DRAINAGE EVALUATION AND IMPROVEMENT PLAN

Lac. Ste. Anne County, AB

Prepared by Bolson Engineering and Environmental Services Ltd.

Drainage Evaluation and Improvement Plan

Prepared For:
Lac. Ste. Anne County

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November 2023

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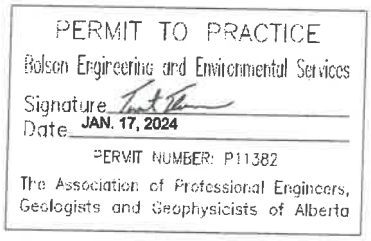

Executive Summary

Bolson Engineering was retained by Lac Ste. Anne County (Client) to conduct a Drainage Evaluation and Improvement plan for the areas upstream of the Summer Village of Val Quentin, the Village of Alberta Beach, and the Summer Village of Sunset Point. These municipalities are all located on the south and eastern shore of Lac Ste. Anne in Lac Ste. Anne County (Municipal District No. 13) approximately 60 km northwest of Edmonton.

A review of numerous existing reports, LiDAR data of the subject area, site specific topographic surveys, and site reviews were utilized to complete the drainage evaluation for the plan area. This report focuses on identified drainage problems and proposes options for improving the drainage at select locations.

Several culvert repairs are identified for the region upstream of the Summer Village of Val Quentin, proposed drainage improvements adjacent to Alberta Beach and in particular upstream of 58th Street and the Central Drainage Channel, and recommended work to be completed at the Alberta Beach Golf Course are discussed in this report with estimated costs to complete and recommended design details included. This report presents preliminary design concepts for discussion and approval purposes. Detailed design is required prior to implementation or construction of any modifications within the plan area.

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1. Introduction

Bolson Engineering was retained by Lac Ste. Anne County (Client) to conduct a Drainage Evaluation and Improvement plan for the areas upstream of the Summer Village of Val Quentin, the Village of Alberta Beach, and the Summer Village of Sunset Point. These municipalities are all located on the south and eastern shore of Lac Ste. Anne in Lac Ste. Anne County (Municipal District No. 13) approximately 60 km northwest of Edmonton. The project study area is shown in **Figure 1 – Lac. Ste. Anne County Plan Area**.

Lac Ste. Anne County was originally established as a municipal district in 1944. It was formed to govern the rural areas surrounding Lac Ste. Anne in Alberta, Canada. Over time, the county has undergone various changes and developments in its governance, infrastructure, and community services. Currently, the county coexists with the various summer villages that populate its area and the most current Municipal Development Plan Bylaw 23-2014 establishes a framework for land use decision making within the county. Refer to **Figure 2 – Future Development Concept** for a snapshot of the future development concept of the county that is part of the current MDP.

As the Summer Village of Val Quentin, the Village of Alberta Beach, and the Summer Village of Sunset Point are all their own independent municipalities with separate municipal design plans and regional inter-municipal development plans that govern certain land use and development decisions, it is not always viable that the areas work together with the county on assessing components of existing and/or future development that may impact some or all of the municipalities. The aim of this Drainage Evaluation and Improvement Plan is to review how the findings of stormwater and drainage reviews of the select municipalities that have been completed in the past can be implemented to improve drainage in general within this plan area.

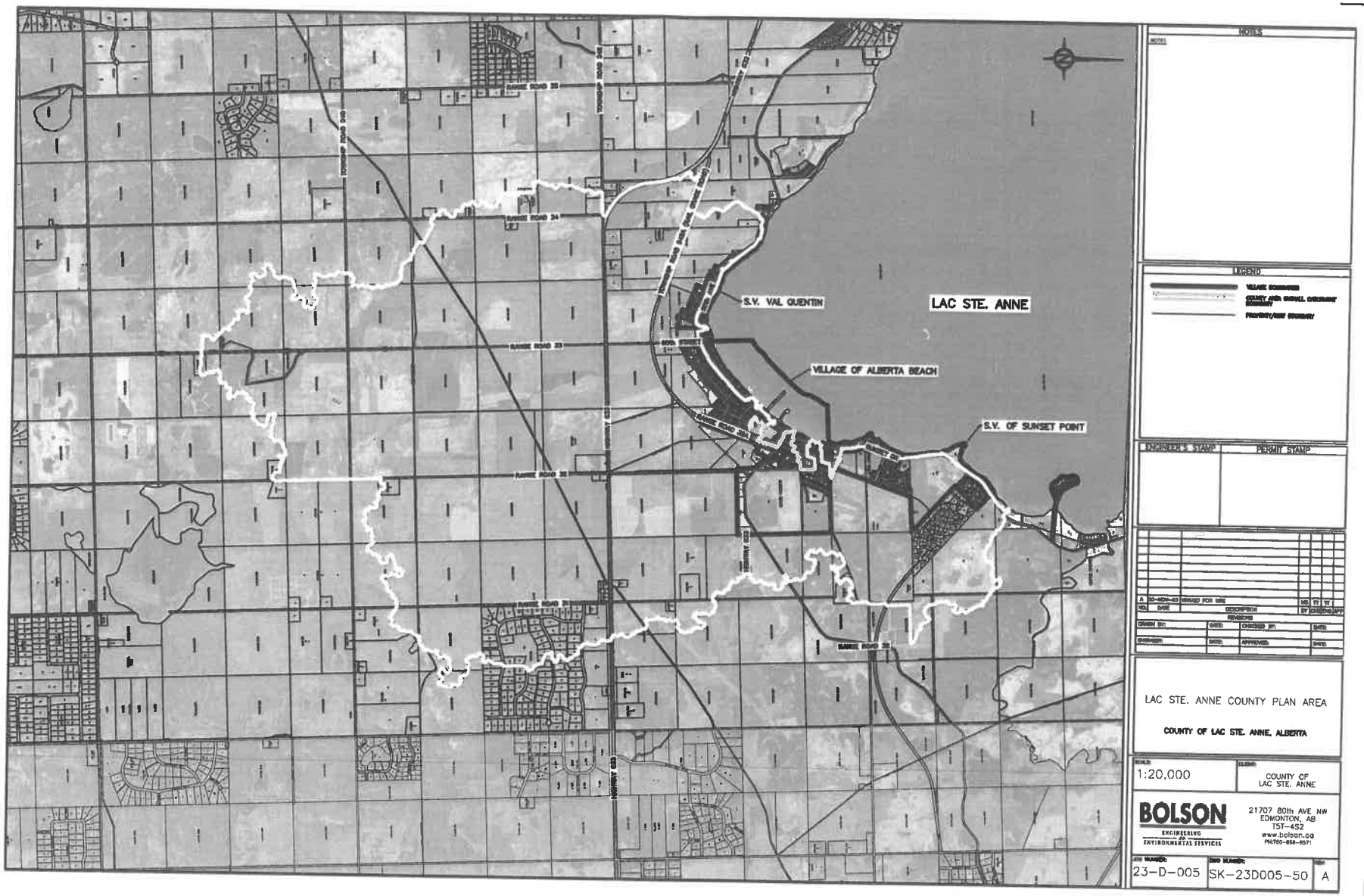


FIGURE 1: LAC STE. ANNE COUNTY PLAN AREA

Future Development Concept

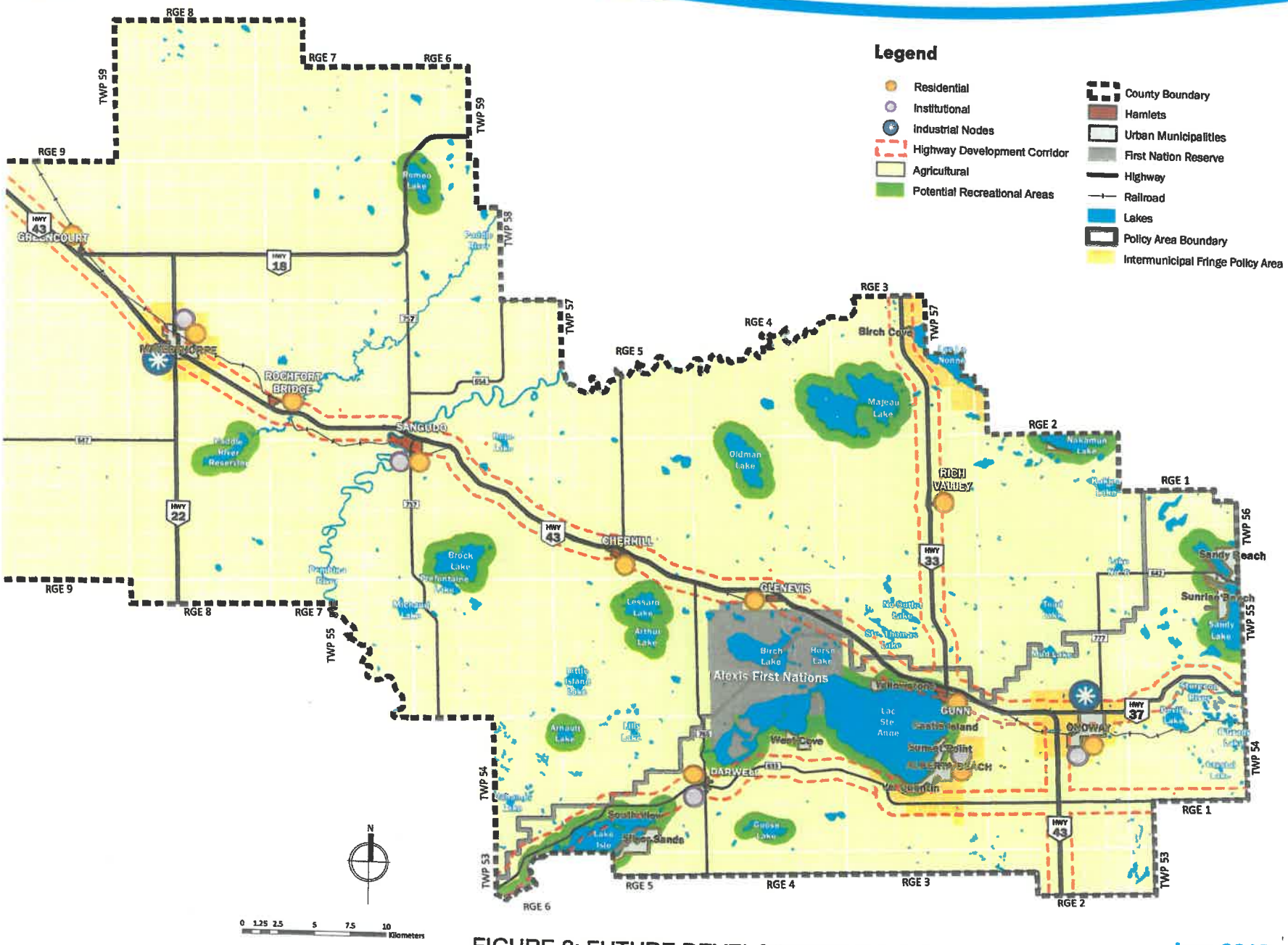


FIGURE 2: FUTURE DEVELOPMENT CONCEPT

1.1 Project Scope

There have previously been completed some independent stormwater drainage and analysis reviews for the Summer Village of Val Quentin, the Village of Alberta Beach, and the Summer Village of Sunset Point, and the goal of this evaluation is to summarize these findings as they apply to the County directly and to supplement with additional upstream drainage analysis to determine existing drainage conditions and recommendations for improvements. The goal of this project is to identify any noted drainage issues within the plan area and to present proposed solutions to these issues. This report presents preliminary design concepts for discussion and approval purposes. Detailed design is required prior to implementation or construction of any modifications within the plan area.

The main objective of this drainage evaluation and improvement plan is to:

- Review existing reports, standards, land use maps, natural features, and drainage issues within the plan boundary;
- Identify both regional and local drainage patterns;
- Quantify peak flow rates for design runoff events;
- Evaluate the existing infrastructure and identify issues if present;
- Propose corrective measures to resolve drainage issues;
- Provide drainage recommendations for future developments;
- Discuss drainage improvements that may be considered the joint responsibility of the county and summer villages.

1.2 Geographic Characteristics

The plan study area occupies an area of approximately 3,124 ha and consists of the Summer Village of Val Quentin, the Village of Alberta Beach, the Summer Village of Sunset Point and residential and agricultural properties upstream of the municipalities.

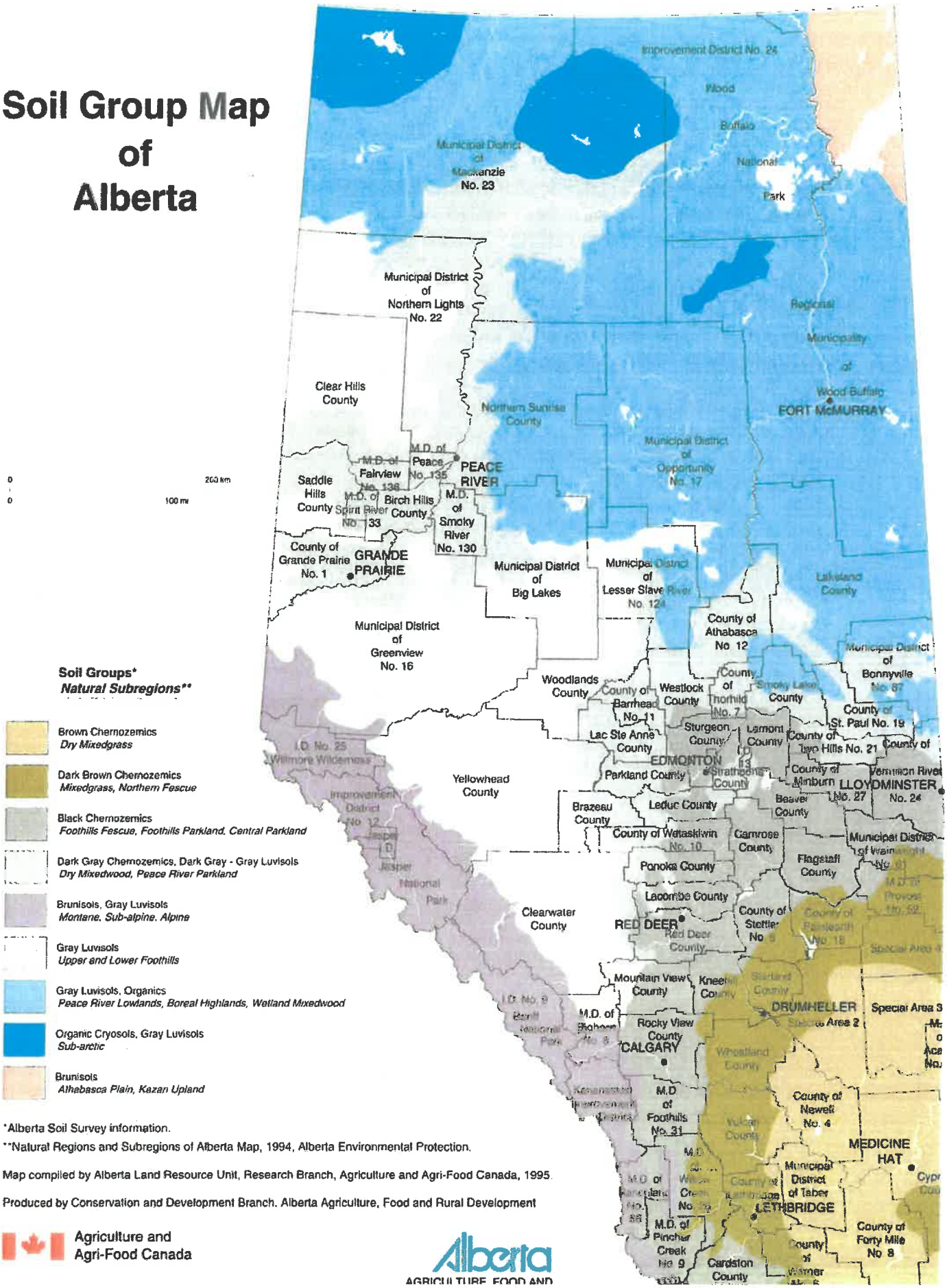
The majority of the plan area consists of undeveloped agricultural properties and roadways with the residential properties congregated within the summer villages. All drainage in the plan area flows south to north towards Lac. Ste. Anne and drainage ultimately funnels through all the municipalities through overland conveyance systems (ditches, culverts, swales).

The plan area lies within the Boreal Plain Ecozone and Boreal Transition Ecoregion. The ecoregion has characteristics of both the Western Alberta Uplands to the west, Aspen Parkland to the east and south, and Mid-Boreal Uplands to the north. The boreal transition ecoregion marks the northern limit of arable agriculture and the southern limit of closed boreal forest. The predominant vegetation includes a closed cover of tall quaking aspen intermixed with balsam poplar, white spruce and balsam fir and a thick understory of mixed herbs and tall shrubs. Poorly drained sites are usually covered with sedges, willow, some black spruce, and tamarack. The region features topography of hummocky to kettled plains and is characterized by a mix of farmland, forests and many small ponds and sloughs occupying shallow depressions.

The geology of the plan area consists primarily of sand and clay till deposits overlying the bedrock of the Wapiti Formation (Alberta Geological Society). The soil itself falls into the Dark Gray Chemozemics and Dark Gray-Gray Luvisols formation as noted in **Figure 3 – Soil Group Map of Alberta**, which is a black-colored soil containing a high percentage of humus, phosphorus and ammonia. This soil is typical of the Prairie Regions. The near surface geology of the plan area is characterized by glacial deposits which include, but are not limited to, tills and lacustrine deposits that vary in thickness across the area. Intermixed with these glacial deposits are sands, silts, and gravels that may be of fluvial origin. Below the surficial deposits within the plan area is the Horseshoe Canyon Formation. The Horseshoe Canyon Formation is the lower part of the Alberta Group. The Horseshoe Canyon consists of sandstone, siltstone and shale with interbedded coal seams.

Figure 4 –Existing Natural Features shows the wetland and water body data of the study area as per recent aerial photograph overlaid by the basemap and wetland and water body boundaries obtained from Altalis as of October 31st, 2023. Lac Ste. Anne is located directly adjacent the plan area to the north and west and 14 smaller wetlands were noted within the plan area boundary itself.

Soil Group Map of Alberta



*Alberta Soil Survey information.

**Natural Regions and Subregions of Alberta Map, 1994, Alberta Environmental Protection.

Map compiled by Alberta Land Resource Unit, Research Branch, Agriculture and Agri-Food Canada, 1995.

Produced by Conservation and Development Branch. Alberta Agriculture, Food and Rural Development

Agriculture and Agri-Food Canada

Alberta AGRICULTURE, FOOD AND

FIGURE 3: SOIL GROUP MAP OF ALBERTA

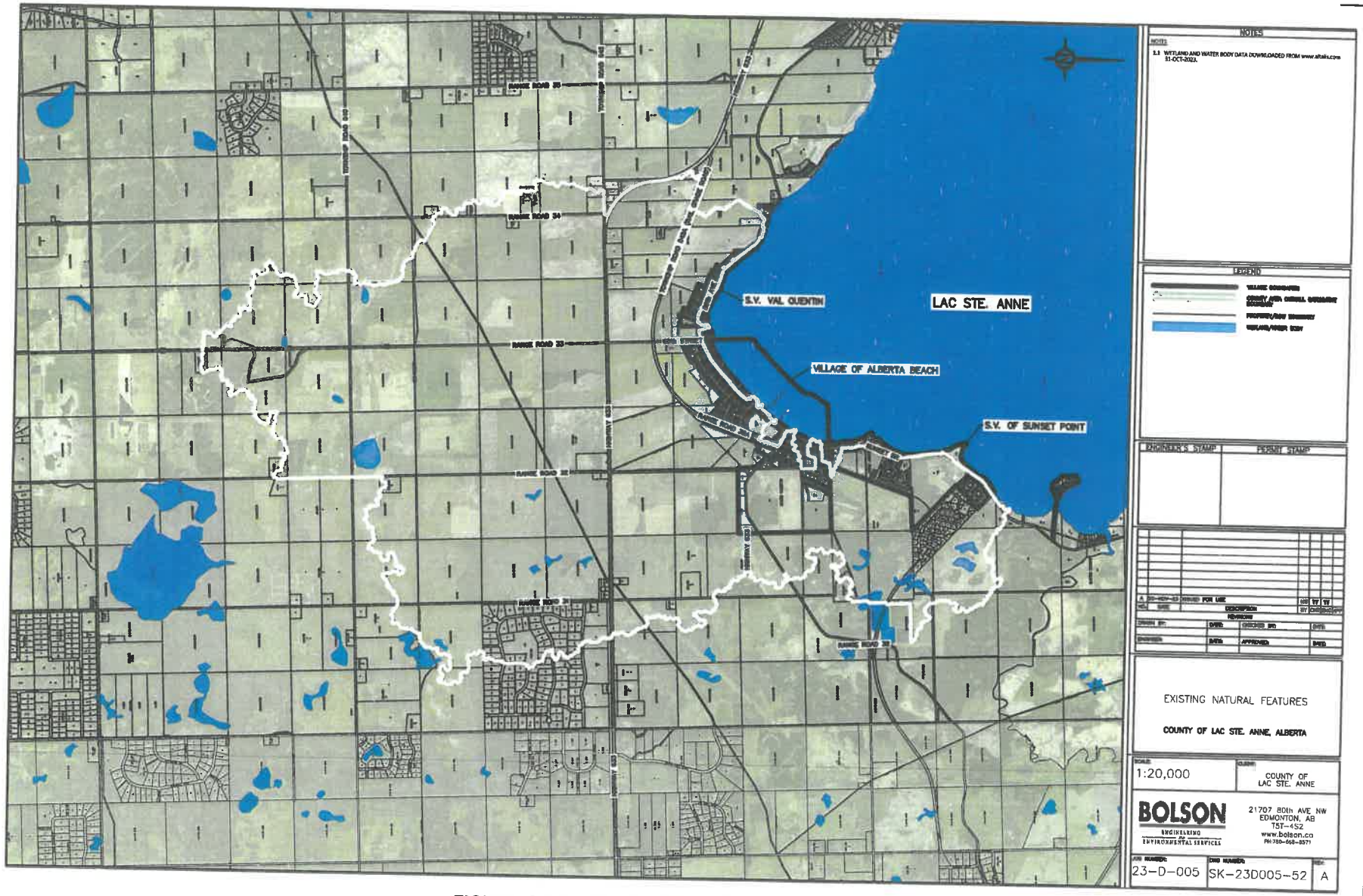


FIGURE 4: EXISTING NATURAL FEATURES

2. Drainage Evaluation

Outlined below are the methodology and documents that were reviewed to complete the drainage evaluation and improvement plan for the plan area.

2.1 Drainage Evaluation Methodology

The following is a summary of the activities that were performed for the preliminary drainage evaluation within the plan area:

- Cadastral basemap data was obtained and spatial files were created for reference using the basemap data;
- 1m LiDAR data was obtained from the County of Lac Ste. Anne and a corresponding digital elevation model (DEM) of the plan area was created;
- Review of aerial photography obtained from publically available sources (ESRI Maps, Bing Maps and Google Maps);
- Topographic survey of existing drainage infrastructure within the plan area was conducted, processed, and reviewed;
- Site visits were conducted to confirm drainage patterns, photograph problem areas, and confirm flow paths determined from previously mentioned analysis;
- Review of existing reports was conducted to itemize proposed drainage improvements and confirm catchment areas, sub-catchment areas, and outlet discharge sizing and locations within the plan area.

2.2 Drainage Characteristics of the Plan Area Watershed

The preliminary drainage evaluation identified and delineated the drainage characteristics of the plan area watershed. **Figure 5 – Overall Area Existing Topography** shows the elevation change across the study area as you move closer to Lac Ste. Anne. The entire area currently drains north and west towards the lake. **Figure 6 – Regional Drainage Patterns** identifies the major catchment areas that contribute to the plan area and ultimately drain to Lac Ste. Anne.

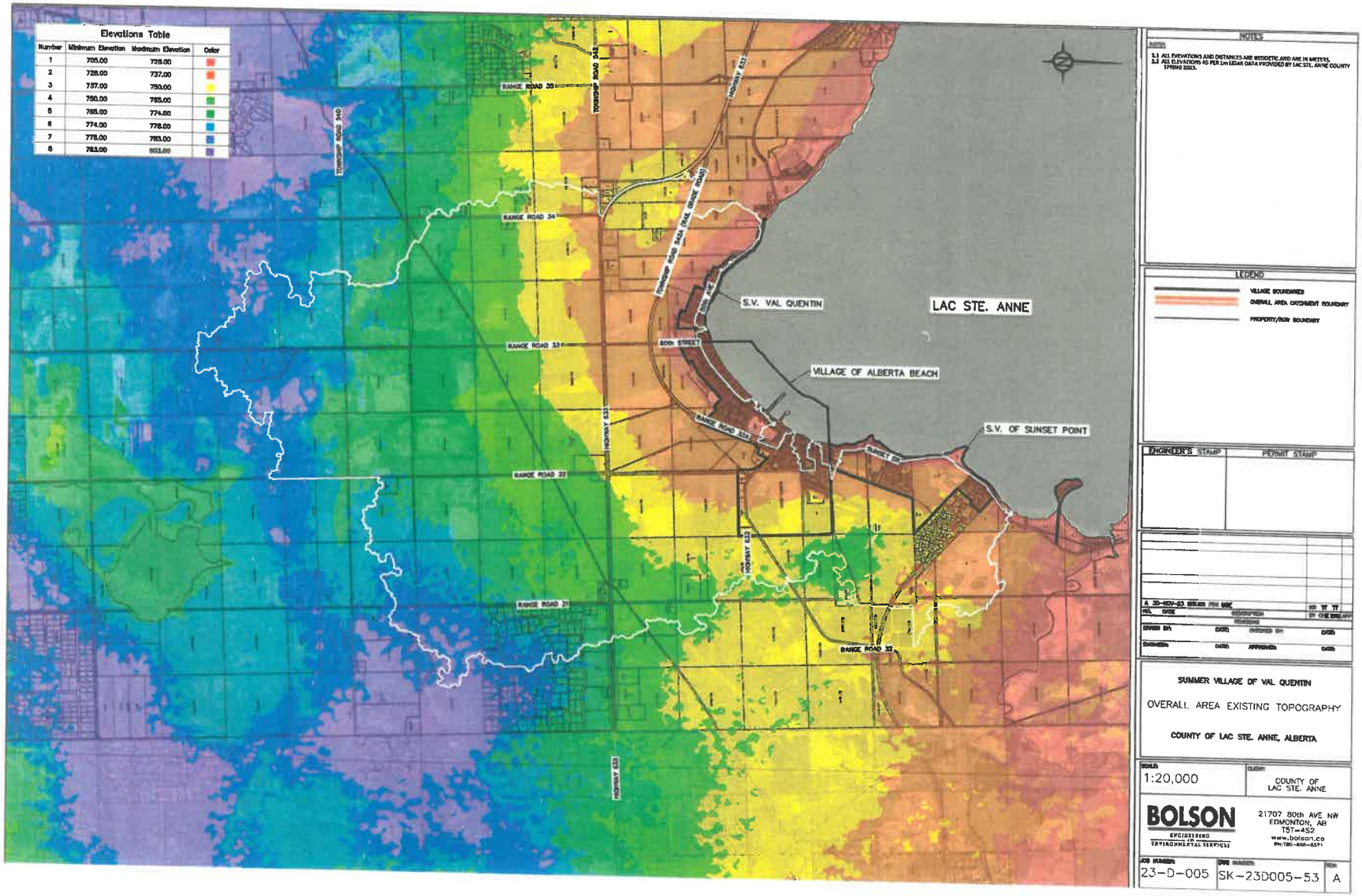


FIGURE 5: OVERALL AREA EXISTING TOPOGRAPHY

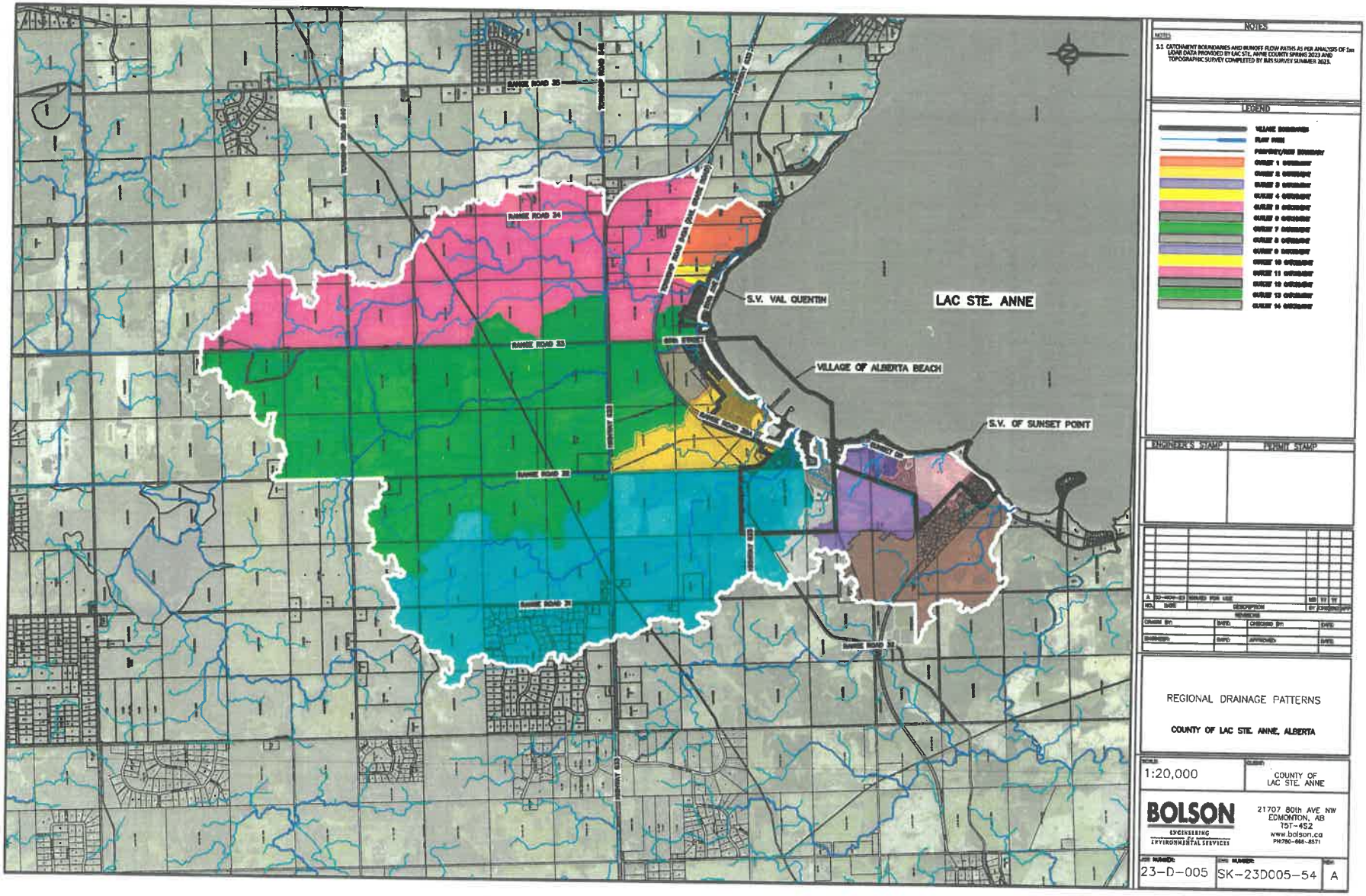


FIGURE 6: REGIONAL DRAINAGE PATTERNS

2.3 Review of Relevant Documents

As part of the drainage evaluation and improvement plan for the plan area, various existing planning, environmental, and drainage reports for the area were reviewed along with relevant policies, standards, legislation and bylaws. The main documents that were reviewed consist of:

1. Lac Ste. Anne County General Municipal Servicing Standards (GMSS)
2. Big Lake Stormwater Management Plan
3. North Saskatchewan Watershed Alliance – Isle Lake and Lac Ste. Anne State of the Watershed Report
4. Lac Ste. Anne and Lake Isle Water Quality Management Society – Briefing on Water Quality
5. SE Design and Consulting Stormwater Management Plan – Summer Village of Sunset Point
6. SE Design and Consulting Drainage Analysis and Improvement Plan – Alberta Beach Central Drainage Course
7. Summer Village of Val Quentin – Land Use Bylaw 218-08
8. Alberta Beach Regional Inter-Municipal Development Plan
9. Summer Village of Val Quentin Municipal Development Plan
10. Stormwater Drainage Analysis Val Quentin by Bolson Engineering

The various documents identified proposed post development release rates for the plan area (2.5 L/s/ha as per the Big Lake Stormwater Management Plan), recommended guiding principles for the installation of culverts and future development, and identified drainage and stormwater issues within different locations of the plan area. This study intends to expand on the identified drainage issues within the above referenced reports and to make recommendations and cost estimates to evaluate and improve drainage systems within the plan area.

3. Identified Drainage Issues within the Plan Area

A review of the various reports identified several drainage issues within the plan area. These were reviewed with updated LiDar data, topographical survey, and stormwater modeling to confirm the best recommendations for addressing drainage at these locations. A summary of the findings is outlined below:

a) Culverts and drainage conveyance systems upstream from the Summer Village of Val Quentin. The Bolson Engineering Stormwater Drainage Analysis for Val Quentin completed in November 2023 identified 19 upstream culverts/crossings that direct water to the 8 main outlets within Val Quentin. Of these 19 culverts, 9 were noted to be deficient either in slope, condition, or size.

b) A review of the off-site drainage to the south of the Village of Alberta Beach completed by Bolson Engineering using updated LiDar data and on-site topographical survey identified a large area of un-accommodated flows that are directed towards 58th Street. These flows cause flooding issues north of 49th Avenue at 58th Street and generate stormwater flows that cannot be handled within the existing conveyance system (culverts/ditches) that direct the flow to the outlet at Lac. Ste. Anne.

c) The SE Design and Consulting Inc. Summer Village of Sunset Point Stormwater Management Report issued in June 2020 noted four key areas with existing drainage and flooding issues. External flows from the Alberta Beach Golf Resort, Golf Course stormwater management pond and flooding of 48A avenue residences, 49A avenue drainage, and the 56 avenue major flow paths.

d) The SE Design and Consulting Inc. Drainage Analysis and Improvement Plan for the Alberta Beach Central Drainage Course noted flooding and issues with the entire central drainage course and upstream proposed future industrial development areas.

4. Proposed Drainage Improvement Projects within the Plan Area

Based on the findings of the existing drainage issues within the areas adjacent to the Summer Village of Val Quentin, the Village of Alberta Beach, and the Summer Village of Sunset Point, the following remediation projects and recommendations are to be considered:

4.1 Summer Village of Val Quentin Upstream Culvert and Drainage Systems

Of the 19 various culverts identified within the catchment areas upstream of Val Quentin, 9 were deemed to require repairs or replacement due to various factors. Please refer to **Figure 7 - Summary of Culverts Upstream of Val Quentin** for location information and data on each of the culverts.

The culverts were evaluated based on size, condition, slope, and type of installation and recommendations as to the proposed method of repair is summarized along with preliminary cost estimates for the work in the pages below. The flows and capacities of these culverts have been verified in the Bolson Engineering Stormwater Drainage Analysis for Val Quentin with the delineation of the various catchment and sub-catchment areas.

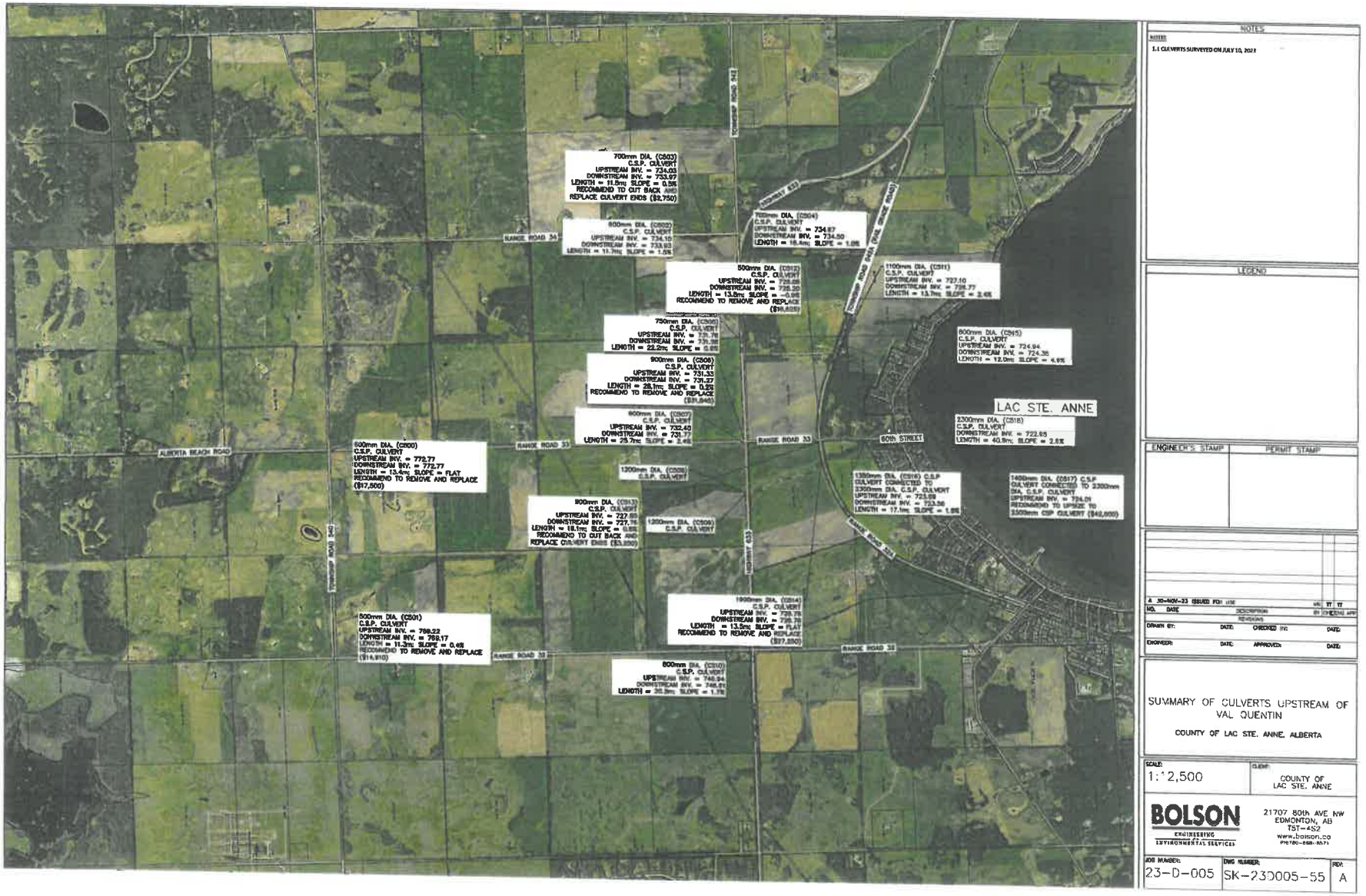


FIGURE 7: SUMMARY OF CULVERTS UPSTREAM OF VAL QUENTIN

Culvert C500:

Specifications: 600mm CSP Culvert
Upstream Invert = 772.77
Downstream Invert = 772.76
Length = 13.5m; Slope = Flat

CULVERT C500

Existing culvert is flat graded and culvert ends are below existing ditch. No rip-rap is present on culvert.

Recommendations: Remove culvert, re-grade adjacent ditch as required upstream and downstream to achieve minimum 0.5% slope on ditch and culvert system, reinstall existing or new culvert, and place rip-rap at culvert end.

Estimated Cost of Repair:

C-500 (600mm CSP CULVERT)				
ITEM	***UNIT***	***QUANTITY***	***$/UNIT***	***TOTAL***
Remove and Replace 600mm CSP Culvert	m	14.0	$600.00	$8,400.00
Regrade ditch	L. Sum	1.0	$5,000.00	$5,000.00
Rip-Rap	m^2	4.0	$150.00	$600.00
Engineering (15%)	L. Sum	1.0	-	$2,100.00
Contingency (10%)	L. Sum	1.0	-	$1,400.00
			TOTAL:	**$17,500.00**

Culvert C501:

Specifications: 500mm CSP Culvert
Upstream Invert = 769.22
Downstream Invert = 769.17
Length = 11.3m; Slope = 0.4%

Existing culvert has shallow slope. No rip-rap is present on culvert.

Recommendations: Remove culvert, re-grade adjacent ditch as required upstream and downstream to achieve minimum 0.5% slope on ditch and culvert system, reinstall existing or new culvert, and place rip-rap at culvert end.

C-501 (500mm CSP CULVERT)				
ITEM	***UNIT***	***QUANTITY***	***$/UNIT***	***TOTAL***
Remove and Replace 500mm CSP Culvert	m	11.5	$550.00	$6,325.00
Regrade ditch	L. Sum	1.0	$5,000.00	$5,000.00
Rip-Rap	m^2	4.0	$150.00	$600.00
Engineering (15%)	L. Sum	1.0	-	$1,788.75
Contingency (10%)	L. Sum	1.0	-	$1,192.50
			TOTAL:	**$14,906.25**

Culvert C503:

Specifications: 700mm CSP Culvert
Upstream Invert = 734.03
Downstream Invert = 733.97
Length = 11.5m; Slope = 0.5%

CULVERT C503

Existing culvert has damaged (crushed) end. No rip-rap is present on culvert.

Recommendations: Cut back culvert and replace damaged end in kind and place rip-rap at culvert end.

Estimated Cost of Repair:

C-503 (700mm CSP CULVERT)				
ITEM	***UNIT***	***QUANTITY***	***$/UNIT***	***TOTAL***
Cut back and replace culvert end	m	2.0	$800.00	$1,600.00
Rip-Rap	m^2	4.0	$150.00	$600.00
Engineering (15%)	L. Sum	1.0	-	$330.00
Contingency (10%)	L. Sum	1.0	-	$220.00
			TOTAL:	**$2,750.00**

Culvert C506:

Specifications: 900mm CSP Culvert
Upstream Invert = 731.33
Downstream Invert = 732.27
Length = 26.1m; Slope = 0.2%

CULVERT C506

Existing culvert has damaged (crushed) end and shallow slope. No rip-rap is present on culvert.

Recommendations: Remove culvert, re-grade adjacent ditch as required upstream and downstream to achieve minimum 0.5% slope on ditch and culvert system, reinstall new culvert, and place rip-rap at culvert end.

Estimated Cost of Repair:

C-506 (900mm CSP CULVERT)				
ITEM	***UNIT***	***QUANTITY***	***$/UNIT***	***TOTAL***
Remove and Replace 900mm CSP Culvert	m	26.5	$750.00	$19,875.00
Regrade ditch	L. Sum	1.0	$5,000.00	$5,000.00
Rip-Rap	m^2	4.0	$150.00	$600.00
Engineering (15%)	L. Sum	1.0	-	$3,821.25
Contingency (10%)	L. Sum	1.0	-	$2,547.50
			TOTAL:	**$31,843.75**

Culvert C512:

Specifications: 500mm CSP Culvert
Upstream Invert = 728.08
Downstream Invert = 728.20
Length = 13.8m; Slope = -0.9%

CULVERT C512 – UPSTREAM END

CULVERT C512 – DOWNSTREAM END

Existing culvert has damaged (crushed) ends and shallow slope and reverse grade. No rip-rap is present on culvert.

Recommendations: Remove culvert, re-grade adjacent ditch as required upstream and downstream to achieve minimum 0.5% slope on ditch and culvert system, reinstall new culvert, and place rip-rap at culvert end.

Estimated Cost of Repair:

C-512 (500mm CSP CULVERT)				
ITEM	*UNIT*	*QUANTITY*	*$/UNIT*	*TOTAL*
Remove and Replace 500mm CSP Culvert	m	14.0	$550.00	$7,700.00
Regrade ditch	L. Sum	1.0	$5,000.00	$5,000.00
Rip-Rap	m^2	4.0	$150.00	$600.00
Engineering (15%)	L. Sum	1.0	-	$1,995.00
Contingency (10%)	L. Sum	1.0	-	$1,330.00
			TOTAL:	**$16,625.00**

Culvert C513:

Specifications: 900mm CSP Culvert
Upstream Invert = 727.85
Downstream Invert = 727.76
Length = 16.1m; Slope = 0.6%

CULVERT C513

Existing culvert has damaged (crushed) end. No rip-rap is present on culvert.

Recommendations: Cut back culvert and replace damaged end in kind and place rip-rap at culvert end.

Estimated Cost of Repair:

C-513 (900mm CSP CULVERT)				
ITEM	***UNIT***	***QUANTITY***	***$/UNIT***	***TOTAL***
Cut back and replace culvert end	m	2.0	$1,000.00	$2,000.00
Rip-Rap	m^2	4.0	$150.00	$600.00
Engineering (15%)	L. Sum	1.0	-	$390.00
Contingency (10%)	L. Sum	1.0	-	$260.00
			TOTAL:	**$3,250.00**

Culvert C514:

Specifications: 1900mm CSP Culvert
Upstream Invert = 726.78
Downstream Invert = 726.78
Length = 13.5m; Slope = Flat

Existing culvert is flat graded and culvert ends are below existing ditch. No rip-rap is present on culvert.

Recommendations: Remove culvert, re-grade adjacent ditch as required upstream and downstream to achieve minimum 0.5% slope on ditch and culvert system, reinstall existing or new culvert, and place rip-rap at culvert end.

Estimated Cost of Repair:

C-514 (1900mm CSP CULVERT)				
ITEM	*UNIT*	*QUANTITY*	*$/UNIT*	*TOTAL*
Remove and Replace 1900mm CSP Culvert	m	13.5	$1,200.00	$16,200.00
Regrade ditch	L. Sum	1.0	$5,000.00	$5,000.00
Rip-Rap	m^2	4.0	$150.00	$600.00
Engineering (15%)	L. Sum	1.0	-	$3,270.00
Contingency (10%)	L. Sum	1.0	-	$2,180.00
			TOTAL:	**$27,250.00**

Culvert C517 & C518:

Specifications: 1400mm CSP connected to 2300mm CSP
Upstream Invert = 724.01
Downstream Invert = 722.95
Length = 40.6m; Slope = 2.6%

CULVERT C518 DOWNSTREAM END

Existing culvert consists of 2 culverts attached together (1400mm and 2300mm). If larger flows are directed to this location in the future, (ie. from the lands to the east as proposed in the remediation option to address drainage flows into Alberta Beach) then culverts should be upsized to continuous 2300mm CSP size.

Recommendations: Remove 1400mm portion of CSP culvert and replace with 2300mm CSP

Estimated Cost of Repair:

C-517 (1400mm CSP CULVERT)				
ITEM	*UNIT*	*QUANTITY*	*$/UNIT*	*TOTAL*
Cut back and replace 1400mm with 2300mm CSP	m	22.0	$1,500.00	$33,000.00
Rip-Rap	m^2	4.0	$150.00	$600.00
Engineering (15%)	L. Sum	1.0	-	$5,040.00
Contingency (10%)	L. Sum	1.0	-	$3,360.00
			TOTAL:	**$42,000.00**

4.2 Un-accommodated Flows to the South of 49th Avenue and 58th Street in the Village of Alberta Beach

There is a large catchment area with un-accommodated flows that directs water to 58th Street in the Village of Alberta Beach through the property located at NW 15 54-3-W45M. During large storm events and spring melts flooding has been known to occur on the private properties that are adjacent to this location. Please refer to **Figure 8- Un-Accommodated Flows South of 58th Street** for location information on the catchment area referenced.

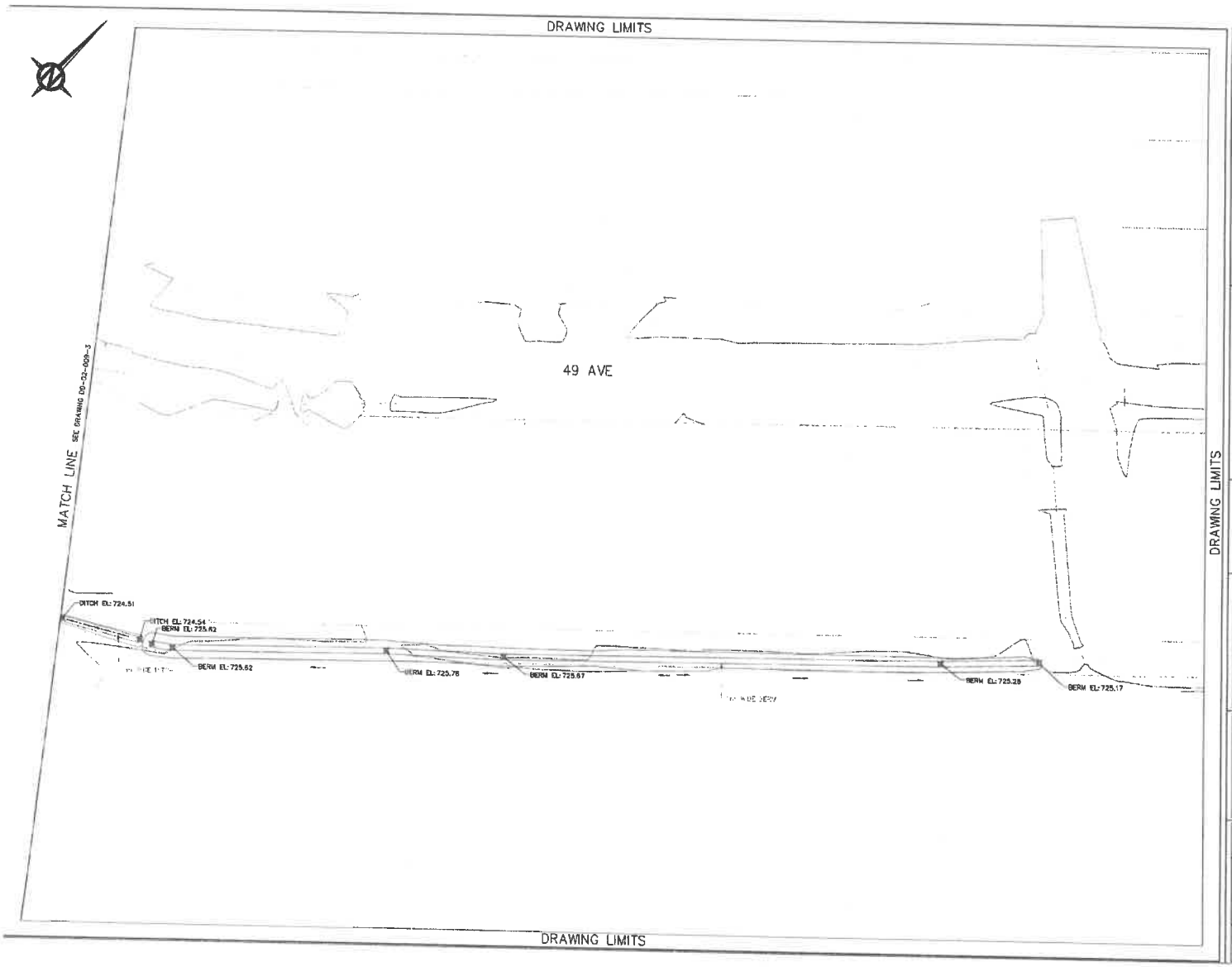
To prevent flooding and provide stormwater management for these flows, 2 drainage improvement programs are recommended to be implemented at this location:

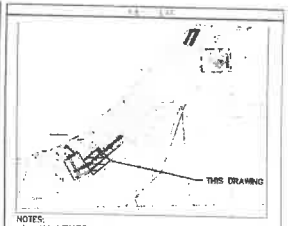
i) Upgrade the culvert and conveyance system along 58th Street north of 49th Avenue within the Village of Alberta Beach. Construction of a ditch/berm along the north edge of the NW ¼ Sec. 15 54-3-W5M will prevent water from draining overland to the private residences and will instead direct it west towards the ditch and culvert system along 58th Street. To handle these additional flows, the existing ditch feeding into the crossing at 49th Avenue is recommended to be increased in size and the downstream culverts increased or doubled up to handle the total flows contributing to this area and flowing north to the discharge at Lac. Ste Anne.

Refer to **DD-22D009-01-49 Avenue Grading Plan and Details Sheet 1, DD-22D009-02-49 Avenue Grading Plan and Details Sheet 2** and **DD-22D009-03-49 Avenue Grading Plan and Details Sheet 3** for the proposed remediation construction details.

Estimated Cost of Repair:

49 Avenue and 50 Street Alberta Beach Culvert and Ditch Upgrades				
ITEM	*UNIT*	*QUANTITY*	*$/UNIT*	*TOTAL*
Install additional culverts	m	196.0	$550.00	$107,800.00
Road Crossing (49th Avenue)	L. Sum	1.0	$15,000.00	$15,000.00
Rip-Rap	m^2	80.0	$150.00	$12,000.00
Ditch/Berm Construction	L. Sum	1.0	$35,000.00	$35,000.00
Engineering (15%)	L. Sum	1.0	-	$20,220.00
Contingency (10%)	L. Sum	1.0	-	$13,480.00
			TOTAL:	**$203,500.00**





NOTES:
1. ALL UTILITIES ARE ESTIMATED LOCATIONS AND SHOULD BE VERIFIED BY CONTRACTOR.
2. DITCH OUTLET TO COLLECTOR DITCHES TO BE FIELD FIT.
3. BERM TO HAVE RIPRAP PLACED ON ROAD SIDE AND TOP SOIL AND SEED ON LOT SIDE.
4. 2"STEAM LINE TO BE INSTALLED IN ALL NEW CULVERTS DETAILS TO BE DIRECTED BY ALBERTA BEACH PUBLIC WORKS DEPARTMENT.

LEGEND

U/G PHONE LINE
O/H POWER LINE
U/G GAS LINE
CULVERT
DRAINAGE ARROW

VILLAGE OF ALBERTA BEACH

49 AVENUE
SHEET 1

SCALE:	DESIGN:
1:500	VILLAGE OF ALBERTA BEACH

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JOB NUMBER:	DRAWING NUMBER:	REV:
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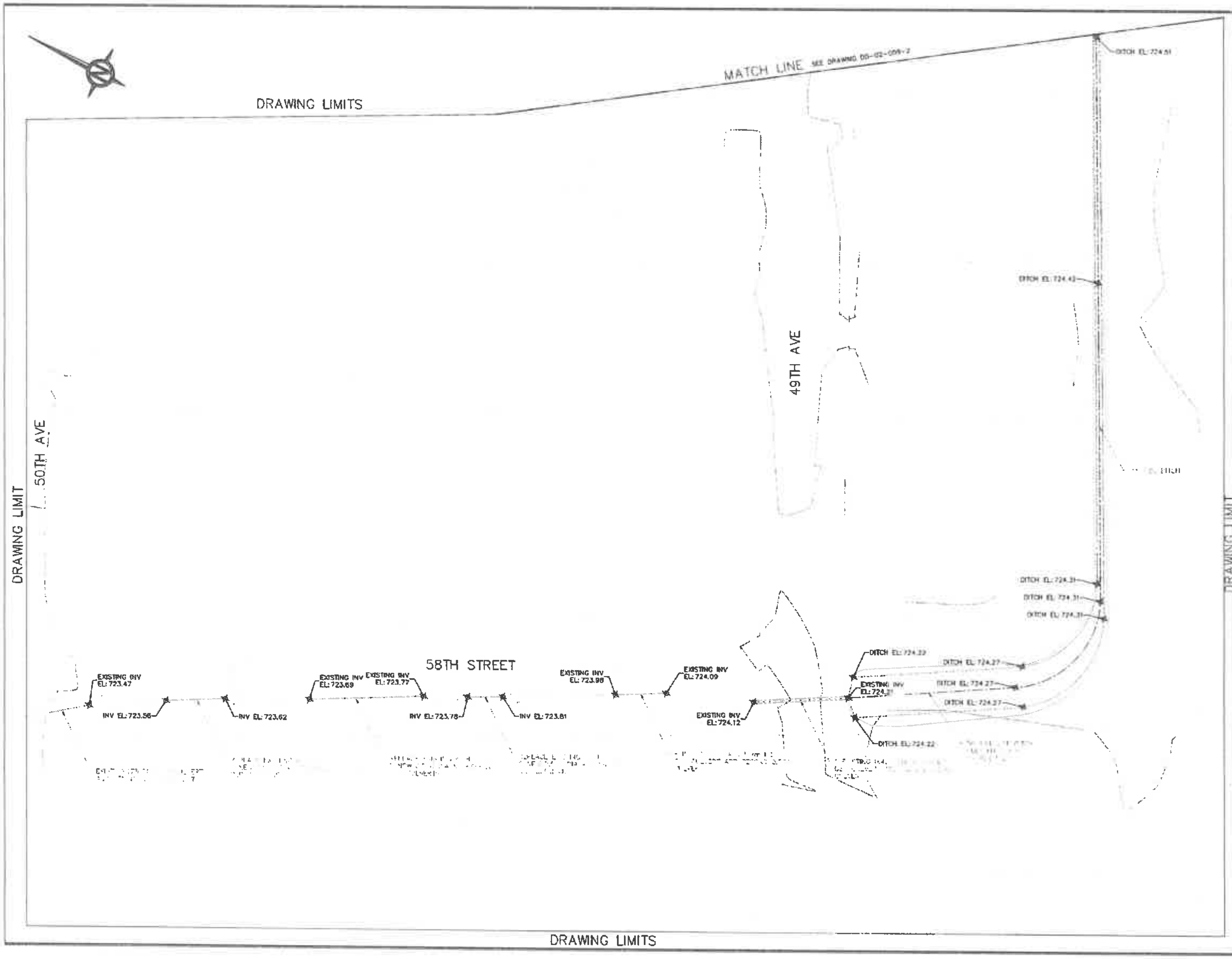

NOTES:
1. ALL UTILITIES ARE ESTIMATED LOCATIONS AND SHOULD BE VERIFIED BY CONTRACTOR.
2. DITCH OUTLET TO COLLECTOR DITCHES TO BE FIELD FIT.
3. BERM TO HAVE RIPRAP PLACES ON ROAD SIDE AND TOP SOIL AND SEED ON LOT SIDE.
4. 2"STEAM LINE TO BE INSTALLED IN ALL NEW CULVERTS DETAILS TO BE DIRECTED BY ALBERTA BEACH PUBLIC WORKS DEPARTMENT.
5. MATCH EXISTING INV. ELEVATIONS FOR ALL NEW CULVERTS.

LEGEND

- U/G PHONE LINE
- O/H POWER LINE
- U/G GAS LINE
- CULVERT
- DRAINAGE ARROW

VILLAGE OF ALBERTA BEACH

49 AVENUE

SHEET 2

SCALE	CLIENT
1:500	VILLAGE OF ALBERTA BEACH

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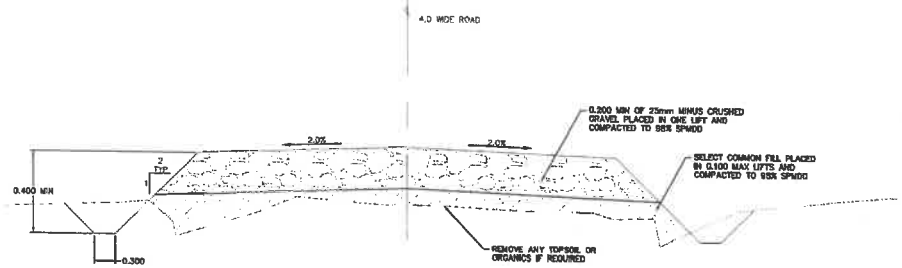
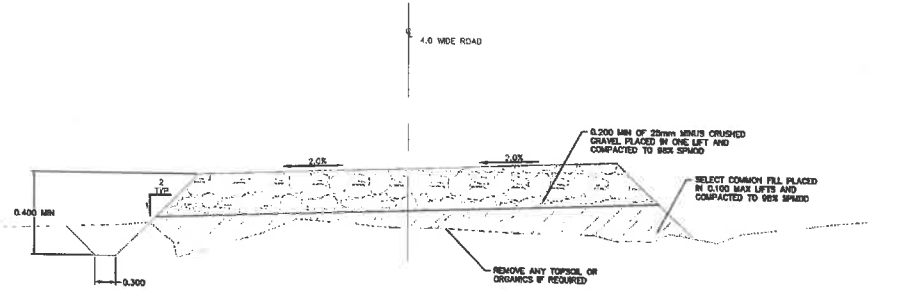
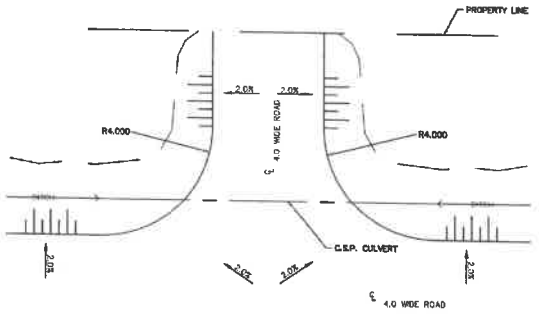
22-D-009	DD-22D009-02	B



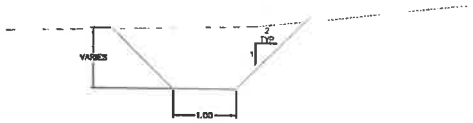
TYPICAL DUAL DITCH ROAD SECTION
SCALE: 1:20



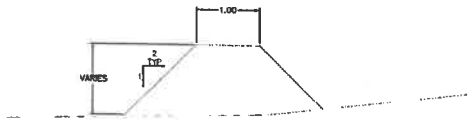
TYPICAL SINGLE DITCH ROAD SECTION
SCALE: 1:20



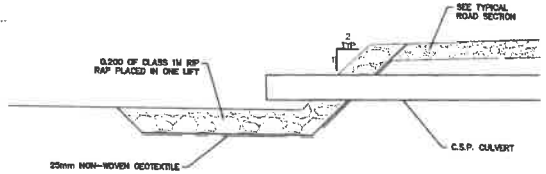
TYPICAL ROAD APPROACH DETAIL
SCALE: 1:75

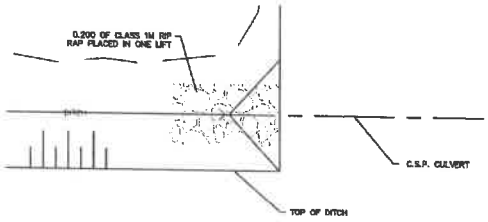


TYPICAL COLLECTOR DITCH SECTION
SCALE: 1:10



TYPICAL BERM SECTION
SCALE: 1:10





TYPICAL ROAD CULVERT DETAILS
SCALE: 1:75

LAC STE ANNE COUNTY, ALBERTA

VILLAGE OF ALBERTA BEACH

TYPICAL SECTIONS AND DETAILS

AS NOTED	VILLAGE OF ALBERTA BEACH

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22-D-009	DD-22D009-03	B

ii) A more permanent solution to the un-accommodated flows from NW 15 54-3-W45M is to construct an approximately 550m long ditch to convey stormwater southwest towards the existing culverts C516 and C517. The ditch is proposed to be 3.0m wide at the bottom with 5:1 side slopes and a 0.03% overall slope. This conveyance system will act to transport water to culverts C516 and C517 which can handle the larger flows as per the recommendations for upsizing C517 to a 2300mm CSP culvert. Water will then flow north through the existing catchment areas and outlets to Lac. Ste Anne through Val Quentin. The ditch system that is being proposed will act both to convey water west and to also pond and collect water and prevent it from discharging uncontrolled overland to 58th Street in Alberta Beach. As this work would be proposed within private property on Lac. Ste. Anne County property, landowner authorization considerations would need to be confirmed prior to the work taking place and a final detail design of the ditch system implemented.

Refer to **Figure 8 - Un-Accommodated Flows South of 58th Street** for the details of the proposed ditch system.

Estimated Cost of Repair:

NW 1/4 SEC. 15 54-3-W5M DITCH CONSTRUCTION				
ITEM	*UNIT*	*QUANTITY*	*$/UNIT*	*TOTAL*
Construct 3.0m Wide Ditch Bottom	m	550.0	$175.00	$96,250.00
Engineering (15%)	L. Sum	1.0	-	$14,437.50
Contingency (10%)	L. Sum	1.0	-	$9,625.00
			TOTAL:	**$120,312.50**

FIGURE 8: UN-ACCOMMOATED FLOWS SOUTH OF 58 STREET

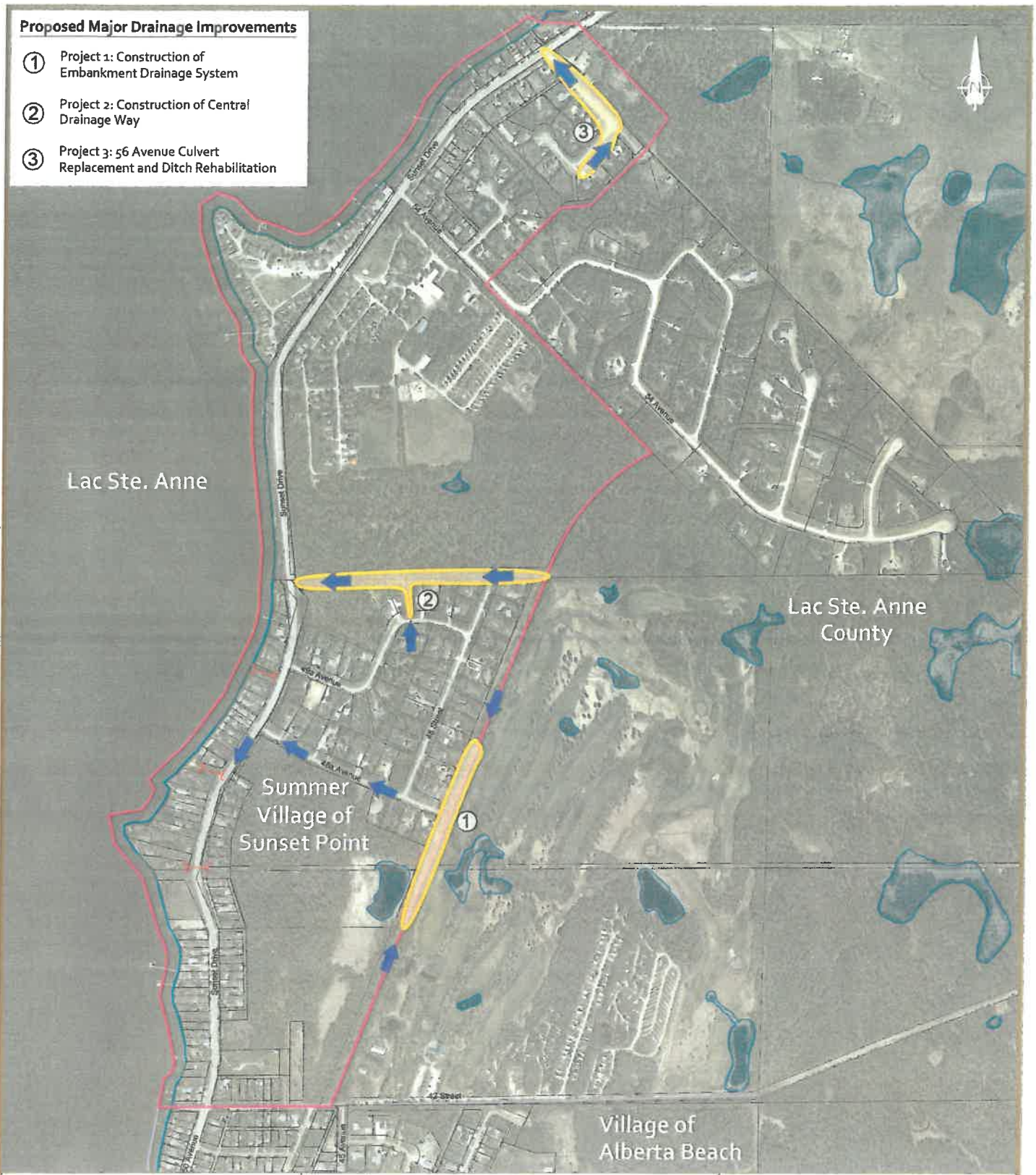
4.3 External Flows from Alberta Beach Golf Resort and Upstream into the Summer Village of Sunset Point

The SE Design and Consulting Stormwater Management Plan – Summer Village of Sunset Point that was completed in June 2020 identified two main drainage improvement projects that were attributed to flows coming from the Alberta Beach Golf Course and impacting residential properties downstream within the Summer Village of Sunset Point.

Project 1 recommended the construction of an embankment drainage system to capture the external flows from the Alberta Beach Golf Resort and convey them across the railway embankment to ultimately discharge to Lac. Ste. Anne.

Project 2 recommended the construction of a Central Drainage Way to convey stormwater from the Woodland Subdivision and any potential future residential developments to Lac. Ste. Anne. Both projects are outlined in the attached Figure 9 – Proposed Major Drainage System Improvements and within the SE report itself.

It is recommended to implement these drainage improvements in the future if funding becomes available to allow for better overland conveyances of stormwater in the upstream areas of Sunset Point.



Summer Village of Sunset Point

W26 54-3-5, NW23 54-3-5 and NE22 54-3-5

Stormwater Management Plan (SWMP)

Legend:

- Sunset Point Boundary
- Albert Beach Boundary
- Seasonally Flooded Area
- Improvement Area
- Existing Outlet Culvert
- Proposed Flow Direction

General Notes:

1. 2019 Cadastral Shown
2. 2019 Aerial Photograph provided by Lac Ste. Anne County

Figure 9

Proposed Major Drainage System Improvements

Scale 1:10,000

SE DESIGN AND CONSULTING INC.

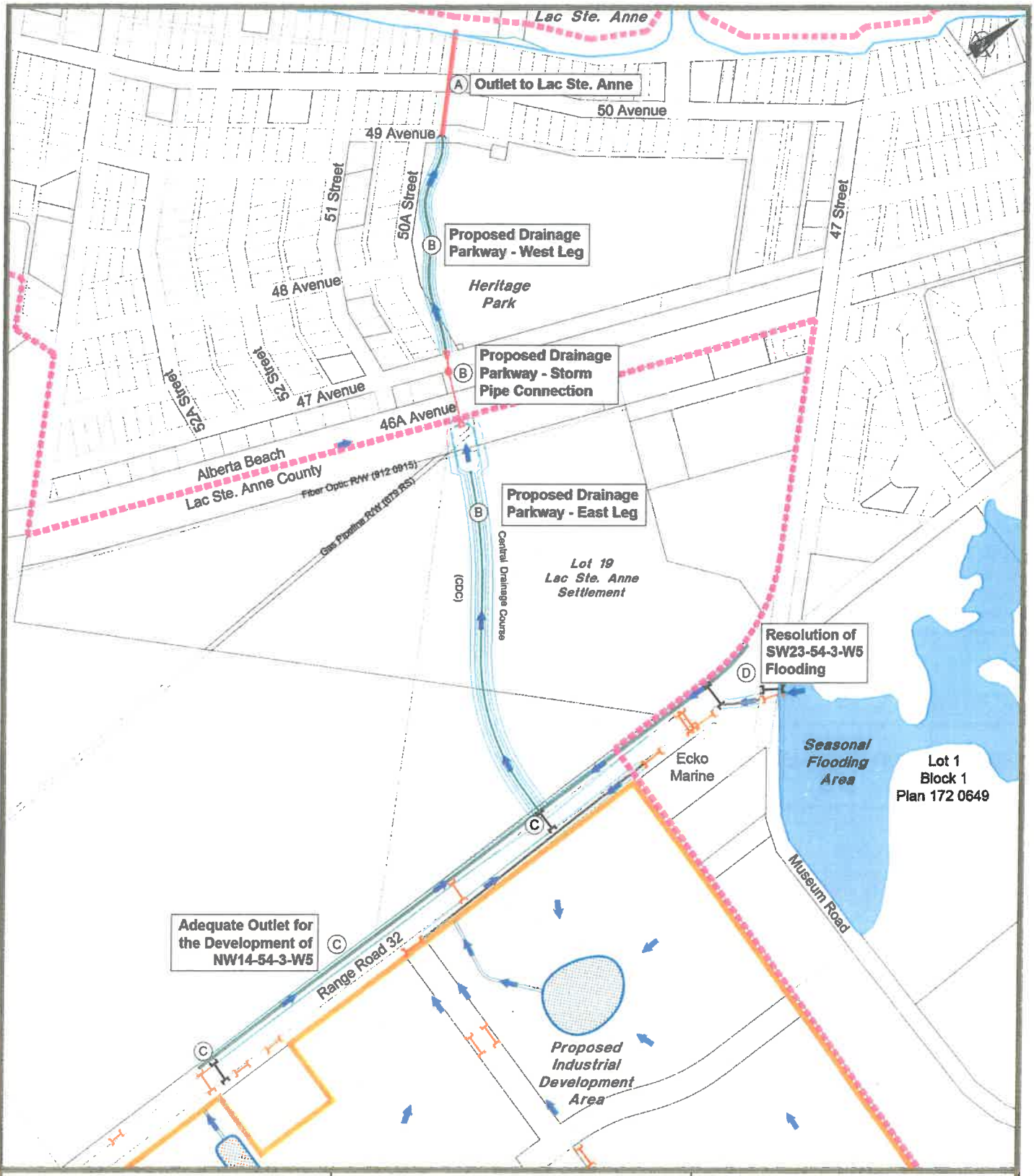
S:\7- Miscelaneous\Misc-0185 - Sunset Point - SWM Plan\4.Working Drawings\Report Figure Drawings\Sunset Point SWMP Figures - APRIL2020.dwg

4.4 Alberta Beach Central Drainage Course

The SE Design and Consulting Drainage Analysis and Improvement Plan – Alberta Beach Central Drainage Course that was completed in 2020 identified several recommended upgrades to the central drainage course and outlet to Lac. Ste. Anne within the Village of Alberta Beach.

It is recommended if possible to implement the upstream drainage improvement recommendations provided in the SE Design and Consulting Drainage Analysis and Improvement Plan – Alberta Beach Central Drainage Course including Drainage Improvements B and C as outlined on Figure 15 – Overall Drainage Improvement Plan and within the SE report itself.

The existing 1000mm CSP outlet is functional in its current condition and would require extensive costs and land acquisition to upgrade to a box culvert style installation so it is suggested to provide the upstream drainage improvements to better manage stormwater at this location and to facilitate additional development of the village. As noted in all previous reports, if future development incorporates proper stormwater management principles and adheres to the 2.5 L/s/Ha release rate requirement, the Central Drainage Course and other conveyance systems within the plan area will not become overwhelmed.



Lac Ste. Anne County
54-3-W5M
Village of Alberta Beach
Central Drainage Course: Drainage Analysis and Improvement Plan

Legend:

- Alberta Beach Boundary
- Proposed Drainage Parkway and Ditch Improvements
- Proposed Flow Direction
- Proposed Storm Pipe
- Proposed Culverts
- Existing Culverts
- Proposed Box Culvert

Figure 15
Overall Drainage Improvement Plan

SCALE 1:4,000

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S:\7- MISCELANEOUS\MISC-0192 - ALBERTA BEACH EAST DRAINAGE REVIEW\4.WORKING DRAWINGS

5. Summary

In general, all water within the plan area flows to Lac. Ste. Anne and discharges through the noted outlets within the Summer Village of Val Quentin, the Village of Alberta Beach, and the Summer Village of Sunset Point. The drainage improvements outlined in this report are situated within Lac. Ste. Anne County lands but benefit the downstream municipalities and as such can be considered joint projects between the different municipalities if/when the work proceeds. All future culvert installations and/or repairs should follow the details included in Appendix A: *Typical Construction Details* and formal detailed design for each of the projects must be completed prior to executing the work.

A summary of the anticipated repair budgets for the remediation options outlined in the report are included in *Table 5.1 – Summary of Remediation Budgets*:

TABLE 5.1 - SUMMARY OF REMEDIATION BUDGETS	
ITEM	***REMEDIATION BUDGET***
C-500: Remove and Replace Culvert	$17,500.00
C-501: Remove and Replace Culvert	$14,960.25
C-503: Cut back and Replace Culvert End	$2,750.00
C-506: Remove and Replace Culvert	$31,843.75
C-512: Remove and Replace Culvert	$16,625.00
C-513: Cut back and Replace Culvert End	$3,250.00
C-514: Remove and Replace Culvert	$27,250.00
C-517: Cut back and Replace Culvert	$42,000.00
49 Ave & 50 St Alberta Beach Ditch Upgrades	$203,500.00
NW 1/4 Sec. 15 54-3-W5M Ditch Construction	$120,312.50
TOTAL:	**$479,991.50**

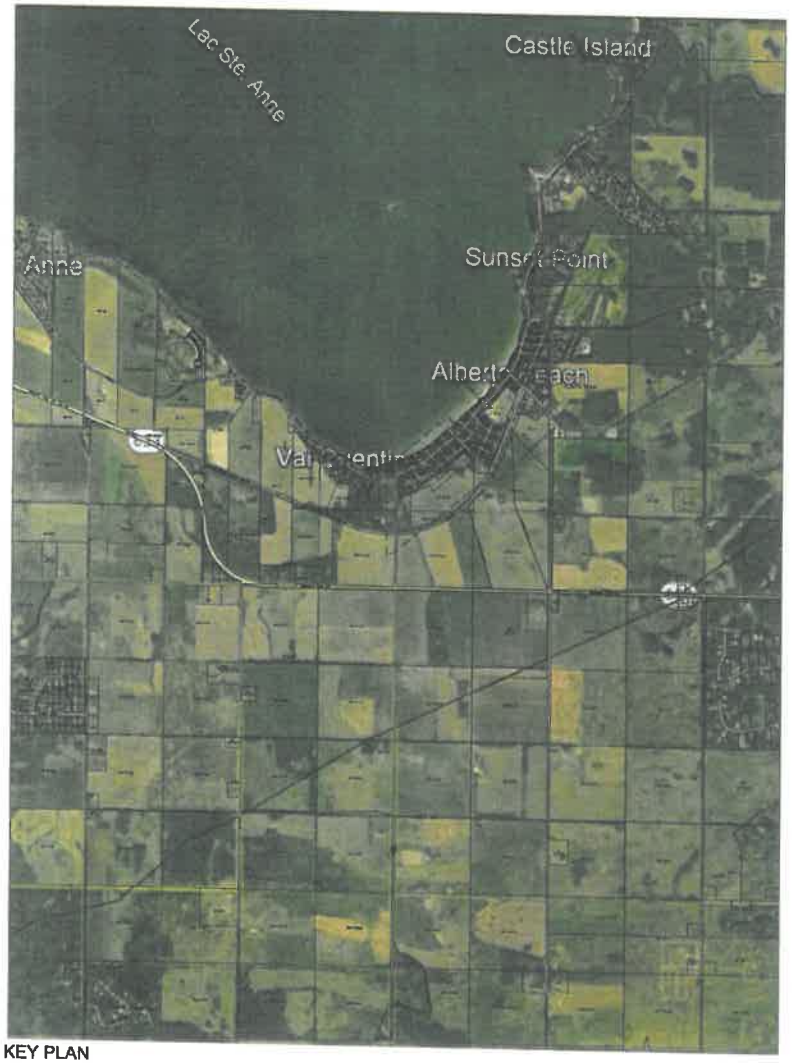
6. Closure

We trust that this report meets your present requirements. We have identified or confirmed drainage improvements that are to be considered for areas upstream of the Summer Village of Val Quentin, the Village of Alberta Beach and the Summer Village of Sunset Point along with preliminary costs estimates to complete the work. As funding becomes available, further detailed design and implementation of the proposed improvements can be completed. If there are any major changes in the land use or newly flooded areas occur within the study area in the future, the results of this report and conceptual design should be reviewed and adjusted accordingly.

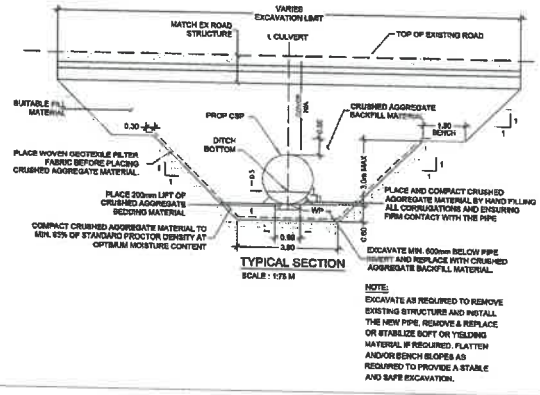
This document was prepared by Bolson Engineering in accordance with generally accepted engineering practices and is intended for the exclusive use and benefit of Lac Ste. Anne County.

APPENDIX A:

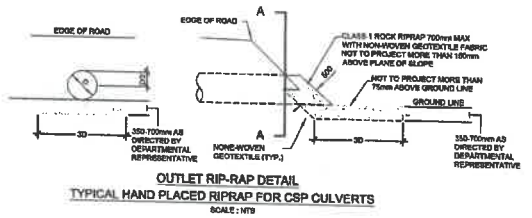
TYPICAL CONSTRUCTION DETAILS



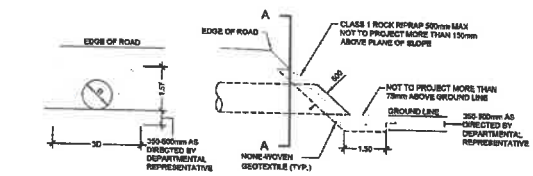
KEY PLAN
NTS



TYPICAL SECTION
SCALE : 1:75 M



OUTLET RIP-RAP DETAIL
TYPICAL HAND PLACED RIPRAP FOR CSP CULVERTS
SCALE : NTS



INLET RIP-RAP DETAIL
TYPICAL HAND PLACED RIPRAP FOR CSP CULVERTS
SCALE : NTS

Note: Riprap @ Inlet = 6.0m2
Riprap @ Outlet = 9.0m2

SECTION DETAILS
SCALE AS SHOWN

NOTES

LEGEND

ENGINEER'S STAMP | PERMIT STAMP

NO.	DATE	REVISIONS	BY
1	2023-11-24	ISSUED FOR APPROVAL	TT

DRAWN BY:	DATE:	CHECKED BY:	DATE:
YD	23-11-23	TT	23-11-24
ENGINEER:	DATE:	APPROVED:	DATE:
TT	23-11-24	TT	23-11-24

KEY PLAN
CULVERT PLAN AND DETAILS
FOR ROADWAY CROSSINGS > 600mm
COUNTY OF LAC STE ANNE, ALBERTA

SCALE:	CLIENT:
1:200	COUNTY OF LAC STE ANNE

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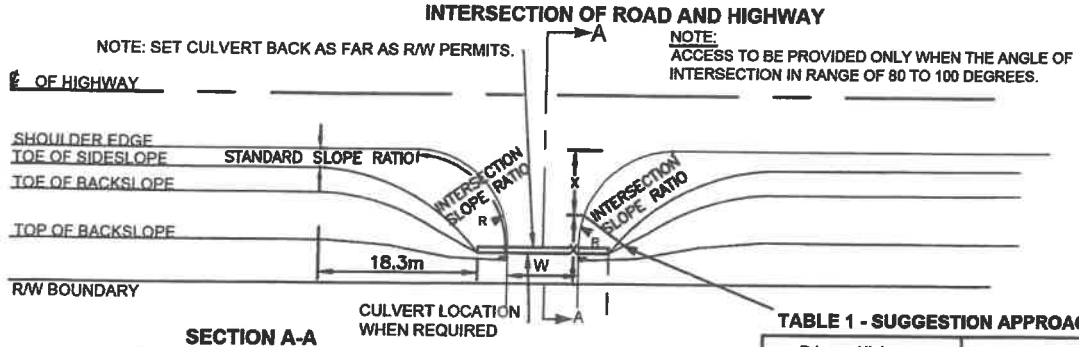
FAX:780-413-6879

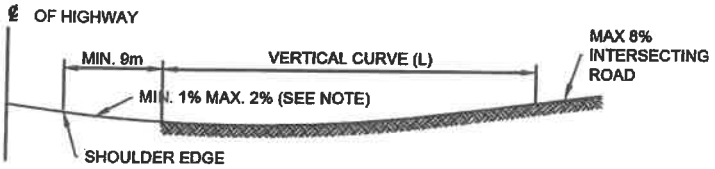
JOB NUMBER:	DWG NUMBER:	REV:
23-D-005	C-1.0	0

APPROACH TREATMENT FOR MINOR INTERSECTING ROADWAY

INTERSECTION OF ROAD AND HIGHWAY



SECTION A-A
INTERSECTING ROAD IN CUT



SECTION A-A
INTERSECTING ROAD IN FILL

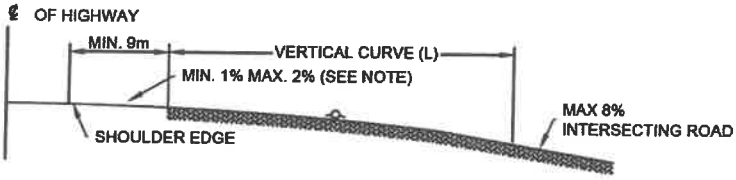


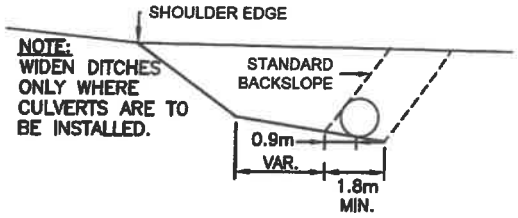
TABLE 1 - SUGGESTION APPROACH SIDESLOPES *

Primary Highway Posted>= 100km/h	Fill Height	Desirable Slope on New Approach
Undivided Highway AADT <1,000	<4m fill	7:1
	>4m fill	4:1
Undivided Highway 1,000<AADT<3,000	<4m fill	7:1
	>4m fill	5:1
Undivided Highway AADT >3,000	<4m fill	7:1
	>4m fill	6:1
Divided Highway AADT <6,000	<4m fill	7:1
	>4m fill	7:1
Divided Highway 6,000<AADT<15,000	<4m fill	8:1
	>4m fill	7:1
Divided Highway AADT>15,000	<4m fill	10:1
	>4m fill	7:1

* APPROACH TO SLOPE TO BE MEASURED AT A POINT MIDWAY BETWEEN THE HIGHWAY SHOULDER AND BASIC RIGHT-OF-WAY BOUNDARY AS ILLUSTRATED ON FIGURES D-33a AND D-33b

MINIMUM LENGTH OF VERTICAL CURVE

ALGEBRAIC DIFF IN GRADIENT (%)	LENGTH (m)	
	CREST	SAG
1	6	8
2	12	15
3	18	23
4	24	30
5	30	38
6	37	46
7	/	46
8	/	46
9	/	46



DETAIL OF DITCH AND CULVERT LOCATION

NOTE:
WHERE THE MINOR INTERSECTING ROADWAY HAS A LARGE NUMBER OF WB-15 VEHICLES TURNING, THE APPROACH TREATMENT SHOWN IN FIGURE D-3.3a SHOULD BE USED.

TABLE FOR DETERMINATION OF ROADWAY WIDTH			RADIUS OF INTERSECTION EDGE OF SHOULDER (R)
USE	ROADWAY WIDTH, W * (m)		
	SINGLE	JOINT	SINGLE OR JOINT ACCESS
RESIDENTIAL	8	10	10
AGRICULTURAL	10	10.5	15
UTILITY MAINTENANCE	8		15
PUBLIC ROAD ALLOWANCE	8		15

* ENGINEERING DISCRETION SHOULD BE USED IN SELECTING A ROADWAY WIDTH TO SUIT THE NEEDS OF THE ACCESS.

NOTE:
DESIRABLE MINIMUM 1% IS TO PREVENT PONDING AND SUBSEQUENT ICING AT THE INTERSECTION.

DESIRABLE MAXIMUM 2% IS FOR EASE OF OPERATION IN ALL WEATHER CONDITIONS.

APPROACH GRADES BETWEEN 0.5 % AND 3%, ABSOLUTE MAXIMUM 6% ARE CONSIDERED ACCEPTABLE. APPROACH ROAD GRADES UP TO 1% SLOPING DOWN TOWARD THE HIGHWAY MAY BE USED TO MATCH SUPERELEVATION ON THE HIGHWAY, IF DESIRABLE FOR ENGINEERING REASONS.

MINIMUM CULVERT REQUIRED

APPROACH: 500mm

CENTERLINE: 600mm

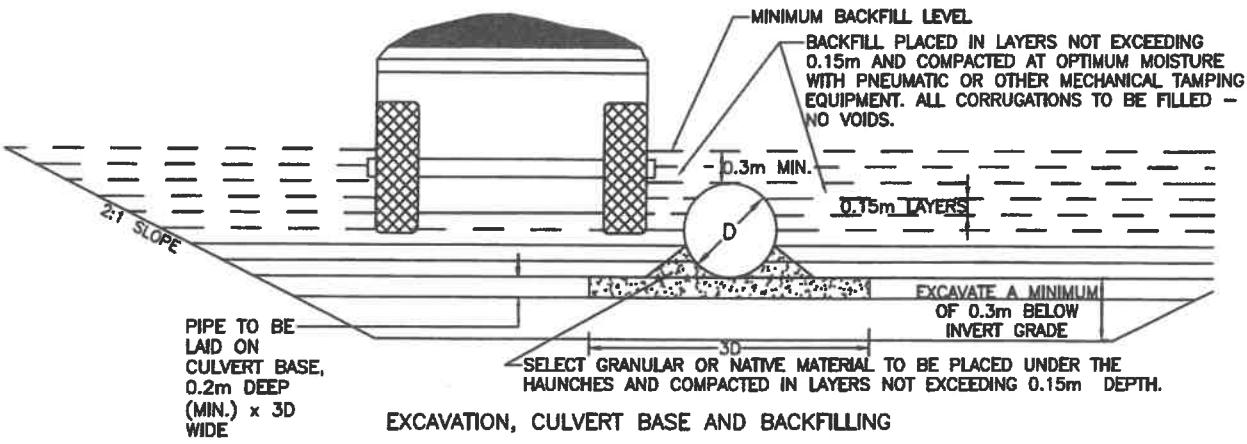
Scale: N.T.S.

Date: JUNE 24, 2020

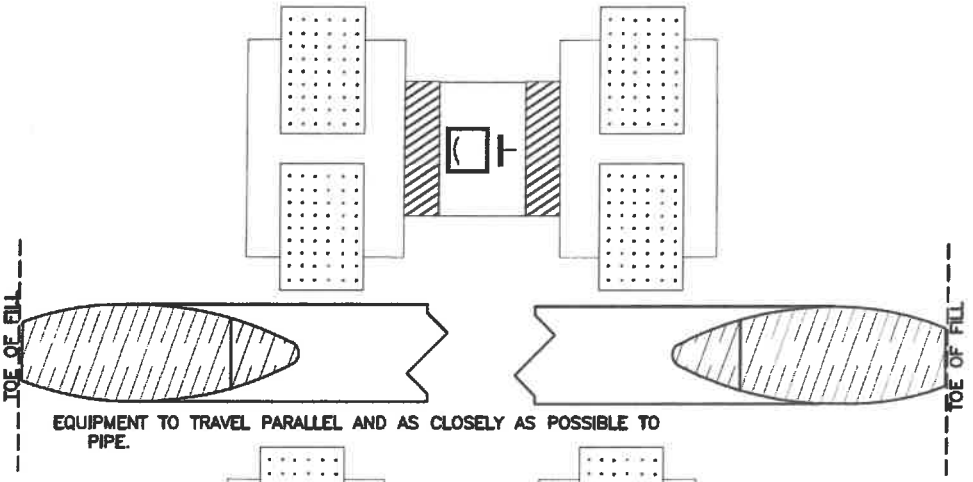
Drawn By: SE Design

DESIGN SPECIFICATIONS FOR CULVERTS

CORRUGATED METAL PIPE CULVERT INSTALLATION

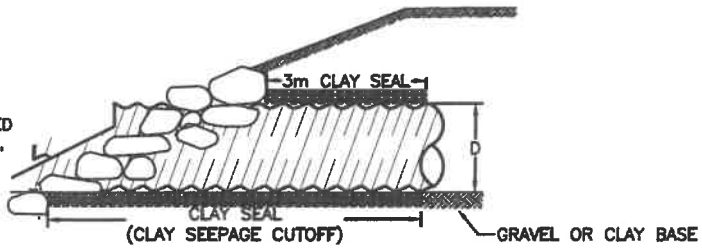


EXCAVATION, CULVERT BASE AND BACKFILLING



COMPACTION (PLAN VIEW)

CLAY SEAL FOR SEEPAGE TO BE PLACED AT BOTH ENDS, FOR A LENGTH OF 3m, AND TO THE TOP OF THE PIPE



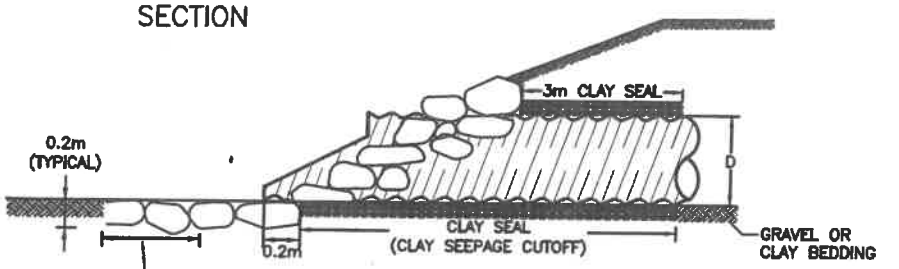
CLAY SEAL DETAIL

	MINIMUM CULVERT REQUIRED **APPROACH: 500mm** **CENTERLINE: 600mm**	Scale: N.T.S. Date: JUNE 25, 2020 Drawn By: SE Design

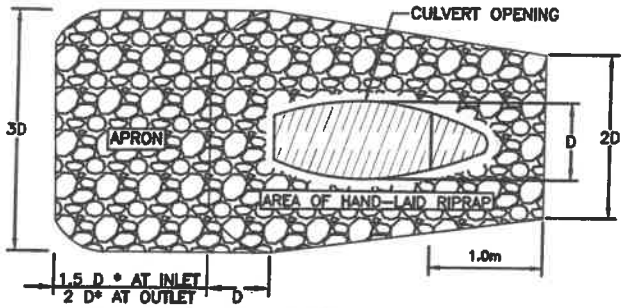
DESIGN SPECIFICATIONS FOR CULVERTS

HAND LAID ROCK RIPRAP

SECTION

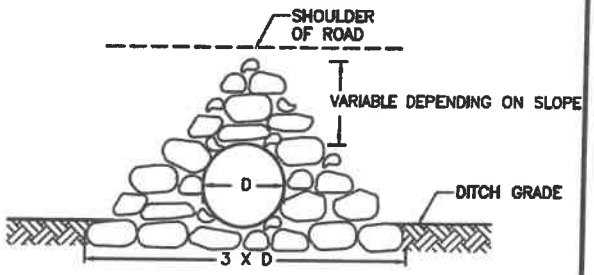


APRONS TO BE CONSTRUCTED AT INLET AND OUTLET ENDS OF CULVERT WHEN SPECIFIED



* THESE ARE THE TYPICAL MINIMUM DIMENSIONS.

PLAN VIEW



ELEVATION

NOTES:

1. ROCKS AND BOULDERS SHALL BE SELECTED AS NEARLY CUBICAL IN FORM AS PRACTICAL AND SHALL HAVE AT LEAST A MINIMUM DIMENSION OF 200mm. THE STONES SHALL BE PLACED WITH THEIR BEDS AT RIGHT ANGLES TO THE SLOPE, THE LARGER STONES BEING USED IN THE BOTTOM COURSES AND THE SMALLER STONES AT TOP. THEY SHALL BE LAID IN CLOSE CONTACT SO AS TO BREAK JOINTS AND IN SUCH MANNER THAT THE WEIGHT OF THE STONE IS CARRIED BY THE EARTH AND NOT BY THE ADJACENT STONES. THE FINISHED WORK SHALL PRESENT AN EVEN TIGHT, AND REASONABLY PLANE SURFACE, VARYING NOT MORE THAN 75mm FROM THE REQUIRED CONTOUR.
2. WHERE NO SPECIAL TREATMENT IS REQUIRED CULVERT INVERT ELEVATIONS ARE TYPICALLY SET ABOUT 0.15 X DIAMETER BELOW THE DRAINAGE COURSE ELEVATION.
3. A CLAY SEAL IS TO BE PLACED AT BOTH ENDS OF THE CULVERT FOR A LENGTH OF 3m TO CUT OFF SEEPAGE. THE CLAY SEAL SHALL EXTEND FROM THE BOTTOM OF THE EXCAVATION TO 300mm ABOVE THE CROWN OF THE PIPE AND FOR THE FULL WIDTH OF THE EXCAVATION.
4. WHERE APRONS ARE REQUIRED DUE TO HIGH VELOCITY FLOW OR EROSION PRONE SOIL, TYPICALLY THE MINIMUM INLET APRON IS 1.5x DIAMETER LONG WHILE THE MINIMUM OUTLET APRON (WHERE WATER VELOCITY IS HIGHER IS HIGHER) IS TWO DIAMETERS LONG.

ESTIMATED RIPRAP SURFACE AREAS*

PIPE DIAMETER (mm)	AREA OF ONE END EXCLUDING APRON (m^2)	AREA OF ONE END INCLUDING INLET APRON (m^2)	AREA OF ONE END INCLUDING OUTLET APRON (m^2)
500	2	3	4
600	3	5	6
700	4	6	7
800	5	8	9
900	6	10	11
1000	7	12	13
1100	9	14	16
1200	10	16	19
1400	13	22	25

* THE ESTIMATED RIPRAP SURFACE AREAS SHOWN IN THIS TABLE ARE BASED ON A 4:1 SIDESLOPE

MINIMUM CULVERT REQUIRED

APPROACH: 500mm

CENTERLINE: 600mm

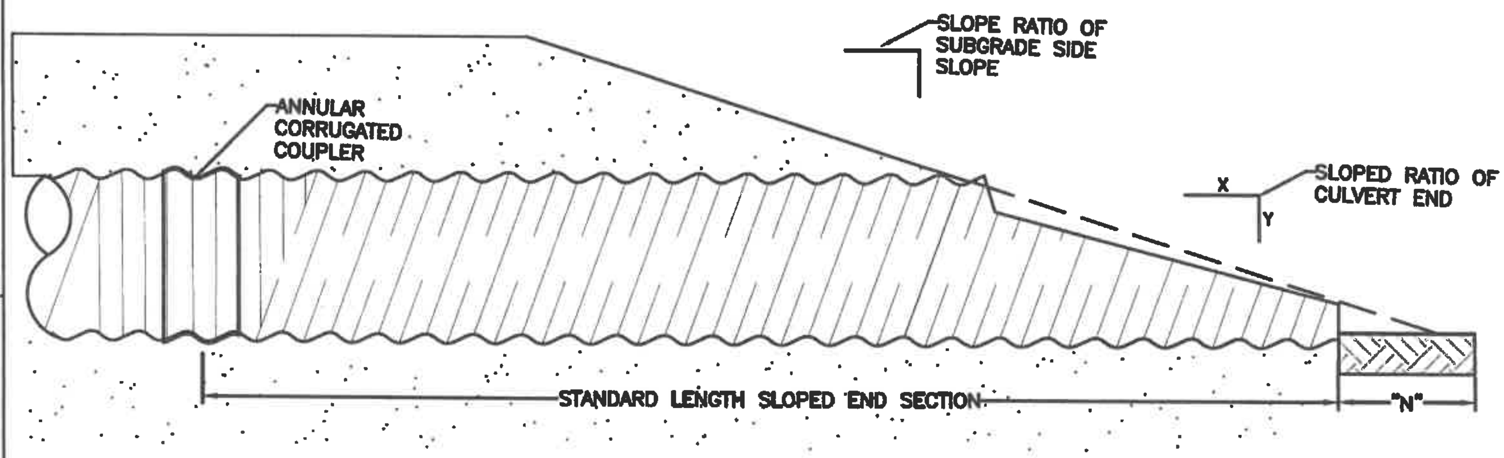
Scale: N.T.S.

Date: JUNE 25, 2020

Drawn By: SE Design

DESIGN SPECIFICATIONS FOR CULVERTS

SLOPED END INSTALLATIONS FOR ROUND SECTION CORRUGATED METAL PIPE



SELECTION OF SLOPE RATIO FOR SLOPED END SECTION:

A 4 : 1 SLOPED END SECTION SHALL BE USED IN CONJUNCTION WITH ALL SUBGRADE SIDE SLOPES WITH THE EXCEPTION OF 1200mm DIA. AND LARGER WHERE APPLICABLE.

C.S.P. DIAMETER – D mm	SLOPE RATIO OF CULVERT END X:Y	"N" – m WITH 3:1 SUBGRADE SLOPE RATIO	WITH 4:1 SUBGRADE SLOPE RATIO	WITH 5:1 SUBGRADE SLOPE RATIO	WITH 6:1 SUBGRADE SLOPE RATIO	INVERT LENGTH OF SLOPE END SEC. METRE
400	4 : 1	0.3	0.5	0.8	1.2	6.0
500	4 : 1	0.3	0.6	0.9	1.5	6.0
600	4 : 1	0.3	0.6	1.0	1.6	6.0
700	4 : 1	0.3	0.8	1.2	2.0	6.0
800	4 : 1	0.4	0.9	1.4	2.3	6.0
900	4 : 1	0.5	1.0	1.6	2.5	6.0
1000	4 : 1	0.5	1.2	1.8	2.8	6.0
1200	3 : 1 4 : 1	0.5 0.5	1.7 1.4	2.4 2.2	3.7 3.5	6.0
1400	3 : 1 4 : 1	0.5 0.5	1.9 1.6	2.8 2.5	4.3 3.9	6.0

DETERMINING INSTALLATION LENGTH

THE LENGTH OF PIPE CULVERT TO BE INSTALLED SHALL BE DETERMINED AS FOLLOWS:

1) ESTABLISH THE THEORETICAL LENGTH BASED ON SLOPE STAKE REQUIREMENTS. WHERE NO SPECIAL TREATMENT IS REQUIRED, CULVERT INVERT ELEVATIONS ARE TYPICALLY SET ABOUT 0.15 X DIAMETER BELOW THE DRAINAGE COURSE ELEVATION.
2) ADJUST THE THEORETICAL LENGTH BY APPLYING THE END CORRECTION N AS DETERMINED FROM THE TABLE TO EACH END OF THE CULVERT.
3) INSTALLATION LENGTH SHALL BE THE LENGTH DETERMINED IN "2" ABOVE, ROUNDED OFF TO THE NEAREST METRE.

MINIMUM CULVERT REQUIRED

APPROACH: 500mm

CENTERLINE: 600mm

Scale: N.T.S.

Date: JUNE 25, 2020

Drawn By: SE Design

DESIGN SPECIFICATIONS FOR CULVERTS