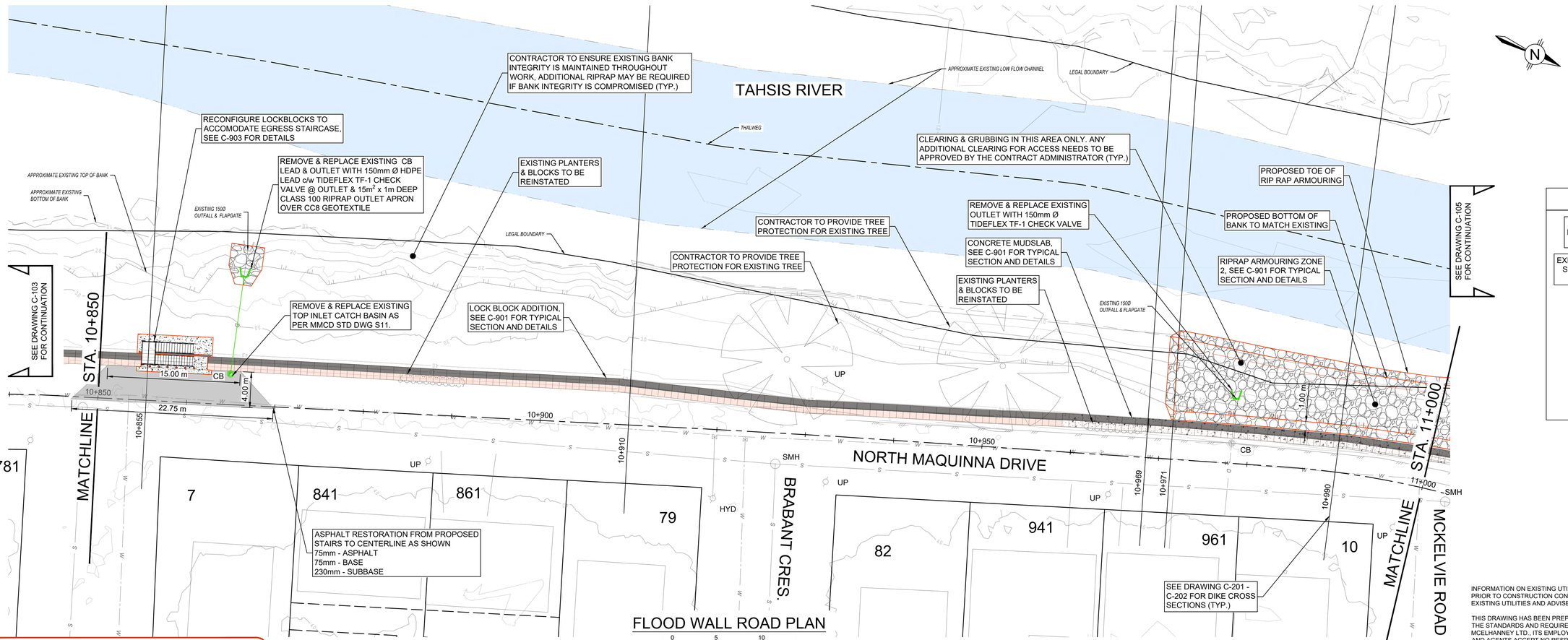


FLOOD WALL PROFILE VIEW

SCALE 1:250 H / 1:50 V

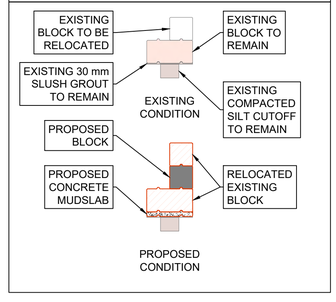


FLOOD WALL ROAD PLAN

0 5 10

SCALE: 1:250

HATCHING LEGEND



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C	U/G SHAW	C	D	STORM DRAIN	D	SMH / DMH	SAN. SEWER & STRM. DRAIN MANHOLES	SMH / DMH
E	U/G HYDRO	E	W	WATER MAIN	W	SIDE INLET / TOP INLET	CATCH BASIN	SIDE INLET / TOP INLET
G	NATURAL GAS	G		PAVEMENT		HYD	FIRE HYDRANT	HYD
FM	SANITARY - FORCEMAIN	FM		CURB & GUTTER		WV	WATER VALVE	WV
	LAWN DRAIN			SIDEWALK		UP	UTILITY POLE	UP
	INSPECTION CHAMBER			STREET LIGHTS		ANC	GUY LINE ANCHOR	ANC

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2023-06-08

VILLAGE OF TAHSIS

TAHSIS DIKE PROFILE
STA. 10+850 - 11+000

FLOOD MITIGATION PROJECT - PHASE 2

TAHSIS, BC

SHEET REFERENCE: C-104
McELHANNEY PROJECT #: 2221-49140-00 T2026
SHEET 4 OF 11
REV. 5

DRAWING PATH: G:\PROJECTS\ACTIVE\49140-00 village of tahsis - 2018 msa\task 2026 flood protection ph 1&2\10.0 drawings\10.4 sheets\49140-DIKE.dwg Tab C-104 Jun 08, 2023 10:52:36am

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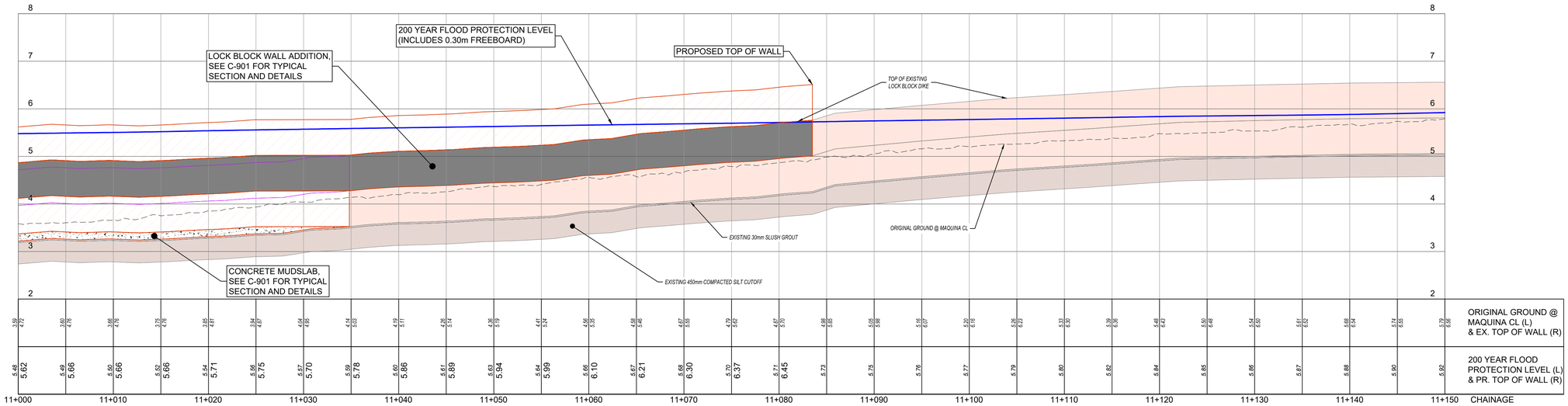
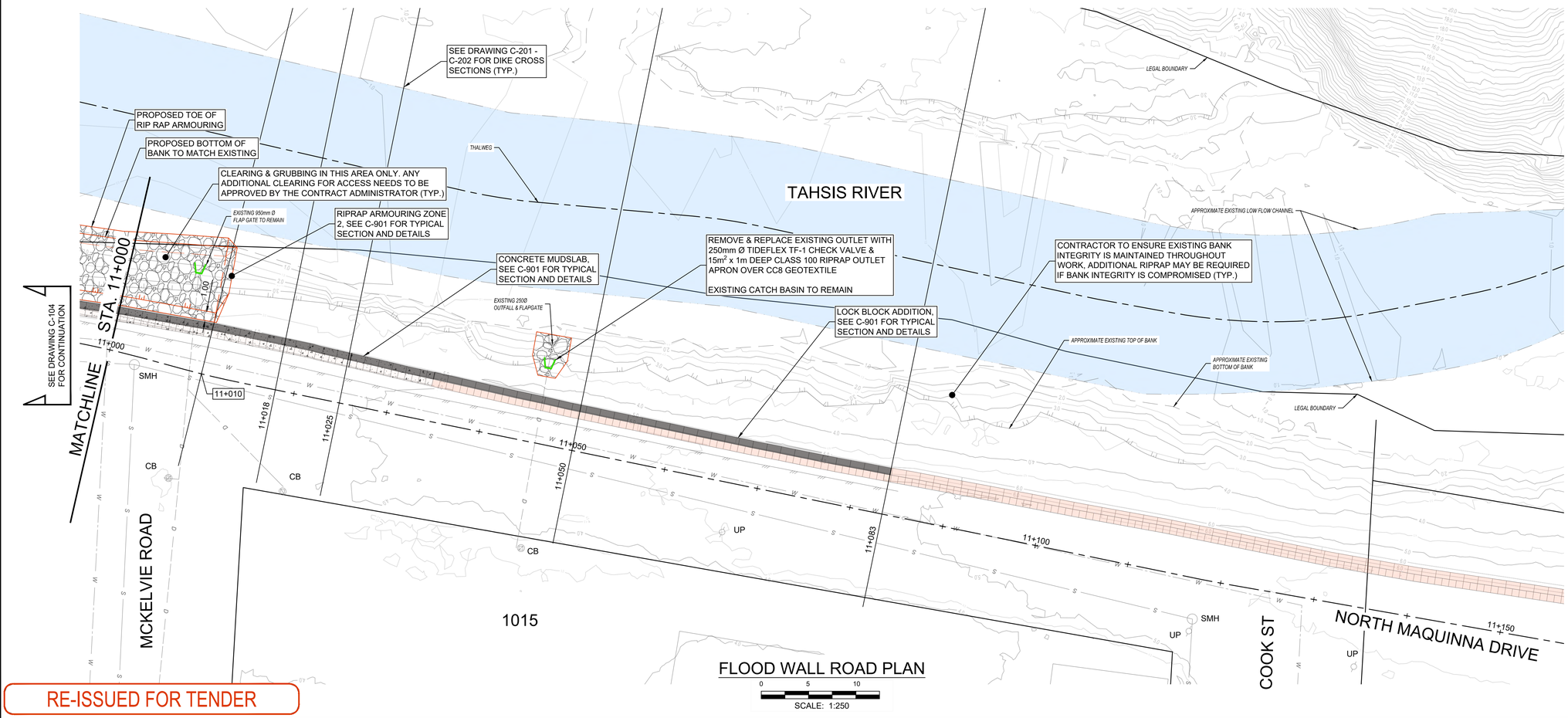


FLOOD WALL PROFILE VIEW

SCALE 1:250 H / 1:50 V

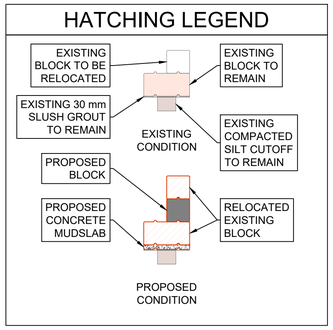


FLOOD WALL ROAD PLAN

0 5 10

SCALE: 1:250

HATCHING LEGEND



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4	ISSUED FOR APPROVAL	AC	2022-12-02	DC	2022-12-02
3	ISSUED FOR TENDER - ADDENDUM 5	AC	2022-04-14	DC	2022-04-14
2	ISSUED FOR ADDENDUM 2	AC	2022-03-23	DC	2022-03-23
1	ISSUED FOR TENDER	AC	2022-03-03	DC	2022-03-03
0	ISSUED FOR APPROVALS	AC	2021-12-13	DC	2021-12-13

EXISTING: U/G TELUS, U/G SHAW, U/G HYDRO, NATURAL GAS, SANITARY - FORCEMAIN, LAWN DRAIN, INSPECTION CHAMBER

LEGEND: SANITARY SEWER, STORM DRAIN, WATER MAIN, PAVEMENT, CURB & GUTTER, SIDEWALK, STREET LIGHTS

DESIGN: SWALE, SAN. SEWER & STRM. DRAIN MANHOLES, CATCH BASIN, FIRE HYDRANT, WATER VALVE, UTILITY POLE, GUY LINE ANCHOR

DESIGNED: DC	A1 SCALE: H: 1:500 V: 1:100
DRAWN: AC	DATE: 2021-12-13
CHECKED: MD	DATE: 2021-12-13
APPROVED: DC	DATE: 2021-12-13

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2023-06-08

VILLAGE OF TAHSIS

TAHSIS DIKE PROFILE
STA. 11+000 - 11+150

FLOOD MITIGATION PROJECT - PHASE 2

TAHSIS, BC

SHEET REFERENCE: C-105
McELHANNEY PROJECT #: 2221-49140-00 TZ026
SHEET 5 OF 11
REV. 5

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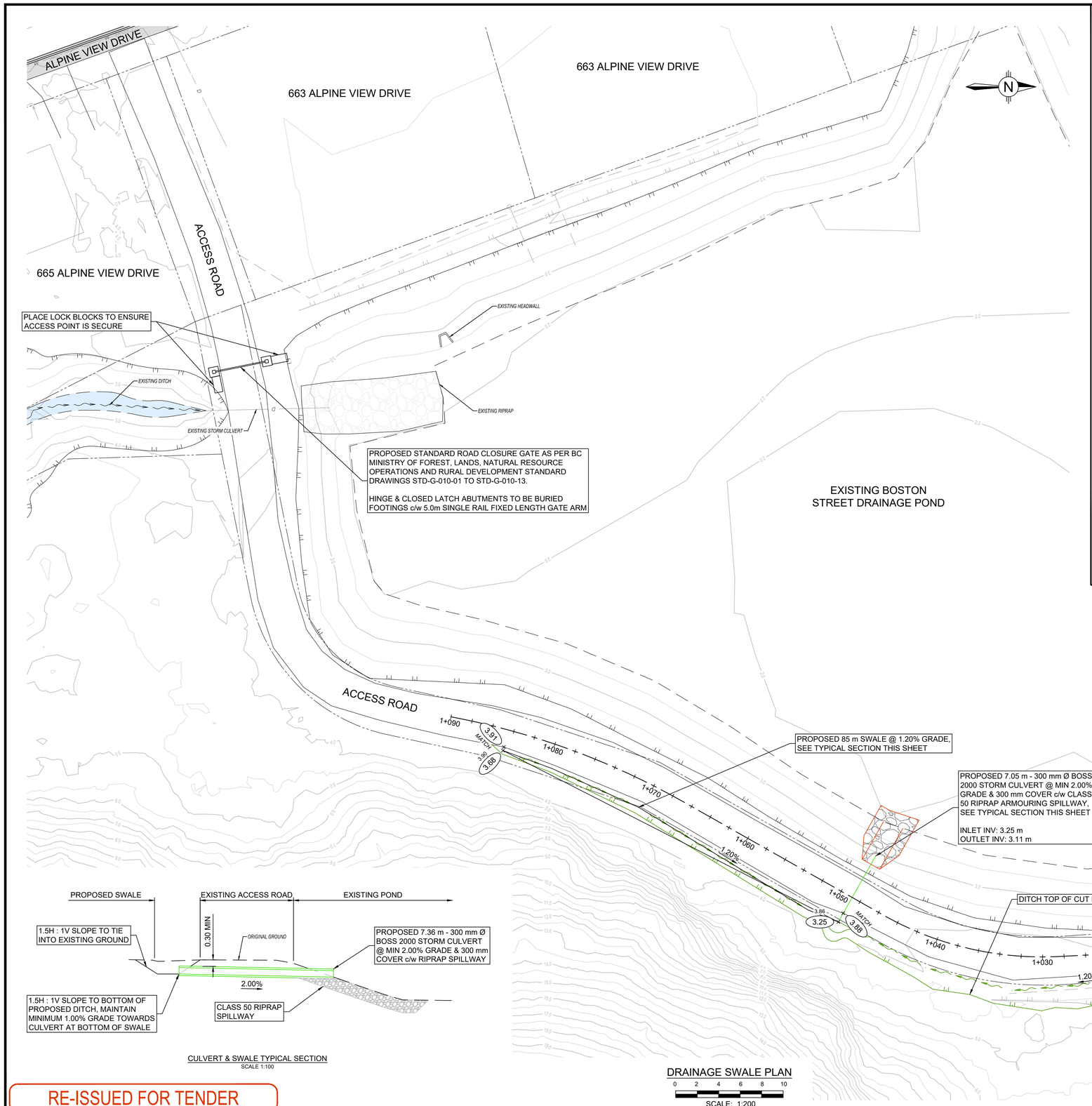

DRAINAGE SWALE PLAN

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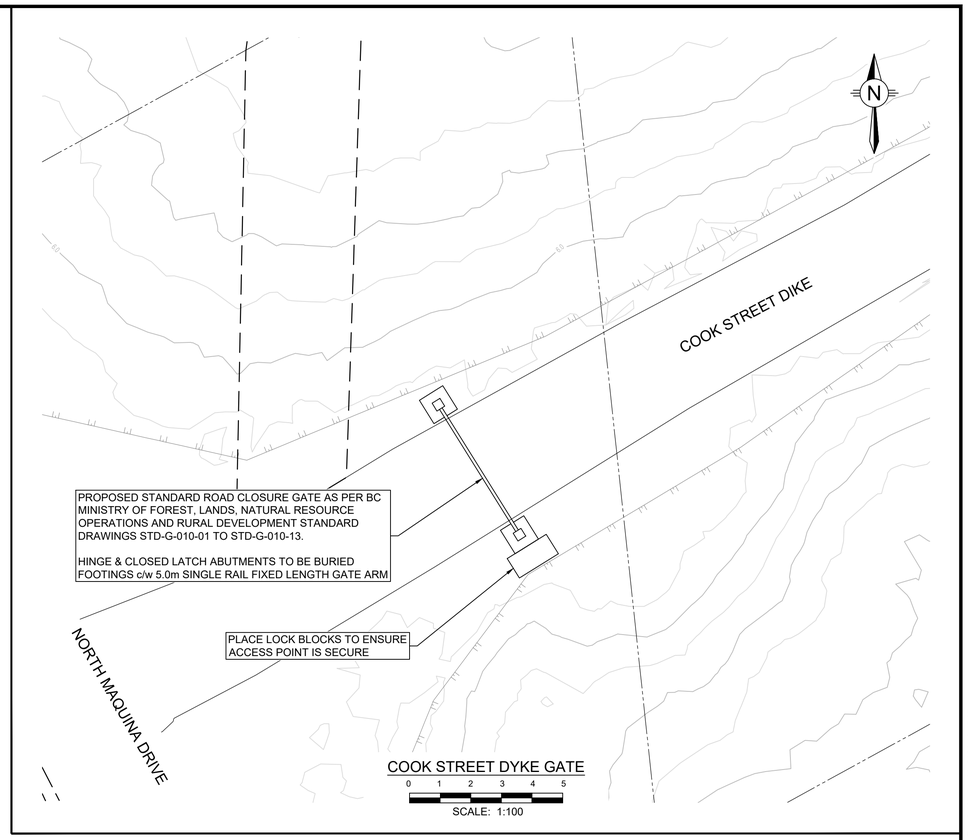
SCALE: 1:200



COOK STREET DYKE GATE

0 1 2 3 4 5

SCALE: 1:100

CULVERT & SWALE TYPICAL SECTION

SCALE 1:100

RE-ISSUED FOR TENDER

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1	ISSUED FOR TENDER	AC	2022-03-03	DC	2022-03-03
0	ISSUED FOR APPROVALS	AC	2022-01-10	DC	2022-01-10

EXISTING	LEGEND	DESIGN	EXISTING	LEGEND	DESIGN	EXISTING	LEGEND	DESIGN
T	U/G TELUS	T	S	SANITARY SEWER	S		SWALE	
C	U/G SHAW	C	D	STORM DRAIN	D	SMH / DMH	SAN. SEWER & STRM. DRAIN MANHOLES	SMH / DMH
E	U/G HYDRO	E	W	WATER MAIN	W	SIDE INLET / TOP INLET	CATCH BASIN	SIDE INLET / TOP INLET
G	NATURAL GAS	G		PAVEMENT		HYD	FIRE HYDRANT	HYD
FM	SANITARY - FORCEMAIN	FM		CURB & GUTTER		WV	WATER VALVE	WV
	LAWN DRAIN			SIDEWALK		UP	UTILITY POLE	UP
	INSPECTION CHAMBER			STREET LIGHTS		ANC	GUY LINE ANCHOR	ANC

DESIGNED: DC	A1 SCALE: H: 1:200 V: -
DRAWN: AC	DATE: 2022-01-10
CHECKED: MD	DATE: 2022-01-10
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2023-06-08

VILLAGE OF TAHSIS

BOSTON STREET POND CULVERT & ROAD CLOSURE GATES

FLOOD MITIGATION PROJECT - PHASE 2

TAHSIS, BC

SHEET REFERENCE: C-106
McELHANNEY PROJECT #: 2221-49140-00 T2026
SHEET 6 OF 11
REV. 2

DRAWING PATH: G:\PROJECTS\ACTIVE\49140-00 village of tahsis - 2018 msa\task 2026 flood protection ph 1&2\10.0 drawings\10.4 sheets\49140-DITCH.dwg Tab C-107 Jun 08, 2023 10:47:27am

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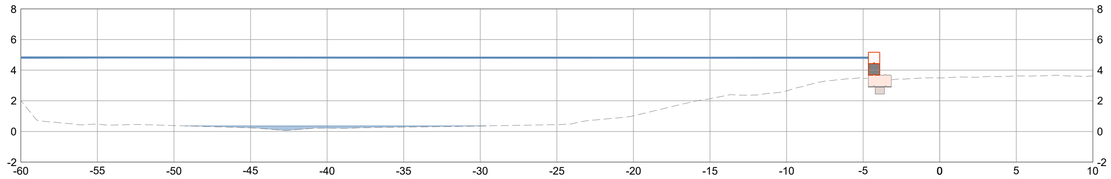
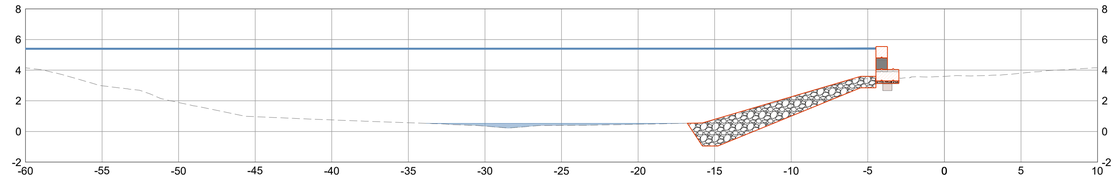


10+765



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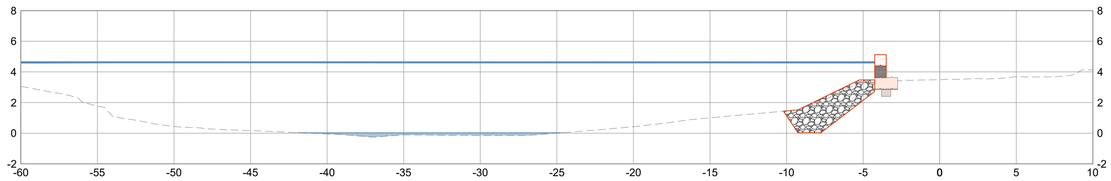
START OF RIP RAP ZONE 2, SEE C-901 FOR TYPICAL SECTION AND DETAILS



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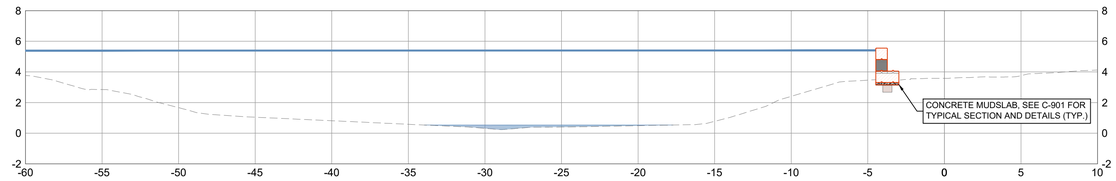
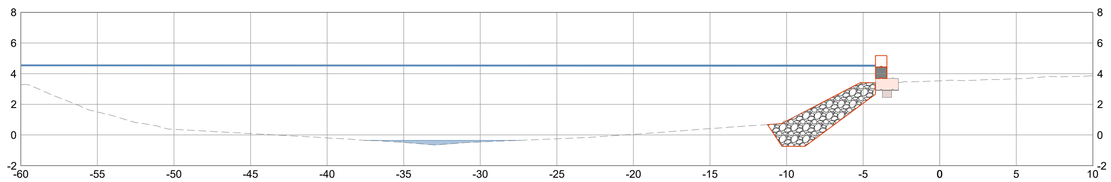


CONCRETE MUDSLAB, SEE C-901 FOR TYPICAL SECTION AND DETAILS (TYP.)

10+969

START OF CONCRETE MUDSLAB, SEE C-901 FOR TYPICAL SECTION AND DETAILS



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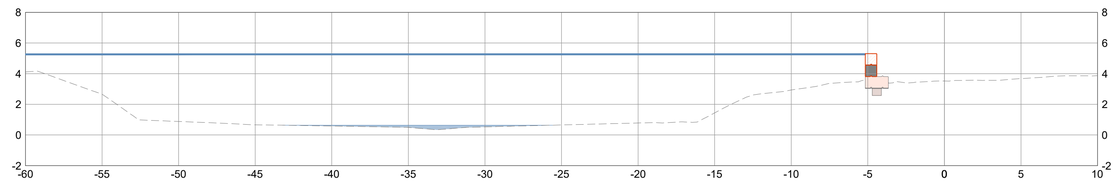
NORTH MAQUINNA DRIVE STATIONING & CENTERLINE (TYP.)



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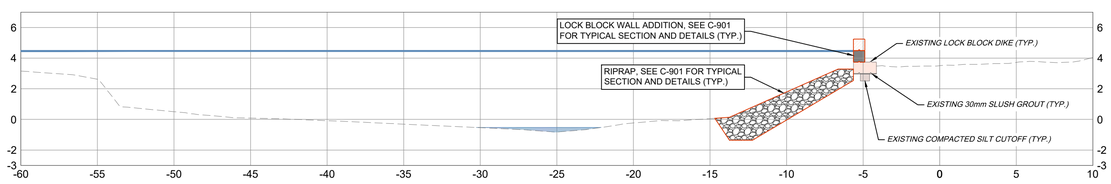
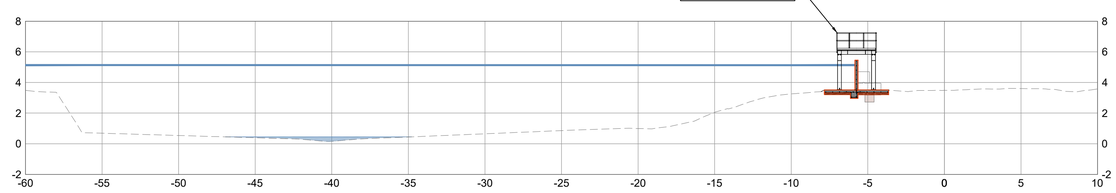


10+668

END OF RIP RAP SUPPLEMENT, START OF LOCK BLOCK WALL ADDITION AND RIPRAP ZONE 1, SEE C-901 FOR TYPICAL SECTION AND DETAILS



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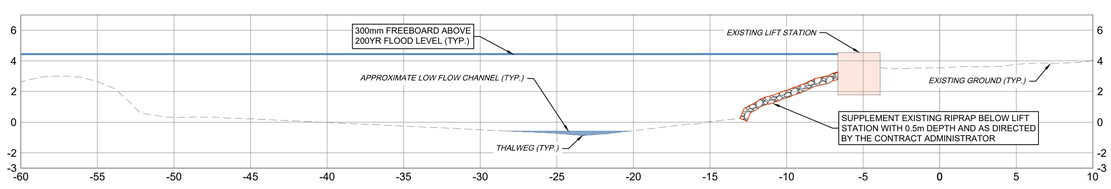
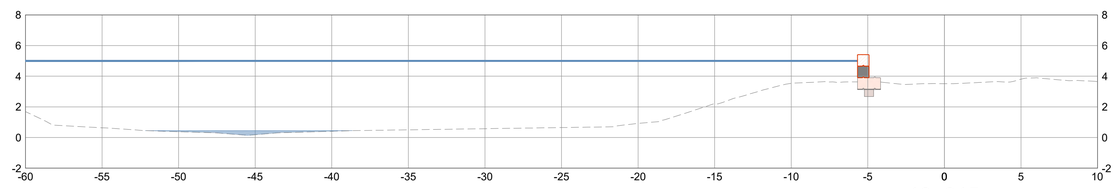


10+658

START OF RIPRAP SUPPLEMENT, SEE C-901 FOR TYPICAL SECTION AND DETAILS



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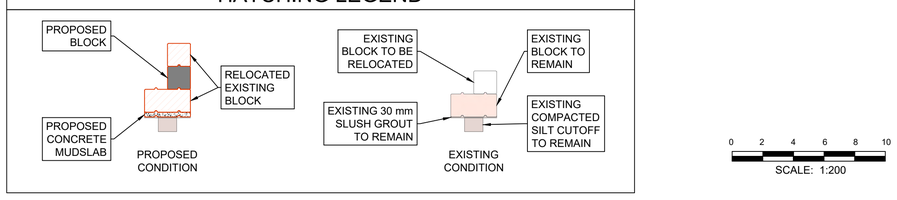

0 2 4 6 8 10

SCALE: 1:200

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EXISTING	LEGEND	DESIGN	EXISTING	LEGEND	DESIGN	EXISTING	LEGEND	DESIGN
T	U/G TELUS	T	S	SANITARY SEWER	S	SMH / DMH	SWALE / SAN. SEWER & STRM. DRAIN MANHOLES	SMH / DMH
C	U/G SHAW	C	D	STORM DRAIN	D	SIDE INLET / TOP INLET	CATCH BASIN	SIDE INLET / TOP INLET
E	U/G HYDRO	E	W	WATER MAIN	W	HYD	FIRE HYDRANT	HYD
G	NATURAL GAS	G		PAVEMENT		WV	WATER VALVE	WV
FM	SANITARY - FORCEMAIN	FM		CURB & GUTTER		UP	UTILITY POLE	UP
	LAWN DRAIN			SIDEWALK		ANC	GUY LINE ANCHOR	ANC
	INSPECTION CHAMBER			STREET LIGHTS				

DESIGNED: DC	A1 SCALE: H: 1:200 V: 1:200
DRAWN: AC	DATE: 2021-12-13
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VILLAGE OF TAHSIS

TAHSIS RIVER SECTIONS
STA. 10+658 - 10+971

FLOOD MITIGATION PROJECT - PHASE 2

TAHSIS, BC

SHEET REFERENCE: C-201
MCELHANNEY PROJECT #: 2221-49140-00 T2026
SHEET 7 OF 11
REV. 4

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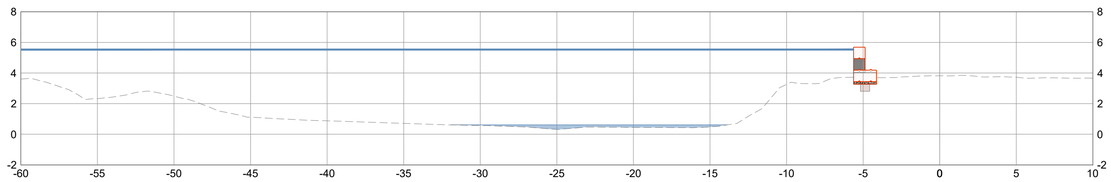

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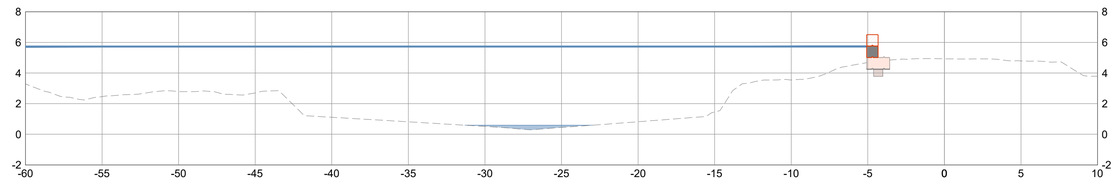
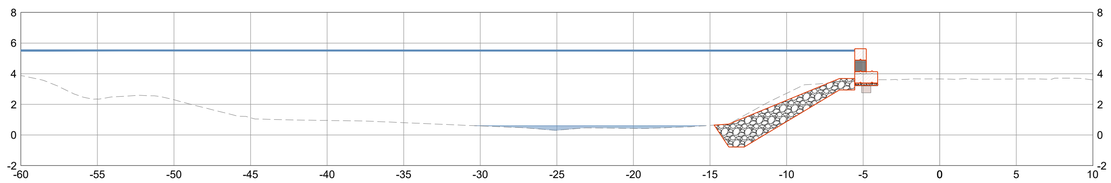


11+083

END OF LOCK BLOCK WALL ADDITION, SEE C-901 FOR TYPICAL SECTION AND DETAILS



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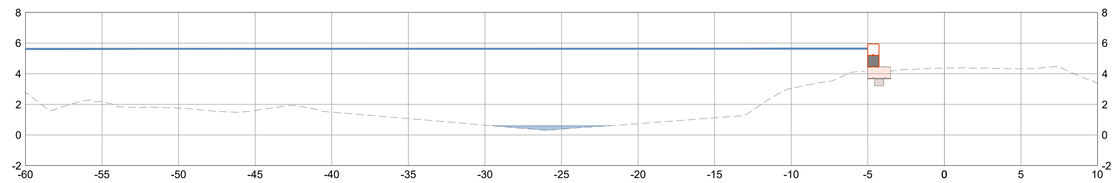
END OF RIP RAP ZONE 2, SEE C-901 FOR TYPICAL SECTION AND DETAILS



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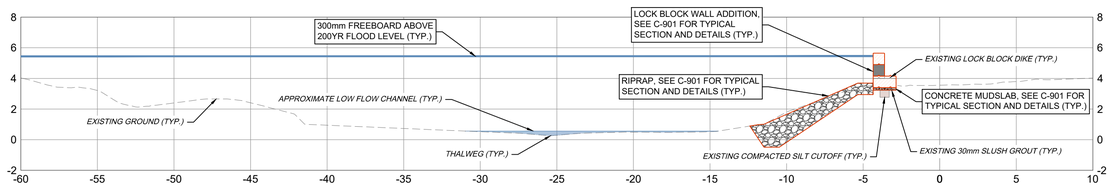
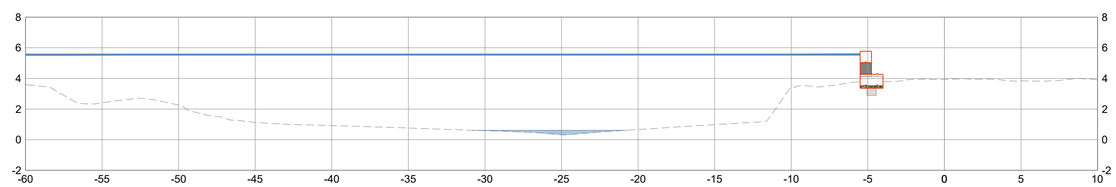


10+990

NORTH MAQUINNA DRIVE STATIONING & CENTERLINE (TYP.)



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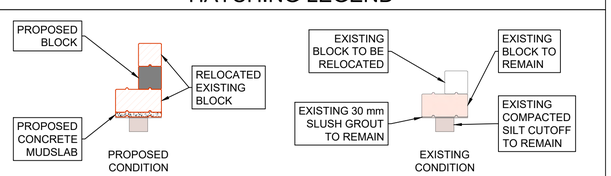
END OF CONCRETE MUDSLAB, SEE C-901 FOR TYPICAL SECTION AND DETAILS

HATCHING LEGEND



0 2 4 6 8 10

SCALE: 1:200

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2	ISSUED FOR TENDER - ADDENDUM 5	AC	2022-04-14	DC	2022-04-14
1	ISSUED FOR TENDER	AC	2022-03-03	DC	2022-03-03
0	ISSUED FOR APPROVALS	AC	2021-12-13	DC	2021-12-13

EXISTING	LEGEND	DESIGN	EXISTING	LEGEND	DESIGN	EXISTING	LEGEND	DESIGN
T	U/G TELUS	T	S	SANITARY SEWER	S		SWALE	
C	U/G SHAW	C	D	STORM DRAIN	D	SMH / DMH	SAN. SEWER & STRM. DRAIN MANHOLES	SMH / DMH
E	U/G HYDRO	E	W	WATER MAIN	W	SIDE INLET / TOP INLET	CATCH BASIN	SIDE INLET / TOP INLET
G	NATURAL GAS	G		PAVEMENT		HYD	FIRE HYDRANT	HYD
FM	SANITARY - FORCEMAIN	FM		CURB & GUTTER		WV	WATER VALVE	WV
	LAWN DRAIN			SIDEWALK		UP	UTILITY POLE	UP
	INSPECTION CHAMBER			STREET LIGHTS		ANC	GUY LINE ANCHOR	ANC

DESIGNED: DC	A1 SCALE: H: 1:200 V: 1:200		
DRAWN: AC	DATE: 2021-12-13		
CHECKED: MD	DATE: 2021-12-13		
APPROVED: DC	DATE: 2021-12-13		

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51236
2023-06-08

VILLAGE OF TAHSIS

TAHSIS RIVER SECTIONS
STA. 10+990 - 11+083

FLOOD MITIGATION PROJECT - PHASE 2

TAHSIS, BC

SHEET REFERENCE: C-202
McELHANNEY PROJECT #: 2221-49140-00 T2026
SHEET 9 OF 11
REV. 4

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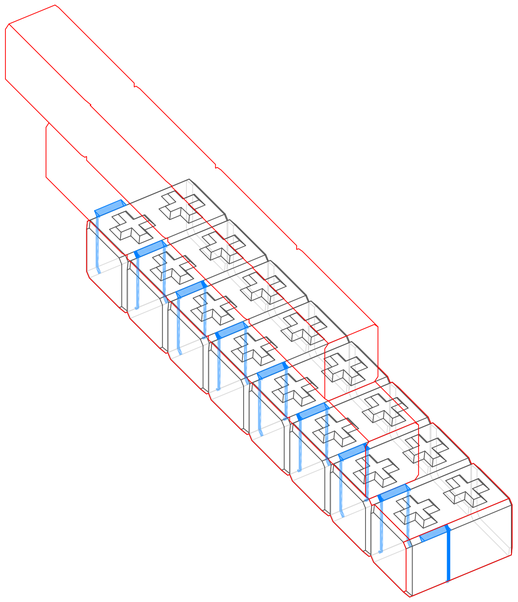
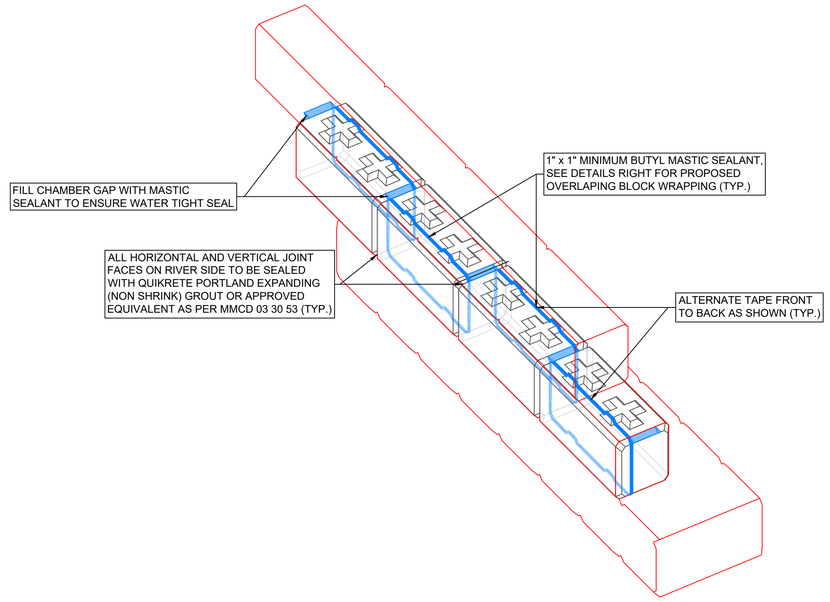


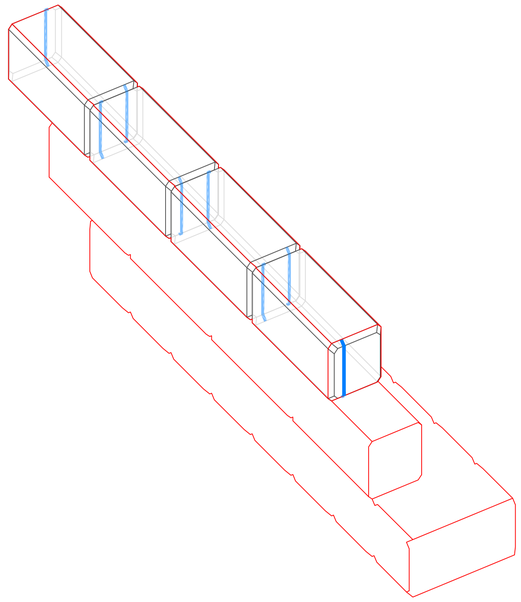
LOCK BLOCK WALL - EXISTING BOTTOM ROW

NOT TO SCALE



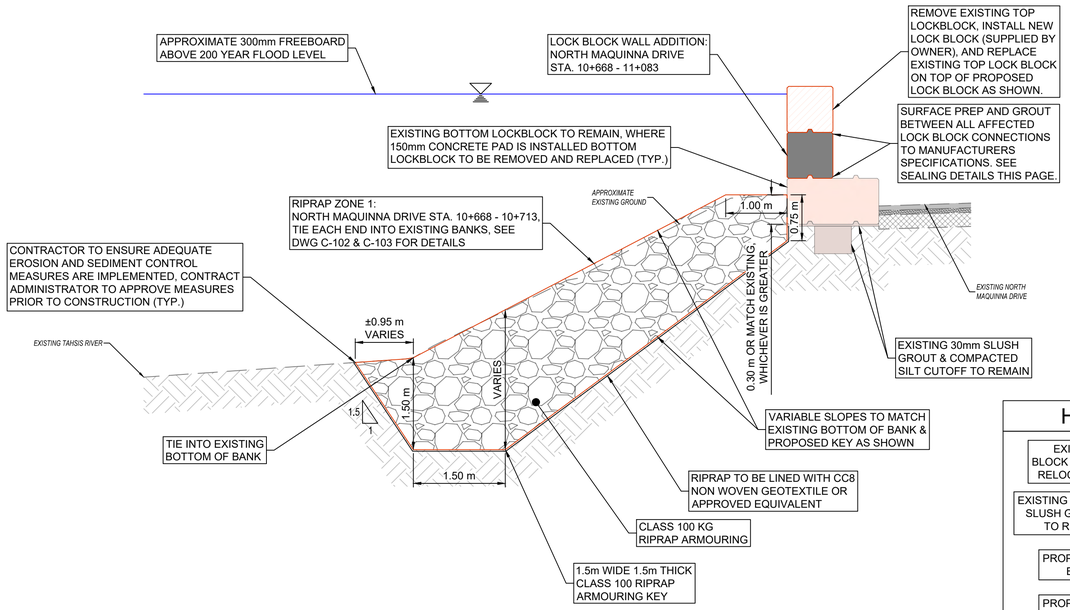
LOCK BLOCK WALL - PROPOSED MIDDLE ROW

NOT TO SCALE



LOCK BLOCK WALL - ADJUSTED TOP ROW

NOT TO SCALE



ZONE 1
STA. 10+668 - 10+713
LOCK BLOCK WALL & RIPRAP

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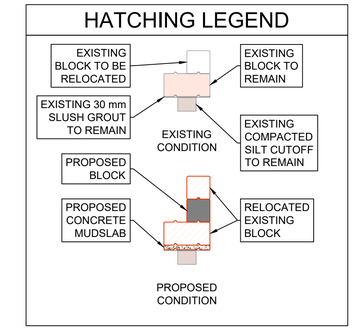

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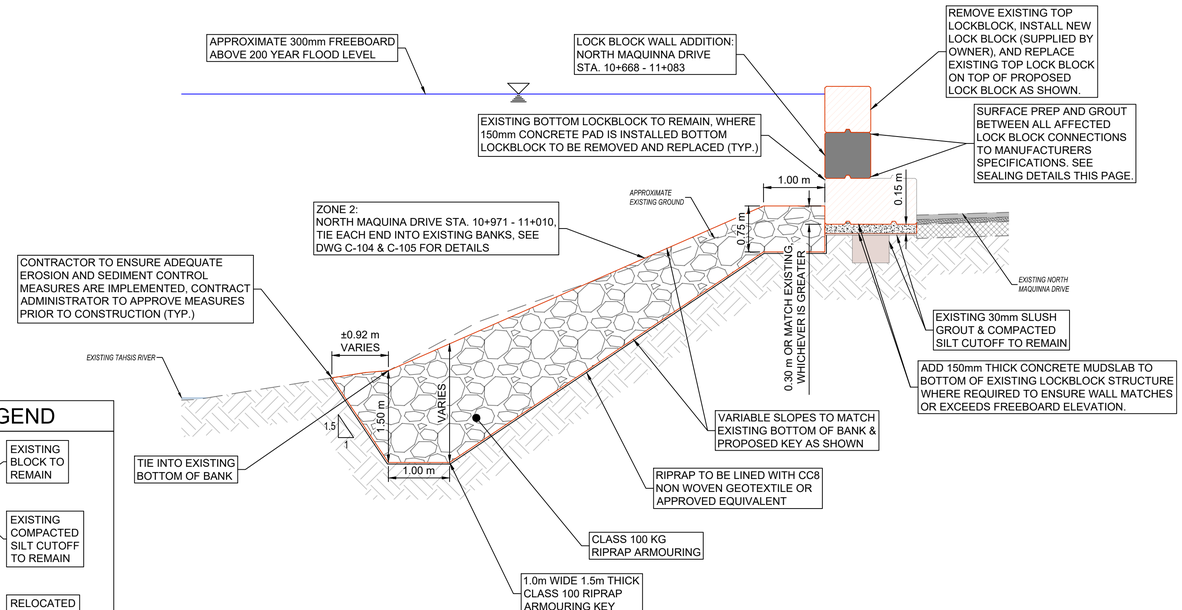
SCALE: 1:50



ZONE 2
STA. 10+971 - 11+010
LOCK BLOCK WALL, CONCRETE MUDSLAB, & RIPRAP

SCALE = 1:50

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DESIGNED: DC	A1 SCALE: H: - V: -
DRAWN: AC	DATE: 2021-12-13
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APPROVED: DC	DATE: 2021-12-13

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PERMIT NUMBER: 1003299
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D. R. CYBAK
51236
2023-06-08

VILLAGE OF TAHSIS

DETAILS
RIPRAP & LOCK BLOCK WALL

FLOOD MITIGATION PROJECT - PHASE 2

TAHSIS, BC

SHEET REFERENCE: C-901
McELHANNEY PROJECT #: 2221-49140-00 T2026
SHEET 9 OF 11
REV. 4

DRAWING PATH: G:\PROJECTS\ACTIVE\49140-00 village of tahsis - 2018 msa\task 2026 flood protection ph 1&2\10.0 drawings\10.4 sheets\49140-DETAILS.dwg Tab C-901 Jun 08, 2023 10:49:24am

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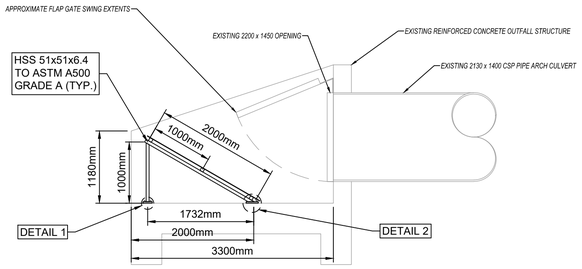
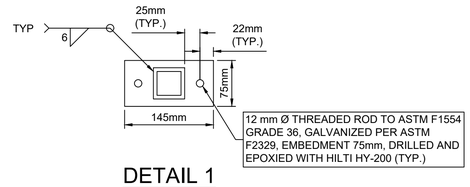


BOSTON POND OUTFALL FISH SCREEN ELEVATION VIEW

SCALE = 1:50

NOTES:

- ALL WELDS TO BE MINIMUM 6 mm FILET WELDS
- HSS FRAME SHALL BE EITHER GALVANIZED OR COATED WITH APPROVED EPOXY COATING SUITABLE FOR AN IMMERSED CONDITION
- ALL ENDS OF HSS SHALL BE SEALED WITH 6 mm END PLATES AND SEAL WELDS



DETAIL 1

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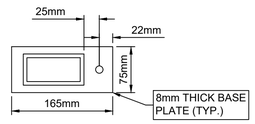
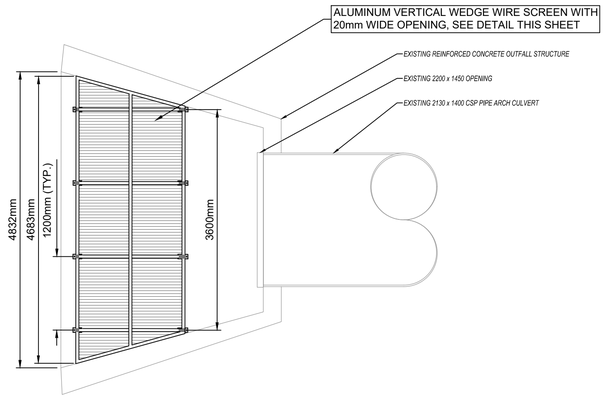


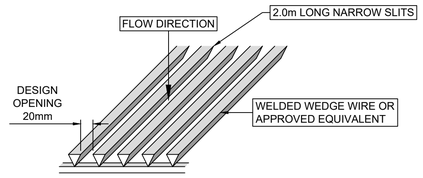
DETAIL 2

SCALE = 1:5



BOSTON POND OUTFALL FISH SCREEN PLAN VIEW

SCALE = 1:50



BOSTON POND OUTFALL FISH SCREEN DETAIL

SCALE = NTS

NOTE:
FISH SCREEN SHALL BE CAPABLE OF SPANNING 1000mm
UNDER A MINIMUM UNIFORMLY DISTRIBUTED LOAD OF 0.5 kPa

0 0.5 1.0 1.5 2.0 2.5

SCALE: 1:50

0 0.05 0.1 0.15 0.2 0.25

SCALE: 1:5

GENERAL NOTES:

1. SEE DRAWING C-101 FOR GENERAL NOTES
2. CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN TO BE APPROVED BY THE CONTRACT ADMINISTRATOR PRIOR TO CONSTRUCTION
3. FULL TIME ENVIRONMENTAL MONITOR REQUIRED DURING IN-WATER WORKS
4. CONTRACTOR TO CONFIRM ALL EXISTING DIMENSIONS PRIOR TO FABRICATION

STRUCTURAL STEEL:

1. STRUCTURAL STEEL SHALL BE DESIGNED AND FABRICATED TO CSA-S16 AND THE CISC CODE OF STANDARD PRACTICE.
2. STEEL CONNECTIONS NOT DETAILED ON THE DRAWINGS SHALL BE DESIGNED BY THE FABRICATOR'S ENGINEER. ALL CONNECTION FORCES SHALL RUN THROUGH A COMMON WORK POINT WHICH SHALL BE THE INTERSECTION OF THE PRINCIPAL AXES OF THE CONNECTED MEMBERS UNLESS SHOWN OTHERWISE. BOLTED CONNECTIONS SHALL HAVE MINIMUM 9.5 mm (3/8") THICK CONNECTOR PLATES OR 6.4 mm (1/4") THICK ANGLE CLIPS AND TWO 19 mm (3/4") DIAMETER BOLTS OR WELDS OF EQUIVALENT STRENGTH. BEAM CONNECTIONS SHALL BE DESIGNED FOR THE MAXIMUM UNIFORMLY DISTRIBUTED LOAD ON THE BEAM, BUT NO LESS THAN 50% OF THE SHEAR RESISTANCE. BRACING AND TENSION MEMBER CONNECTIONS SHALL BE DESIGNED FOR THE FULL TENSILE RESISTANCE.
3. STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING UNLESS NOTED OTHERWISE:
   BARS & PLATES: CSA-G40.21 GRADE 300W
   ANGLES & CHANNELS: CSA-G40.21 GRADE 350W
   PIPES: ASTM A53 GRADE B
   STRUCTURAL BOLTS: ASTM F3125 GRADE A325
   ANCHOR BOLTS: ASTM F1554 GRADE 36
4. STRUCTURAL STEEL SHALL BE WELDED IN ACCORDANCE WITH CSA-W59 BY COMPANIES AND WELDERS CERTIFIED TO CSA-W47.1 BY CWB.
5. WELDS SHALL BE MADE USING E49XX ELECTRODES OR BETTER UNLESS NOTED OTHERWISE.
6. FIELD WELDING IS NOT PERMITTED UNLESS SPECIFIED OR AUTHORIZED BY THE ENGINEER.
7. PRE-TENSIONED STRUCTURAL BOLTS SHALL BE PRE-TENSIONED USING THE TURN-OF-NUT METHOD. STRUCTURAL BOLTS SHALL BE MATCH MARKED PRIOR TO PRE-TENSIONING.
8. STRUCTURAL BOLTS AND ANCHOR BOLTS SUBJECTED TO VIBRATION OR LEFT LOOSE TO ALLOW FOR EXPANSION AND CONTRACTION SHALL HAVE THEIR THREADS INTERRUPTED BY WELDING OR GOUGING AFTER FINAL INSTALLATION TO PREVENT NUTS BACKING OFF.
9. HSS SECTIONS AND PIPES SHALL BE PROVIDED WITH SEAL WELDED CAP PLATES AT OPEN ENDS AND DRAIN HOLES AT THE BASE.
10. BEARING PLATES AND BASE PLATES SUPPORTED BY MASONRY OR CONCRETE SHALL BE GROUTED SOLID WITH NON-METALLIC, NON-SHRINK GROUT HAVING A 7-DAY COMPRESSIVE STRENGTH OF AT LEAST 40 MPa (5,800 psi) IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.
11. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF ALL STRUCTURAL STEEL TO THE ENGINEER FOR REVIEW AT LEAST TWO WEEKS PRIOR TO FABRICATION. THE DRAWINGS SHALL BE SEALED BY THE FABRICATOR'S ENGINEER. THE SHOP DRAWINGS SHALL SHOW ALL DETAILS, MATERIAL SPECIFICATIONS AND DESIGN LOADS. THE FABRICATOR'S ENGINEER SHALL CARRY OUT FIELD REVIEWS AND CERTIFY THAT THE WORK WAS COMPLETED IN ACCORDANCE WITH THE SHOP DRAWINGS AND ALL OTHER STRUCTURAL REQUIREMENTS.
12. THE CONTRACTOR SHALL SUBMIT MILL CERTIFICATES FOR ALL STRUCTURAL STEEL TO THE ENGINEER.
13. ALL STEELWORK TO BE GALVANIZED IN ACCORDANCE WITH ASTM A123 AND/OR CSA G164

INFORMATION ON EXISTING UTILITIES MAY NOT BE COMPLETE OR ACCURATE. PRIOR TO CONSTRUCTION CONTRACTOR SHALL EXPOSE LOCATIONS OF ALL EXISTING UTILITIES AND ADVISE THE ENGINEER OF POTENTIAL CONFLICTS.

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VILLAGE OF TAHSIS

DETAILS
FISH SCREEN

FLOOD MITIGATION PROJECT - PHASE 2

TAHSIS, BC

SHEET REFERENCE: C-902
McELHANNEY PROJECT #: 2221-49140-00 T2026
SHEET 10 OF 11
REV. 4

DRAWING PATH: G:\PROJECTS\ACTIVE\49140-00 Village of Tahsis - 2018 MSA\Task 2026 Flood Protection Ph 1&2\10.0 DRAWINGS\10.4 Sheets\49140-DETAILS.dwg Tab C-902 Jun 08, 2023 9:23:57am

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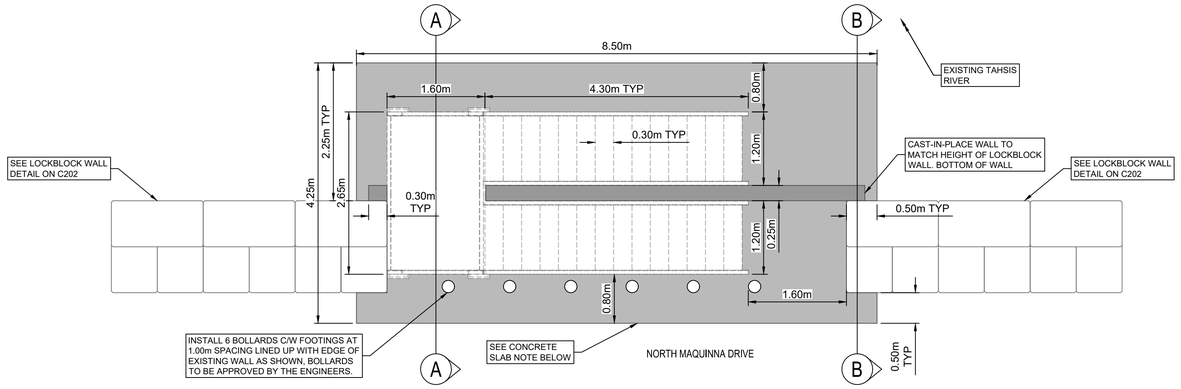

STAIRS DETAIL - PLAN

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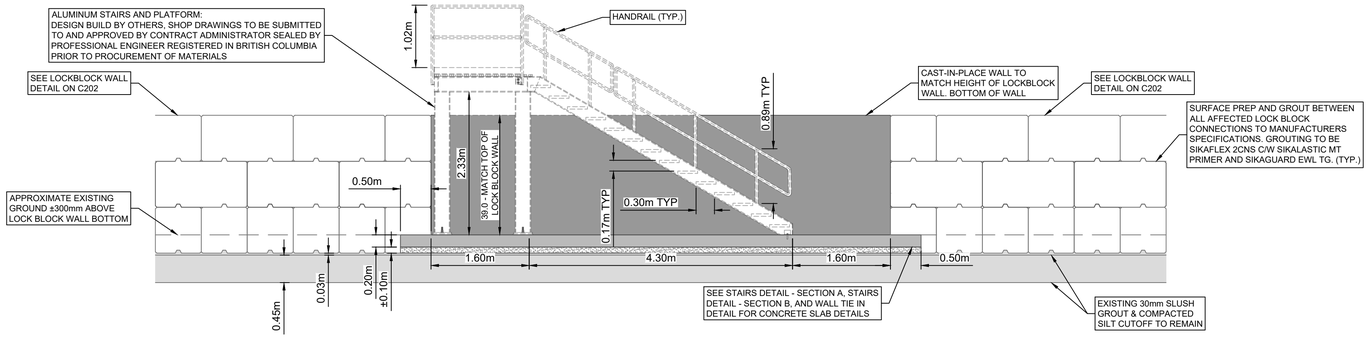

STAIRS DETAIL PROFILE

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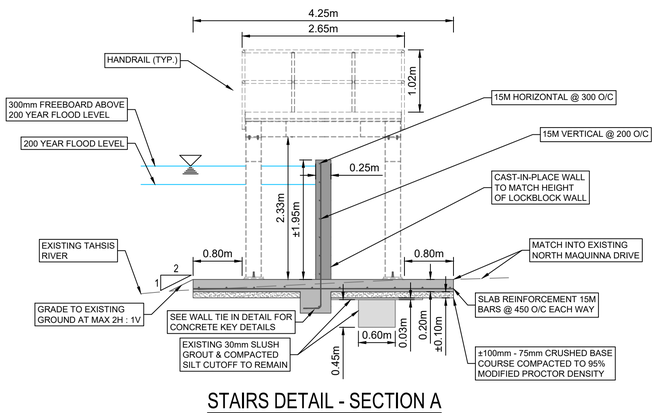
SCALE: 1:10

0 0.5 1.0 1.5 2.0 2.5
SCALE: 1:50



STAIRS DETAIL - SECTION A

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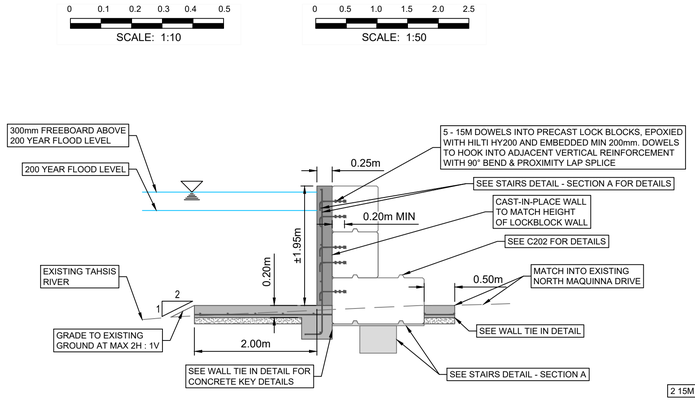
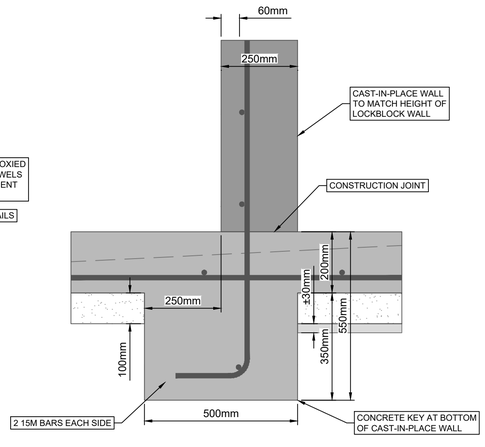


STAIRS DETAIL - SECTION B

SCALE = 1:50

NOTE: STAIRS DETAIL - SECTION B-B IS TYPICAL FOR WEST AND EAST LOCK BLOCK TIE IN LOCATIONS



WALL TIE IN DETAIL

SCALE = 1:10

CONCRETE NOTES:

1. PROVIDE CONCRETE AND PERFORM WORK TO CSA-A23.1-04. PROVIDE HOT AND COLD WEATHER PROTECTION IN ACCORDANCE WITH CSA-A23.1-04. ALL CONCRETE TO BE NORMAL WEIGHT 23.6KN/ CUm (150PSF) TYPE GU CEMENT. MAXIMUM 19mm (3/4") AGGREGATE FOR ALL CONCRETE. MINIMUM 28 DAY COMPRESSIVE STRENGTHS AS INDICATED BELOW:

STRENGTH MPA	MAX W/C	SLUMP RANGE	EXPOSURE CLASS	AIR ENTRAINMENT
35	0.40	3" TO 4" (75 TO 100mm)	C-1	6 TO 8 %

*SLUMPS NOTED ARE BEFORE THE ADDITION OF A SUPERPLASTICIZER.

2. CHLORIDE-TYPE ADMIXTURES ARE NOT PERMITTED IN THE CONCRETE.
3. MIX DESIGNS SHALL BE PROVIDED FOR THE ENGINEER AND CONCRETE TESTING AGENCY FOR REVIEW AND APPROVAL PRIOR TO CONCRETE PLACEMENT.
4. CONCRETE MUST BE TESTED IN ACCORDANCE WITH CSA-A23.2 BY AN ENGINEER APPROVED INDEPENDENT TESTING AGENCY. UNLESS NOTED OTHERWISE, A MINIMUM OF 3 TEST CYLINDERS SHALL BE CAST FOR EACH 50 CUm OR EACH DAYS POUR, WHICHEVER IS LESS. TEST 1 CYLINDER AT 7 DAYS AND 2 AT 28 DAYS AND SUBMIT WRITTEN REPORTS FOR REVIEW BY THE ENGINEER. REPORTS SHALL IDENTIFY LOCATIONS WHERE THE CONCRETE TESTED WAS LOCATED WITHIN THE STRUCTURE.
5. ALL CONCRETE WORKS TO BE IN ACCORDANCE WITH CSA-A23.1-04.
6. STRIPPING OF FORMS FOR STRUCTURAL ELEMENTS WILL BE ONLY AFTER CONCRETE HAS REACHED 50% OF THE 28 DAY STRENGTH FOR WALLS AND COLUMNS AND 70% OF THE 28 DAY STRENGTH FOR SLABS AND BEAMS. CONCRETE STRENGTH WILL BE DETERMINED BY FIELD CURED CYLINDERS.
7. UNLESS NOTED OTHERWISE, ALL STEEL REINFORCING MUST HAVE THE FOLLOWING CONCRETE COVER:

   SURFACES PLACED IN CONTACT WITH GROUND : 75mm
   FORMED SURFACES TO BE EXPOSED TO GROUND, WEATHER, OR WATER : 60mm

8. REJECT ALL CONCRETE WHEN TIME BETWEEN BATCHING AND PLACING EXCEEDS 1hr 20mins.
9. DO NOT USE ADMIXTURES WITHOUT PRIOR APPROVAL OF THE ENGINEER.
10. CONSOLIDATE ALL CONCRETE USING MECHANICAL VIBRATORS.
11. PROTECT CONCRETE FROM ADVERSE WEATHER CONDITIONS IN ACCORDANCE WITH CSA-A23.1-04 OR AS DETERMINED BY THE ENGINEER.

REINFORCING STEEL:

1. ALL REINFORCING STEEL TO CONFORM TO CSA SPECIFICATION G30.18 GRADE 400W.
2. ALL LAPS TO BE AS NOTED BELOW, UNLESS INDICATED OTHERWISE ON THE DRAWINGS.

BAR SIZE	BOTTOM BAR	TOP BAR
15M	510	660

3. REINFORCING STEEL LAP SPLICES ARE TO BE STAGGERED SO THAT NOT MORE THAN EVERY SECOND BAR IS SPLICED AT ANY ONE LOCATION EXCEPT AS OTHERWISE INDICATED.
4. COVER TO REINFORCING IS AS FOLLOWS UNLESS NOTED OTHERWISE ON THE DRAWINGS.
   - FOOTINGS CAST AGAINST SOIL 100mm
   - FORMED SURFACES 70mm
5. REINFORCING STEEL SHALL NOT BE WELDED
6. ENGINEER TO REVIEW AND APPROVED STEEL REINFORCEMENT SHOP DRAWINGS PRIOR TO THE CONTRACTOR PROCURING STEEL REINFORCEMENT

STRUCTURAL STEEL:

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2. STEEL CONNECTIONS NOT DETAILED ON THE DRAWINGS SHALL BE DESIGNED BY THE FABRICATOR'S ENGINEER. ALL CONNECTION FORCES SHALL RUN THROUGH A COMMON WORK POINT WHICH SHALL BE THE INTERSECTION OF THE PRINCIPAL AXES OF THE CONNECTED MEMBERS UNLESS SHOWN OTHERWISE. BOLTED CONNECTIONS SHALL HAVE MINIMUM 9.5 mm (3/8") THICK CONNECTOR PLATES OR 6.4 mm (1/4") THICK ANGLE CLIPS AND TWO 19 mm (3/4") DIAMETER BOLTS OR WELDS OF EQUIVALENT STRENGTH. BEAM CONNECTIONS SHALL BE DESIGNED FOR THE MAXIMUM UNIFORMLY DISTRIBUTED LOAD ON THE BEAM, BUT NO LESS THAN 50% OF THE SHEAR RESISTANCE. BRACING AND TENSION MEMBER CONNECTIONS SHALL BE DESIGNED FOR THE FULL TENSILE RESISTANCE.
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   ANCHOR BOLTS: ASTM F1554 GRADE 36
4. STRUCTURAL STEEL SHALL BE WELDED IN ACCORDANCE WITH CSA-W59 BY COMPANIES AND WELDERS CERTIFIED TO CSA-W47.1 BY CWB.
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0	ISSUED FOR APPROVALS	AC	2021/12/13	MF	2021/12/13

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DRAWN: AC	DATE: 2021/12/13
CHECKED: DC	DATE: 2021/12/13
APPROVED: MF	DATE: 2021/12/13

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1196 Dogwood Street
Campbell River BC
Canada V9W 3A2
T 250 287 7799

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PERMIT NUMBER: 1003299
Engineers and Geoscientists of BC

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA M. A. FRIDERICHS # 41733
2023-06-08

VILLAGE OF TAHSIS

DETAILS
STAIRS

FLOOD MITIGATION PROJECT - PHASE 2

TAHSIS, BC

SHEET REFERENCE: C-903
McELHANNEY PROJECT #: 2221-49140-00 T2026
SHEET 11 OF 11
REV. 2

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DESTROY PRINTS OF PREVIOUS REVISION

Fisheries and Oceans Canada
Pêches et Océans Canada

Pacific Region
Ecosystem Management Branch
3190 Hammond Bay Road
Nanaimo, BC
V9T 6N7

Région du Pacifique
Direction de la gestion des écosystèmes
3190, rue Hammond Bay
Nanaimo, (C.-B.)
V9T 6N7

May 24, 2023

Our file *Notre référence*
22-HPAC-01269

Village of Tahsis
ATTENTION: Mark Tatchell
977 South Maquinna Drive
Tahsis, BC
VOP1X0

Via email: MTatchell@villageoftahsis.com

Dear Mark Tatchell:

Subject: Implementation of Measures to Avoid and Mitigate the Potential for Prohibited Effects to Fish and Fish Habitat

The Fish and Fish Habitat Protection Program (the Program) of Fisheries and Oceans Canada (DFO) received your proposal on **April 14, 2023**. We understand that you propose to:

- Conduct flood prevention works in the Tahsis River through upgrades to two sections of floodwall. Increasing the height of the flood wall is required to match projected flood levels as well as tsunami protection design. The increased floodwall height will require additional riprap on the slope below to support the added weight. A slope excavation and riprap placement will occur above the ordinary high-water mark. Riparian clearing will be required for excavation and riprap placement.

Our review considered the following information:

- *Request for Review Form,* signed by Kendra Freund (Pacificus Biological Services Ltd), received via email on April 14, 2023;
- *Village of Tahsis Floodwall Protection Improvement Project Assessment*, produced by Pacificus, dated April 2023, submitted via email April 14, 2023.

Your proposal has been reviewed to determine whether it is likely to result in:

- the death of fish by means other than fishing and the harmful alteration, disruption or destruction of fish habitat which are prohibited under subsections 34.4(1) and 35(1) of the *Fisheries Act*; and
- effects to listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in a manner which is prohibited under sections 32, 33 and subsection 58(1) of the *Species at Risk Act*.

The aforementioned outcomes are prohibited unless authorized under their respective legislation and regulations. As of the date of this letter, no individuals of any aquatic species listed under the *Species at Risk Act* were identified in the vicinity of the proposed works.

To avoid and mitigate the potential for prohibited effects to fish and fish habitat (as listed above), we recommend implementing the measures listed below in addition to those set out in your project proposal:

- Conduct full-time environmental monitoring during all works that have the potential to negatively impact fish or fish habitat.
- Conduct instream works only during the project-specific least-risk timing window of July 15 - September 15 and during periods of low flow/low tide.
- Equipment is to be operated from the top of the bank (i.e., above the high-water mark).
- Develop and implement an erosion and sediment control plan to reduce the risk of sedimentation of fish habitat.
    - Do not stockpile materials such as rock, riprap, or dirt below the high-water mark or in areas where the material has the potential to enter fish-bearing waters.
    - Effective sediment and erosion control measures should be installed, inspected, and repaired, as required, to prevent the introduction of sediment into fish habitat.
    - Keep the erosion and sediment control measures in place until all disturbed ground has been permanently stabilized.
    - Remove all exposed non-biodegradable sediment control materials once site is stabilized.
    - Use biodegradable erosion and sediment control materials whenever possible.
    - Regularly monitor the watercourse for signs of sedimentation during all phases of the work, undertaking or activity, and take corrective action if necessary.
- Ensure that materials placed below the top of bank of the watercourse(s) are non-acid generating and free of silt, overburden, debris, or other substances deleterious to aquatic life.
- The removal of or disturbance to riparian vegetation should be limited to the area of disturbance as outlined in the project proposal. Establish and mark the riparian areas that are not to be disturbed.
- Remove vegetation selectively and in phases. Do not fall trees into the watercourse.
-
- Revegetate disturbed areas with native seed mix and rooted stock upon completion of the works where possible.
- Conduct works during favourable weather conditions, monitor weather forecasts, and suspend works during high precipitation weather events.
- Restore/replace any other disturbed habitat features and remediate any areas impacted by the works, undertakings, or activities.
- Do not deposit any substances deleterious to fish or fish habitat directly or indirectly into fish-bearing waters (e.g., below the high-water mark).
- Develop and implement a spill response plan to avoid a spill of deleterious substances.
- Ensure that all heavy equipment is inspected regularly and is free of dirt, leaks, or debris prior to conducting works in or near fish habitat.

Provided that you incorporate these measures into your plans, the Program is of the view that your proposal is not likely to result in the contravention of the above-mentioned prohibitions and requirements.

Should your plans change or if you have omitted some information in your proposal, further review by the Program may be required. Consult our website (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) or

consult with a qualified environmental consultant to determine if further review may be necessary. It remains your responsibility to remain in compliance with the *Fisheries Act*, the *Species at Risk Act* and the *Aquatic Invasive Species Regulations.*

It is also your Duty to Notify DFO if you have caused, or are about to cause, the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to the DFO-Pacific Observe, Record and Report phone line at 1-800-465-4336 or by email at DFO.ORR-ONS.MPO@dfo-mpo.gc.ca.

Please notify the Program by email at Michael.Lockhart@dfo-mpo.gc.ca. at least 10 days before starting your project, ensuring your file number and appropriate on-site contact information is included. We recommend that a copy of this letter be kept on site while the work is in progress. It remains your responsibility to meet all other federal, provincial, and municipal requirements that apply to your proposal.

Please note that this Letter of Advice does not provide relief from the obligations set out in the government of British Columbia's Riparian Areas Protection Regulations (RAPR) and cannot be construed to provide authorization pursuant to section 3(2) of the RAPR, for any work, undertaking or activity within the Riparian Assessment Area. For more information on the RAPR, including contacts, please visit: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/aquatic-habitat-management/riparian-areas-regulation.

Please note that the advice provided in this letter will remain valid for a period of one year from the date of issuance. If you plan to execute your proposal after the expiry of this letter, we recommend that you contact the Program to ensure that the advice remains up-to-date and accurate. Furthermore, the validity of the advice is also subject to there being no change in the relevant aquatic environment, including any legal protection orders or designations, during the one-year period.

If you have any questions with the content of this letter, please contact the undersigned at our Nanaimo office by email at Michael.Lockhart@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,

Michael Lockhart
A/ Senior Fisheries Biologist
Fish and Fish Habitat Protection Program

c.c.: Doug McCorquodale, Pacificus Biological Services, doug@pacificus.ca

Village of Tahsis Floodwall Protection Improvement Project Assessment

April 2023

Version 4.0

PACIFICUS
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Village of Tahsis Floodwall Protection Improvement Project Assessment

Prepared for

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Written by:

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Reviewed by:

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April 11, 2023

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Executive Summary

The Village of Tahsis is in the planning stages of improving their existing flood protection infrastructure. Currently the Village of Tahsis utilizes a concrete lock-block flood wall, a dike, as well as a large storm pond as methods of combatting flooding. Though these methods have decreased the severity of recent flooding, flooding still occurs in the Village of Tahsis. In order to increase the effectiveness of the floodwall protection structure (to account for 1:200 storm event, and modelled climate change impacts), the Village of Tahsis has proposed the increase in height of the wall by one lock-block high. It was determined that the extra weight of the wall would compromise the integrity of the existing river banks in two identified areas (Figure 3, Appendix 2) [1].

The Village of Tahsis has proposed the modification of a riprap bank that will provide the improved flood protection structure with the bank stability it requires. A previous assessment and submission were completed in 2021[2], however, the project has been modified for this submission. Pacificus Biological Services Ltd. (Pacificus) was contracted by the Village of Tahsis to conduct an assessment of the proposed work areas and affiliated sections of the Tahsis river in order to determine if the proposed works will involve any in-stream works, and/ or have the potential to cause the *death of fish*, or *harmful alteration, disruption, or destruction of fish habitat* (*HADD*).

Biological assessments of the site were performed, leading to modifications from a previous proposal. The current project plans to conduct all works above the normal high-water mark (NHWM) and therefore would not require any in-stream works and/ or encroachment of the Tahsis River. Some riparian vegetation will be required to be removed, however, where possible, the unnecessary removal of said vegetation will be avoided. The assessment determined that the proposed works are unlikely to cause the *death of fish* and *harmful alternation, disruption or destruction of fish habitat*. Although there are no in-stream works required, and no encroachment of the channel will occur, due to the proximity to the Tahsis River, the modified project will be submitted to DFO for review.

[1] McElhanney. 2021. Environmental Impact Assessment – for the Tahsis Floodwall Protection Project.
[2] McElhanney. 2021. Environmental Impact Assessment – for the Tahsis Floodwall Protection Project.

Introduction

The Village of Tahsis is a small community located on the west coast of Vancouver Island, approximately 102km west of Campbell River, BC (49° 55.542'N 126° 39.285'W) (Figure 1). Positioned at the head of Tahsis Inlet, the Village of Tahsis is located within the floodplain of the Tahsis and Leiner Rivers, and has a long history of flooding events[3]. In order to protect the Village and its inhabitants from potential flooding, in 2001 a concrete lock-block floodwall was installed along the banks of the river in areas with the highest flood risk. Though this installation has helped with the severity of flooding in Tahsis, significant flooding events still occur. The current proposal aims to account for a 1:200 storm event, as well as sea level rise impacts up to the year 2100 (using current climate change modelling).

In order to increase the effectiveness and longevity of the existing floodwall, the Village of Tahsis has proposed increasing the height of the floodwall. This increase would require additional concrete lock blocks to be installed on top of the existing wall, to an additional one block in height. Upon completion of the engineering survey, it was determined that the additional weight of the wall would affect the river bank stabilization in two identified areas (Zone 1 and Zone 2) (Figure 3, Appendix 2). In order to ensure adequate bank stabilization, the Village of Tahsis propose the installation of large riprap fill equating to 265.5m^2 in Zone 1, and 225m^2 in Zone 2 (Appendix 2). This large stable rock would replace the existing river bank material, increasing the integrity of the bank. In order to determine if the proposed works will involve any in-stream works, and/ or have the potential to cause the *death of fish*, or *harmful alteration, disruption, or destruction of fish habitat* (*HADD*), the Village of Tahsis contracted Pacificus Biological Services Ltd. to conduct an assessment of the river and banks in the associated areas.

Watershed Background

The Tahsis River drains into the head of Tahsis Inlet, and is tidally influenced for approximately 1.4km, until just downstream of the confluence of McKelvie Creek. The Tahsis River (WSC: 930-569100) is also influenced by multiple minor tributaries, including, McKelvie Creek (WSC: 930-569100-09400)[4]. The Tahsis Watershed encompasses an area of approximately 77km^2.

Online fisheries databases and stock assessment reports confirm the presence of chinook salmon (*Oncorhynchus tshawytscha),* chum salmon (*O. keta*), coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), sockeye salmon (*O. nerka*), and steelhead (*O. mykiss*) within the Tahsis River. Though all five salmon species have been known to utilize the Tahsis River historically, the dominant species utilizing the river in recent years are chum salmon, chinook salmon, and

[3] McElhanny. 2019. Tahsis Flood Risk Assessment. http://villageoftahsis.com/wp-content/uploads/2019/09/49140TahsisFloodRiskAssessmentFinalReportComplete.pdf.
[4] Ministry of Environment. Habitat Wizard. https://maps.gov.bc.ca/ess/hm/habwiz/

steelhead. Pink salmon, sockeye salmon, and coho salmon are occasionally observed, albeit in extremely low numbers (Pers. Comm. Mark Tatchell to Kendra Freund).

Historic Flooding

During the development of the Village of Tahsis prior to the 1930's[5], the channel of the Tahsis River was relocated from its historic flow path on the eastern side of the valley to its existing location on the western side of the valley (pers. Comm. Mark Tatchell to Kendra Freund). The existing flow path is now in immediate proximity to the center of the village. The Village of Tahsis has historically experienced moderate to significant flooding events caused by a combination of high river flows and storm season high tides (Photo 1). These events have previously threatened emergency evacuation, and in 2001 flood protection structures in the form of the Marine Drive floodwall and Cook St dyke were established[6].

The three main watersheds contributing to the flooding of the village are the Tahsis River, McKelvie Creek and the Leiner River (Figure 2). With a total watershed area of 145km^2, when high flows in these three systems and high tides converge, over 50% of the village of Tahsis is in danger of at least minor, if not moderate to high risk of flooding[3].

[5] McElhanny. 2019. Tahsis Flood Risk Assessment. http://villageoftahsis.com/wp-content/uploads/2019/09/49140TahsisFloodRiskAssessmentFinalReportComplete.pdf.
[6] McElhanny. 2019. Tahsis Flood Risk Assessment. http://villageoftahsis.com/wp-content/uploads/2019/09/49140TahsisFloodRiskAssessmentFinalReportComplete.pdf. Appendix A.

Figure 1. Map depicting the location of the Village of Tahsis and the proposed work areas.

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Figure 2. Map of the watersheds that contribute to the flood risk in the Village of Tahsis.

Photo 1. Images demonstrating some of the historic flooding experienced by the Village of Tahsis. Photos provided by the Tahsis Flood Risk Assessment completed by McElhanney in 2019[7].

[7] McElhanny. 2019. Tahsis Flood Risk Assessment. http://villageoftahsis.com/wp-content/uploads/2019/09/49140TahsisFloodRiskAssessmentFinalReportComplete.pdf

Methodology

The proposed floodwall improvement project has incorporated assessment efforts from two biological firms, covering various pathways focused on determining the likelihood of environmental impacts occurring as result of the proposed works. Initial assessments were conducted by McElhanney, on March 15th, 2021, resulting in a comprehensive Environmental Impact Assessment (McElhanney 2021). Following this assessment, the proposed work areas and new construction designs were assessed and reviewed by biological professionals from Pacificus Biological Services Ltd. Prior to visiting the proposed work location, a reconnaissance assessment was conducted on the Tahsis River in order to obtain important details regarding existing fisheries, watershed and historic flood information. Additionally, the initial assessment conducted by McElhanney was reviewed to ensure all areas of significance would be assessed. Environmental professionals from Pacificus (Doug McCorquodale, RPBio., Kendra Freund, BSc., BIT., and Alex Heckels, MSc.) conducted two field assessments in the location of the proposed works, one on January 20, 2023 and another on February 24, 2023.

Upon arrival onsite, georeferenced maps and engineered designs were utilized to identify the proposed work areas. Assessments were conducted during both high and low tides in order to develop a full picture of water levels in proximity to the proposed work areas. Fish habitat was assessed extensively with multiple foot transects extending the length of each proposed work area. These surveys were intended to document the type and value of substrate and feature habitat within immediate proximity to the work areas, and to delineate the normal high-water mark. The riparian area was assessed in the same manner, focusing on determining present species, value of habitat, potential recruitment of large-woody debris (LWD) and overall functionality. Additionally, the objective of these surveys was to ensure that modified project designs would not encroach on the normal high-water mark (NHWM), and to determine if the removal of riparian vegetation would impact adjacent fish habitat. For the proposed riparian removal, a desktop review of online information was conducted to determine total riparian vegetation within the anadromous reach of the Tahsis River, and what percent would be removed based on the size of the zones. Habitat areas were documented in the field with ground and drone photos and any significant habitat areas were documented and a georeferenced location was recorded (e.g., significant trees).

Proposed Construction

The proposed construction for this project will occur in two locations along the lower Tahsis River and can be identified as Zone 1 and Zone 2 (Figure 3, Appendix 2). Previous designs had been developed by McElhanney for the proposed work areas[8] as part of the initial submission completed for this project in 2021. These original designs demonstrated slight encroachment on the Tahsis River in the form of rock infill below the normal high-water mark, resulting in what was considered a contravention of the *Fisheries Act*. However, upon completion of the most recent assessments conducted by Pacificus, new modified designs for construction have been developed. In this new rendition, deliberate alterations have been in an attempt to avoid contravening the *Fisheries Act*. The alterations include steepening the slope of the rock to allow for the toe of the infill to be positioned behind the edge of terrestrial vegetation, and subsequently behind the normal high-water mark (NHWM) (Appendix 2). This alteration enables the work to be conducted without any encroachment of the Tahsis River and therefore does not require any work to be conducted below the normal HWM.

As mentioned above, the proposed work areas can be identified as Zone 1 and Zone 2. Both zones are along the left-wetted bank of the lower Tahsis River, within the historic channel relocation area. Zone 1 is the downstream-most work area and extends along the existing bank for approximately 59m, with a width of 4.5m. Zone 2 is upstream of Zone 1 and extends approximately 45m along the bank, with a width of 5.0m. The proposed works require the excavation and replacement of approximately 265.5m^2 of existing bank material for Zone 1 and approximately 225.0m^2 for Zone 2, respectively (Appendix 2).

Construction works will be conducted from the upland with an excavator. No machinery will be required below the NHWM. First, the removal of any necessary vegetation will be completed. Depending on the size of the vegetation being removed, either an excavator or a hand faller will conduct the removal. During construction, excavated material will be removed from the work site and disposed of in an appropriate spoil area in order to prevent any sedimentation on the upland at the site. Geotextile fabric will be placed in all excavated areas prior to the installation of rock. Placement of rock will occur from the base or toe of the slope in an upward fashion to the top of the bank. This portion of construction will be conducted in sections in order to ensure that all excavated areas are filled prior to the end of the low-tide window. Replacement material to be utilized will be large riprap and will be as clean and free of fine sediment as possible. Additionally, once construction is completed, native grasses and other plants will be planted where appropriate in order to replace some of the removed riparian vegetation.

Due to the proximity of the Tahsis River to the work site, all works must be conducted during periods of low flows, and low or appropriate tides (1.4m Chart Datum or less) and within the appropriate least risk work window (Vancouver Island; July 15 – September 15[9]). This is important

[8] McElhanney. 2021. Environmental Impact Assessment – for the Tahsis Floodwall Protection Project.
[9] Ministry of Environment. Regional Terms & Conditions & Timing Windows. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/terms_conditions_van_island.pdf

as the toe of the work area is immediately adjacent to the wetted perimeter during high tides, and could be inundated if high tides and high flows persist concurrently.

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Assessment Results

Fish and Fish Habitat

As described previously, the Tahsis River is known to historically contain all five salmon species and steelhead. However, the habitat provided by the lower Tahsis River has been dominated by chum salmon (*O. keta*), with chinook salmon (*O. tshawytscha)* and steelhead (*O. mykiss*) also present (pers. Comm. Mark Tatchell to Kendra Freund). The dominant salmon species in the Tahsis River typically utilize spawning habitat present near the confluence of McKelvie Creek and continue upstream, upstream of the vicinity of the proposed work areas (>200m upstream) (Pers. Comm. Mark Tatchell to Kendra Freund). Sampling via electrofishing was attempted within the proposed work areas, however, due to the heavy tidal influence in these areas, the conductivity within this section of the river was high and therefore sampling was unable to be safely conducted. Additionally, hydraulic sampling was not conducted due to the inadequate substrate (sand, large cobble) identified near the proposed work areas.

Overall, fish habitat quality immediately adjacent to the proposed works can be considered low-moderate. The channel substrate nearest the bank consists of predominately sand, with some larger cobble. In the southern-most section of Zone 1 (Figure 3, Appendix 2), the substrate above, and immediately below the High-water mark consisted of existing boulder infill, which transitioned into sand and large cobble further into the active channel. The above-mentioned substrate types are not considered high quality for spawning or rearing of anadromous fish. Habitat features in the channel such as woody debris and overhead cover were observed, albeit inconsistently throughout Zone 1, and even less in Zone 2. These features were identified to have minimal functionality as they are only wetted during seasonal high flows and high tides. The habitat near the proposed work zones lacked deep-slow moving pools for holding or rearing, and substrate suitable for spawning. As previously mentioned, the lower portion of the Tahsis River was relocated from its historic flow path on the eastern side of the valley to its existing location on the western side of the valley (pers. Comm. Mark Tatchell to Kendra Freund). This historic disruption and re-channelization have likely affected the overall functionality of fish habitat throughout the re-channelized area.

In the vicinity of Zone 1 the thalweg of the river is located more towards the left wetted bank (when looking downstream) at the southern-most boundary of the proposed work area. Further upstream, the thalweg progresses into the middle of the channel, away from the remainder of Zone 1 and Zone 2. Due to the position of the thalweg, the banks along Zone 1 and Zone 2 are dry during periods of low tide (below 1.2m Chart Datum) (Figure 4). Therefore, the river substrate immediately adjacent to the proposed work areas are only wetted during significant rain or snow melt events, and high tides. Based on previous years, the work areas remained dry throughout the summer months and more specifically, the entire duration of the affiliated least risk fish window (Vancouver Island)[10].

[10] Ministry of Environment. Regional Terms & Conditions & Timing Windows. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/terms_conditions_van_island.pdf

Riparian Vegetation

Riparian vegetation is the terrestrial vegetation that lines the banks of rivers and when functional, provides a variety of benefits for overall stream health and productivity. These benefits may consist of bank stabilization, temperature management, habitat cover and structure, induction of nutrients and food, and sediment control. The Pathways of Effects for vegetation clearing outlined on DFO's Projects Near Water Website[11] demonstrate the potential effects of vegetation removal on fish and fish habitat, and were considered during the assessment of the existing riparian vegetation in Zone 1 and Zone 2. The results of the assessment are described below.

Overall, the riparian vegetation throughout Zone 1 and Zone 2 was observed to be of low productivity. The most dominant species were red alder (*alnus rubra*), sword fern (*Polystichum munitum*), salmonberry (*Gaultheria shallon*), black cottonwood (*Populus trichocarpa*), various mosses, and Himalayan blackberry (*Rubus armeniacus*). Additional species consisted of English holly (*Ilex aquifolium*), English ivy (*Hederia helix*), one small western red cedar (*Thuja plicata*), and one large spruce (*Picea sp*.) observed near the edge of Zone 2. This large conifer will remain undisturbed so long as it doesn't present a safety concern during construction. Of the identified species, three are considered invasive species in British Columbia (blackberry, holly and ivy) and do not provide any functional benefits to the adjacent fish habitat. The lack of functional conifers within the riparian vegetation of Zone 1 and Zone 2 is likely a result of the historic re-location of this section of the river, the immediate proximity to the Village of Tahsis and that the vegetation is growing on existing rock fill introduced during the original construction of the floodwall in 2001. Furthermore, based on the existing species composition, it is unlikely that a stable, long-term productive forest would develop in the pre-disturbed areas. In turn, this low-productivity vegetation also did not demonstrate the potential recruitment of woody debris for the benefit of fish habitat.

Data published in the 2016 West Coast of Vancouver Island Salmon Extensive Escapement Stream Summary[12] describes that the Tahsis River contains anadromous access for approximately 8km upstream of the confluence with the ocean. Therefore, it can be assumed that in that 8km section of anadromous access, riparian vegetation is present along both wetted banks, resulting in a lateral distance of approximately 16,000m of riparian vegetation. Approximately 104m of riparian vegetation along the banks of Zone 1 and Zone 2 will be removed, however, when compared to the entire length of riparian habitat present within the anadromous extent of the Tahsis River, the work area can be considered less than 1% of existing riparian vegetation. This is based on the 104m of vegetation to be removed out of approximately 8km of anadromous access with riparian habitat on both the left and right wetted banks (104m / 16,000m of habitat x 100 = 0.65%) (Figure 3). As such, this is a minimal portion of available riparian habitat along the Tahsis River, and it contains poorer, less productive habitat than the remaining >99%.

Moreover, as the work areas are in a section of the Tahsis river that flows north to south, the benefit of shade provided by riparian vegetation is less significant. Additionally, as previously

[11] DFO Project Near Water website. Pathways of Effects; Vegetation Clearing. https://www.dfo-mpo.gc.ca/pnw-ppe/pathways-sequences/vegetation-eng.html
[12] 2016 West Coast of Vancouver Island Salmon Extensive Escapement Stream Summary. https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/40718931.pdf

mentioned, the substrate adjacent to the work areas is dry for the majority of the year, and does not contain any large pool habitat. Therefore, the removal of riparian vegetation in these areas is unlikely to impact the overall temperature, shade cover or nutrient concentrations of that portion of the river.

Finally, since the floodwall separates the community from the riparian vegetation on the bank, it acts as a silt fence, or debris curtain preventing sediment and/or deleterious substances from becoming runoff. In these areas, since the floodwall acts as buffer, the existing riparian vegetation does not play a significant role in the control of contaminants entering the river. As such, the removal of this vegetation is unlikely to affect the continued control of contaminant concentrations in the future.

Photo 2. View of the large conifer located near the edge of Zone 2.

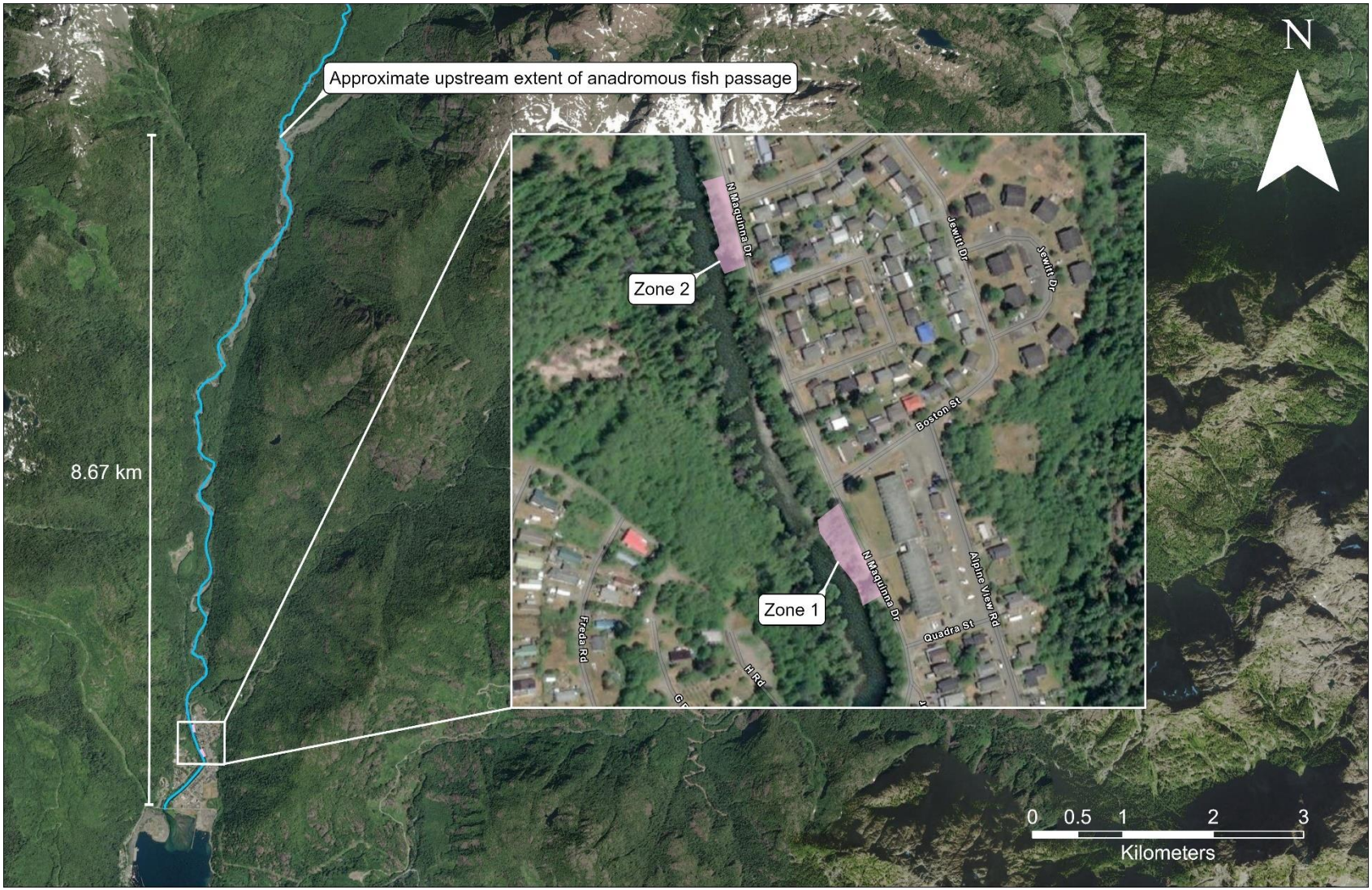

Figure 3. Overview map depicting the less than 1% of riparian vegetation to be removed along the anadromous extent of the Tahsis River.

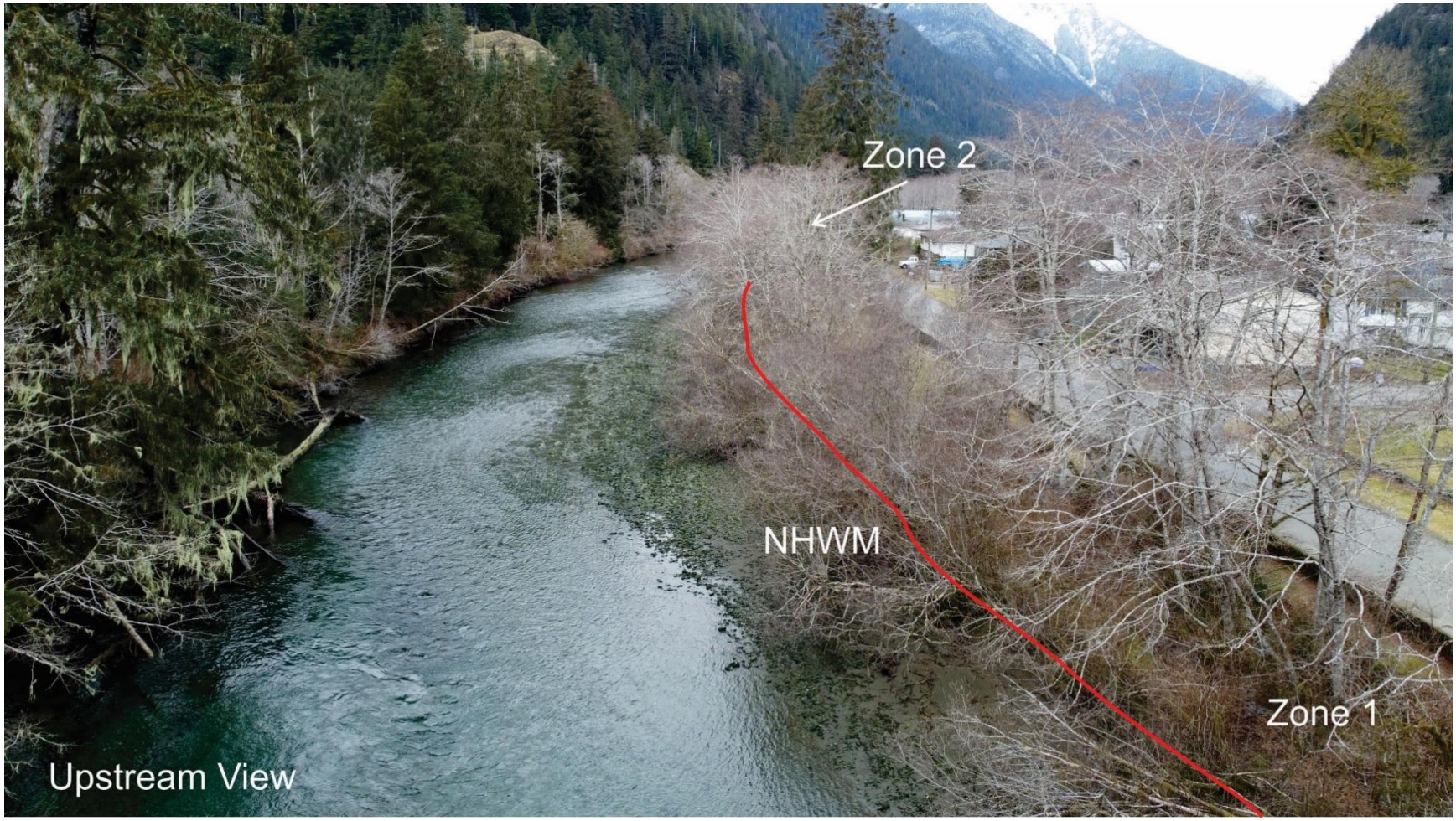

Figure 4. Figure demonstrating the location of the normal high-water mark (HWM) in relation to water levels during low discharge and low tide.

Photo 3. Photos of various areas within Zone 1, showing the bank, channel substrate and riparian vegetation. All photos were taken during a falling high tide with seasonally high flows. Work will not be conducted below the normal HWM, which can be delineated by the edge of terrestrial rooted vegetation.

Photo 4. Photos of various areas within Zone 2, showing the bank, channel substrate and riparian vegetation. All photos were taken during a falling high tide with seasonally high flows. Work will not be conducted below the normal HWM, which can be delineated by the edge of terrestrial rooted vegetation.

Discussion

For the purpose of this project an original assessment was conducted, and construction designs were developed and submitted for review in 2021. With intention of wanting to avoid contravening the *Fisheries Act*, additional assessments were conducted by Pacificus and new modified construction designs were developed. The initial assessment and designs were viewed as a contravention of the *Fisheries Act*. The most recent assessment was conducted in order to minimize potential impact. After the completion of the assessment, new designs were developed with alterations from the initial designs. These alterations changed the steepness of the rock so that the toe of the fill slope would remain above the high-water mark, and behind the edge of terrestrial vegetation. As outlined on DFO's Measures to Protect Fish and Fish Habitat website[13], the *harmful alteration, disruption or destruction of fish habitat can* be prevented by avoiding; conducting any work, undertaking or activity in water, and, placing fill or other temporary structure below the high-water mark.

The results of the assessment determined that the overall fish habitat immediately adjacent to the proposed work areas were of low- moderate productivity. Substrates and habitat features were not indicative of productive, beneficial habitat for the spawning or rearing for anadromous fish (sand substrate, no holding pools, minimal large woody debris cover). Additionally, as all construction works will be conducted during periods of low flows and low tides, the stream channel adjacent to the construction areas will be dry throughout construction. Though the adjacent habitat is of low quality, once more, no work will be conducted below the high-water mark and therefore the present fish habitat will not be impacted as result of the proposed construction.

Another important aspect of this project is riparian vegetation. Riparian vegetation is the terrestrial vegetation that lines the banks of rivers, streams and lakes. When functional, riparian vegetation provides a variety of benefits for overall stream health and productivity. Generally, this vegetation contributes to the stream by means of bank stabilization, temperature management, habitat cover and structure, induction of nutrients and food, and sediment control. Since the removal of riparian vegetation is required for the purpose of this project, the Pathways of Effects for vegetation clearing outlined on DFO's Projects Near Water Website[14] were reviewed in conjunction with the assessment of the existing riparian vegetation in Zone 1 and Zone 2. The Pathways of Effects demonstrate the potential effects of vegetation removal on fish and fish habitat. These effects are described as the change in; water temperature, habitat structure and cover, sediment concentrations, nutrient concentrations, food supply, and contaminant concentrations. These effects were considered, and the following bullets provide context:

- The existing riparian vegetation is less than 20 years old, and has established over a previously disturbed bank consisting of large riprap fill.
- Similarly, to the establishment of the existing vegetation composition, similar species will likely re-colonize the riprap bank after the improvement construction, as it did following the initial construction in 2001. Planting post construction may improve riparian areas.

[13] DFO Measure to Protect Fish and Fish Habitat. https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html
[14] DFO Project Near Water website. Pathways of Effects; Vegetation Clearing. https://www.dfo-mpo.gc.ca/pnw-ppe/pathways-sequences/vegetation-eng.html

- Species composition is dominated by red alder (*alnus rubra*), a species with a short life span of approximately 40-60 years. Without the presence of productive, functional conifers, the existing riparian is unlikely to grow into a long-term, productive forest.
- Existing vegetation does not demonstrate the possibility of recruitment of woody debris for the purpose and benefit of fish habitat.
- Due to the less than 1% of overall anadromous riparian habitat to be removed, it is extremely unlikely that shade cover, temperature or nutrient concentrations will be affected.
- It is unlikely that the removal of the riparian vegetation will impact the nutrient concentrations and food supply for the lower reach as it is tidally influenced, and constantly receives an influx of beneficial food and various nutrients during this exchange.
- Finally, the floodwall acts as a silt fence, or debris curtain in the sense that it prevents runoff of sediment and/ or deleterious substances from the street down the bank and into the river. Therefore, the removal of the vegetation is unlikely to have an effect on contaminant concentrations.

Furthermore, the floodwall protection improvements will not only be beneficial for the overall safety of infrastructure, private property and community members, but for the overall health of the Tahsis River and estuary. When floodwaters breach the containment of the river banks and spread throughout the community, the likelihood of the introduction of hydrocarbons, sewage and other deleterious substances into the waterbody increases. Implementing the proposed improvements will be beneficial in the prevention of this introduction by decreasing the volume of floodwater spreading through the community.

Although there are no in-stream works required, and no encroachment of the channel will occur, due to the proximity to the Tahsis River the project will be submitted to DFO for review.

References

DFO. (2022). Measures to Protect Fish and Fish Habitat website. https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html

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DFO. (2013). Projects Near Water website. Pathways of Effects; Vegetation Clearing https://www.dfo-mpo.gc.ca/pnw-ppe/pathways-sequences/vegetation-eng.html

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Appendix 1 – Environmental Mitigation Plan (EMP)

To prevent the *death of fish* and *harmful alteration, disruption and destruction of fish and fish habitat*, the following mitigation measures should be adhered to throughout the floodwall stabilization works.

Timing and Scheduling:

- Postpone or reschedule work in the event of severely wet and/or inclement weather.
    - Works should be conducted in the dry during a period of low flow and low tide.
- A plan should be in place to ensure the project is completed in a timely manner without delay once work commences.
- Conduct works during the reduced risk work window for species known to inhabit the affiliated habitat (Vancouver Island; July 15 – September 15[15]).

Environmental Monitor:

While the proposed bank stabilization works will not require any instream works, a Qualified Environmental Professional to act as an EM should be onsite to monitor the construction works due to the proximity to the Tahsis River. Mitigation measures to be implemented by the EM during the bank stabilization works should include but are not limited to the following;

- Conducting a pre-work meeting in order to review the details of the EMP with work crews.
- Providing advice and guidance to the construction crew when necessary.
- Implementing sediment and erosion mitigation measures as required.
- Where applicable, install debris mitigation around the work area to prevent the introduction of foreign material into the stream channel.
- Inspect all machinery and equipment that will be operating on site for cleanliness, leaks, drips, spill kits, etc.
- The EM should ensure that any unnecessary impacts to the channel banks and riparian vegetation are prevented during the proposed works.

Fish Salvage and Exclusion:

No works will be conducted below the High-Water Mark and therefore fish salvage and exclusion is not required for the proposed project.

Erosion and Sediment Control:

- Materials to prevent the downstream transport of sediment should be on hand and readily available; these materials may include silt fencing, geotextile, hay bales, sand bags, coffer dams and/or water pumps with hoses.
- All material must be excavated slowly and deliberately so as to prevent solid foreign material from inadvertently entering the channel.
- Unnecessary removal of riparian vegetation should be avoided.

[15] Ministry of Environment. Regional Terms & Conditions & Timing Windows. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/terms_conditions_van_island.pdf

- Should any solid foreign material inadvertently enter the channel, it should be carefully removed immediately without causing further disturbance.
- Works should be conducted during periods of low tide, or appropriate tides as determined by the EM.
- Excavated areas should not be left bare at the end of the low tide period. All excavated areas must be filled with geotextile material and rock infill prior to high tide.

Spill Response and Prevention:

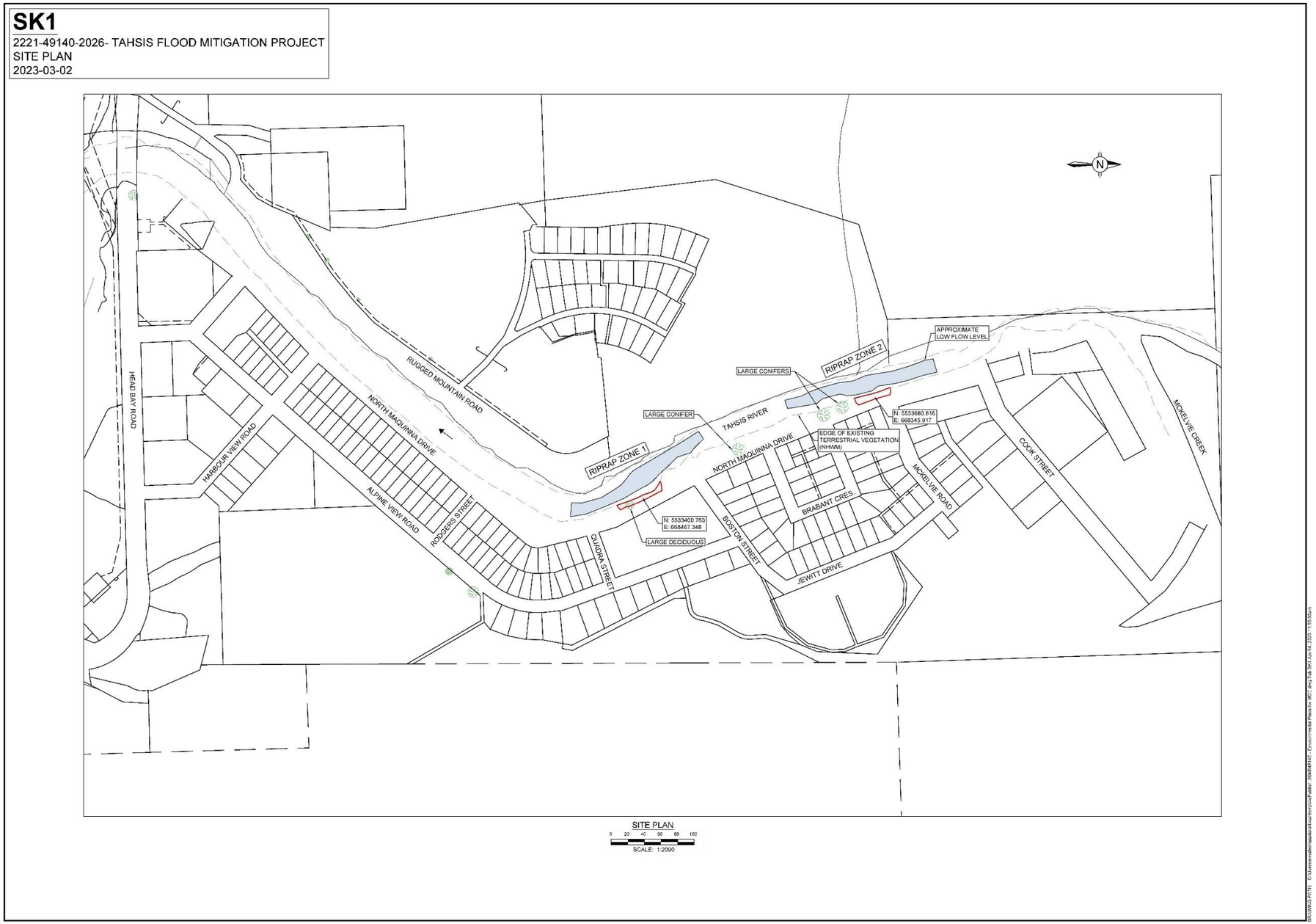
- Ensure that equipment and machinery are in good operating condition (i.e. clean and free of leaks) and ensure refueling or servicing occurs >30m from the HWM of the stream.
- Ensure a spill response kit is readily accessible onsite with the appropriate spill response materials

Removal of Required Riparian Vegetation:

Measures to limit the potential impact on the riparian vegetation within the work site should be in place. These measures include but are not limited to the following;

- Remove <u>only</u> required and necessary vegetation.
- Removal of vegetation with a chainsaw should be done in a manner that prevents saw dust/ chips from entering the channel. If this is not possible;
- Appropriate catchment should be utilized to catch chainsaw dust/ chips so it can be disposed of away from the channel (tarp, geotextile cloth, etc.).
- All vegetation must be removed slowly and deliberately so as to prevent solid foreign material from inadvertently entering the channel.
- Where applicable, replace any removed vegetation on/near stream bank with a native grass seed mixture.

Appendix 2 – Engineered Designs



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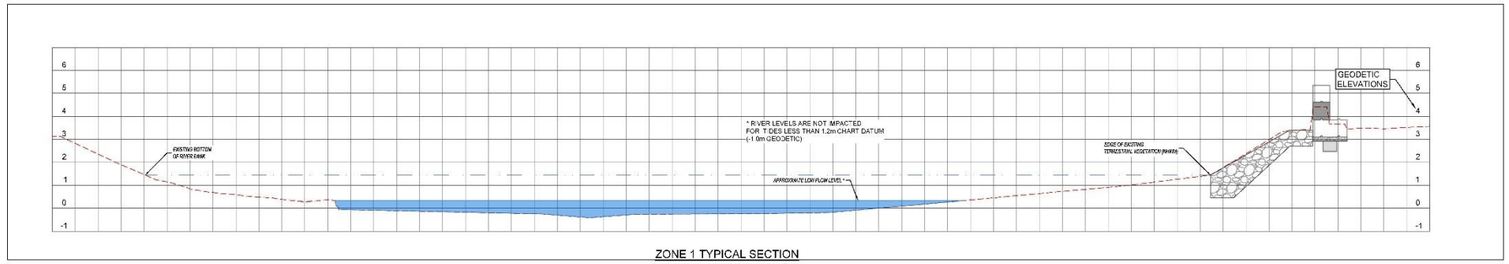
SK2

2221-49140-2026- TAHSIS FLOOD MITIGATION PROJECT
ZONE 1 DETAIL
2023-03-02



ZONE 1 TYPICAL SECTION

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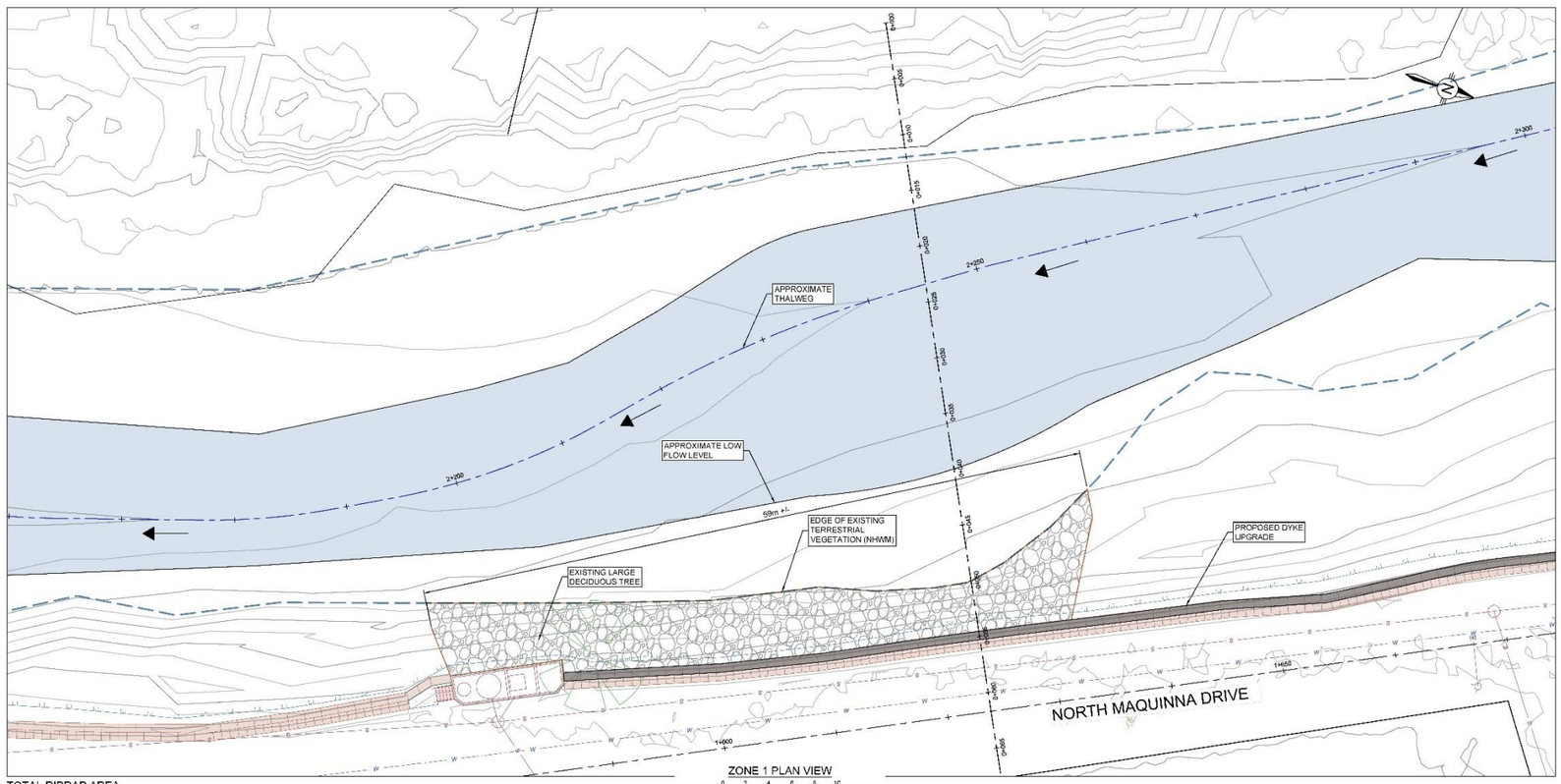


ZONE 1 PLAN VIEW

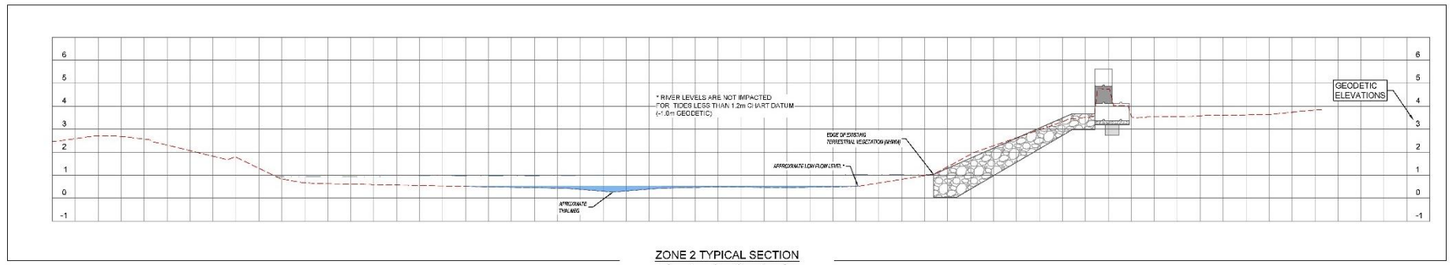
SCALE: 1:200

TOTAL RIPRAP AREA
ABOVE NHWM: 265.5m² (59m x 4.5m)

PACIFICUS

SK3

2221-49140-2026- TAHSIS FLOOD MITIGATION PROJECT
ZONE 2 DETAIL
2023-03-02



ZONE 2 TYPICAL SECTION

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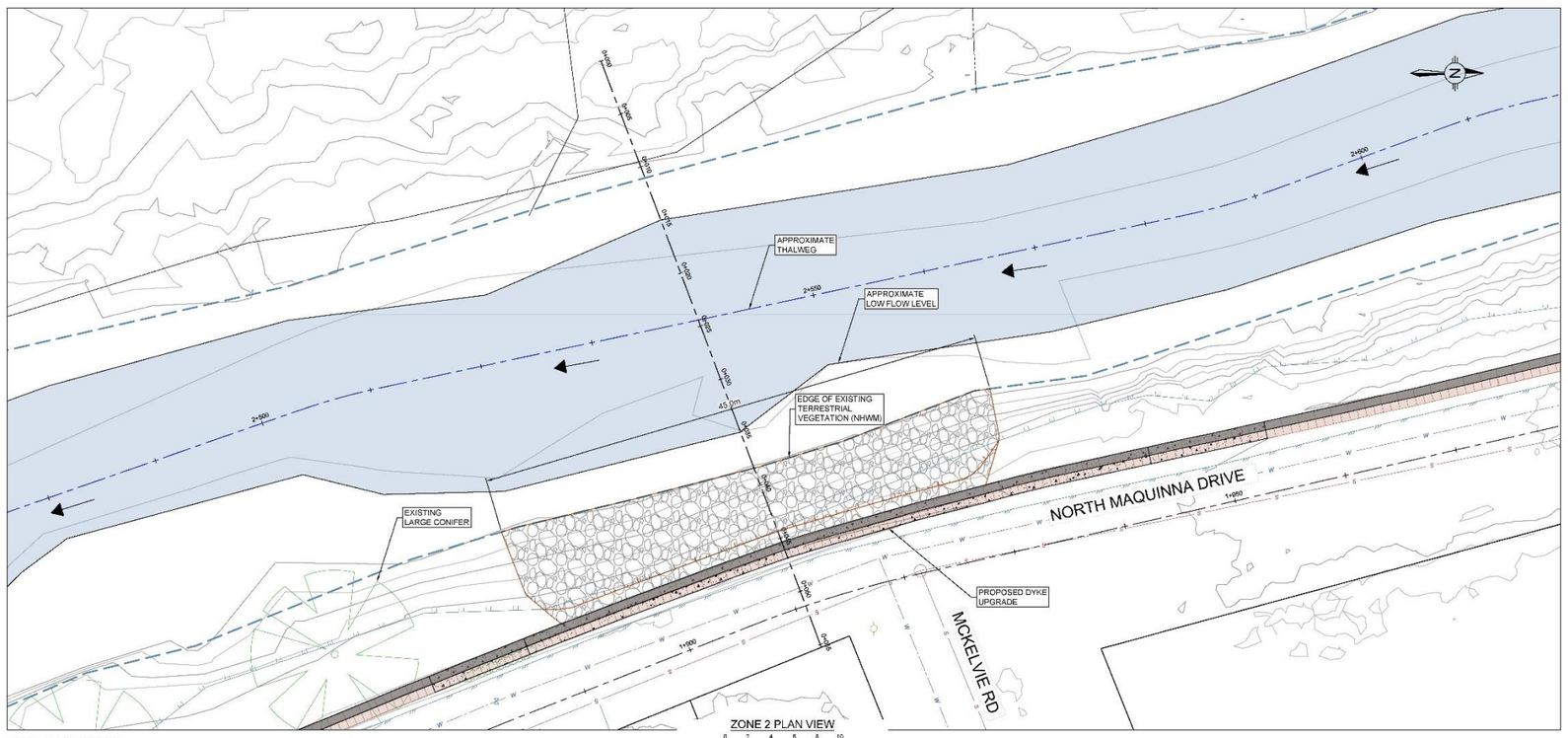

ZONE 2 PLAN VIEW

SCALE: 1:200

TOTAL RIPRAP AREA
ABOVE NHWM: : 225m² (45.0m x 5.0m)

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Baseline archaeological services ltd.

556 Harmston Avenue Courtenay B.C. V9N 2X5 Phone: (250) 897-3853

Archaeological Overview Assessment and Preliminary Field Reconnaissance

Client/Developer:	**Village of Tahsis** Mark Tatchell, CAO 977 South Maquinna Drive Tahsis, BC V0P 1X0
Development:	**Flood Protection Improvement Project**
Development type:	Floodwall, dike, and drainage pond
First Nation(s):	**Mowachaht/Muchalaht First Nation** (MMFN) Dorothy Hunt, Lands and Economic Development Manager PO Box 459 Gold River, BC V0P 1G0
Distributed To:	Mark Tatchell (Tahsis)
Project #:	21001
Report Author:	Phil Whalen, BA
Report Date:	June 22, 2021
Municipality:	Village of Tahsis
Location:	The proposed development is located on western Vancouver Island, along the east side of the Tahsis River within the community of Tahsis
Elevation:	0 – 5 m above sea level (asl)
Survey Date:	May 13, 2021
Survey Crew:	Phil Whalen (Baseline)
NTS Map Sheet: **Report Maps:**	92E15 Zeballos (1:50000) 1:50000, 1:5000
Assessed Potential:	**Low**
Archaeological Concerns:	**None**

Management Summary

This report presents the results of an archaeological site potential assessment conducted by Baseline Archaeological Services Ltd. (Baseline). This potential assessment, also known as an archaeological overview assessment (AOA), assesses the archaeological potential of the proposed Flood Protection Improvement Project in the Village of Tahsis on western Vancouver Island.

The work reported herein consists of an AOA as defined in the *British Columbia Archaeological Impact Assessment Guidelines* (1998) and as outlined in the *Protocol Agreement on the Management of Cultural Heritage Resources* (1994) between the Ministry of Forests, Lands and Natural Resource Operations and Rural Development and the BC Archaeology Branch, as well as a ground truthing component defined as a Preliminary Field Reconnaissance (PFR). This AOA report is concerned with determining the potential for archaeological sites. It does not address potential impacts to traditional use activities and sites by development activities. As such, this report does not comprehensively document all First Nations interest in the land. The study was conducted without prejudice to First Nations treaty negotiations, aboriginal rights or aboriginal title.

Background Information

The Village of Tahsis contacted Baseline Archaeological Services Ltd. (Baseline) regarding an archaeological assessment of the proposed Flood Protection Improvement Project, which includes the development of a flood drainage pond and improvements to the existing dike and floodwall along the Tahsis River and McKelvie Creek.

This study area is within area assessed under an archaeological potential model of the Northern Nuu-chah-nulth Hahoulthees prepared by Arcas Consulting Archaeologists Ltd (1998) and refined by Baseline (2007). This model indicates that the development area overlaps with areas modelled to have archaeological potential. A review of the Remote Access to Archaeological Data (RAAD) website indicated that no previously recorded archaeological sites are in conflict with the proposed development area. The nearest known archaeological site is **DlSp-1** and **DlSp-8**, recorded approximately 1 km south on the east and west shores of Tahsis Inlet, respectively (*Figures 1*).

Archaeological sites are defined as locations which contain physical evidence of past human activity such as artifacts or features. A list of expected site types that would likely be identified in the study area is presented in the following section. Archaeological remains which predate or are likely to predate 1846 are automatically protected from any form of alteration, excavation, damage or desecration in British Columbia under the *Heritage Conservation Act (HCA)*.

Methodology

The AOA was conducted by reviewing a development plan, aerial imagery, the results of recent geotechnical borehole testing, the aforementioned potential model and the RAAD review.

The potential for the presence of archaeological sites types was also based on both the distance from tidal waters and major water bodies, as well, the overall slope. The potential for finding archaeological sites decreases dramatically with increased distance from tidal waters, water bodies and river courses and on slopes greater than five degrees. Distance to known archaeological sites is also important when assessing archaeological potential in a proposed development area.

Based on the aforementioned criteria, it was determined that the development area may contain areas of archaeological potential. Therefore, a PFR of the development was conducted by Baseline on May 17, 2021 to ground truth and confirm the assessed potential. Additionally, geotechnical testing occurring on the same day were monitored for the presence of cultural materials.

The PFR consisted of traverses through the development areas. Natural land and water features, GPS, and the development plan determined the traverse locations. Survey maps were used to identify areas of moderate and high potential for archaeological sites in the field. Surface and subsurface exposures, such as sparsely vegetated areas, tree bases, root wads, creek banks and rock outcrops were inspected for archaeological material or modifications where applicable.

Description

Floodwall/Dike Improvements

The existing floodwall is located along N Maquinna Drive, following the east side of the Tahsis River for approximately 600 m and existing dike along Cook Street, following the south side of McKelvie Creek (*Figure 1*). The structure is constructed on riprap, concrete lock-blocks and imported gravels. Improvements will include the raising of the existing lock-block floodwall by up to 1.5 m, raising and extending the earthen work dike by ~0.4 m, and raising North Maquinna Road ~2 m above existing grade.

Geotechnical borehole testing generally reported gravels and loose brown sands up to 3 m below surface followed by compact grey sands and gravels up to 12 m below surface.

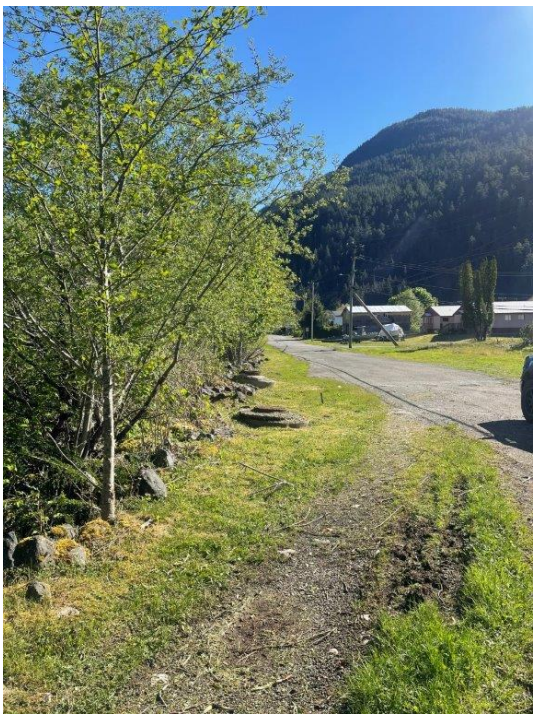

Photo 1. Looking north along N Maquinna Rd – riprap shoring along Tahsis River

Photo 2. Looking south along N Maquinna Rd – lock-block flood wall along Tahsis River

Flood Drainage Pond

The proposed flood drainage pond is located on the southeast corner of Boston Street and Alpine View (*Figure 1*). The proposed area is currently a grassy field, which has historically been tilled, stripped, and contoured and is being used to keep livestock. Immature second growth alder, Douglas-fir, and cedar are present around the perimeter of the field. Seasonal drainages are also present on the southwest and northeast edges of the field. The proposed upgrades will include riprap armouring along the inlets and outlets of the drainages and excavation of the field by ~2 m – berming the perimeter.

Photo 3. Looking southeast across proposed drainage pond location

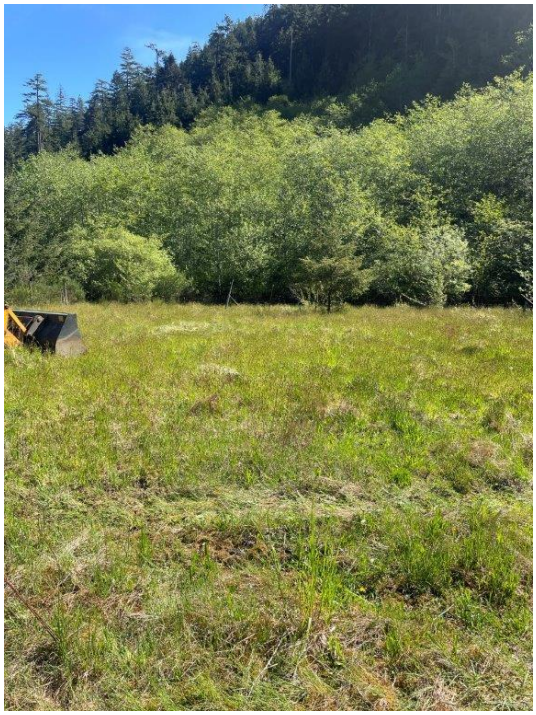

Photo 4. Looking northeast across proposed drainage pond location

Field Potential and Coverage

The in-field potential assessment for archaeological sites is assessed as low. This is based on the historically altered landscape in combination with the development locations within areas of existing fill material.

Results

Floodwall/Dike Improvements

No archaeological remains or areas of archaeological potential were identified along the floodwall/dike improvement alignment.

Flood Drainage Pond

No archaeological remains were identified within the proposed drainage pond. Brown sandy silts and grey glacial tills were observed during geotechnical trenching with groundwater present beyond 2 m below surface.

Photo 5. Geotechnical trenches #1 (foreground, #2 (midfield), #3 (background)

Photo 6. Culturally sterile soils observed in geotechnical trench #2

Recommendations

No further archaeological work is recommended for the proposed Flood Protection Improvement Project as all development components have been assessed as having low archaeological potential.

Developers and operators must be aware of the potential presence of undiscovered archaeological remains, which are protected under the *HCA*, in any surveyed or unsurveyed areas. In the event that any such archaeological remains are encountered during development, *HCA* requires that all development activities in the vicinity be halted as not to threaten these remains, and that the BC Archaeology Branch and District Manager, Ministry of Forests, Lands, Natural Resource Operations and Rural Development be immediately notified.

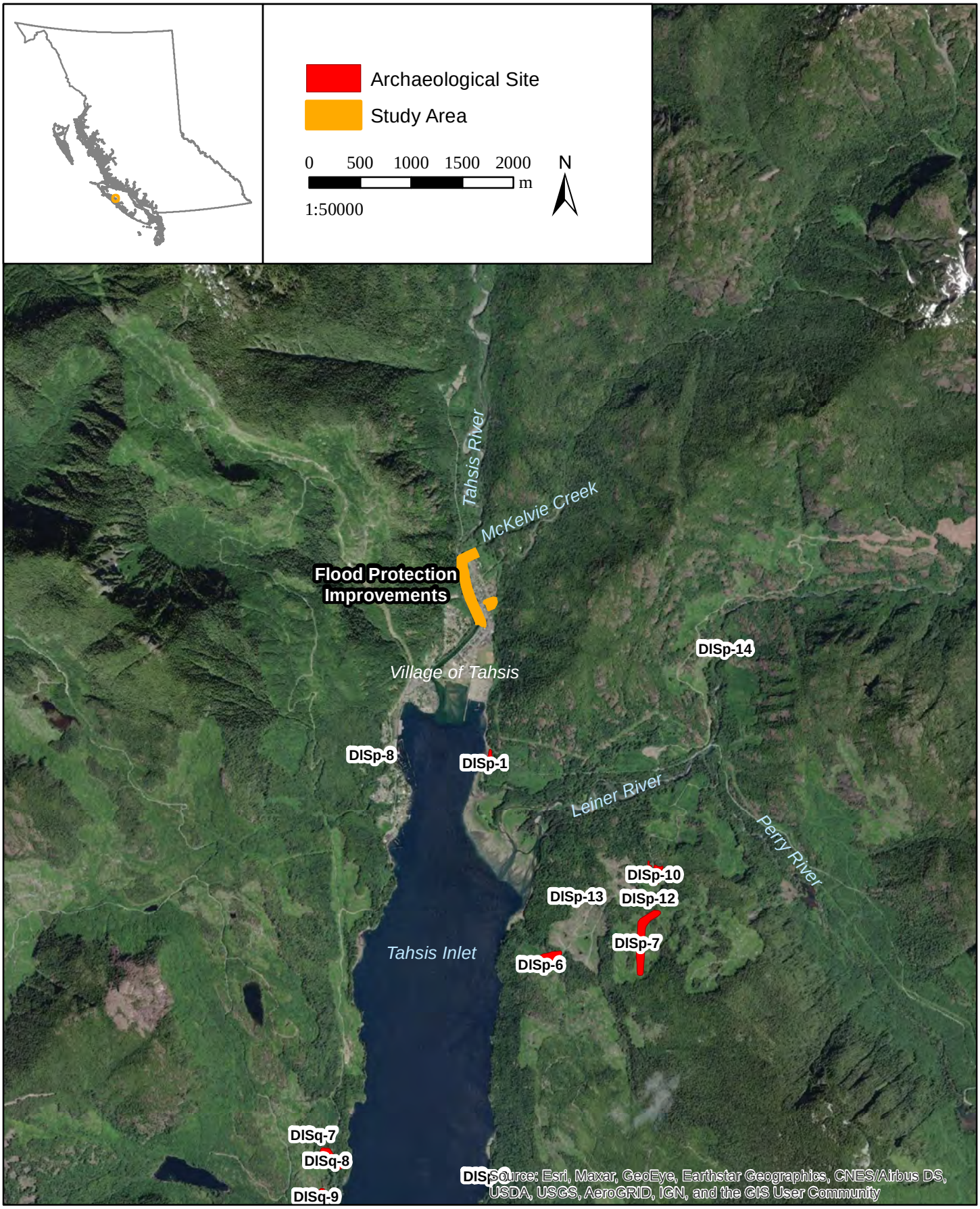

Figure 1. Location of Study Area

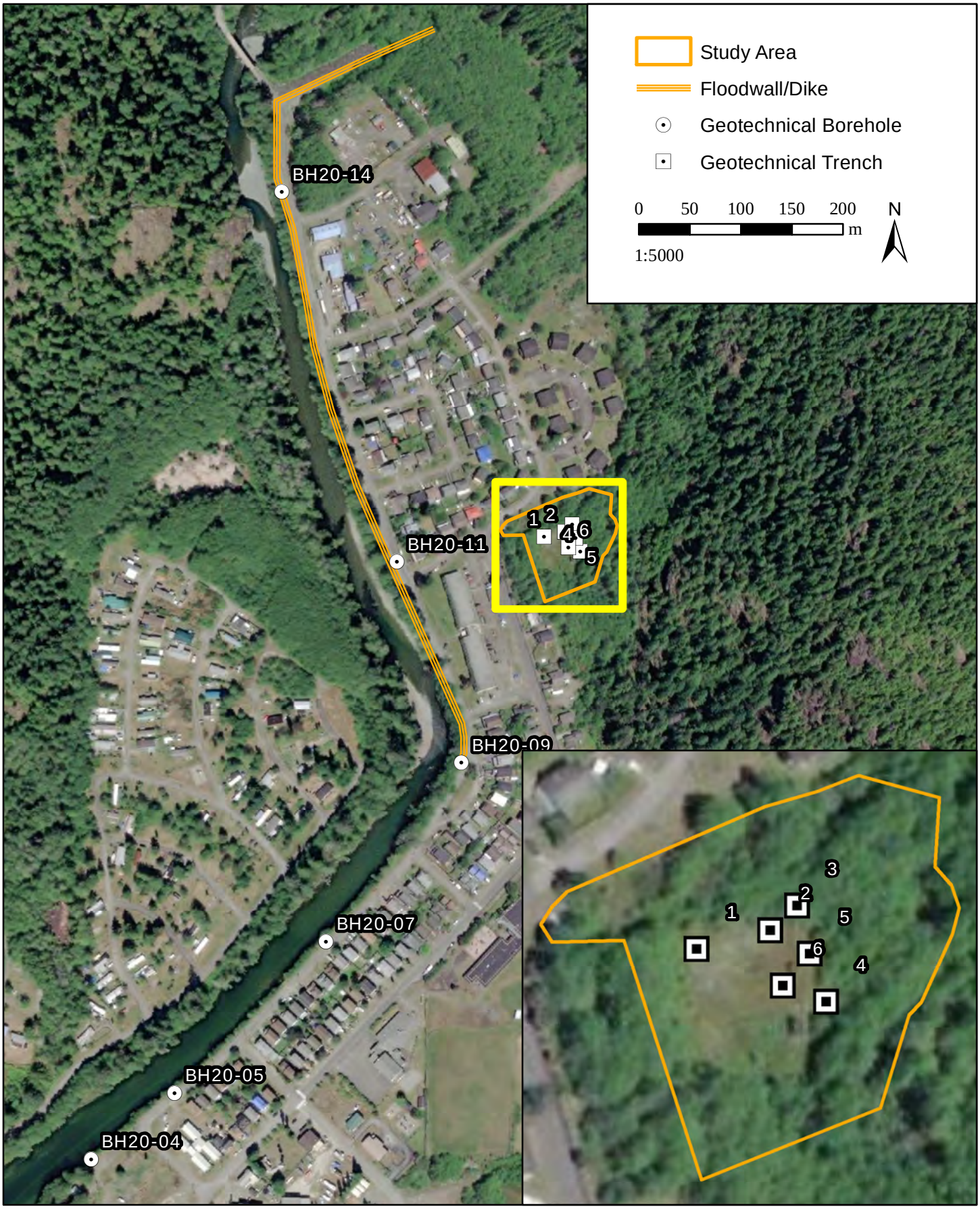

Figure 2. Development Map