



REGIONAL DISTRICT OF CENTRAL KOOTENAY

RIONDEL WATER AND DRAINAGE SERVICES COMMUNITY ADVISORY COMMITTEE DISCUSSION NOTES

A meeting of the Riondel Water and Drainage Services Community Advisory Committee was held at 9:05 am PST / 10:05 am MST on Tuesday, November 28, 2023 through a hybrid model.

Join by Video:

<https://nelsonho.webex.com/nelsonho/j.php?MTID=m5daf4c2c1046205692359379684b8844>

Join by Meeting Number:

Meeting Number (access code): 2771 605 5395

Meeting Password: 2771 605 5395)

Join by Phone:

+1-604-449-3026 Canada Toll (Vancouver)

COMMITTEE MEMBERS PRESENT

Commissioner/Committee Member Gerald Panio
Commissioner/Committee Member Sylvia Horwood
Commissioner/Committee Member Lawrence Elgert
Director Garry Jackman, Electoral Area A (ex-officio)

STAFF

Uli Wolf, GM – Environmental Services - Present
Jason McDiarmid, Utility Services Manager
Alex Divlakovski, Water Operations Manager
Allan Richardson, Water Operations Supervisor

1. WELCOME AND INTRODUCTIONS

2. STAFF REPORTS

2.1 Riondel Drainage Presentation and Highland Consulting Reports

- Asset Challenge - Riondel Drainage Presentation (Attachment A)
- Condition Assessment for Existing Drainage Infrastructure at Riondel Report, Highland Consulting Ltd, 2023 – Provided for Information. (Attachment B)
- Culvert Analysis for Existing Drainage Infrastructure at Riondel, Highland Consulting Ltd, 2023 – Provided for Information. (Attachment C)

Action Item: Staff to review Campbell drainage options that might including planning for a new drainage line or ditching by the Province.

2.2 Drainage System Operations and Maintenance Update

2.3 Water System Operations and Maintenance Update

- Annual flushing and valve exercising
- Intake cleaned
- Replaced actuating valve for backwash and maintenance clean of membranes

Action Item: *Committee Member Lawrence Elgert reported that his pressure has been decreasing. Operators to confirm if it might be a system issue or private side issue.*

3. 2024-2028 FINANCIAL PLANS

A copy of the following Financial Plans is provided:

- 2024-2028 Financial Plan for Service S241 Water Utility-Area A (Riondel)
- 2024-2028 Financial Plan for Service S165 Drainage Area A

Action Item: *Uli Wolf to confirm with our Corporate Officer if it is possible to raise taxes beyond the limit set in the tax bylaw, if work resulting in the tax increase is considered an emergency.*

Action Item: *The proposed 2025 tax increase may need to be postponed until 2026 to allow time for Public Assent, if required.*

4. NEXT ASSEMBLY

The next assembly of Riondel Water and Drainage Services Community Advisory Committee will be schedule in accordance with Section of 9 (1) of the RDCK Drainage, Water and Wastewater System Community Advisory Committee Bylaw No. 2858.

A drainage meeting will likely be required. Time and date to be determined.

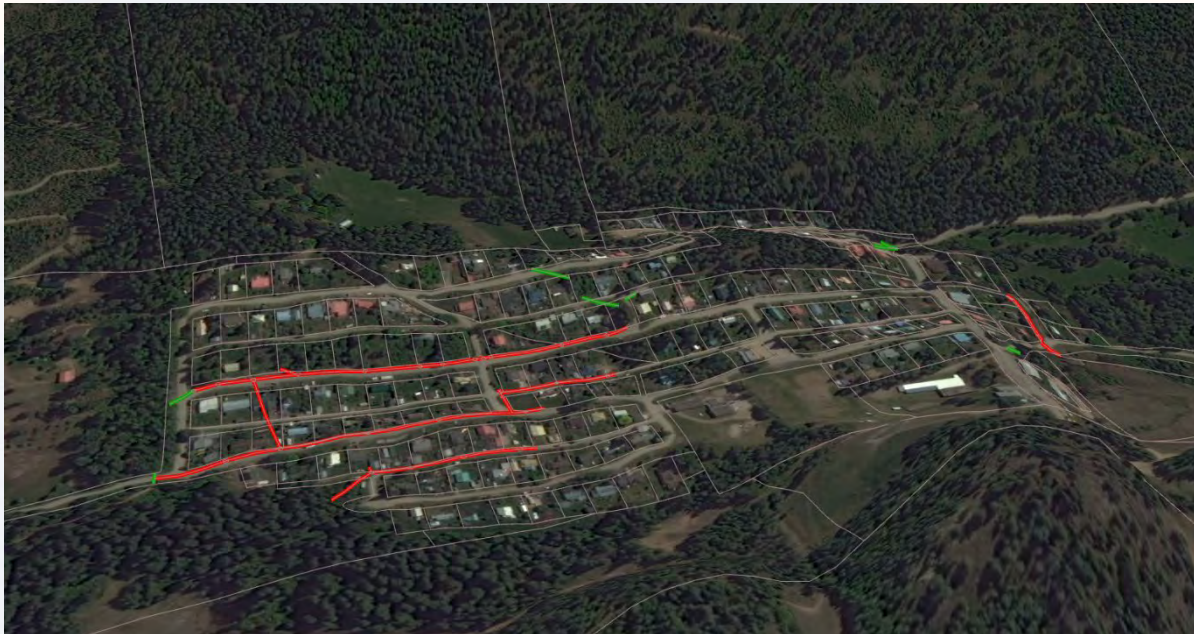
SUMMARY OF ACTION ITEMS:

1. Committee Member Lawrence Elgert reported that his pressure has been decreasing. Operators to confirm if it might be a system issue or private side issue.
2. Uli Wolf to confirm with our Corporate Officer if it is possible to raise taxes beyond the limit set in the tax bylaw, if work resulting in the tax increase is considered an emergency.
3. The proposed 2025 tax increase may need to be postponed until 2026 to allow time for Public Assent, if required.

Attachment A

Asset Challenge

Riondel Drainage



Presented by: J. McDiarmid

Prepared for: Water Services Committee

Date: December 06, 2023

rdck.ca



Riondel Drainage Background

- Riondel has the only Regional District Drainage Service
- Built by Bluebell mine and its successors starting around 1950s
- Service created by BC Order in Council #3343/65 and Letters Patent dated November 30, 1965
- Transferred to the Regional District in 1992 by BC Order in Council #687/1992 and service establishment Bylaw 1386





Riondel Drainage Considerations

- No Drainage Bylaw
- Repairs vs Assessment & Replacement and Capital Upgrade Plan
- Flooding & Private Property Drainage
- Mapping Accuracy and Inventory
- No Agreement with Ministry of Transportation and Infrastructure
- Asset Condition and Aging Infrastructure
- No Asset Management Plan
- System Upgrade and Replacement Funding



Ainsworth Inlet



Three Unknown (Private) Connections

Drainage Bylaw

- Currently staff do not have clear delegated authority from the Board to operate the system and all decision should be directed to the Board
- There is no clear direction provided by the Board on how to manage the service outside of Board approved Financial Plans
- A Drainage Bylaw is needed to regulate and manage the Riondel drainage service:
 - Would delegate authority to staff to operate the service
 - Private drainage connections
 - Unauthorized tampering with the system
 - Adverse discharge to the drainage system
- Draft Drainage Bylaw presented to the Water Services Committee in November 2022 but adoption placed on hold until an agreement can be executed with MoTI regarding drainage infrastructure ownership



Repairs vs Assessment & Replacement and Capital Upgrade Plan

- Historically limited maintenance has been provided due to low funding levels
- Should limited funds be spent on maintenance or assessment & replacements?
- Safety issues need to be addressed
- The public has expressed concern about spending limited funds on assessments rather than repairs
- The Regional District has expressed that we needed to do assessment, repairs, asset planning and replacement, leading to a stalemate on progress for many years



Wood Decking Catch Basin Cover
Safety Concern for Traffic and Pedestrians



Hole in Exposed Steel Pipe

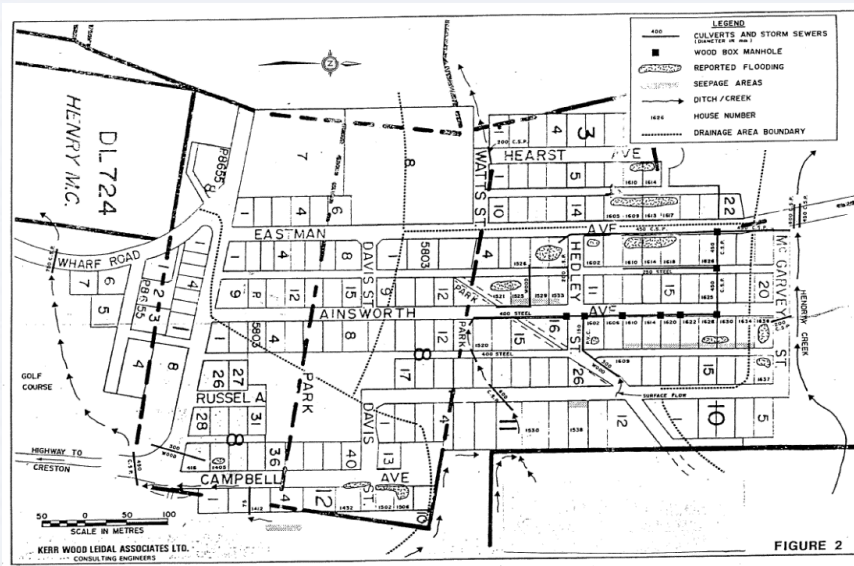


Non Traffic Rated Grate



Flooding & Private Property Drainage

- 1990 KWL Study indicated flooding was a concern due to collapsing wood culverts that have since been replaced
- No roadway flooding has been reported to the Regional District in recent years
- Residence have expressed concerns about wet properties
- Property should drain to roadways and not directly to drainage system

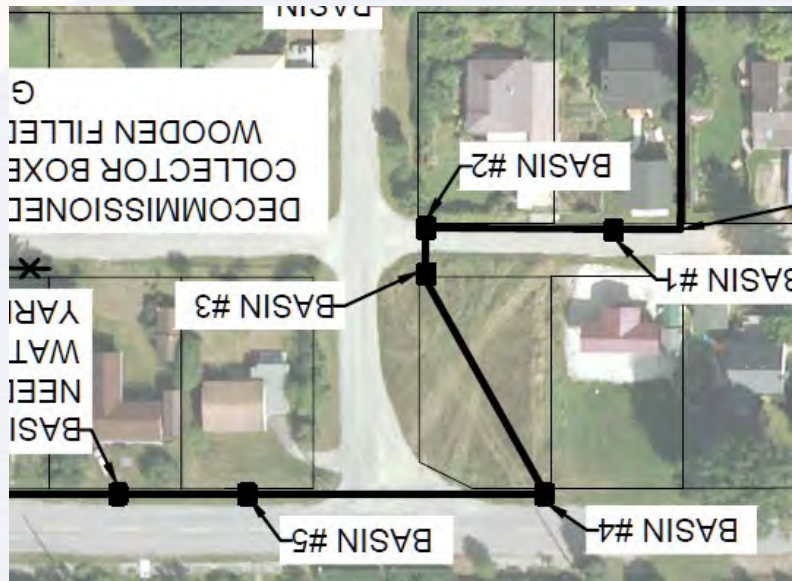


1990 KWL Report on Riindel Drainage Map

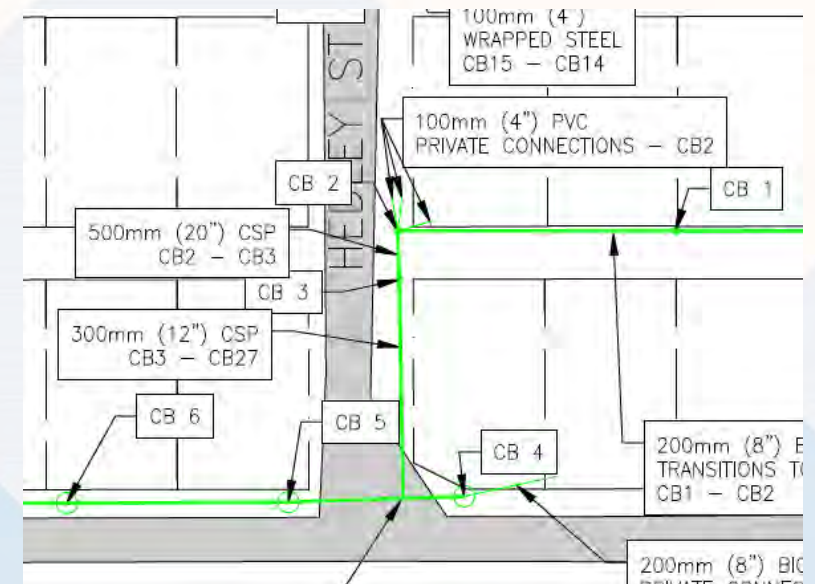


Mapping Accuracy and Inventory

- The Regional District did not have an up to date asset inventory and mapping
- Highland Consulting recently provided updated mapping
- Example mapping issue shown where existence of drain line crossing private property in existing Regional District map was found to not cross private property by Highland



Regional District Existing Map



Highland Consulting Updated Map



No Agreement with Ministry of Transportation and Infrastructure

- Road crossing culverts are generally believed to be the responsibility of the Ministry of Transportation and Infrastructure (MoTI) as culverts are required to drain roads
- The drainage system is owned by Regional District but there is no official ownership inventory
- Staff feel the primary purpose of the drainage system is to drain roads not private properties
- There is no agreement with MoTI regarding ownership responsibility between culverts and the drainage system
- The Regional District does not have a permit from MoTI permitting District drainage infrastructure to be located on MoTI roads
- MoTI has indicated that they do not provide agreements but would provide a permit
- Accurate mapping indicating inventory ownership is required for the permit



No Agreement with Ministry of Transportation and Infrastructure



Assumed:

- MoTI culverts in green
- Regional District drainage in red



Asset Condition and Aging Infrastructure

- 1990 KWL Report on Riondel Drainage is considered out of date to undocumented system changes and inflation
- There are a number of private drain line connections that were undocumented
- The system was believed to have a large amount of non-standard materials and construction



Wood Catch Basin Cover



No Concrete Base



Infiltration Opening



Non Standard Cover



Asset Condition and Aging Infrastructure

- A drainage system assessment and mapping updated has been completed by Highland Consulting in November 2023
 - The drainage system was not videoed due to costs
 - Assessment based on inspection of catch basins only
 - The system was assessed in generally poor condition due to large amount of non-standard materials and construction but most of it is likely still serviceable for many years
 - The south end of the Ainsworth Avenue is considered in potentially dangerous condition
 - The system has some non-traffic rated catch basin tops that should be addressed



Unsecured Cover – No Grate



Asset Condition and Aging Infrastructure



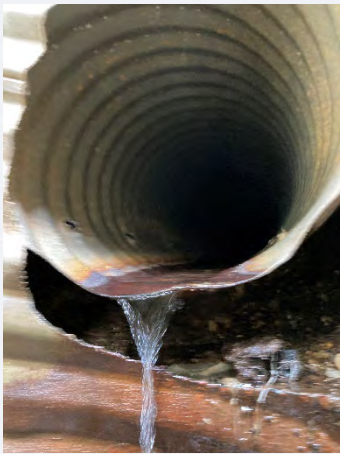
Private Service Inlet



Surface Water Cannot Flow In



Non Traffic Rated Grate



Pipe Not Grouted



Pipe Miss Aligned



Laundry Tub CB



Cannot Remove Cover



No Catch Basin at Tee



Asset Management Plan

- A draft asset management plan (AMP) has been completed by the Regional District based on Highland Consulting’s assessment and mapping work
 - System installation dates and potential service life needed to be assumed for most of the drainage system
 - AMP replacement costs are higher than Highland’s report costs as detailed asset replacement planning was not part of Highland’s scope of work

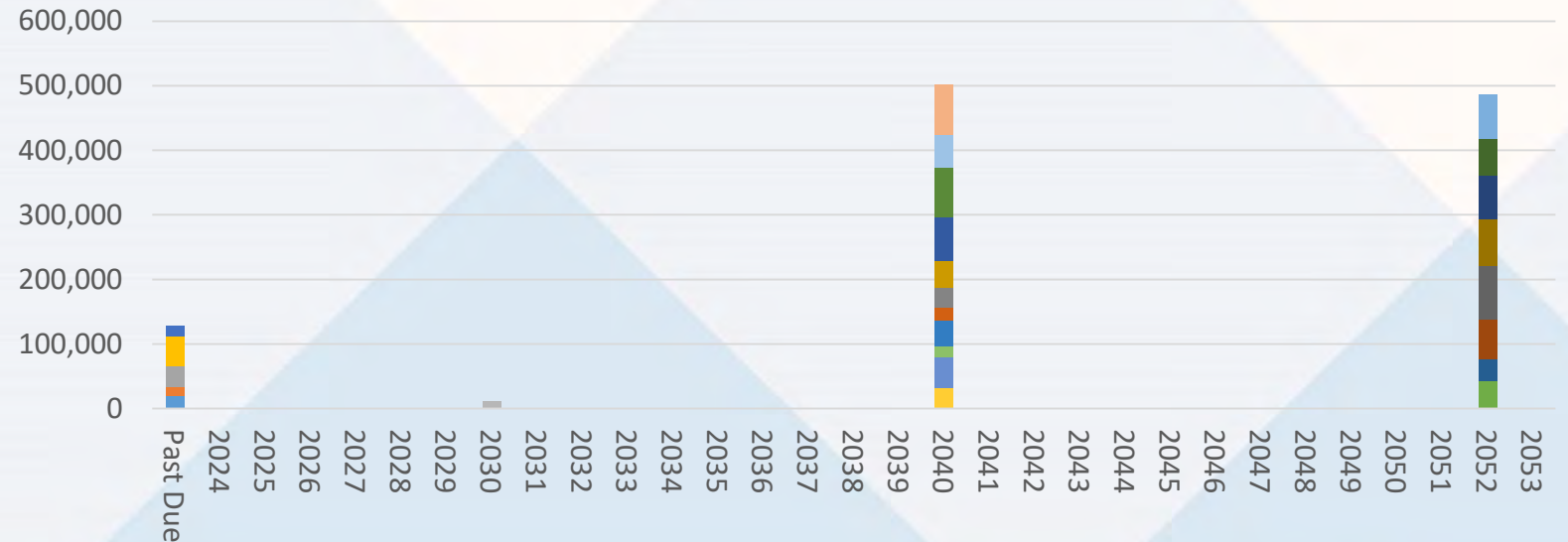
Asset ID	Location	Class	Material	Approximate Length	Future	Service	Year to Replace	Upstream	Upstream	Upstream	CB Top Material		
1	Intersect	Arrowsmith Avenue					1990				Concrete		
4	1045-CB24	Arrowsmith Avenue	22 Street	~1.2	300	450	1990	Y	50	2000	0	Intersect	
5	1024-CB25	Arrowsmith Avenue	43 Street	~1.2	200	450	1990	Y	50	2000	0	Intersect	
6	1025-CB14	Arrowsmith Avenue	64 Street	~1.2	200	450	1990	Y	50	2000	0	Intersect	
7	1024-CB26	Arrowsmith Avenue	14 C/P	~1.2	200	450	1990	Y	40	2000	0	Intersect	
8	1014-CB17	Arrowsmith Avenue	38 C/P	~1.2	500	450	2012	N	40	2002	28	0	
9	1017-CB18	Arrowsmith Avenue	20 C/P	~1.2	500	450	2012	N	40	2002	28	0	
10	1018-CB19	Arrowsmith Avenue	40 C/P	~1.2	500	450	2012	N	40	2002	28	0	
11	1019-CB20	Arrowsmith Avenue	54 C/P	~1.2	500	450	2012	N	40	2002	28	0	
12	1020-CB21	Arrowsmith Avenue	36 C/P	2.4 to 3.6	500	450	2012	N	40	2002	28	0	
13	1021-CB22	Arrowsmith Avenue	28 C/P	~1.8	500	450	2012	N	40	2002	28	0	
14	1022-CB23	Arrowsmith Avenue	20 C/P	~1.8	500	450	2012	N	40	2002	28	0	
15	1023-CB24	Arrowsmith Avenue	26 C/P	2.4 to 3.6	400	900	2012	N	40	2002	28	0	
16	Outflow	Arrowsmith Avenue					2012	Y	50	2000	0	Rock Rip Rap	
17	1014-CB15	Arrowsmith Avenue	7 Street	~1.2	300	300	1990	Y	50	2000	0	Intersect	
18	1016-CB1	Lane W of Arrowsmith	48 HDP "Big Q"	~1.2	200	200	1990	Y	50	2000	0	Intersect	
19	1015-CB2	Lane W of Arrowsmith	48 HDP to C/P	1.2 to 2.4	200	300	1990	Y	50	2000	0	Intersect	
20	1020-CB21	Wedday Street	6 C/P	1.2 to 2.4	300	300	1990	Y	50	2000	0	Intersect	
21	1020-CB22	Wedday Street	38 C/P	1.2 to 2.4	300	300	1990	Y	50	2000	0	Intersect	
22	1024-CB17	Eastman Avenue	11 C/P	~1.2	500	450	1990	Y	50	2000	0	Intersect	
23	1027-CB20	Eastman Avenue	20 C/P	~1.2	500	450	1990	Y	50	2000	0	Intersect	
24	1026-CB26	Eastman Avenue	39 C/P	~1.2	500	450	1990	Y	50	2000	0	Intersect	
25	1026-CB27	Eastman Avenue	55 C/P	1.2 to 2.4	500	450	1990	Y	50	2000	0	Intersect	
26	1027-CB28	Eastman Avenue	65 C/P	1.2 to 2.4	500	450	1990	Y	50	2000	0	Intersect	
27	1028-CB29	Eastman Avenue	40 C/P	1.2 to 2.4	500	450	1990	Y	50	2000	0	Intersect	
28	1029-CB30	Eastman Avenue	50 C/P	1.2 to 2.4	500	450	1990	Y	50	2000	0	Intersect	
29	Quarry	Eastman Avenue					1990	Y	50	2000	0	Intersect	
30	1021-CB22	Arrowsmith to Eastman	Abandoned line not to be replaced	88	C/P		1990	Y	50	2000	0	Intersect	
31	1020-CB21	Lane E of Inverness	Infiltration line not to be replaced	43	Perforated HDP "Big Q"		200	1990	Y	50	2000	0	Intersect
32	1021-CB22	Lane E of Inverness	Infiltration line not to be replaced	43	Perforated HDP "Big Q"		200	1990	Y	50	2000	0	Intersect
33	1021-CB23	Lane E of Inverness	Infiltration line not to be replaced	29	Perforated HDP "Big Q"		200	1990	Y	50	2000	0	Intersect
34	1021-CB24	Lane E of Inverness	Infiltration line not to be replaced	43	Perforated HDP "Big Q"		200	1990	Y	50	2000	0	Intersect
35	Rock Pit	North of Inverness	Infiltration line not to be replaced									Intersect	
36	Golf View	Golf View Street	Infiltration line not to be replaced	114	Perforated HDP "Big Q"		300	1990	Y	50	2000	0	Intersect



Asset Management Plan

- Existing drainage system replacement value: \$790,000
- Future drainage system replacement value: \$1,170,400 at 2% inflation
- Required annual contribution reserves \$32,433 to fund replacements, excluding past due replacements which would need to be funded from existing reserves and financing

Riondel Drainage Future Replacement Costs





Repairs vs Replacement – Ainsworth South Drainage Line

- Two new catch basins on Ainsworth might cost \$20,000 but the line also needs replacement
- Due to catch basin size, even temporary traffic rated lids might cost \$10,000
- Catch basins have been barricaded for now and staff is recommending catch basin and line replacement in 2024





Ainsworth South Replacement

- Riondel Drainage is funded from drainage service parcel taxes based on lot frontage
- Average tax per parcel in 2023 was \$72
- Ainsworth south drainage line replacement is anticipated to cost \$152,000 in 2024
- Riondel drainage service projected to have \$35,000 in reserves at year end 2023 with an additional contribution of \$20,000 in 2024.
- \$100,000 in short-term financing would be required for Ainsworth south replacement
- Public have not been supportive of replacement of the drain line with a lower cost swale





System Replacement Funding

- The draft Riondel Drainage 2024 Financial Plan includes a 62.2% increase in parcel tax resulting in an average parcel tax of \$117
- An additional 50% rate increase to \$176 average per parcel is anticipated for 2025 to pay financing costs
- 2025 tax increase will require public approval unless replacement work deemed an emergency
- The required annual contribution reserves is \$32,433 to fund replacements, excluding past due replacements which would need to be funded from existing reserves and financing
- 2024 budgeted contribution to reserves is \$11,700 plus 2023 surplus



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Environmental Services Department
Box 590, 202 Lakeside Drive,
Nelson, B.C. V1L 5R4

November 8th, 2023

Reference: Condition Assessment for Existing Drainage Infrastructure at Riondel, BC- Rev B

With regards to previous discussions held between Jason McDiarmid (RDCK) and Mr. Paul Kernan, P.Eng (of Highland Consulting Ltd), please find enclosed a condition assessment for the existing drainage infrastructure at Riondel, BC.

1. PROJECT BACKGROUND

The client, Regional District of Central Kootenay (RDCK), is proposing to review the condition and remaining design life of the existing drainage infrastructure at Riondel, BC. The location of all infrastructure is to be confirmed. Upgrades may be required depending on the results of the condition assessment.

The existing drainage infrastructure was originally installed by Teck and consisted of wooden box catch basins and wooden culverts. The infrastructure has been upgraded on several occasions and now primarily consists of corrugated steel pipe (CSP) connected to catch basins of varying sizes, depths, material of construction, and conditions.

2. CONDITION ASSESSMENT

An initial site visit was completed by Jacob Hildebrand of Highland Consulting on June 26th, 2023, in order to survey the locations of existing infrastructure. A follow up site visit was completed by Cooper Husband, EIT of Highland Consulting and Jason McDiarmid, P.L.Eng of RDCK on July 25th, 2023, in order to assess the condition of the existing infrastructure.

In addition, a desktop study of the existing drainage infrastructure (catch basins, culverts, storm sewer) was performed. Photographs and information for the community of Riondel's catch basins were provided in reports by KWL (Jan 1990), Highland Consulting (Sept 2010), and survey technologist Garth Norris (June 2008).

A good/fair/poor/very poor rating system was used in order to establish priority for upgrades. Please refer to Appendix A for drawings showing locations of infrastructure. A full assessment including photographs of each catch basin can be found in Appendix B. Appendix C has a full assessment including photographs



of each culvert (MoTI). In addition, a summary and a full condition assessment is located in the tables below.

The following metrics were considered for the assessment of catch basins: use of appropriate materials; sizing; depth of basin; height of grate; condition of basin, lid, and connections; and the design/construction. The following metrics were considered for the assessment of culverts: use of appropriate materials; sizing; condition of culvert; sediment buildup; and the design/construction. Generally, much of the drainage system is serviceable, but given a Poor rating due to the use of non-standard materials and non-standard construction. Definitions for each rating are provided below.

Good –

Catch Basin: All aspects of the catch basin are in good condition. The catch basin has been constructed to an appropriate depth with appropriate materials and appropriate construction. A traffic rated grate is present and graded to allow inflow.

Culvert: All aspects of the culvert are in good condition. The culvert has been constructed to an appropriate size with appropriate materials and appropriate construction. Little or no sediment buildup is present.

Fair –

Catch Basin: The catch basin is in generally good condition with appropriate depth, materials, and construction. Some decay of materials may be present but should not affect the function of the catch basin. Traffic rated grates that allow inflow should be present but may not be graded appropriately.

Culvert: The culvert is in generally good condition with appropriate materials and construction. Some decay of materials may be present but should not affect the function of the culvert. The culvert may be undersized but should not cause a hazard in the near future. Sediment buildup may be present but should not significantly affect the function of the culvert.

Poor –

Catch Basin: The catch basin has structural deficiencies or has been constructed with non-standard materials or non-standard construction. Catch basins with lids that do not allow inflow have been given a poor condition rating.

Culvert: The culvert has structural deficiencies or has been constructed with non-standard materials or non-standard construction. The culvert is significantly undersized, or sediment buildup may affect the function of the culvert.

Very Poor –

Catch Basin: The catch basin has structural deficiencies that are a danger to the public or the catch basin is not accessible.

Culvert: The culvert has structural deficiencies that are a danger to the public or is non-functional due to the amount of sediment buildup.



Table 1 – Condition Assessment, Catch Basins

Catch Basin	Condition Assessment (Good/Fair/Poor/Very Poor)
CB 1	Poor
CB 2	Poor
CB 3	Poor
CB 4	Poor
CB 5	Poor
CB 6	Poor
CB 7	Poor
CB 8	Poor
CB 9	Poor
CB 10	Poor
CB 11	Poor
CB 12	Poor
CB 13	Poor
CB 14	Very Poor - Dangerous
CB 15	Poor
CB 16	Poor
CB 17	Poor
CB 18	Poor
CB 19	Poor
CB 20	Poor
CB 21	Poor
CB 22	Poor
CB 23	Poor
CB 24	Very Poor - Buried
CB 25	Very Poor
CB 26	Very Poor
CB 27	Very Poor - Buried
CB 28	Very Poor - Private
Weir	Fair - Weir



Table 2 – Condition Assessment, Culverts

Catch Basin	Condition Assessment (Good/Fair/Poor/Very Poor)
CV 1	Fair
CV 2	Fair
CV 3	Fair
CV 4	Fair
CV 5	Fair
CV 6	Poor
CV 7	Very Poor - Buried
CV 8	Fair – Homeowner Installed

3. COST ESTIMATE

A preliminary cost estimate was performed for replacement of all drainage infrastructure including catch basins, pipes, and culverts. The replacement costs were calculated using the same diameter and alignments of installed infrastructure, as well as recommended sizing. Privately owned or installed infrastructure including catch basin #28, catch basin #26, culvert #8, and other private connections were not included in replacement costs.

All catch basins were upgraded to 1050mm concrete manholes with steel grates. Replacement costs for storm sewer pipes have been assessed using currently installed material (CSP and Big O HDPE) and recommended material (DR35 PVC). CSP and Big-O HDPE are typically used for culverts but are considered non-standard materials for storm sewer pipes as they are subject to high potential infiltration rates. Summary tables are listed below. Please refer to Appendix D for a full cost breakdown.

Table 3 – Cost Estimate Summary

Infrastructure	Material Costs	Installation Costs	Sum
Culverts (CVs) (MoTI)	\$ 46,952.18	\$ 99,414.00	\$146,366.18
Catch Basins (CBs)	\$ 73,874.70	\$ 210,600.00	\$284,474.70
Storm Sewer Pipe (Option A - CSP & Big O HDPE)	\$ 148,812.44	\$ 367,578.00	\$516,390.44
Storm Sewer Pipe (Option B - PVC)	\$ 329,191.97	\$ 367,578.00	\$696,769.97

Sub Total (RDCK Scope) – Catch Basins + Storm Sewer Pipe Option A	\$800,865.14
Sub Total (RDCK Scope) – Catch Basins + Storm Sewer Pipe Option B	\$981,244.67

***Cost estimates are based on existing infrastructure replacement like-for-like. Upgraded storm infrastructure cost estimate not undertaken. For discussion purposes only.**



A complete like-for-like replacement of all drainage infrastructure (not including MoTI culverts) using currently installed materials (CSP and Big O HDPE) is estimated at \$800,865.14.

A complete like-for-like replacement of all drainage infrastructure (not including MoTI culverts) using recommended materials (DR35 PVC) is estimated at \$981,244.67.

Please note that due to reduced Manning's roughness coefficient of PVC compared to CSP, PVC can accept higher flow rates than CSP for equivalent pipe sizes. As such, replacement using PVC may be more cost effective than CSP depending on pipe size requirements.

A price per meter cost estimate for various diameters (at the time of this report) is included in appendix D for reference.



4. RECOMMENDATIONS

In order to establish priority of upgrades, recommended replacements of the drainage infrastructure have been placed in phases.

4.1 Phase 1 – Immediate Priority

- Replace wooden catch basins 14 and 25 with their associated piping (1050mm dia. concrete manhole with steel grate recommended). The catch basins in their current state provide a safety concern. It is recommended to replace storm sewer piping from catch basin 14 to the concrete weir or investigate a drainage swale.
- Clear and grade the inlet and outlet of culvert #7 crossing Galena Bay Wharf Rd (MoTI scope).

4.2 Phase 2 – Medium Priority

- Clear sediment from existing catch basins and culverts.
- Replace the following non-standard lids from catch basins with concrete tops and steel grates to allow surface water ingress.
 - Catch Basin #7
 - Catch Basin #8
 - Catch Basin #9
 - Catch Basin #16
 - Catch Basin #21
 - Catch Basin #22
 - Catch Basin #26
- Lower the lid level of the following above grade catch basins.
 - Catch Basin #16
 - Catch Basin #17
 - Catch Basin #19
 - Catch Basin #21
 - Catch Basin #22
 - Catch Basin #23
- Locate source of all private connections to the drainage system, confirm with RDCK.
- Connect the drainage ditch on Mcgarvy St to allow drainage into catch basin #23. The drainage discharge below catch basin #23 is considered to be an MoTI culvert.

4.1 Phase 3 – Low Priority

- Replace remaining catch basins with 1050mm concrete manholes with steel grates.
- Replace remaining culverts and piping, upsizing where necessary. Catch basins 10-13 provide drainage for groundwater only, replacement may not be required.



5. CLOSURE

This report has been prepared by Highland Consulting Ltd (HCL) for use by *the client* and includes distribution or reproduction as may be required for their purposes. The review, assessments, and evaluations contained herein have been carried out in accordance with generally accepted engineering practice. Engineering judgment based on similar experience has been applied in developing recommendations and conclusions. No other warranty is made, either expressed or implied. The disclosure of any information contained within report is the sole responsibility of the client. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. HCL accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this report.

LIMITATION OF LIABILITY – Notwithstanding any other provision of this agreement, the total liability of Highland Consulting Ltd for liabilities, claims, judgements, demands and causes of action arising under or related to this agreement, whether based in contract or tort, shall be eliminated to the total compensations actually paid to Highland Consulting Ltd for the services hereunder. All claims by CLIENT shall be deemed relinquished unless filled within one (1) year after substantial completion of the services hereunder.

Highland Consulting Ltd trusts that this report meets your requirements, however if you have any questions or require further information, please do not hesitate in contacting the undersigned.

Yours sincerely,
HIGHLAND CONSULTING LTD
Permit to Practice # 1002652

Designed

Cooper Husband, EIT Civil Engineer

Reviewed

Paul Kernan, P.Eng, Civil Engineer

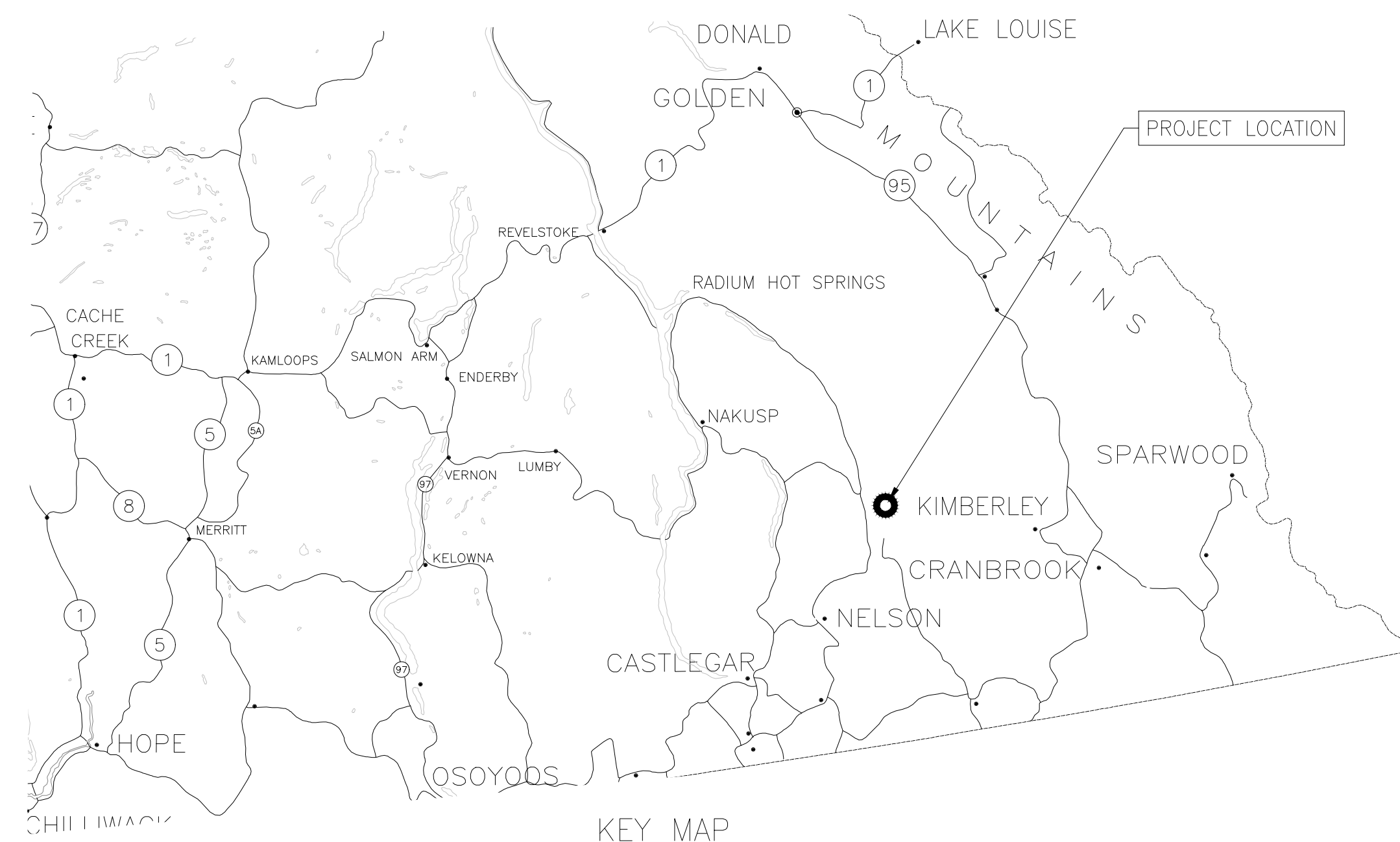
Appendices:

Appendix A
Appendix B
Appendix C
Appendix D

Drawings
Condition Assessment – Catch Basins
Condition Assessment - Culverts
Cost Estimate

APPENDIX A

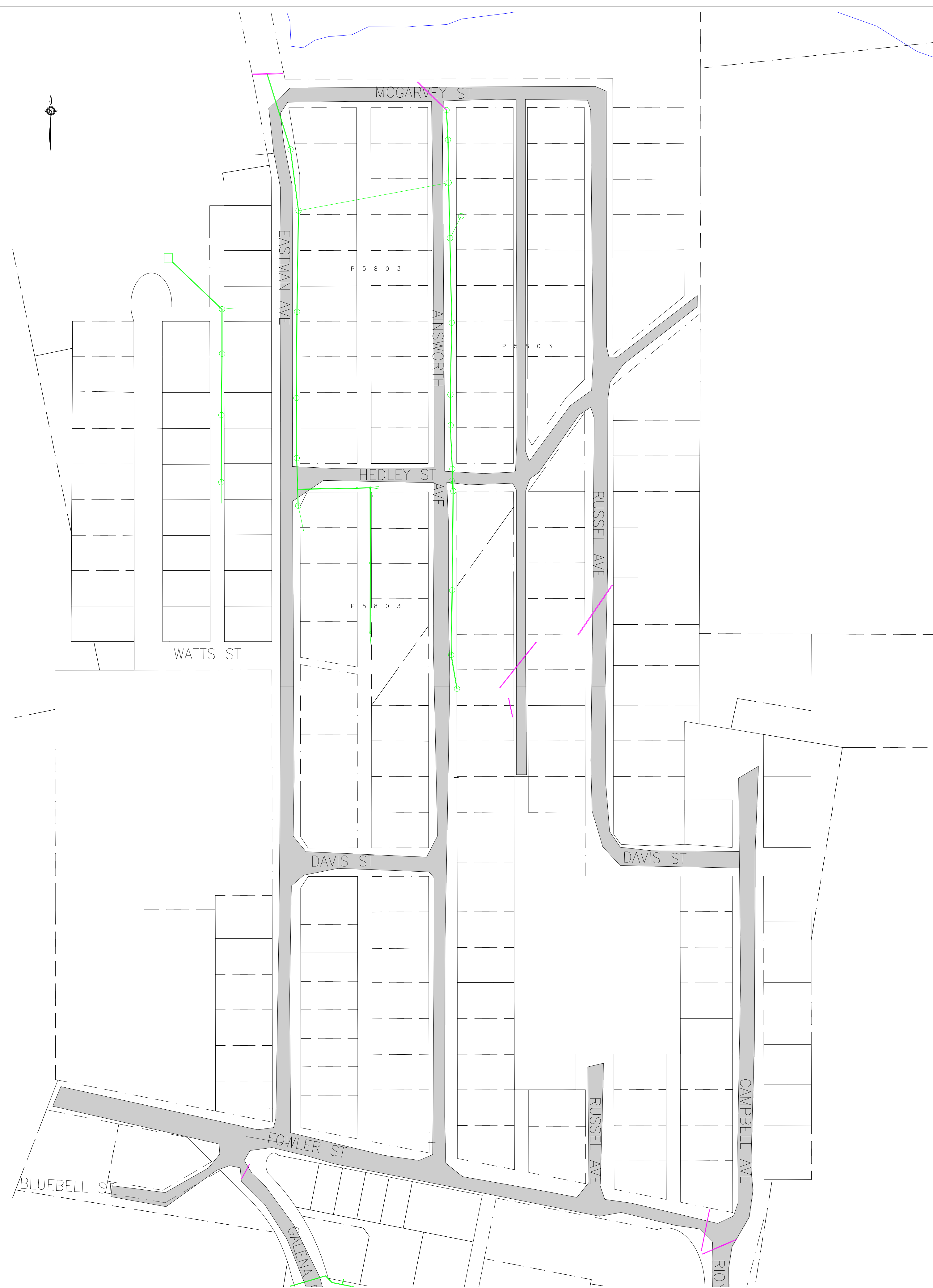
Drawings



KEY MAP
SCALE-NTS



SITE LOCATION
SCALE-1:2500



SITE PLAN VIEW
SCALE-1:1500

**PRELIMINARY
NOT FOR CONSTRUCTION**

LEGEND:

RDCK CULVERT/STORM SEWER

MoTi CULVERT

CATCH BASIN

GENERAL NOTES:

ALL DIMENSIONS ARE SPECIFIED IN METERS UNLESS OTHERWISE STATED.

LOT PLAN BASED ON ROCK MAPPING DATA AND SURVEY CARRIED OUT BY HIGHLAND CONSULTING. HIGHLAND CONSULTING IS NOT LIABLE FOR INACCURACIES IN DRAWING.

SCALE IS BASED ON ARCH EXPANDED D (24"x36") DRAWINGS.

NO VARIATION TO THIS DRAWING SHALL BE PERMITTED UNLESS AUTHORIZED BY ENGINEER IN WRITING.

AERIAL IMAGERY FROM ROCK MAPPING IMPORTED (07/17/2023)

REV.	DESCRIPTION	DATE
C	ISSUED TO CLIENT	06-NOV-23
B	ISSUED TO CLIENT	31-AUG-23
A	FOR REVIEW	23-AUG-23

ISSUED



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This drawing not to be used for construction purposes until noted and dated "Issued for Construction". All measurements must be checked on site and be verified with the drawings by Contractor.


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SEAL

PROJECT TITLE
RIONDEL STORM

DRAWING TITLE
LOCATION MAP

CLIENT NAME
RDCK

SCALE: REFER TO DWG	JOB No. 23611
DRAWN: JH	REVISION 
CHECKED: PK	DWG. No. S01
DATE: 17-Aug-22	
PLOT: 6-Nov-23	



LEGEND:

- RDCK CULVERT/STORM SEWER
- MoTi CULVERT
- CATCH BASIN

GENERAL NOTES:

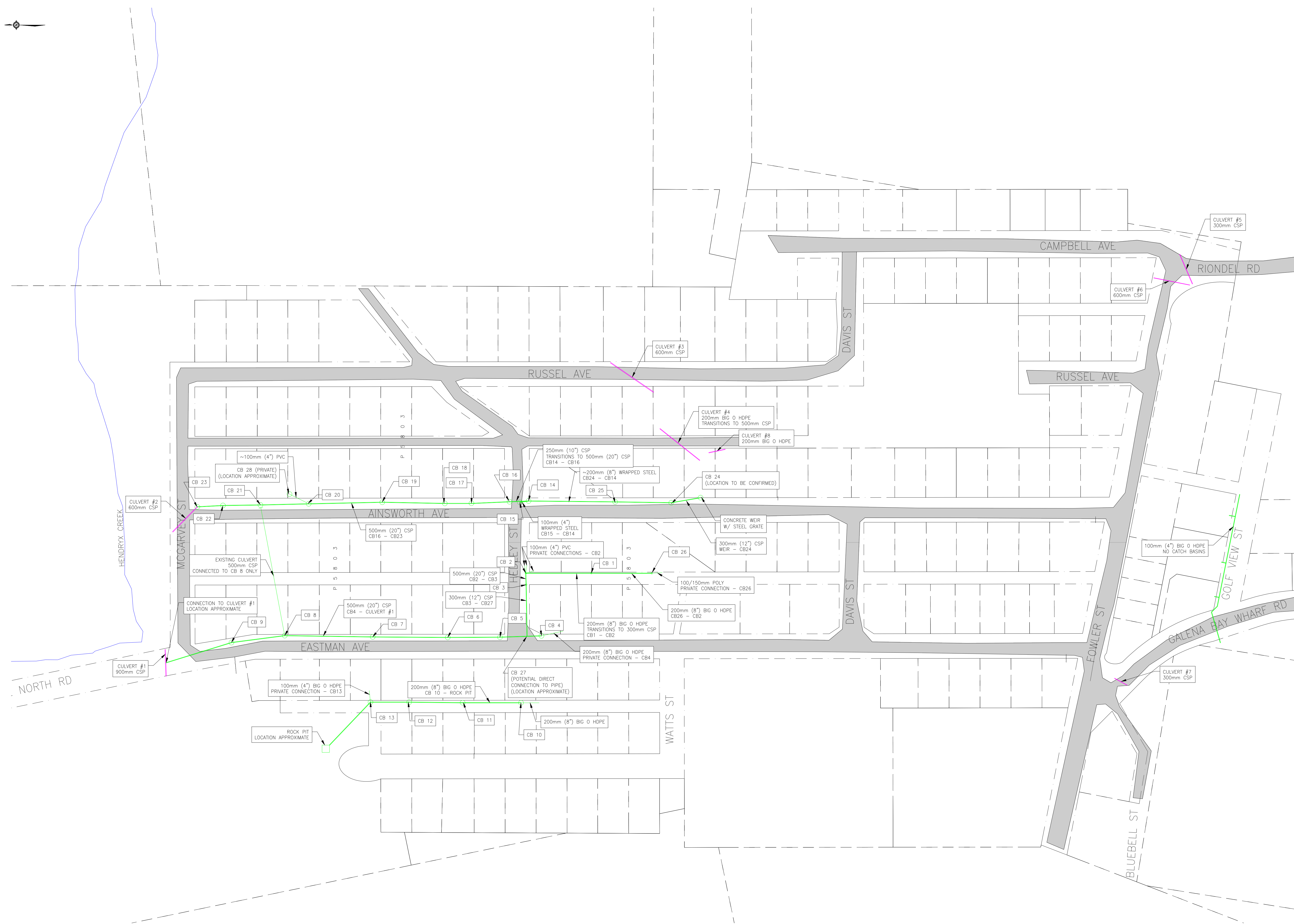
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AERIAL IMAGERY FROM ROCK MAPPING IMPORTED (07/17/2023)



SITE PLAN VIEW
SCALE: 1:1250

**PRELIMINARY
NOT FOR CONSTRUCTION**

REV.	DESCRIPTION	DATE
C	ISSUED TO CLIENT	06-NOV-23
B	ISSUED TO CLIENT	31-AUG-23
A	FOR REVIEW	23-AUG-23
	ISSUED	

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#210-601 FRONT ST
Nelson, BC
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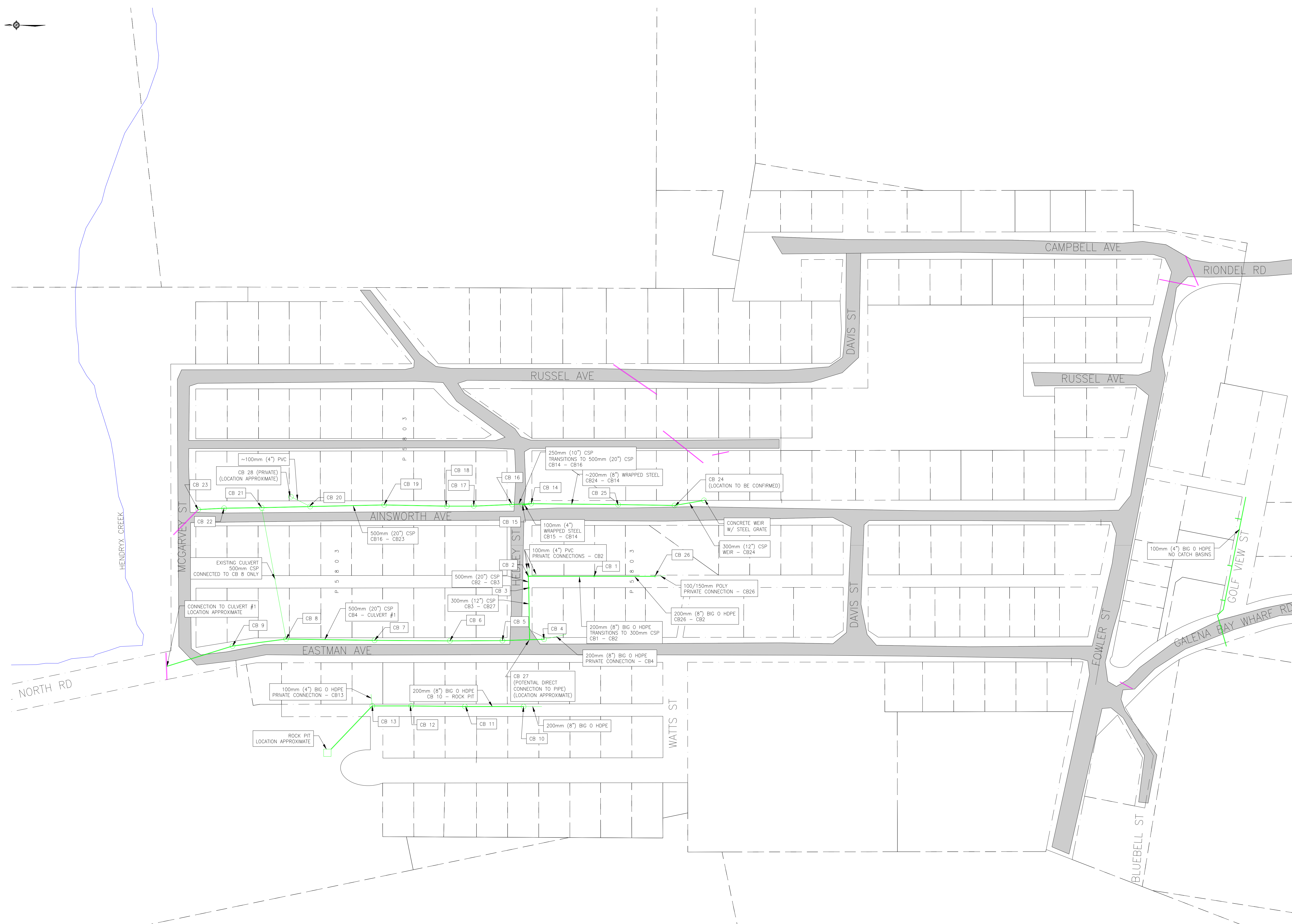
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SEAL

PROJECT TITLE	RIONDEL STORM
DRAWING TITLE	EXISTING INFRASTRUCTURE (ALL)
CLIENT NAME	RDCK
SCALE: REFER TO DWG	JOB No. 23611
DRAWN: JH	REVISION
CHECKED: PK	DWG. No. S02
DATE: 17-Aug-22	
PLDT: 6-Nov-23	

FILE: \\hcn\projects\2023\11_26_23\RDCK\RDCK_2023_11_26_23_01.dwg



LEGEND:

- RDCK CULVERT/STORM SEWER
- MoTi CULVERT
- CATCH BASIN

GENERAL NOTES:

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REV.	DESCRIPTION	DATE
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B	ISSUED TO CLIENT	31-AUG-23
A	FOR REVIEW	23-AUG-23

ISSUED

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SEAL

PROJECT TITLE
RIONDEL STORM

DRAWING TITLE
EXISTING INFRASTRUCTURE (RDCK)

CLIENT NAME
RDCK

SCALE: REFER TO DWG	JOB No. 23611
DRAWN: JH	REVISION
CHECKED: PK	DWG. No.
DATE: 17-Aug-22	S03
PLOT: 6-Nov-23	

PRELIMINARY
NOT FOR CONSTRUCTION

SITE PLAN VIEW
 SCALE=1:1250

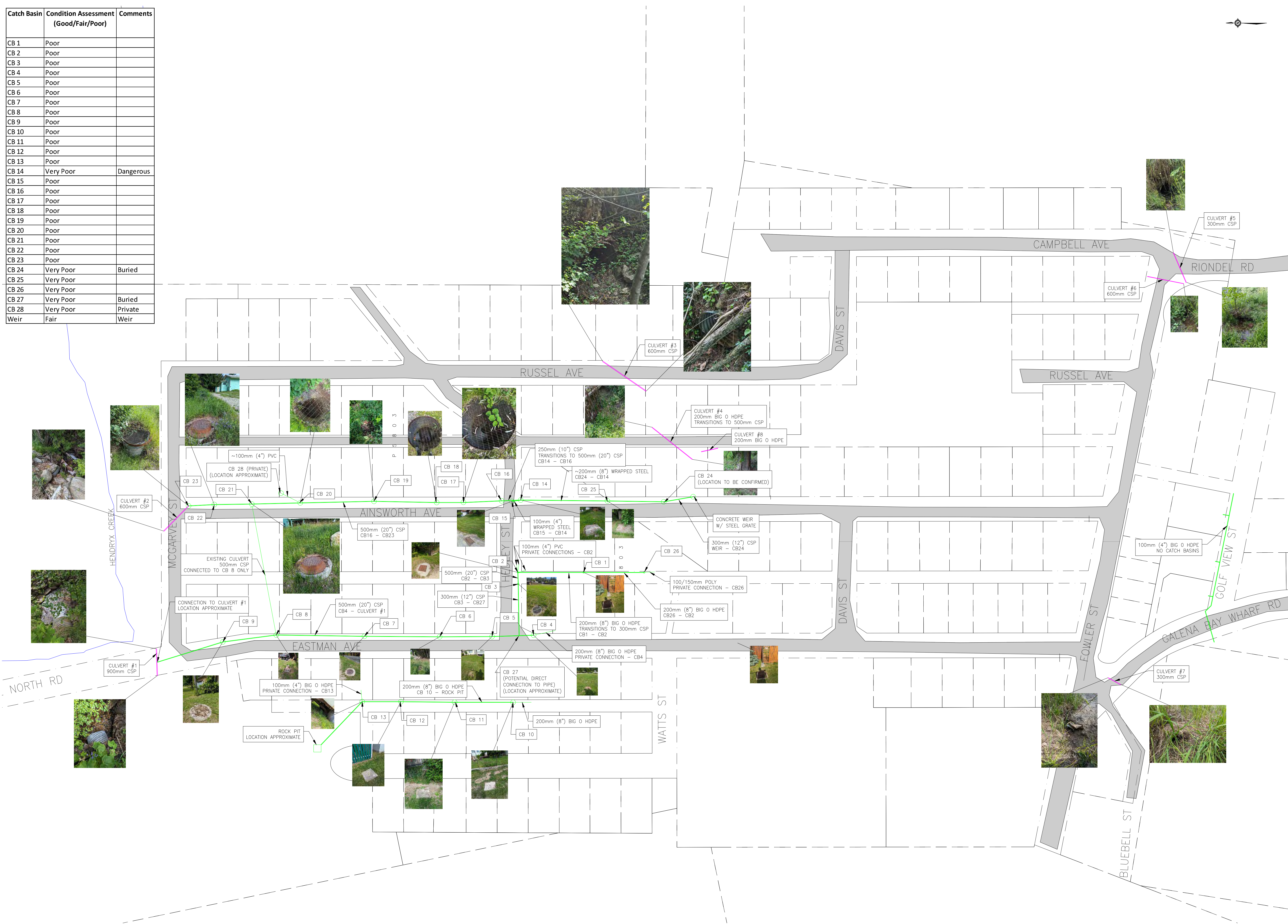
Catch Basin	Condition Assessment (Good/Fair/Poor)	Comments
CB 1	Poor	
CB 2	Poor	
CB 3	Poor	
CB 4	Poor	
CB 5	Poor	
CB 6	Poor	
CB 7	Poor	
CB 8	Poor	
CB 9	Poor	
CB 10	Poor	
CB 11	Poor	
CB 12	Poor	
CB 13	Poor	
CB 14	Very Poor	Dangerous
CB 15	Poor	
CB 16	Poor	
CB 17	Poor	
CB 18	Poor	
CB 19	Poor	
CB 20	Poor	
CB 21	Poor	
CB 22	Poor	
CB 23	Poor	
CB 24	Very Poor	Buried
CB 25	Very Poor	
CB 26	Very Poor	
CB 27	Very Poor	Buried
CB 28	Very Poor	Private
Weir	Fair	Weir

LEGEND:

- RDCK CULVERT/STORM SEWER
- MoTi CULVERT
- CATCH BASIN

GENERAL NOTES:

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 AERIAL IMAGERY FROM ROCK MAPPING IMPORTED (07/17/2023)



SITE PLAN VIEW
SCALE=1:1250

**PRELIMINARY
NOT FOR CONSTRUCTION**

REV.	DESCRIPTION	DATE
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B	ISSUED TO CLIENT	31-AUG-23
A	FOR REVIEW	23-AUG-23
REV.	DESCRIPTION	DATE
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SEAL

PROJECT TITLE
RIONDEL STORM

DRAWING TITLE
CONDITION ASSESSMENT

CLIENT NAME
RDCK

SCALE: REFER TO DWG	JOB No. 23611
DRAWN: JH	REVISION
CHECKED: PK	DWG. No. S04
DATE: 17-Aug-22	
PLOT: 6-Nov-23	

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APPENDIX B

Condition Assessment – Catch Basins

<u>Basin #:</u> CB 1	<u>Material:</u> CSP, Steel grate	<u>Material Condition:</u> Fair *Non Standard
	<u>Depth:</u> 70cm	
	<u>Sediment:</u> Low	
<u>Inlet(s):</u> 200mm Big O HDPE	<u>Comments:</u> Grate likely not traffic rated	
<u>Outlet(s):</u> 200mm Big O HDPE		



Overall Condition **Poor**

Basin #: CB 2	Material: Concrete	Material Condition: Fair *Non Standard
	Depth: 137cm	
	Sediment: Medium	
Inlet(s):	100mm (4") PVC (Private connection) 100mm (4") PVC (Private connection) 100mm (4") PVC (Private connection) 300mm (12") CSP	Comments: Rebar located inside for unknown reason. PVC connections are from unknown locations, but are likely from private property. Grate likely not traffic rated.
Outlet(s):	500mm (20") CSP	



Overall Condition **Poor**

Basin #: CB 3	Material: CSP	Material Condition: Poor *Non Standard
	Depth: 133 cm	
	Sediment: Medium	
Inlet(s): 500mm (20") CSP	Comments: Bulges in catch basin wall noted. Outlet flows to an unlocated catch basin or t's into drainage pipe.	
Outlet(s): 300mm (12") CSP		



Overall Condition **Poor**

Basin #: CB 4	Material: Concrete	Material Condition: Fair *Non Standard
	Depth: 116cm	
	Sediment: Low	
Inlet(s): 200mm (8") Big O HDPE (Private connection) Infiltration Inlet	Comments: Additional inlet filled with rocks, likely to accommodate infiltration - not standard practice. Big O HDPE inlet is coming from adjacent private property.	
Outlet(s): 500mm (20") CSP		



Overall Condition **Poor**

<u>Basin #:</u> CB 5	<u>Material:</u> Concrete	<u>Material Condition:</u> Fair *Non Standard
	<u>Depth:</u> 105cm	
	<u>Sediment:</u> Low	
<u>Inlet(s):</u> 500mm (20") CSP	<u>Comments:</u> Additional inlet filled with rocks. Grate was covered with dirt and difficult to access	
<u>Outlet(s):</u> 500mm (20") CSP Infiltration Inlet		



Overall Condition **Poor**

<u>Basin #:</u> CB 6	<u>Material:</u> Concrete	<u>Material Condition:</u> Fair *Non Standard
	<u>Depth:</u> 135cm	
	<u>Sediment:</u> Medium	
<u>Inlet(s):</u> 500mm (20") CSP Infiltration Inlet	<u>Comments:</u> Additional inlet hole filled with rocks. It has been reported that water runs around the catch basin, although the ground is graded appropriately.	
<u>Outlet(s):</u> 500mm (20") CSP		



Overall Condition **Poor**

<u>Basin #:</u> CB 7	<u>Material:</u> Concrete	<u>Material Condition:</u> Fair *Non Standard
	<u>Depth:</u>	
	<u>Sediment:</u> Low	
<u>Inlet(s):</u> 500mm (20") CSP Infiltration Inlet	<u>Comments:</u> Additional inlet filled with rocks. Non-standard grate.	
<u>Outlet(s):</u> 500mm (20") CSP		



Overall Condition **Poor**

Basin #: CB 8	Material: CSP	Material Condition: Poor *Non Standard
	Depth: 140cm	
	Sediment: Medium	
Inlet(s): 500mm (20") CSP 500mm (20") CSP	Comments: Concrete manhole lid. Warping noted in CSP walls. Additional inlet from abandoned line from CB 21. Abandoned line is no longer connected to CB 21 and there are no additional catch basins located between CB 21 and CB 8. No grate for inflow.	
Outlet(s): 500mm (20") CSP		



Overall Condition **Poor**

<u>Basin #:</u> CB 9	<u>Material:</u> CSP	<u>Material Condition:</u> Fair *Non Standard
	<u>Depth:</u> 190cm	
	<u>Sediment:</u> Medium	
<u>Inlet(s):</u> 500mm (20") CSP	<u>Comments:</u> Lid is a concrete manhole lid and does not allow inflow. Outlet t's into culvert crossing Eastman Ave.	
<u>Outlet(s):</u> 500mm (20") CSP		



Overall Condition **Poor**

<u>Basin #:</u> CB 10	<u>Material:</u> Unknown (concrete lid)	<u>Material Condition:</u> Poor *Non Standard
	<u>Depth:</u> Unknown	
	<u>Sediment:</u> Unknown	
<u>Inlet(s):</u> Unknown	<u>Comments:</u> Unable to remove lid. Catch basin does not have a manhole lid so this section of drainage infrastructure is likely for groundwater drainage only.	
<u>Outlet(s):</u> Unknown		



Overall Condition Poor

<u>Basin #:</u> CB 11	<u>Material:</u> Unknown (concrete lid)	<u>Material Condition:</u> Unknown *Non Standard
	<u>Depth:</u> Unknown	
	<u>Sediment:</u> Unknown	
<u>Inlet(s):</u> Unknown	<u>Comments:</u> Located underneath truck. Unable to remove lid. Catch basin does not have a manhole lid so this section of drainage infrastructure is likely for groundwater drainage only.	
<u>Outlet(s):</u> Unknown		



Overall Condition Poor

<u>Basin #:</u> CB 12	<u>Material:</u> Unknown (concrete lid)	<u>Material Condition:</u> Unknown *Non Standard
	<u>Depth:</u> Unknown	
	<u>Sediment:</u> Unknown	
<u>Inlet(s):</u> Unknown	<u>Comments:</u> Unable to remove lid. Catch basin does not have a manhole lid so this section of drainage infrastructure is likely for groundwater drainage only.	
<u>Outlet(s):</u> Unknown		



Overall Condition Poor

<u>Basin #:</u> CB 13	<u>Material:</u> Unknown (concrete lid)	<u>Material Condition:</u> Unknown *Non Standard
	<u>Depth:</u> Unknown	
	<u>Sediment:</u> Unknown	
<u>Inlet(s):</u> Unknown	<u>Comments:</u> Located under truck. Unable to remove lid. Catch basin does not have a manhole lid so this section of drainage infrastructure is likely for groundwater drainage only.	
<u>Outlet(s):</u> Unknown		



Overall Condition **Poor**

Basin #: CB 14	Material: Wood	Material Condition: Very Poor Dangerous *Non Standard
	Depth:	
	Sediment: Medium	
Inlet(s): 100mm (4") wrapped steel ~200mm (8") Wrapped Steel	Comments: Pipe entering the manhole has a hole in it. There are gaps surrounding the catch basin as well that could be a hazard. Replacement is deemed a high priority.	
Outlet(s): 250mm (10") CSP		



Overall Condition **V. Poor**

Basin #:	CB 15	Material:	Material Condition: Fair *Non Standard
		Depth: Shallow	
		Sediment: High	
Inlet(s):		Comments: Catch basin located in road and drains to CB 14.	
Outlet(s): 100mm (4") Wrapped Steel			



Overall Condition **Poor**

Basin #:	CB 16	Material:	CSP	Material Condition:	Fair *Non Standard
		Depth:	200cm		
		Sediment:	Medium		
Inlet(s):	500mm (20") CSP	Comments: Overgrown. Top of catch basin is well above ground level. There is a hole cut in the side from inspection ~10 years ago			
Outlet(s):	500mm (20") CSP				



Overall Condition **Poor**

<u>Basin #:</u> CB 17	<u>Material:</u> CSP	<u>Material Condition:</u> Fair *Non Standard
	<u>Depth:</u> 113cm	
	<u>Sediment:</u> High	
<u>Inlet(s):</u> 500mm (20") CSP	<u>Comments:</u> Non-standard grate, not traffic rated. Grate is too high to allow surface inflow.	
<u>Outlet(s):</u> 500mm (20") CSP		



Overall Condition **Poor**

<u>Basin #:</u> CB 18	<u>Material:</u> CSP	<u>Material Condition:</u> Fair *Non Standard
	<u>Depth:</u> 114cm	
	<u>Sediment:</u> Medium	
<u>Inlet(s):</u> 500mm (20") CSP	<u>Comments:</u> 125cm width	
<u>Outlet(s):</u> 500mm (20") CSP		



Overall Condition **Poor**

Basin #: CB 19	Material: CSP	Material Condition: Fair *Non Standard
	Depth: 147cm	
	Sediment:	
Inlet(s): 500mm (20") CSP	Comments: Overgrown. 125cm width. Located in a very wet area. Surface flow is noted entering it even during dry conditions. Inflow is entering from side cuts as the grate is too high.	
Outlet(s): 500mm (20") CSP		



Overall Condition **Poor**

Basin #: CB 20	Material:	Material Condition: Fair *Non Standard
	Depth: 265cm	
	Sediment:	
Inlet(s): 500mm (20") CSP 200mm (8") PE private inlet enters the drainline downstream of catch basin	Comments: Includes a private inlet that is not completely attached (see photo). 125cm width.	
Outlet(s): 500mm (20") CSP		



Overall Condition **Poor**

<u>Basin #:</u> CB 21	<u>Material:</u> CSP	<u>Material Condition:</u> Fair *Non Standard
	<u>Depth:</u> 430cm	
	<u>Sediment:</u>	
<u>Inlet(s):</u> 500mm (20") CSP	<u>Comments:</u> Lid is above ground, does not allow inflow. No sign of outlet connecting CB 21 to CB 8.	
<u>Outlet(s):</u> 500mm (20") CSP		



Overall Condition **Poor**

<u>Basin #:</u> CB 22	<u>Material:</u> CSP	<u>Material Condition:</u> Fair *Non Standard
	<u>Depth:</u> 425cm	
	<u>Sediment:</u>	
<u>Inlet(s):</u> 500mm (20") CSP	<u>Comments:</u> Lid is above ground and does not allow for inflow.	
<u>Outlet(s):</u> 500mm (20") CSP		



Overall Condition **Poor**

Basin #: CB 23	Material: CSP	Material Condition: Fair *Non Standard
	Depth: 324cm	
	Sediment:	
Inlet(s): 500mm (20") CSP 12 punched holes	Comments: Overgrown and above ground. The drainage ditch does not directly connect to the catch basin. There are 12 inlets drilled into the catch basin walls in a circle at ~235cm depth. The holes are likely draining water from the ground. No pipes appear to be connected to these 12 holes.	
Outlet(s): 600mm (24") CSP		



Overall Condition **Poor**

<u>Basin #:</u> CB 24	<u>Material:</u> Unknown	<u>Material Condition:</u> Unknown
	<u>Depth:</u> Unknown	
	<u>Sediment:</u> Unknown	
<u>Inlet(s):</u> Unknown. Likely 300mm (12") CSP	<u>Comments:</u> Unable to locate catch basin. It has likely become buried. Located in front of 1520 Ainsworth Ave.	
<u>Outlet(s):</u> Unknown. Likely 200mm (8") wrapped steel		



Overall Condition **V. Poor**

Basin #:	CB 25	Material:	Wood	Material Condition:	Very Poor *Non Standard
		Depth:	Shallow		
		Sediment:	High		
Inlet(s):	~200mm (8") wrapped steel			Comments: Replacement deemed a high priority for safety	
Outlet(s):	~200mm (8") wrapped steel				



Overall Condition **V. Poor**

<u>Basin #:</u> CB 26	<u>Material:</u> Non standard	<u>Material Condition:</u> Poor *Non Standard
	<u>Depth:</u> 72cm	
	<u>Sediment:</u> Medium	
<u>Inlet(s):</u> 100mm/150mm poly (likely perforated)	<u>Comments:</u> Inlet pipe is likely perforated and draining ground water. Catch basin is likely a private install. Inlet to catch basin likely drains the nearby garage.	
<u>Outlet(s):</u> 200mm (8") Big O HDPE		



Overall Condition **V. Poor**

Basin #: CB 27	Material: Unknown	Material Condition: Unknown
	Depth: Unknown	
	Sediment: Unknown	
Inlet(s): Likely 300mm (12") CSP Likely 500mm (20") CSP	Comments: Buried catch basin or outlet from CB 3 directly ties into underground pipe. Located underneath intersection of Hedley St and Eastman Ave.	
Outlet(s): Likely 500mm (20") CSP		



Overall Condition V. Poor

Basin #:	CB 28	Material:	Poly	Material Condition:	Unknown
		Depth:	Unknown		
		Sediment:	Unknown		
Inlet(s):				Comments:	
				Illegal catch basin or steep inlet pipe located on private property. No lid is present and the catchbasin/inlet pipe was flooded at time of inspection. Likely connects to a deep storm line between catch basins	
Outlet(s):		PVC			



Overall Condition **V. Poor**

Basin #:	Weir	Material:	Concrete; CSP	Material Condition:	Fair
		Diameter:	300mm		
		Sediment:	Low		

Comments: Concrete channel and weir are in fair condition, with some stones and debris in the channel. CSP pipe is in fair condition and connects to catch basin #24 (previously unnumbered) which was not located.



Overall Condition **Fair**

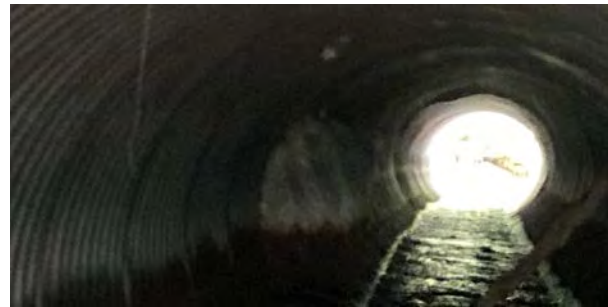
APPENDIX C

Condition Assessment – Culverts

Basin #:	CV 1	Material:	CSP	Material Condition:	Fair
		Diameter:	900mm		
		Sediment:	Low		

Comments: Culvert crosses Eastman Ave, connecting two drainage ditches. Outlet from catch basin #9 (500mm CSP) t's into the culvert at ~8m from the culvert inlet. This places the connection point at approximately the road shoulder.

Inlet



Outlet



Overall Condition **Fair**

Basin #:	CV 2	Material:	CSP	Material Condition:	Fair
		Diameter:	600mm		
		Sediment:	Medium		

Comments: Culvert crosses McGarvey St, connecting catch basin #23 and a drainage ditch.

Inlet



Overall Condition **Fair**

Basin #:	CV 3	Material:	CSP	Material Condition:	Fair
		Diameter:	600mm		
		Sediment:	Medium		

Comments: Culvert crosses Russel Ave and connects two drainage ditches. Neighbour has said that the culvert has no flow in the spring. The outlet is likely on Teck land. The outlet is difficult to access.

Inlet



Outlet



Overall Condition **Fair**

Basin #:	CV 4	Material:	Big O HDPE; CSP	Material Condition:	Fair
		Diameter:	200mm (ID); 500mm		
		Sediment:	Medium		

Comments: Culvert crosses the alley between Russel Ave and Ainsworth Ave and connects two drainage ditches. Inlet is 240mm and transitions to 500mm CSP at some point underground. Culvert was dry at time of inspection. Inlet and outlet are located on park land (Teck).

Inlet



Outlet



Overall Condition **Fair**

Basin #:	CV 5	Material:	CSP	Material Condition:	Fair
		Diameter:	300mm		
		Sediment:	Medium		

Comments: Culvert crosses Riodel Rd and connects two drainage ditches. Pipe is in fair condition but could be cleaned up.

Inlet



Outlet



Overall Condition **Fair**

Basin #:	CV 6	Material:	CSP	Material Condition:	Fair
		Diameter:	600mm		
		Sediment:	High		

Comments: Culvert crosses Folwer St and connects a drainage ditch to an unknown location. There is a concrete pad on the North side of Fowler St that may be covering a catch basin. The culvert may continue into the neighbouring property (416 Folwer St). Recommended to confirm culvert outlet and replace concrete pad with a steel grate if covering a catch basin. Culvert should be graded appropriately for MoTI.

Inlet



Outlet



Overall Condition **Poor**

Basin #:	CV 7	Material:	CSP	Material Condition:	Poor
		Diameter:	300mm		
		Sediment:	High		

Comments: Culvert crossing Galena Bay Wharf Rd. Inlet is partially buried and surround area does not flow appropriately into the inlet. Outlet is completely buried and unable to be identified.

Inlet



Outlet



Overall Condition **Very Poor**

Basin #:	CV 8	Material:	Big O HDPE	Material Condition:	Good
		Diameter:	~200mm (ID)		
		Sediment:	Low		

Comments: Privately installed culvert crossing the alley between Ainsworth Ave and Russel Ave. The inlet was not able to be located but a neighbour reported that it comes from a private property (house on corner of alley).

Inlet



Outlet



Overall Condition **Fair**

APPENDIX D

Condition Assessment – Cost Estimate

Preliminary Project Cost Estimate - Catch Basins				
Task	Unit	Est'd Qty	Unit Rate	Total (\$)
Material				
42" (1060mm) Manhole Base	ea	26	195.00	\$ 5,070
42" x 1ft Manhole Barrel	ea	7	140.00	\$ 980
42" x 2ft Manhole Barrel	ea	3	260.00	\$ 780
42" x 3ft Manhole Barrel	ea	4	390.00	\$ 1,560
42" x 4ft Manhole Barrel	ea	30	520.00	\$ 15,600
Manhole Gasket	ea	26	25.00	\$ 650
Manhole Lid - Steel Grate	ea	26	1,157.00	\$ 30,082
Engineering & Construction Contingency (35%)				\$ 19,152.70
			Sub Total	\$ 73,874.70
Installation				
Manhole installation per	ea	26	6,000.00	\$ 156,000
Engineering & Construction Contingency (35%)				\$ 54,600.00
			Sub Total	\$ 210,600.00
Sum				
			Total	\$ 284,474.70
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<div style="border: 2px solid red; padding: 10px; display: inline-block;"> <p>DRAFT - FOR DISCUSSION</p> </div>				

Preliminary Project Cost Estimate - Culverts				
Task	Unit	Est'd Qty	Unit Rate	Total (\$)
Material				
Corrugated Steel Pipe (CSP) 300mm	m	34.5	\$ 84.23	\$ 2,906
Corrugated Steel Pipe (CSP) 500mm	m	37.7	\$ 139.50	\$ 5,259
Corrugated Steel Pipe (CSP) 600mm	m	92	\$ 167.41	\$ 15,402
Corrugated Steel Pipe (CSP) 900mm	m	19.9	\$ 293.86	\$ 5,848
CSP Coupling 300mm	ea	4	\$ 80.00	\$ 320
CSP Coupling 500mm	ea	6	\$ 160.00	\$ 960
CSP Coupling 600mm	ea	14	\$ 220.00	\$ 3,080
CSP Coupling 900mm	ea	3	\$ 335.00	\$ 1,005
Engineering & Construction Contingency (35%)				\$ 12,172.79
			Sub Total	\$ 46,952.18
Installation				
Trench Excavation-Shallow Trench (asphalt)	linear meter	184.1	\$ 400.00	\$ 73,640
Engineering & Construction Contingency (35%)				\$ 25,774.00
			Sub Total	\$ 99,414.00
Sum				
			Total	\$ 146,366.18
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<div style="border: 2px solid red; padding: 10px; display: inline-block;"> <b style="color: red; font-size: 1.2em;">DRAFT - FOR DISCUSSION </div>				

Preliminary Project Cost Estimate - Storm Sewer Pipes (Option A - CSP & Big O HDPE)				
Task	Unit	Est'd Qty	Unit Rate	Total (\$)
Material				
Corrugated Steel Pipe (CSP) 300mm	m	108.4	\$ 84.23	\$ 9,131
Corrugated Steel Pipe (CSP) 500mm	m	532.8	\$ 139.50	\$ 74,324
Big O HDPE 200mm	m	266.4	\$ 35.95	\$ 9,577
CSP Coupling 300mm	ea	25	\$ 80.00	\$ 2,000
CSP Coupling 500mm	ea	95	\$ 160.00	\$ 15,200
Engineering & Construction Contingency (35%)				\$ 38,581
			Sub Total	\$ 148,812.44
Installation				
Trench Excavation-Shallow Trench (no asphalt)	linear meter	907.6	\$ 300.00	\$ 272,280
Engineering & Construction Contingency (35%)				\$ 95,298.00
			Sub Total	\$ 367,578.00
Sum				
			Total	\$ 516,390.44
<p>This Cost Estimate has been prepared by Highland Consulting Ltd (HCL) for use by the client and includes distribution or reproduction as may be required for his purposes. The review, assessments, and evaluations contained herein have been carried out in accordance with generally accepted engineering practice. Engineering judgment based on similar experience has been applied in developing recommendations and conclusions. No other warranty is made, either expressed or implied. The disclosure of any information contained within report is the sole responsibility of the client. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. HCL accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this report.</p>				
<div style="border: 2px solid red; padding: 10px; display: inline-block;"> <p>DRAFT - FOR DISCUSSION</p> </div>				

Preliminary Project Cost Estimate - Storm Sewer Pipes (Option B - PVC)				
Task	Unit	Est'd Qty	Unit Rate	Total (\$)
Material				
DR35 PVC 200mm	m	266.4	\$ 62.43	\$ 16,631
DR35 PVC 300mm	m	108.4	\$ 141.23	\$ 15,309
DR35 PVC 500mm	m	532.8	\$ 397.72	\$ 211,905
Engineering & Construction Contingency (35%)				\$ 85,346.07
			Sub Total	\$ 329,191.97
Installation				
Trench Excavation-Shallow Trench (no asphalt)	linear meter	907.6	\$ 300.00	\$ 272,280
Engineering & Construction Contingency (35%)				\$ 95,298.00
			Sub Total	\$ 367,578.00
Sum				
			Total	\$ 696,769.97
<p>This Cost Estimate has been prepared by Highland Consulting Ltd (HCL) for use by the client and includes distribution or reproduction as may be required for his purposes. The review, assessments, and evaluations contained herein have been carried out in accordance with generally accepted engineering practice. Engineering judgment based on similar experience has been applied in developing recommendations and conclusions. No other warranty is made, either expressed or implied. The disclosure of any information contained within report is the sole responsibility of the client. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. HCL accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this report.</p>				
<div style="border: 2px solid red; padding: 10px; display: inline-block;"> <p>DRAFT - FOR DISCUSSION</p> </div>				

Price per Meter Cost Estimate (August 2023) - For discussion purposes only. Prices subject to change

Material	Unit per	Unit Rate
Corrugated Steel Pipe (CSP) 200mm	m	\$ 56.82
Corrugated Steel Pipe (CSP) 250mm	m	\$ 70.53
Corrugated Steel Pipe (CSP) 300mm	m	\$ 84.23
Corrugated Steel Pipe (CSP) 400mm	m	\$ 111.64
Corrugated Steel Pipe (CSP) 450mm	m	\$ 125.54
Corrugated Steel Pipe (CSP) 500mm	m	\$ 139.50
Corrugated Steel Pipe (CSP) 600mm	m	\$ 167.41
Corrugated Steel Pipe (CSP) 700mm	m	\$ 248.10
Corrugated Steel Pipe (CSP) 800mm	m	\$ 283.57
Corrugated Steel Pipe (CSP) 900mm	m	\$ 293.86
Corrugated Steel Pipe (CSP) 1000mm	m	\$ 304.14
Corrugated Steel Pipe (CSP) 1200mm	m	\$ 364.90
Alum Corrugated Steel Pipe (CSP) 1400mm	m	\$ 586.00
CSP Coupling 200mm	ea	\$ 60.00
CSP Coupling 250mm	ea	\$ 70.00
CSP Coupling 300mm	ea	\$ 80.00
CSP Coupling 400mm	ea	\$ 100.00
CSP Coupling 450mm	ea	\$ 130.00
CSP Coupling 500mm	ea	\$ 160.00
CSP Coupling 600mm	ea	\$ 220.00
CSP Coupling 700mm	ea	\$ 290.00
CSP Coupling 800mm	ea	\$ 320.00
CSP Coupling 900mm	ea	\$ 335.00
CSP Coupling 1000mm	ea	\$ 350.00
CSP Coupling 1200mm	ea	\$ 380.00
CSP Coupling 1400mm	ea	\$ 400.00
Big O HDPE 200mm	m	\$ 35.95
Big O HDPE 250mm	m	\$ 51.57
Big O HDPE 300mm	m	\$ 63.67
DR35 PVC 200mm	m	\$ 62.43
DR35 PVC 250mm	m	\$ 99.17
DR35 PVC 300mm	m	\$ 141.23
DR35 PVC 375mm	m	\$ 203.81
DR35 PVC 400mm	m	\$ 240.62
DR35 PVC 450mm	m	\$ 314.24
DR35 PVC 500mm	m	\$ 397.72
DR35 PVC 525mm	m	\$ 439.46
DR35 PVC 600mm	m	\$ 558.27
DR35 PVC 675mm	m	\$ 700.28
Trench Excavation-Shallow Trench (asphalt)	linear meter	\$ 400.00
Trench Excavation-Shallow Trench (no asphalt)	linear meter	\$ 300.00



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Regional District of Central Kootenay
Environmental Services Department
Box 590, 202 Lakeside Drive,
Nelson, B.C. V1L 5R4

November 8th, 2023

Reference: Culvert Analysis for Existing Drainage Infrastructure at Riondel, BC – Revision B

With regards to previous discussions held between Jason McDiarmid (RDCK), Alexandra Divlakovski (RDCK), and Mr. Paul Kernan, P.Eng (of Highland Consulting Ltd), please find enclosed an assessment for the existing drainage infrastructure located at Riondel, BC.

1. PROJECT BACKGROUND

The client, Regional District of Central Kootenay (RDCK), is reviewing the condition and sizing of the existing drainage infrastructure at Riondel, BC. The existing drainage infrastructure primarily consists of corrugated steel pipe (CSP) culverts connected to CSP catch basins, with sections of HDPE, and wrapped steel. The condition of existing infrastructure was assessed, please refer to Condition Assessment Letter Report Rev A (2023) produced by Highland Consulting.

2. SITE OBSERVATIONS

An initial site visit was completed by Jacob Hildebrand of Highland Consulting on June 26th, 2023, in order to survey the locations of existing infrastructure. A follow up site visit was completed by Cooper Husband, EIT of Highland Consulting and Jason McDiarmid of RDCK on July 25th, 2023, in order to assess the condition of the existing infrastructure.

In addition, a desktop study of the existing drainage infrastructure (catch basins, culverts, storm sewer) was performed. Photographs and information for the community of Riondel's catch basins were provided in reports by KWL (Jan 1990), Highland Consulting (Sept 2010), and survey technologist Garth Norris (June 2008).

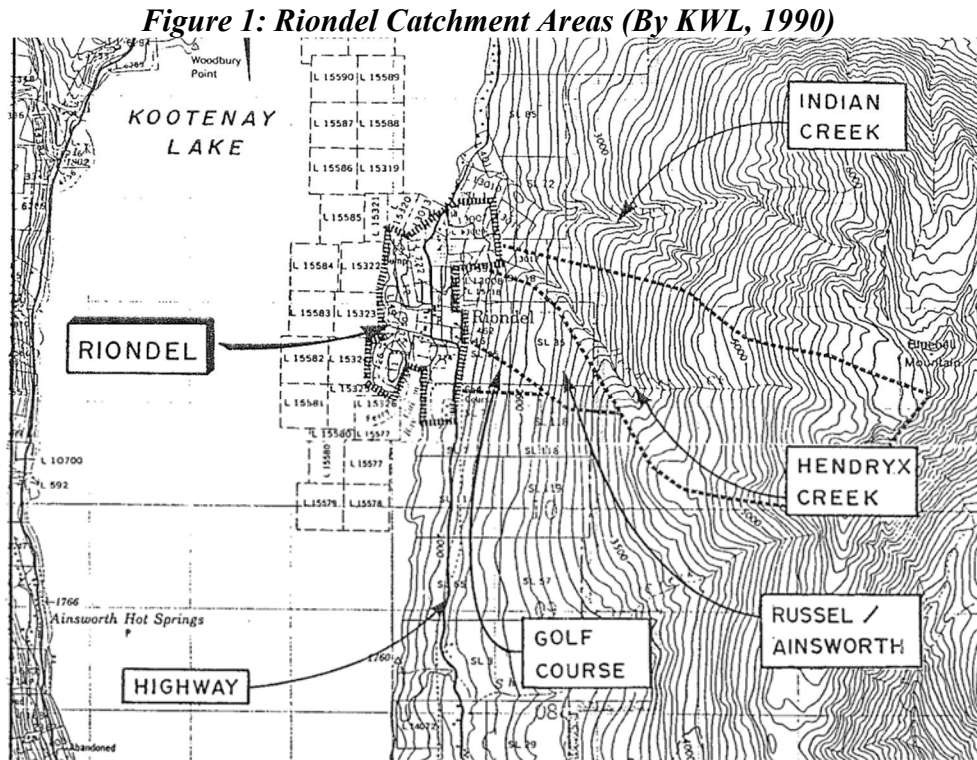
Several sections of drainage infrastructure had no flow during the site visit, including culverts #3, #4, #7, and #8. Please refer to Appendix A for drawings.



3. STORM RUNOFF

3.1 Catchment Areas

Three catchment areas were originally identified by KWL for the community of Riondel. These include 'Hendryx Creek', 'Russel/Ainsworth', and 'Golf Course'. The tributary area for each catchment is 480 ha, 105 ha, and 31 ha respectively, and can be seen in the figure below.



The location of each catchment area was reviewed. The catchment 'Golf Course' was determined to not drain into the Riondel drainage infrastructure, but to a separate outfall located at the Riondel golf course. An additional catchment area 'Riondel Community' was included in calculations and includes the area of the community that drains to the drainage infrastructure. Approximately one third of the area of the community of Riondel was determined to drain to this drainage infrastructure.

3.2 Event Return Periods and Rainfall Intensity

Flow calculations are based on the 100-year return period for the Intensity-Duration-Frequency (IDF) curve for the Nelson monitoring station, as shown in Appendix B. The IDF curve provides the intensity of the storm given the duration of the storm for each return period. The maximum runoff rate occurs when the duration of the storm is equal to the Time of Concentration for a tributary area. The Time of Concentration is the time required for the runoff from the most remote part of the area to reach the channel or culvert and consists of a combination of the Inlet Time, the amount of time for overland flow from the remotest point to reach the inlet location, and Travel Time, the time for flows to travel through a storm sewer. For the purposes of this report, the Nelson IDF curve was used in combination with a calculation spreadsheet.



Time of Concentration was determined to be 1 hr, 35mins, with a corresponding intensity of 20 mm/hr. Please refer to Appendix B for the full IDF.

3.3 Runoff Coefficient

The average surface slope for the entire drainage basin varies between approximately 20% and 40% and is primarily sparse forest cover. Published information for runoff coefficients varies significantly according to surface conditions, soil types, antecedent conditions, etc. To establish runoff coefficients from a similar source, runoff coefficients were selected from The City of Nelson Subdivision and Development Servicing Bylaw No. 3170, 2011, as seen in the table below.

Table 1: Runoff Coefficients
(City of Nelson Subdivision and Development Servicing Bylaw No. 3170, 2011)

Table 2.2		
Type of Area	Coefficient	
	1:10 year	1:100 year
Woodlot	0.05	0.10
Agricultural (cultivated)	0.10	0.15
Sub-Urban Residential	0.35	0.40
Single Family Residential	0.50	0.55
Low Density Multi-Family Residential	0.60	0.65
Apartment	0.70	0.75
Commercial	0.80	0.85
Industrial	0.80	0.85
Institutional	0.75	0.80
Roofs or Pavement	0.95	1.00
Parks/Cemeteries	0.15	0.20
Natural Grass	0.10	0.15

The runoff coefficient for forested areas was determined to be 0.10 for 100-year storm. The runoff coefficient for the Riondel community was determined to be 0.55 for the 100-year storm.

3.4 The Rational Method

The Rational Method was used to calculate the quantity of storm runoff (peak flows) for the area of the drainage basin onto the proposed development. The Rational Method is used for small drainage areas (less than 10 km²) and is based on a simple intensity / runoff relationship and the following assumptions:

- .1 The rainfall intensity is uniform over the entire basin during the entire storm duration;



- .2 The maximum runoff rate occurs when rainfall lasts as long or longer than the time of concentration; and
- .3 The time of concentration is the time required for the runoff from the most remote part of the basin to reach the channel and culvert.

The storm runoff was calculated for a local road with culverts for a 100-year rainfall event, and sizes of all channels and culverts were checked to ensure adequate capacity. The Rational Method is shown as follows:

$$Q_p = \frac{C i A}{360}$$

Where Q_p = Peak flows (m³/s);
 C = Runoff coefficient (dimensionless coefficient);
 i = Rainfall Intensity (mm/hr); and
 A = Tributary area (ha)

Hendryx Creek Catchment

$$Q_1 = \frac{0.1 \times 480 \text{ ha} \times 20 \text{ mm/hr}}{360} = 2.667 \text{ m}^3/\text{s};$$

Russel/Ainsworth Catchment

$$Q_1 = \frac{0.1 \times 105 \text{ ha} \times 20 \text{ mm/hr}}{360} = 0.583 \text{ m}^3/\text{s};$$

Riondel Community Catchment (approx.. 1/3rd of total community area)

$$Q_1 = \frac{0.55 \times 16.3 \text{ ha} \times 20 \text{ mm/hr}}{360} = 0.499 \text{ m}^3/\text{s};$$

3.5 Minimum Culvert Size

Manning's Formula was used to establish minimum culvert and storm sewer sizes. Manning's Formula is as follows:

$$Q = \frac{A R^{2/3} S^{1/2}}{n}$$

Where: Q = Flow (m³/s);
 A = Cross sectional area of pipe (assumed full) (m²);
 R = Hydraulic radius (m);
 S = Slope of Hydraulic Grade Line in open channel, or Energy Grade Line in pipe. Assumed to be equal to average slope of pipe 5% or 0.05 m/m; and
 n = Manning's roughness coefficient (0.024 for corrugated steel pipe – CSP, 0.009 for PVC).



Example calculations are presented below:

Capacity of 450 mm (18") CSP:

$$Q = \frac{0.159 \text{ m}^2 \times (0.113 \text{ m})^{2/3} \times 0.05^{1/2}}{0.024}$$

$$= \underline{\underline{0.345 \text{ m}^3/\text{s}}}$$

Capacity of 450 mm (18") PVC:

$$Q = \frac{0.159 \text{ m}^2 \times (0.113 \text{ m})^{2/3} \times 0.05^{1/2}}{0.009}$$

$$= \underline{\underline{0.921 \text{ m}^3/\text{s}}}$$

Capacity of 600 mm (24") CSP:

$$Q = \frac{0.283 \text{ m}^2 \times (0.15 \text{ m})^{2/3} \times 0.05^{1/2}}{0.024}$$

$$= \underline{\underline{0.744 \text{ m}^3/\text{s}}}$$

Capacity of 600 mm (24") PVC:

$$Q = \frac{0.283 \text{ m}^2 \times (0.15 \text{ m})^{2/3} \times 0.05^{1/2}}{0.009}$$

$$= \underline{\underline{1.983 \text{ m}^3/\text{s}}}$$

Maximum flow rates for all piping reviewed can be found in Appendix C.

Catchment areas were reviewed in order to determine flows contributing to each culvert and section of storm sewer. Infrastructure was sized based on expected flows for the 100 year storm and compared to capacities for different sizes of pipe. Peak flows for each culvert and storm sewer section can be found in Appendix C. Results are summarized below:

Table 2: Minimum Culvert Sizing

Culvert #	Crossing	Existing Material	Current Size, mm	Minimum Culvert Size, CSP, mm
1	Eastman Ave	CSP	900	1200
2	McGarvy St	CSP	600	1200
3	Russel Ave	CSP	600	600
4	Alley – Russel Ave / Ainsworth Ave	CSP / BIG O HDPE	200/500	700
5	Riondel Rd	CSP	300	600
6	Fowler St	CSP	600	600
7	Galena Bay Wharf Rd	CSP	300	400
8	Alley – Russel Ave / Ainsworth Ave	BIG O HDPE	200	Private homeowner installation - not assessed



Table 3: Minimum Storm Sewer Sizing

Storm Sewer Section	Existing Materials	Current Size, mm	Minimum Size, CSP, mm	Minimum Size, PVC, mm
Weir to McGarvy Culvert	CSP, Wrapped Steel	200 - 500	700	450
Basin 1 to Eastman Ave Culvert	CSP, Big O HDPE	200 - 500	400	300
Basin 10 to Rock Pit	Big O HDPE	This section of storm sewer is used to drain ground water only and is not recommended to be upgraded.		

CSP and Big O HDPE are typically used for culverts but are considered non-standard materials for storm drainage lines as they are subject to high potential infiltration rates.

4. DISCUSSION / RECOMMENDATIONS

Based on the Rational Method and the catchment areas identified, peak flow storm water runoff was calculated for each culvert and section of storm sewer, with a maximum value of 3.749 m³/s located at the Eastman Ave culvert. The Riondel drainage system was likely installed with intended underground infiltration, which could impact design storm flows. The Regional District has no records of drainage system overflows in the past.

Further investigation is required to establish a Master Storm Management Plan for Riondel with storm water modeling of complete storm system.

Based on site reconnaissance, review of existing drainage infrastructure documentation, and drainage calculations contained in this report, the following recommendations are provided for the Riondel Storm infrastructure Upgrade.

1. Recommendations as per the Condition Assessment letter by HCL should be followed.
2. Culverts and storm sewers should be upsized to sizes identified in section 3.5. No flooding was identified during site visits, with several sections of drainage infrastructure being dry. As such, priority for this item is recognized as low, but recommended to be completed when infrastructure upgrades occur.



5. CLOSURE

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Highland Consulting Ltd trusts that this report meets your requirements, however if you have any questions or require further information, please do not hesitate in contacting the undersigned.

Yours sincerely,
HIGHLAND CONSULTING LTD
Permit to Practice # 1002652

Designed

Cooper Husband, EIT Civil Engineer

Reviewed

Paul Kernan, P.Eng, Civil Engineer

Appendices:

Appendix A
Appendix B
Appendix C

Drawings
Intensity-Duration-Frequency (IDF) Curve
Calculations



References:

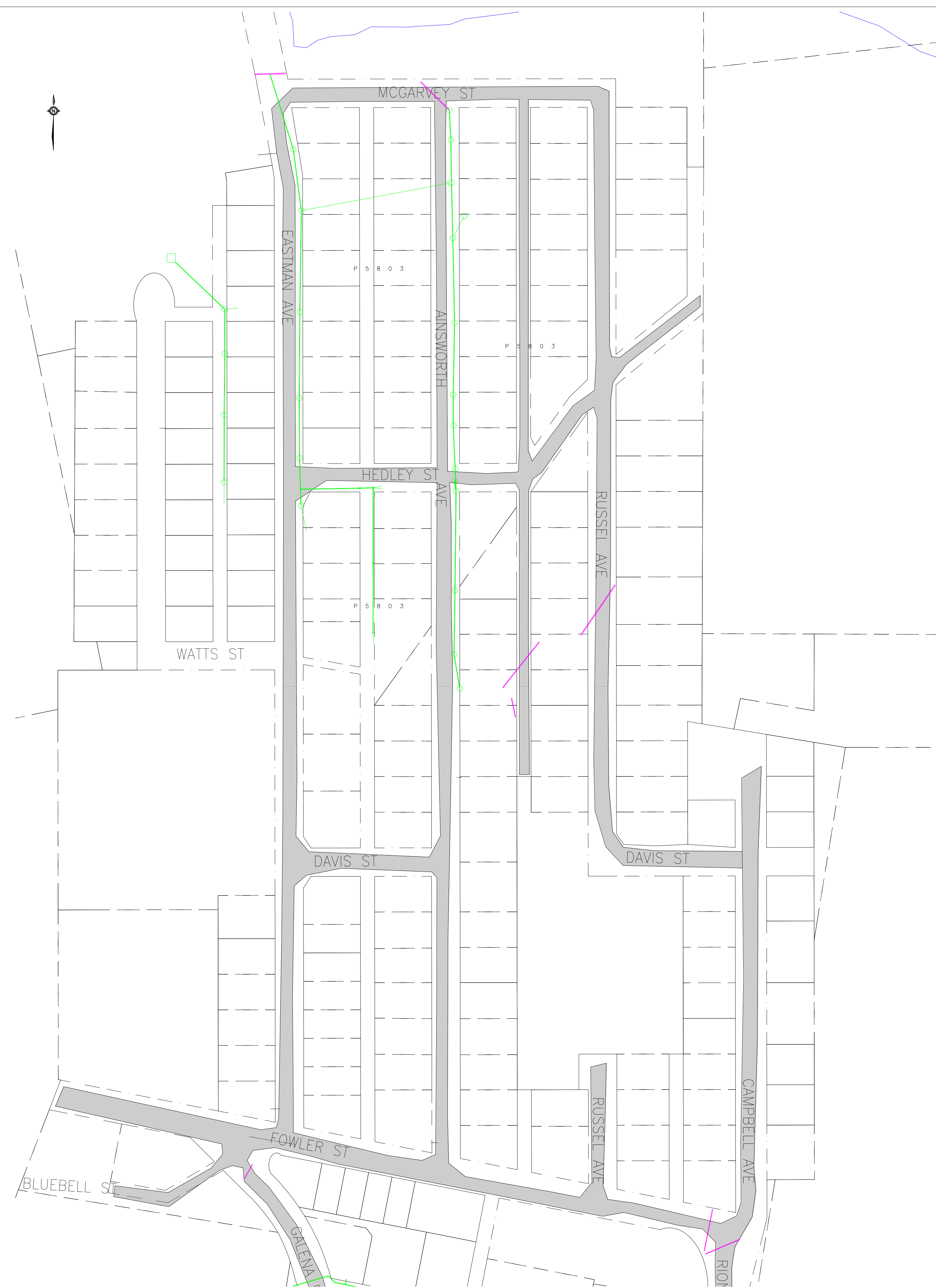
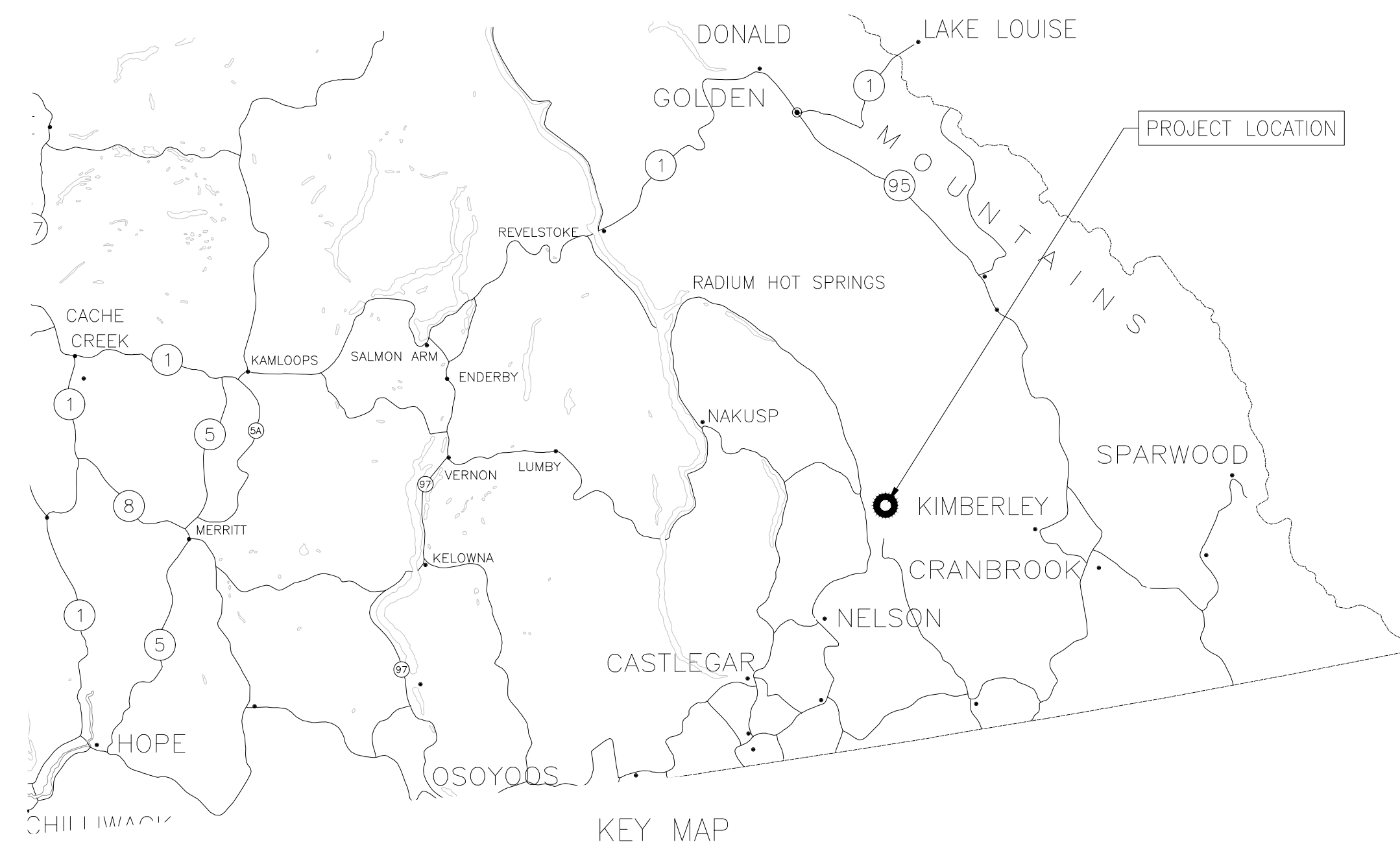
Kerr Wood Leidal Associates LTD. (1990). REPORT ON DRAINAGE FOR RIONDEL

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ClimateData.ca (2022). Nelson CS, BC, Short Duration Rainfall Intensity-Duration-Frequency Data (2022/10/31). Retrieved from [Download — Climate Data Canada](#)

APPENDIX A

Drawings



LEGEND:

- RDCK CULVERT/STORM SEWER
- MoTi CULVERT
- CATCH BASIN

GENERAL NOTES:

ALL DIMENSIONS ARE SPECIFIED IN METERS UNLESS OTHERWISE STATED.

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AERIAL IMAGERY FROM ROCK MAPPING IMPORTED (07/17/2023)

REV.	DESCRIPTION	DATE
C	ISSUED TO CLIENT	06-NOV-23
B	ISSUED TO CLIENT	31-AUG-23
A	FOR REVIEW	23-AUG-23

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SEAL

PROJECT TITLE
RIONDEL STORM

DRAWING TITLE
LOCATION MAP




CLIENT NAME
RDCK

SCALE: REFER TO DWG	JOB No. 23611
DRAWN: JH	REVISION 
CHECKED: PK	DWG. No. S01
DATE: 17-Aug-22	
PLOT: 6-Nov-23	

**PRELIMINARY
NOT FOR CONSTRUCTION**



LEGEND:

-  RDCK CULVERT/STORM SEWER
-  MoTi CULVERT
-  CATCH BASIN

GENERAL NOTES:

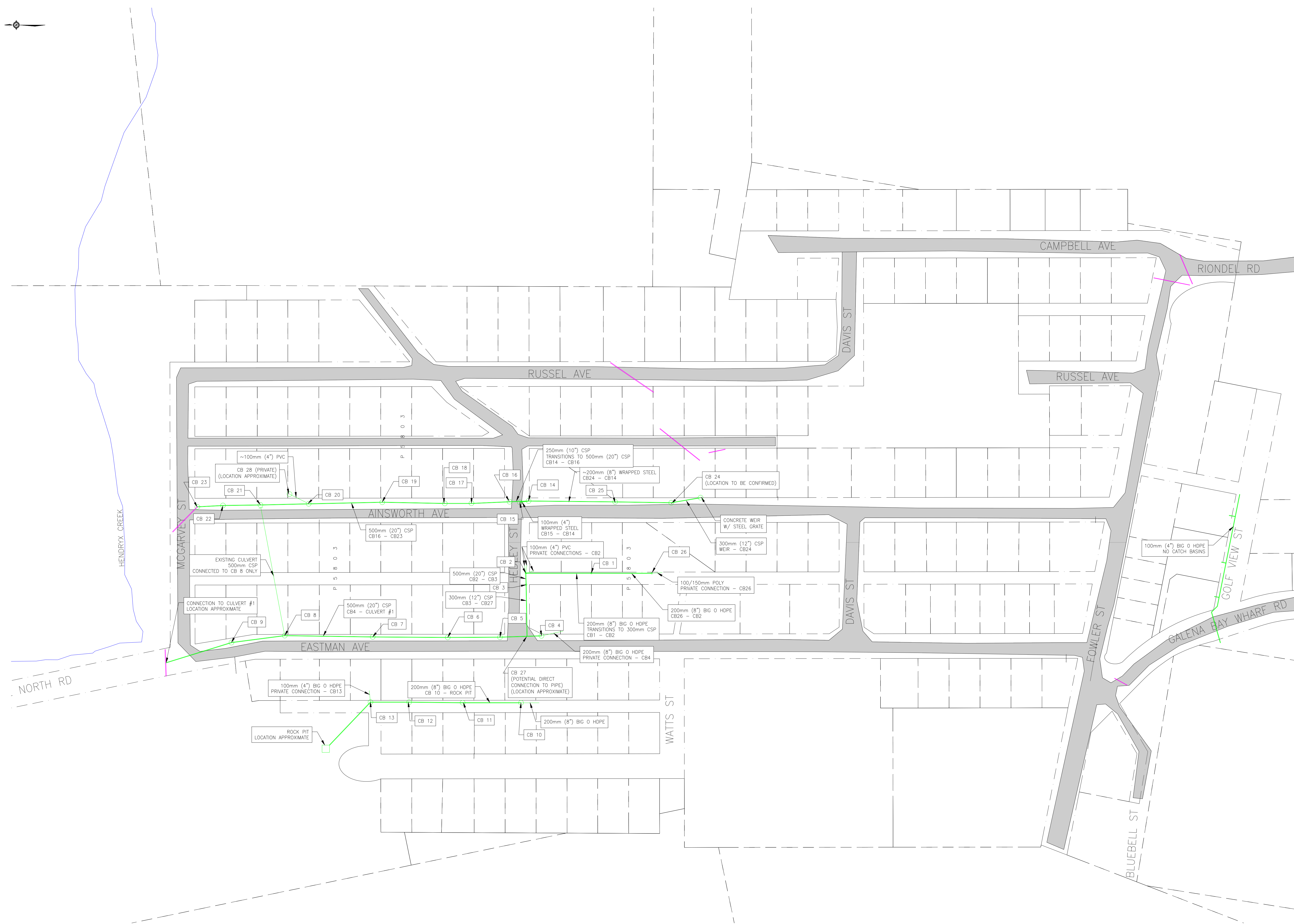
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AERIAL IMAGERY FROM ROCK MAPPING IMPORTED (07/17/2023)



SITE PLAN VIEW
SCALE: 1:1250

PRELIMINARY
NOT FOR CONSTRUCTION

REV.	DESCRIPTION	DATE
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B	ISSUED TO CLIENT	31-AUG-23
A	FOR REVIEW	23-AUG-23
	ISSUED	

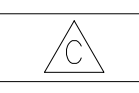


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SEAL

PROJECT TITLE		RIONDEL STORM
DRAWING TITLE		EXISTING INFRASTRUCTURE (RDCK)
CLIENT NAME		RDCK
SCALE: REFER TO DWG	JOB No.	23611
DRAWN: JH	REVISION	
CHECKED: PK	DWG. No.	S03
DATE: 17-Aug-22		
PLOT: 6-Nov-23		

FILE: C:\Users\pkernan\OneDrive\Documents\2023\11-26-23\RDCK STORM SEWER\RDCK\RDCK02\RDCK02\RDCK02\RDCK02.dwg

Catch Basin	Condition Assessment (Good/Fair/Poor)	Comments
CB 1	Poor	
CB 2	Poor	
CB 3	Poor	
CB 4	Poor	
CB 5	Poor	
CB 6	Poor	
CB 7	Poor	
CB 8	Poor	
CB 9	Poor	
CB 10	Poor	
CB 11	Poor	
CB 12	Poor	
CB 13	Poor	
CB 14	Very Poor	Dangerous
CB 15	Poor	
CB 16	Poor	
CB 17	Poor	
CB 18	Poor	
CB 19	Poor	
CB 20	Poor	
CB 21	Poor	
CB 22	Poor	
CB 23	Poor	
CB 24	Very Poor	Buried
CB 25	Very Poor	
CB 26	Very Poor	
CB 27	Very Poor	Buried
CB 28	Very Poor	Private
Weir	Fair	Weir

LEGEND:

- RDCK CULVERT/STORM SEWER
- MoTi CULVERT
- CATCH BASIN

GENERAL NOTES:

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 AERIAL IMAGERY FROM ROCK MAPPING IMPORTED (07/17/2023)



SITE PLAN VIEW
SCALE=1:1250

PRELIMINARY
NOT FOR CONSTRUCTION

REV.	DESCRIPTION	DATE
C	ISSUED TO CLIENT	06-NOV-23
B	ISSUED TO CLIENT	31-AUG-23
A	FOR REVIEW	23-AUG-23
	ISSUED	

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SEAL

PROJECT TITLE
RIONDEL STORM

DRAWING TITLE
CONDITION ASSESSMENT

CLIENT NAME
RDCK

SCALE: REFER TO DWG	JOB No. 23611
DRAWN: JH	REVISION
CHECKED: PK	DWG. No. S04
DATE: 17-Aug-22	
PLOT: 6-Nov-23	

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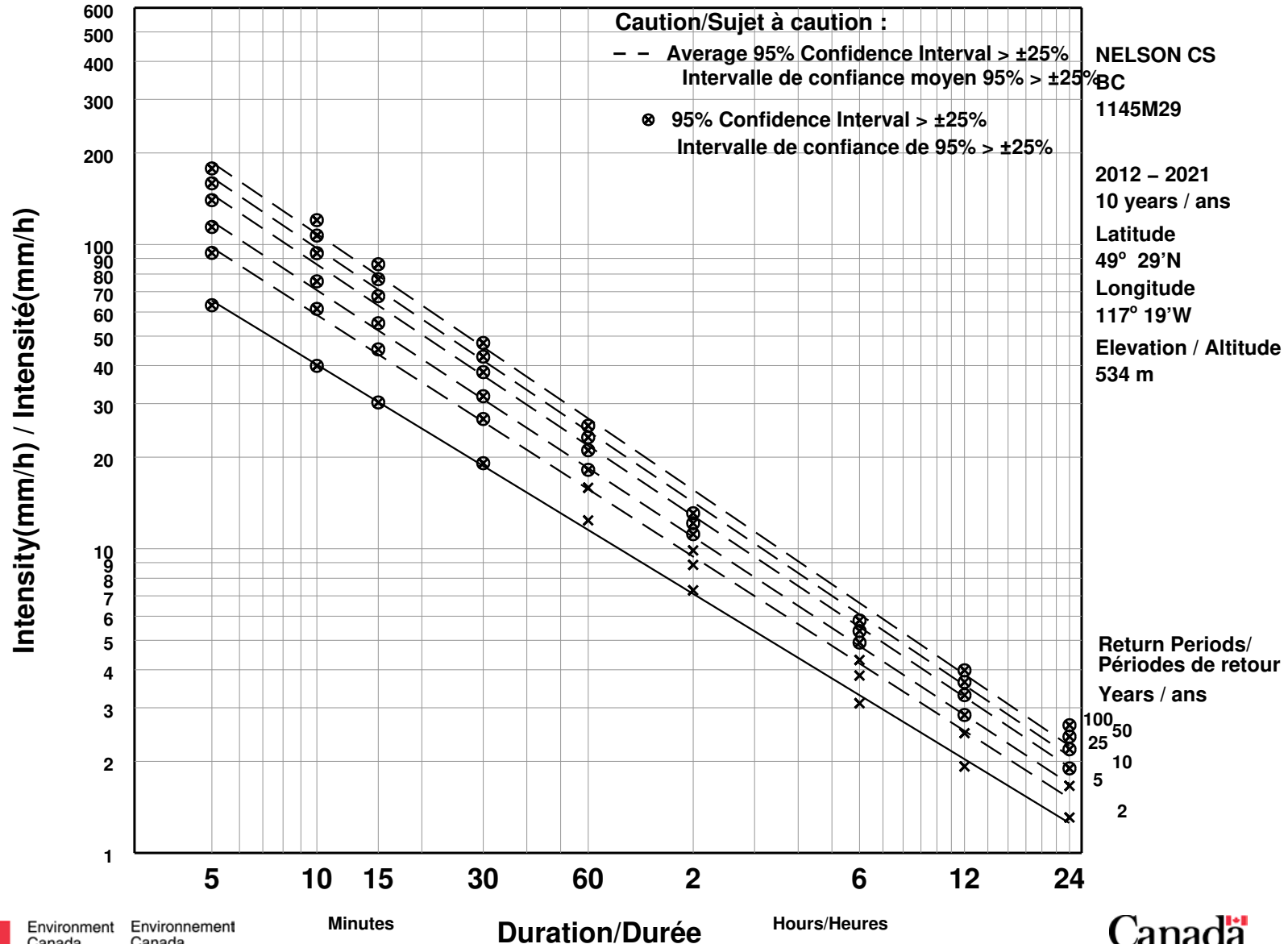
APPENDIX B

Intensity-Duration-Frequency (IDF) Curve

Short Duration Rainfall Intensity–Duration–Frequency Data

2022/10/31

Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée



APPENDIX C

Calculations

CALCULATIONS

Maximum Flow Rates, CSP, Pipes = 100% full

CSP	300 mm
Cross sectional area of pipe (A)	0.071 m ²
Hydraulic Radius (m)	0.075 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.024
Flow (Q)	0.117 m ³ /s

CSP	400 mm
Cross sectional area of pipe (A)	0.126 m ²
Hydraulic Radius (m)	0.1 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.024
Flow (Q)	0.252 m ³ /s

CSP	450 mm
Cross sectional area of pipe (A)	0.159 m ²
Hydraulic Radius (m)	0.113 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.024
Flow (Q)	0.345 m ³ /s

CSP	500 mm
Cross sectional area of pipe (A)	0.196 m ²
Hydraulic Radius (m)	0.125 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.024
Flow (Q)	0.457 m ³ /s

CSP	600 mm
Cross sectional area of pipe (A)	0.283 m ²
Hydraulic Radius (m)	0.15 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.024
Flow (Q)	0.744 m ³ /s

CSP	700 mm
Cross sectional area of pipe (A)	0.385 m ²
Hydraulic Radius (m)	0.175 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.024
Flow (Q)	1.122 m ³ /s

CALCULATIONS

CSP	800 mm
Cross sectional area of pipe (A)	0.503 m ²
Hydraulic Radius (m)	0.2 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.024
Flow (Q)	1.602 m ³ /s

CSP	900 mm
Cross sectional area of pipe (A)	0.636 m ²
Hydraulic Radius (m)	0.225 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.024
Flow (Q)	2.193 m ³ /s

CSP	1000 mm
Cross sectional area of pipe (A)	0.785 m ²
Hydraulic Radius (m)	0.25 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.024
Flow (Q)	2.904 m ³ /s

CSP	1200 mm
Cross sectional area of pipe (A)	1.131 m ²
Hydraulic Radius (m)	0.3 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.024
Flow (Q)	4.722 m ³ /s

CSP	1400 mm
Cross sectional area of pipe (A)	1.539 m ²
Hydraulic Radius (m)	0.35 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.024
Flow (Q)	7.123 m ³ /s

CALCULATIONS

Maximum Flow Rates, PVC, Pipes = 100% full

CSP	300 mm
Cross sectional area of pipe (A)	0.071 m ²
Hydraulic Radius (m)	0.075 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.009
Flow (Q)	0.312 m ³ /s

CSP	400 mm
Cross sectional area of pipe (A)	0.126 m ²
Hydraulic Radius (m)	0.1 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.009
Flow (Q)	0.673 m ³ /s

CSP	450 mm
Cross sectional area of pipe (A)	0.159 m ²
Hydraulic Radius (m)	0.113 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.009
Flow (Q)	0.921 m ³ /s

CSP	500 mm
Cross sectional area of pipe (A)	0.196 m ²
Hydraulic Radius (m)	0.125 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.009
Flow (Q)	1.22 m ³ /s

CSP	600 mm
Cross sectional area of pipe (A)	0.283 m ²
Hydraulic Radius (m)	0.15 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.009
Flow (Q)	1.983 m ³ /s

CSP	700 mm
Cross sectional area of pipe (A)	0.385 m ²
Hydraulic Radius (m)	0.175 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.009
Flow (Q)	2.991 m ³ /s

CALCULATIONS

CSP	800 mm
Cross sectional area of pipe (A)	0.503 m ²
Hydraulic Radius (m)	0.2 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.009
Flow (Q)	4.271 m ³ /s

CSP	900 mm
Cross sectional area of pipe (A)	0.636 m ²
Hydraulic Radius (m)	0.225 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.009
Flow (Q)	5.847 m ³ /s

CSP	1000 mm
Cross sectional area of pipe (A)	0.785 m ²
Hydraulic Radius (m)	0.25 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.009
Flow (Q)	7.744 m ³ /s

CSP	1200 mm
Cross sectional area of pipe (A)	1.131 m ²
Hydraulic Radius (m)	0.3 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.009
Flow (Q)	12.59 m ³ /s

CSP	1400 mm
Cross sectional area of pipe (A)	1.539 m ²
Hydraulic Radius (m)	0.35 m
Slope of hydraulic grade line (S)	0.05 m/m
Mannings roughness coefficient (n)	0.009
Flow (Q)	18.99 m ³ /s

CALCULATIONS

6) CULVERT SIZING, CSP

CV1	Crossing	Eastman Ave
	Current Size	900mm
	Inputs	Tributary Area 1: Hendryx Creek Tributary Area 2: Russel/Ainsworth Tributary Area 3: Riondel Community (Appx. 1/3rd)
	Peak Flows (Q)	3.749 m3/s
	Recommended Size	1200 mm

** Peak flow is comparable to HCL (3.733m3/s) and KWL (3.46 m3/s)*

CV2	Crossing	McGarvy Street
	Current Size	600mm
	Inputs	Tributary Area 1: Hendryx Creek Tributary Area 2: Russel/Ainsworth Tributary Area 3: Riondel Community (Appx. 1/6th)
	Peak Flows (Q)	3.5 m3/s
	Recommended Size	1200 mm

CV3	Crossing	Russel Ave
	Current Size	600mm
	Inputs	Tributary Area 2: Russel/Ainsworth Tributary Area 3: Riondel Community (Appx. 1/10th)
	Peak Flows (Q)	0.733 m3/s
	Recommended Size	600 mm

CV4	Crossing	Alley - Russel Ave and Ainsworth Ave
	Current Size	200mm transitions to 500mm
	Inputs	Tributary Area 2: Russel/Ainsworth Tributary Area 3: Riondel Community (Appx. 1/6th)
	Peak Flows (Q)	0.833 m3/s
	Recommended Size	700 mm

CALCULATIONS

CV5	Crossing	Riondel Rd
	Current Size	300mm
	Inputs	Tributary Area 2: Russel/Ainsworth
	Peak Flows (Q)	0.583 m3/s
	Recommended Size	600 mm

*Unclear what % of Russel/Ainsworth tributary area flows into this culvert

*100% has been assumed to be conservative. Further investigation is required

CV6	Crossing	Fowler St
	Current Size	600mm
	Inputs	Tributary Area 2: Russel/Ainsworth
	Peak Flows (Q)	0.583 m3/s
	Recommended Size	600 mm

*Unclear what % of Russel/Ainsworth tributary area flows into this culvert

*100% has been assumed to be conservative. Further investigation is required

CV7	Crossing	Galena Bay Wharf Rd
	Current Size	300mm
	Inputs	Tributary Area 3: Riondel Community (Appx. 1/6th)
	Peak Flows (Q)	0.25 m3/s
	Recommended Size	400 mm

CV8	Crossing	Alley - Ainsworth Ave Russel Ave
	Current Size	200mm
	Culvert is privately installed by homeowner, therefore not assessed	

CALCULATIONS

7) STORM SEWERS SIZING, CSP

SS 1	Weir to McGarvy Culvert	
	Current Size	
	Inputs	Tributary Area 2: Russel/Ainsworth Tributary Area 3: Riondel Community (Appx. 1/6th)
	Peak Flows (Q)	0.833 m³/s
	Recommended Size	700 mm

SS 2	Basin 1 to Eastman Ave Culvert	
	Current Size	
	Inputs	Tributary Area 3: Riondel Community (Appx. 1/6th)
	Peak Flows (Q)	0.25 m³/s
	Recommended Size	400 mm

SS 3	Basin 10 to Rock Pit	
	Current Size	
	As this section of storm sewer is used to drain ground water only, it is not recommended to upgrade this section of pipe	

CALCULATIONS

7) STORM SEWERS SIZING, PVC

SS 1	Weir to McGarvy Culvert	
	Current Size	
	Inputs	Tributary Area 2: Russel/Ainsworth Tributary Area 3: Riondel Community (Appx. 1/6th)
	Peak Flows (Q)	0.833 m³/s
	Recommended Size	450 mm

SS 2	Basin 1 to Eastman Ave Culvert	
	Current Size	
	Inputs	Tributary Area 3: Riondel Community (Appx. 1/6th)
	Peak Flows (Q)	0.25 m³/s
	Recommended Size	300 mm

SS 3	Basin 10 to Rock Pit	
	Current Size	
	As this section of storm sewer is used to drain ground water only, it is not recommended to upgrade this section of pipe	

Regional District of Central Kootenay

S165 Drainage-Area A

2024 to 2028 Financial Plan

V-P2

Version P2 - Issued for CAC meeting.

SYSTEM INFORMATION AND RATES

	No.	2023	2024	2025	2026	2027	2028
Number of Active Parcels in Service Area	214						
Average Tax per Active Parcel		72	117	176	193	213	251
Requisition Tax % Increase		20%	62.21%	50%	10%	10%	18%

REVENUE

Account	2020	2021	2022	Average	2023 Budget	2023 YTD Actual	2023 Est Year End	2024 Budget	2025 Budget	2026 Budget	2027 Budget	2028 Budget
41010 Requisitions	11,689	12,273	12,887	11,981	15,464	15,464	15,464	25,084	37,626	41,389	45,528	53,723
43100 Proceeds from Borrowing								106,000				
45000 Transfer from Reserves					51,000		16,434	46,000	0	0	0	27,000
49100 Prior Year Surplus	2,606	4,877	1,096	3,742	2,787	2,788	2,788	8,262	0	0	0	0
Revenue	14,295	17,150	13,983	15,723	69,251	18,252	34,686	185,346	37,626	41,389	45,528	80,723

OPERATING EXPENSES

Account	2020	2021	2022	Average	2023 Budget	2023 YTD Actual	2023 Est Year End	2024 Budget	2025 Budget	2026 Budget	2027 Budget	2028 Budget
51010 Salaries	522	1,292	1,397	907	2,172	435	580	1,000	1,040	1,061	1,082	1,104
- CAP support								1,000				
51020 Overtime - Subtotal		35			104	0	0	111	115	118	120	122
51030 Benefits	77	238	172	158	565	63	84	260	270	276	281	287
- CAP support								260				
53050 Insurance	21	25	96	23	100	57	76	106	110	112	115	117
54020 Professional Fees					0		0	0	0	0	0	0
- Asset Management Plan and 10 Year Update Plan					0		0	0				
54030 Contracted Services	60			60	5,000	0	0	500	520	530	541	552
- repairs					0			0	0	0	0	0
- Camera Work & Field Assessment					0			0	0	0	0	0
54040 Consulting Fees					15,000	15,459	16,434					
- Asset Management Plan and 10 Year Update Plan					0	0	0	0	0	0	0	0
55010 Repairs and Maintenance		163			2,000	0	0	2,124	2,209	2,253	2,298	2,344
55040 Utilities					0			0	0	0	0	0
55050 Vehicles					0			0	0	0	0	0
55060 Rentals - Subtotal					0			0	0	0	0	0
Operating Expenses	680	1,753	1,664	1,148	24,940	16,014	17,174	5,361	4,265	4,350	4,437	4,526

CAPITAL EXPENSES

Account	2020	2021	2022	Average	2023 Budget	2023 YTD Actual	2023 Est Year End	2024 Budget	2025 Budget	2026 Budget	2027 Budget	2028 Budget
60000 NO CAP YET RIO W - Ainsworth South Drain Line Replacement					36,000		0	152,000				
60000 NO CAP YET RIO W - Future Upgrades												27,000
Capital Expenses	0	0		0	36,000		0	152,000	0	0	0	27,000

NON-OPERATING EXPENSES

Account	2020	2021	2022	Average	2023 Budget	2023 YTD Actual	2023 Est Year End	2024 Budget	2025 Budget	2026 Budget	2027 Budget	2028 Budget
56120 Short-Term Financing Interest 2023									5,968	4,901	3,775	2,585
56120 Short-Term Financing Principal 2023									18,943	20,010	21,137	22,327
59000 Contribution to Reserve	2,203	7,209	2,162	4,706	760	760	760	9,967	111	3,622	7,504	15,436
59500 Transfer to Other Service	1,337	1,337	1,396	1,337	1,577	940	2,517	11,675	1,742	1,777	1,812	1,848
59510 Transfer to Other Service - General Admin. Fee	300	300	300	300	300	300	300	319	331	338	345	352
59550 Transfer to Other Service - Environmental Services Fee	4,508	5,455	5,673	4,982	5,673	5,673	5,673	6,025	6,266	6,391	6,519	6,649
Non-Operating Expenses	8,348	14,301	9,531	11,324	8,310	7,673	9,250	27,985	33,361	37,039	41,090	49,197

Principal Plus Contribution to Reserves

Total Service	1	(5,435)	8,262	0	0	0	0
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59500 TRANSFER TO OTHER SERVICE

Account	Work Order	2020	2021	2022	Average	2023 Budget	2023 YTD Actual	2023 Est Year End	2024 Budget	2025 Budget	2026 Budget	2027 Budget	2028 Budget
59500 OPR321-112	Riondel Drainage-Transfer to Other Service - Tax Bylaw Public Assent Process								10,000				
59500 OPR321-112	Riondel Drainage-Transfer to Other Service - Fleet	910	1,058	709	984	1,293	0	1,293	1,373	1,428	1,457	1,486	1,516
59500 OPR321-114	RIO F Riondel Drainage-Transfer to Other Service - Project Management					0	940	940					
59500 OPR321-117	Riondel Drainage-Transfer to Other Service - Operator Admin	427	279	687	353	284	0	284	302	314	320	326	333
Total Transfer to Other Service		1,337	1,337	1,396	1,337	1,577	940	2,517	11,675	1,742	1,777	1,812	1,848

RESERVES

	2023	2024	2025	2026	2027	2028
Balance Previous Year	51,216	36,055	382	497	4,124	11,669
Interest (Assumed 1%)	512	361	4	5	41	117
Contribution	760	9,967	111	3,622	7,504	15,436
Withdrawal	(16,434)	(46,000)	0	0	0	(27,000)
	36,055	382	497	4,124	11,669	221

2022 Asset Management Plan Identified Contribution to Reserves

32,433

Excludes 2023 planned replacements

Regional District of Central Kootenay

V-P2

Version P - Issued for CAC meeting.

S241 Water Utility-Area A (Riondel)

2024 to 2028 Financial Plan

SYSTEM INFORMATION AND RATES

	No.	2023	2024	2025	2026	2027	2028
Active Accounts	199						
M-RIONDEL-DWELLING-METERED		5%	6%	3%	3%	3%	3%
- Metered Base Rate	1	333	353	364	374	386	397
- Consumption (m3)	30	1.27	1.35	1.39	1.43	1.47	1.52
Service Charges % Increase		5%	6%	3%	3%	3%	3%
RIO-COMMERCIAL- BUSINESS	1	838	888	915	942	971	1,000
RIO-COMMERCIAL- CAMPGROUND	1	4,162	4,412	4,544	4,680	4,821	4,965
RIO-COMMERCIAL- GOLF COURSE	1	15,575	16,510	17,005	17,515	18,040	18,582
RIO-COMMERCIAL-FOOD & BEV SERVICES	1	1,456	1,543	1,590	1,637	1,686	1,737
RIO-COMMERCIAL-REC-SEASONAL-PER UNIT	2	520	551	568	585	602	620
RIO-DWELLING-MULTI FAMILY-ADDITIONAL	6	838	888	915	942	971	1,000
RIO-DWELLING-MULTI FAMILY-FIRST DWELLING	3	838	888	915	942	971	1,000
RIO-DWELLING-SINGLE FAMILY	191	838	888	915	942	971	1,000
RIO-INSTITUTIONAL- AMBULANCE STATION	1	1,243	1,318	1,357	1,398	1,440	1,483
RIO-INSTITUTIONAL- CHURCH	1	838	888	915	942	971	1,000
RIO-INSTITUTIONAL- CHURCH SEASONAL	1	520	551	568	585	602	620
RIO-INSTITUTIONAL-RDCK-FIRE HALL	1	0	0	0	0	0	0
Number of Parcels Assessed Frontage Tax	214						
Parcel Tax % Increase		4%	0%	2%	2%	2%	2%
		257	257	262	267	273	278

REVENUE

Account	2020	2021	2022	Average	2023 Budget	2023 YTD Actual	2023 Est Year End	2024 Budget	2025 Budget	2026 Budget	2027 Budget	2028 Budget
41010 Requisitions												
41015 Parcel Taxes	52,876	52,876	52,876	52,876	54,991	54,991	54,991	54,991	56,091	57,213	58,357	59,524
42020 Sale of Services		1,460		1,460								
42025 Sale of Services - Specified	1,000	(1,000)		0		200	200					
42030 User Fees	165,494	173,590	181,234	173,439	190,609	189,357	189,357	205,262	211,420	217,762	224,295	231,024
43100 Proceeds from Borrowing												320,000
43020 Grants					17,191	17,191	17,191					
43030 Community Works Grants (Internal)												
45000 Transfer from Reserves	35,574	2,196		18,885	160,000	0	2,280	168,000	75,000	0	0	580,000
49100 Prior Year Surplus	621	13,009	22,351	11,994	(5,300)	(5,243)	(5,243)	4,015	0	0	0	0
Revenue	255,565	242,131	256,461	258,654	417,491	256,495	258,775	432,268	342,510	274,975	282,652	1,190,548

OPERATING EXPENSES

Account	2020	2021	2022	Average	2023 Budget	2023 YTD Actual	2023 Est Year End	2024 Budget	2025 Budget	2026 Budget	2027 Budget	2028 Budget
51010 Salaries	27,224	25,590	28,006	26,940	35,671	21,188	28,251	35,671	37,098	37,840	38,597	39,368
51010 - Leak detection					1,000			1,000				
51020 Overtime	2,227	785	418	1,143	2,118	1,214	1,619	2,249	2,339	2,386	2,434	2,482
51030 Benefits	4,312	4,865	4,116	4,431	9,274	3,648	4,864	9,849	10,243	10,448	10,657	10,870
51030 - Leak detection					190			260				
51050 Employee Health & Safety	0	0	0	0	0	854	854	0	0	0	0	0
51500 Directors - Allowance & Stipend			386		401	505	673	715	744	759	774	789
51565 Directors - Mileage			76		79	187	250	265	276	281	287	293
52010 Travel	271	0	0	90	289	0	0	307	319	326	332	339
52020 Education and Training	0	0	0	0	212	10	1,500	225	234	239	244	248
52030 Memberships, Dues & Subscriptions	60	0	300	120	312	300	300	331	345	351	359	366
53020 Admin, Office Supplies & Postage	0	5	0	2				0	0	0	0	0
53030 Communication	1,170	1,215	1,072	1,152	1,115	777	1,036	1,184	1,231	1,256	1,281	1,307
53050 Insurance	4,093	3,941	5,247	4,427	4,782	4,024	5,366	5,078	5,282	5,387	5,495	5,605
53080 Licence & Permits	150	761	310	407	1,147	414	553	587	610	623	635	648
54030 Contracted Services	6,936	9,952	4,775	7,221	8,243	2,866	3,821	8,754	9,104	9,286	9,472	9,662
- Invasive Plant Management					1,110		1,110	0	0	0	0	0
55010 Repairs & Maintenance	4,926	7,249	13,972	8,716	5,610	11,793	11,793	5,958	6,196	6,320	6,446	6,575
55020 Operating Supplies	712	693	4,575	1,993	4,758	4,146	5,528	5,053	5,255	5,360	5,467	5,577
55025 Chemicals	6,437	7,584	8,870	7,630	9,225	9,547	12,730	9,797	10,189	10,393	10,600	10,812
55030 Equipment	399	296	0	232	0	433	577	613	638	650	663	677
55030 - Chlorine analyser								8,000				
55040 Utilities	6,156	6,268	6,489	6,304	6,749	4,932	6,576	7,167	7,454	7,603	7,755	7,910
55050 Vehicles	902	1,112	1,493	1,169	1,553	1,069	1,426	1,649	1,715	1,750	1,785	1,820
Operating Expenses	65,975	70,316	80,105	71,978	93,838	67,910	88,827	104,715	99,273	101,258	103,283	105,349

CAPITAL EXPENSES

Account	2020	2021	2022	Average	2023 Budget	2023 YTD Actual	2023 Est Year End	2024 Budget	2025 Budget	2026 Budget	2027 Budget	2028 Budget
60000 CAP1005-100 Reservoir Valve Chamber & Meter					70,000	0	0	70,000				
60000 CAP1092-100 RIO W - 2024 WTP Membrane Replacement & Capacity Upgrade									75,000			
60000 CAP1217-100 RIO W - 2021 Intake Repairs					10,000	0	0	10,000				
60000 CAP1216-100 RIO W - 2022 portable generator purchase and install					80,000	0	0	80,000				
60000 NO CAP YET Rio W - ? Twinning reservoir?												900,000
Capital Expenses					160,000	0	0	160,000	75,000	0	0	900,000

NON-OPERATING EXPENSES

Account	2020	2021	2022	Average	2023 Budget	2023 YTD Actual	2023 Est Year End	2024 Budget	2025 Budget	2026 Budget	2027 Budget	2028 Budget
56010 Debenture Interest (MFA 117)	8,125	7,150	3,675	6,317	3,675	1,032	3,675	3,675	3,675	3,675	3,675	3,675
56020 Debenture Principal (MFA 117)	6,003	6,003	6,699	6,235	6,699	0	6,699	6,699	6,699	6,699	6,699	6,699
59000 Contribution to Reserve	26,616	50,941	89,549	55,702	87,895	87,895	87,895	91,459	89,514	93,626	97,884	102,292
59500 Transfer to Other Service	17,359	12,162	19,548	16,356	12,236	1,710	14,516	9,278	9,649	9,842	10,039	10,239
59510 Transfer to Other Service - General Admin. Fee	15,200	15,656	16,439	15,765	13,183	13,183	13,183	14,000	14,560	14,852	15,149	15,452
59520 Transfer to Other Service - IT Fee	4,690	4,750	4,810	4,750	5,516	5,516	5,516	5,858	6,092	6,214	6,338	6,465
59550 Transfer to Other Service - Environmental Services Fee	62,014	50,847	40,879	51,247	34,449	34,449	34,449	36,585	38,048	38,809	39,585	40,377
Non-Operating Expenses	140,007	147,509	181,598	156,371	163,653	143,785	165,933	167,553	168,238	173,717	179,369	185,199

Total Service	49,583	24,307	(5,243)	30,305	160,000	44,800	4,015	0	0	0	0	0
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59500 TRANSFER TO OTHER SERVICE

Account	Work Order	2020	2021	2022	Average	2023 Budget	2023 YTD Actual	2023 Est Year End	2024 Budget	2025 Budget	2026 Budget	2027 Budget	2028 Budget
59500 CAP1005-100 RIO W - Reservoir Valve Chamber & Meter (2021)						0	720	960					
59500 CAP1216-100 RIO W - 2021 Portable generator						0	990	1,320					
59500 OPR322-100 Riondel Water Utility-Distribution - General		3,730	3,730	3,730	3,730								
59500 OPR322-100 - Truck Loan Interest						200	0	200	0				
59500 OPR322-100 - Truck Loan Principal						3,300	0	3,300	0				
59500 OPR322-112 Riondel Water Utility-Transfer to other Service - Fleet		2,752	3,198	2,143	2,698	3,911	0	3,911	4,153	4,320	4,406	4,494	4,584
59500 OPR322-114 Riondel Water Utility-Transfer to other Service - Project Management													
59500 OPR322-117 Riondel Water Utility-Transfer to other Service - Operator Admin		10,877	5,234	13,675	9,929	4,825	0	4,825	5,124	5,329	5,436	5,544	5,655
Total Transfer to Other Service		17,359	12,162	19,548	16,356	12,236	1,710	14,516	9,278	9,649	9,842	10,039	10,239

RESERVES

	2023	2024	2025	2026	2027	2028
Balance Previous Year						
RES 162 Riondel Water Reserve	248,247	334,904	261,711	278,843	375,257	476,893
RES 163 Riondel Water Capital Utility	0	0	0	0	0	0
Total	248,247	334,904	261,711	278,843	375,257	476,893
Interest (Assumed 1%)	2,468	3,349	2,617	2,788	3,753	4,769
Contribution	87,895	91,459	89,514	93,626	97,884	102,292
Withdrawal	(2,280)	(168,000)	(75,000)	0	0	(580,000)
	334,904	261,711	278,843	375,257	476,893	3,954

2022 Asset Management Plan Identified Contribution to Reserves

25 Year	91,715					
100 Year	114,744					
	2023	2024	2025	2026	2027	2028