CHIN GROUPED COUNTRY RESIDENTIAL AREA STRUCTURE PLAN

APRIL 2024

DOUGLAS J. BERGEN & ASSOCIATES LTD.
ARCHITECTURAL TECHNOLOGY

CHIN GROUPED COUNTRY RESIDENTIAL AREA STRUCTURE PLAN

April 2024

Prepared for
Mr. Peter Klassen
Chin, Alberta

Prepared by
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1. INTRODUCTION

1.1. PURPOSE OF THE PLAN

The purpose of the Chin Meadows Area Structure Plan (ASP) is to set out a concept for planning and proposed guidelines for the future subdivision and development of the lands described in this document. The plan has been prepared to compliment the proposed amendment to the Lethbridge County Land Use Bylaw No. 1404 to change the zoning of the subject lands from Rural Urban Fringe (RUF) to Grouped Country Residential (GCR) and Rural General Industrial (RGI).

1.2 LOCATION AND BACKGROUND

(an excerpt from the Lethbridge County – Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission)

The subject property is located immediately north of the Hamlet of Chin. It is legally described as Blocks A, B & E on Plan 899AA. See **Figure 1.0 County Map and Figure 2.0 Land Use Districts**.

The Hamlet of Chin is located approximately 17 miles (27 km) east of the City of Lethbridge, ½ mile (0.8 km) north of Highway 3, situated between the Towns of Coaldale and Taber. Chin is located on the very eastern border of Lethbridge County with the Municipal District of Taber western boundary beginning immediately east of the hamlet. Chin currently encompasses approximately 19.7 acres (7.0 ha) of land within its designated boundary. The hamlet basically functions as a small urban residential area for the surrounding agricultural area. Chin is also located adjacent to the McCain Foods Ltd. potato processing plant, which is one of the larger industrial processing developments in Lethbridge County.

Chin was initially founded as a settlement area in the early 1900s due to both agriculture and the Canadian Pacific Railway (CPR) line being established in close proximity. The name Chin was derived from the native Blackfoot language of the Blackfoot First Nations who historically held a significant presence in southern Alberta. The CPR and the Alberta Railway and Irrigation Company registered the original subdivision site plan in 1910 (Plan 899AA) for lands north of the rail line. The CPR appeared to have grand expectations for the community to grow, as the original plan covered an area twice as large as what exists today. The north half of the original Chin subdivision plan was never developed for hamlet use, and in 1964 was consolidated into one larger block (Block E) and amalgamated with adjacent Blocks A and B into a single title. **Figure 3.0** illustrates the current hamlet layout and lot/block configuration in respect of the 1964 consolidated plan.

LETHBRIDGE COUNTY – SUBJECT LOCATION MAP

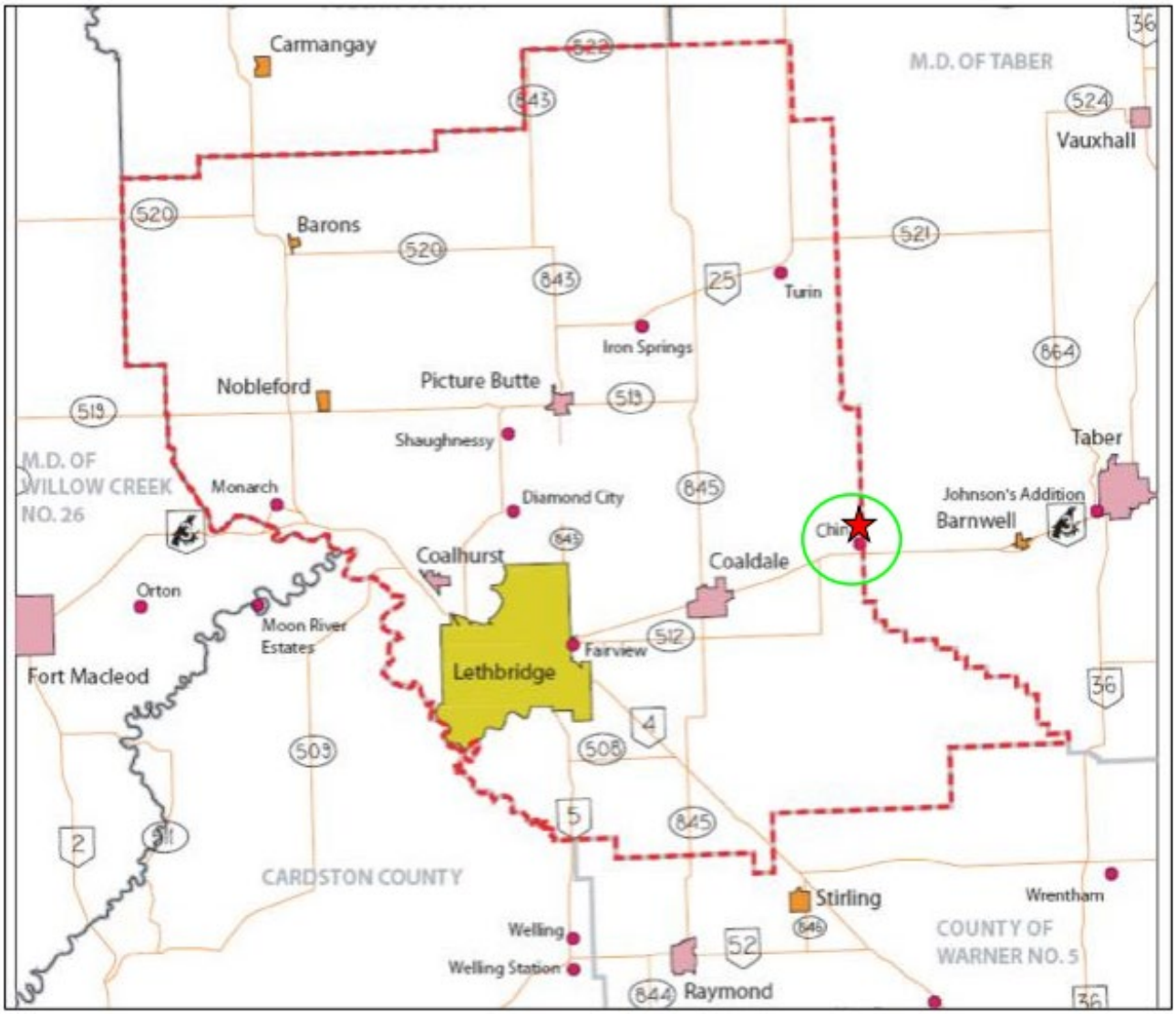


Diagram sourced from Lethbridge County - Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission

Figure 1.0 – County Map

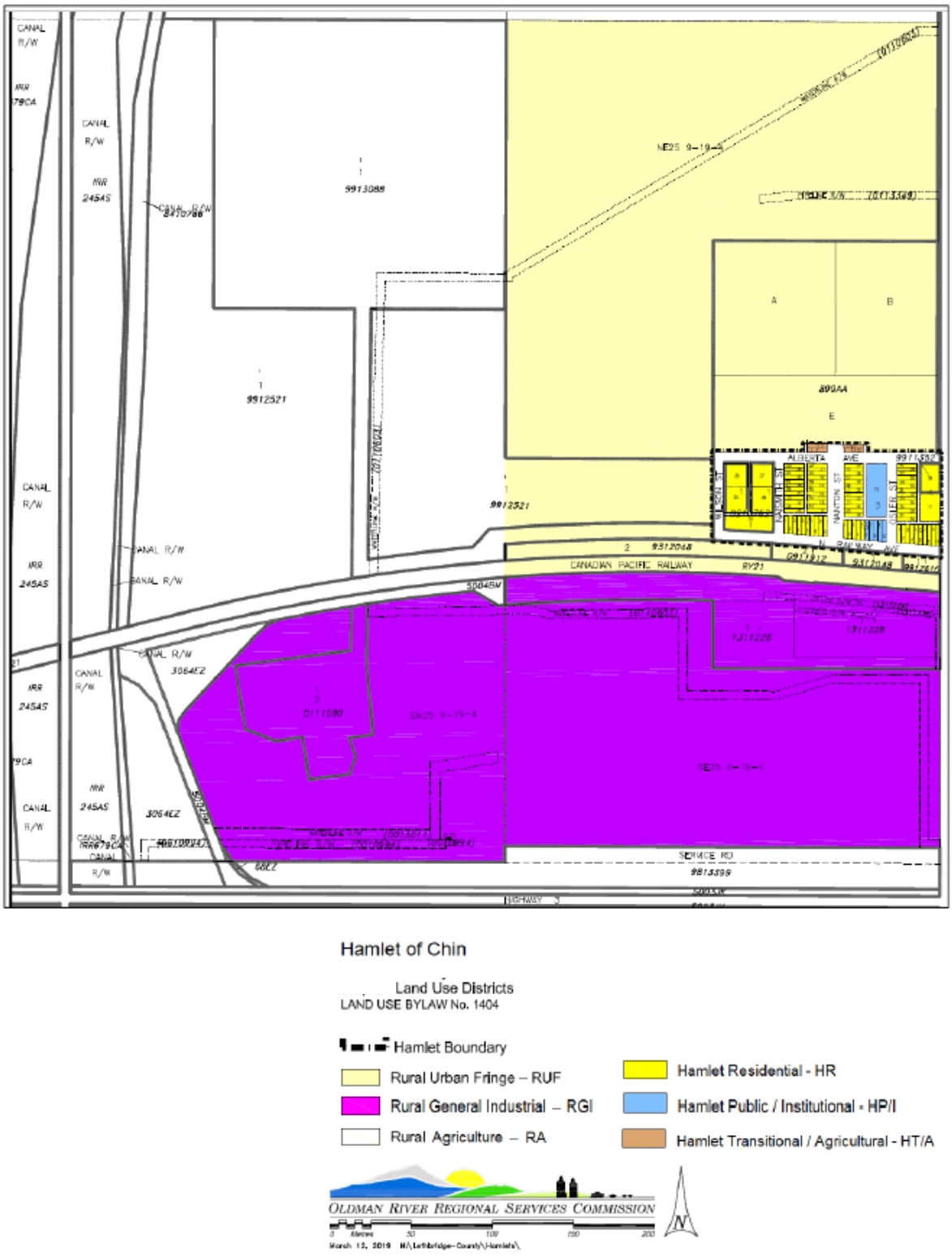


Diagram sourced from Lethbridge County - Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission

Figure 2.0 – Land Use Districts

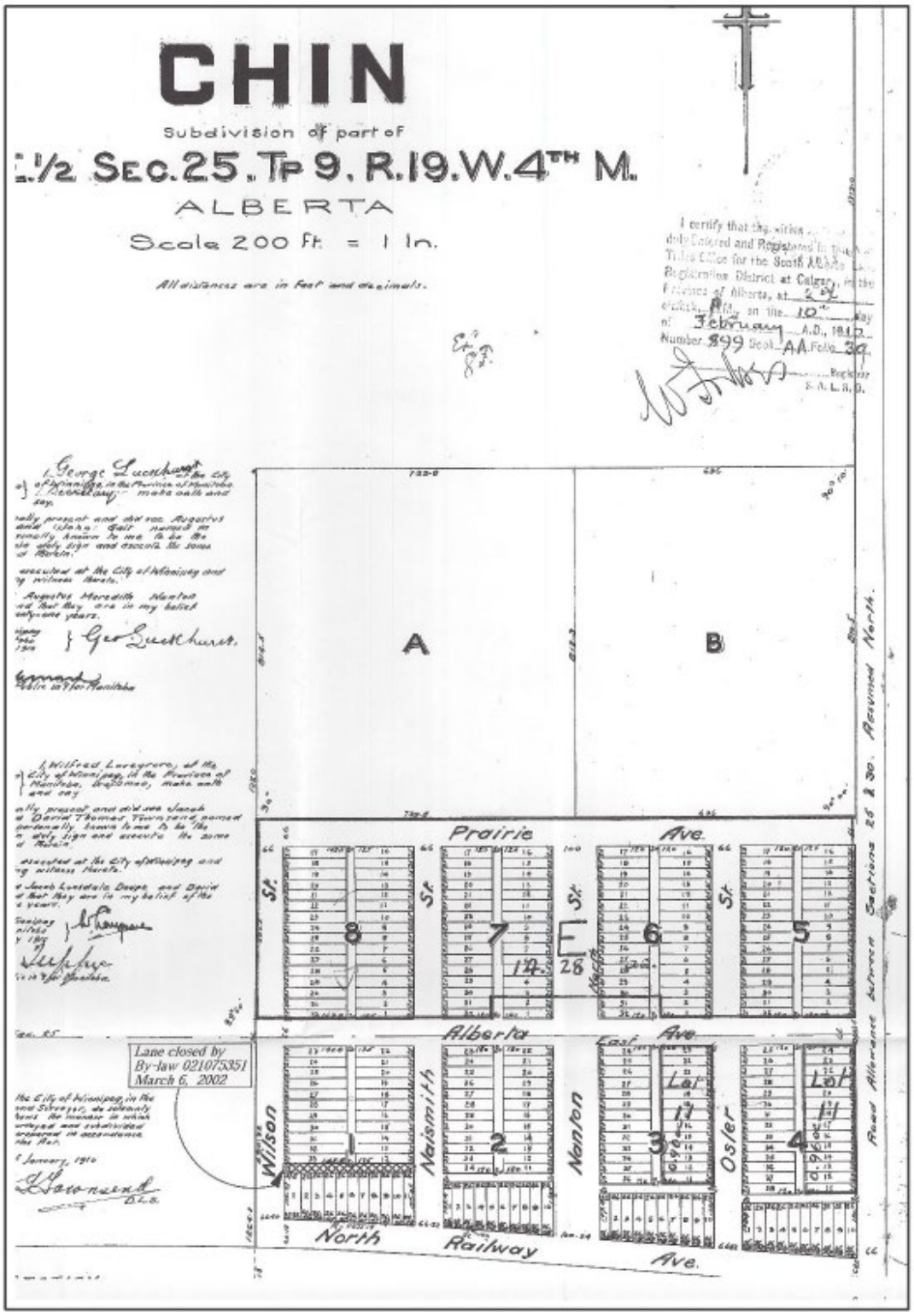


Diagram sourced from Lethbridge County - Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission

Figure 3.0 – Original
Subdivision Plan for Chin

Chin never grew as originally anticipated and today it basically provides for a rural lifestyle within a small urban community setting. After a slight reduction in population size that occurred during the mid-century, the hamlet has experienced significant population growth over the last two decades. Population increases have included three census periods of 20% growth or higher, including one of 52.1% between 1996 and 2001. It is noted that these growth percentages appear high as the population itself is quite small at approximately 62 people. Chin remains a viable rural residential living option, especially as Taber and Coaldale continue to experience significant growth in the region.

Today, the hamlet is situated in close proximity to several large industrial operations, such as McCain Foods Ltd. and an anaerobic digester facility located adjacent in the MD of Taber, which help provide economic viability to the Chin area. This opportunity is recognized by the current land owner and therefore the preparation of this Area Structure Plan.

1.3 APPROVAL PROCESS

This Area Structure Plan will be submitted to the Lethbridge County in support of an application to amend the Lethbridge County Land Use Bylaw. An application will be submitted for a land use amendment from Rural Urban Fringe (RUF) to Grouped Country Residential (GCR) and Business Light Industrial (BLI). The Area Structure Plan application will be circulated in accordance with the Lethbridge County policies seeking comment from the appropriate authorities including:

1. The Oldman River Regional Services Commission
2. St. Mary's Irrigation District
3. Alberta Environment and Parks
4. Alberta Agriculture Food and Rural Development
5. The Chinook Regional Health Authority
6. Municipal District of Taber

Lethbridge County council will evaluate the comments received from the above mentioned authorities prior to rendering a decision on the application for re-designation. If the Area Structure Plan and rezoning applications are approved, the applicant will have a framework from which to make application for the subdivision of the various lots. A Development Agreement will be entered into between the Lethbridge County and the applicant to ensure orderly and quality infrastructure as directed by the agreement.

1.4 LEGISLATIVE FRAMEWORK

1.4.1 The Municipal Government Act

The Municipal Government Act (MGA) is the provincial legislation which regulates municipal land use planning. This legislation sets out the requirements for two documents which this proposal is subject to: The Lethbridge County Municipal Development Plan and the Land Use Bylaw.

1.4.2 The Municipal Development Plan

The Lethbridge County Municipal Development Plan (MDP) documents broad policies relative to development and growth within the County. This planning document pays particular attention to the desire of the County to maintain a strong agricultural base.

The subject property is of a size and scale that does not allow for a viable farming operation and therefore is suitable for consideration of reclassification and further subdivision. This Area Structure Plan is intended to provide the information required by the MDP to enable council to make an informed decision on the application.

1.4.3 Subdivision Regulations

The MGA outlines the requirements for the creation of new parcels of land in the County. The application for subdivision of the new lots as laid out in this Area Structure Plan will be submitted to the Oldman River Regional Services Commission (ORRSC) for processing.

1.4.4 Land Use Bylaw

The Lethbridge County Land Use Bylaw No. 1404 recognizes the area of the proposed development as Rural Urban Fringe (RUF). The purpose of this classification is by in large to protect land for agricultural purposes and prevent fragmentation of parcels that may be considered in future annexations of the Hamlet of Chin. The proposed re-designation of the subject land is intended to be Grouped Country Residential (GCR) for the 12 new residential lots as well as the existing residential parcel. The existing tire shop site would also be considered for reclassification to Business Light Industrial (BLI). See **Figure 8.0 – Subdivision Layout**.

1.5 JUSTIFICATION

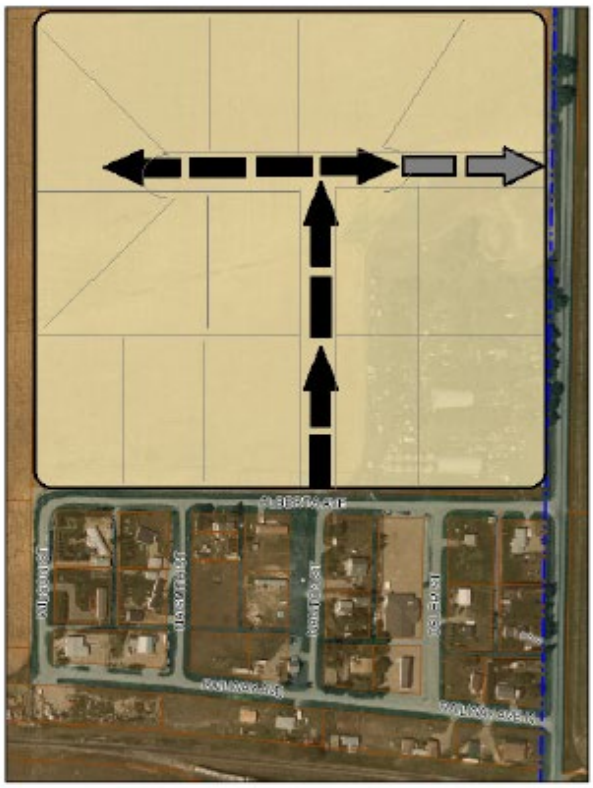
The Hamlet of Chin Growth Study approved by a Resolution of County Council in June of 2020 makes way for the further subdivision of Blocks A, B & E. The overall parcel does not have St. Mary's River Irrigation District irrigation rights and is of an odd shape. Small irregular parcels without irrigation rights are greatly compromised as viable farming operations.

Part 7 Paragraph 3 of the Chin Growth Study recognizes that "future hamlet growth should be directed to land to the north (Blocks A, B and E, Plan 899AA)." See **Figure 4.0 for Recommended Growth Direction**.

This diminished value as agricultural land gives way to a higher and better use of the property as a residential development. Small acreage parcels are a viable option for consideration. This proposed use is prevalent in fringe areas of many County communities with the Hamlet of Chin being no exception. There is increased benefit to the County should this proposal be approved given the land value would increase making way for a greater tax base.

The owner believes that the proposal outlined in this ASP is in keeping with the Municipal Development Plan as well as the Hamlet of Chin Growth Study and therefore offers support for further subdivision.

Map 4A



Map 4B

Diagram sourced from Lethbridge County - Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission

Figure 4.0 – Recommended Growth Direction

2. GOALS

2.1 GOALS

The principal goals of the Chin Meadows Area Structure Plan are:

1. To provide the information required to support the further subdivision of the land;
2. To establish a framework for the future development of the subject parcels;
3. To set out the access, servicing, and development standards that must be met in the development of the lands.

3. PLAN AREA

3.1 SITE ANALYSIS

3.1.1 Site Location

The parcels of subject land are located immediately north of The Hamlet of Chin in Lethbridge County. The proposed subdivided area is 'L' shaped with an existing homestead in the southeast corner. The 'L' shaped portion makes up some 32 acres of the original 41 acre parcel. See **Figure 5.0 – Aerial Photo**.

3.1.2 Existing Land Use

The property is currently farmed as dryland with a grain crop. The lack of irrigation rights prohibits strong consistent yields and therefore the subject 32 acres do not support a viable farming operation.

3.1.3 Topography and Site Characteristics

The property is virtually flat with minimal slopes from the north and south boundary to the centre of the property. The high point along the northern property line is at elevation 847.95 sloping to a low point of 846.84 near the centre. The high point along the southern boundary is at elevation 847.71. The natural low point runs east to west at the midpoint of the parcel. See **Figure 6.0 - Spencer Geometrics Topographical Survey**.

The proposed area to be subdivided is void of any vegetation or site features. The existing farmstead is bounded by a mature shelter belt with several buildings including a residence and shop.

The soils are generally comprised of a 100 mm layer of topsoil on top of low plastic clay and clay till. A geotechnical study was conducted on the site by BDT Engineering Ltd. to evaluate the property for its suitability for residential development and the building of roads. The results of the study support the proposed country residential development. The engineering document is available in **Appendix A – Geotechnical Investigation.**

3.1.4 Environmental, Historical, and Archaeological Significance

The County provided the applicant with a copy of the "Environmentally Significant Areas in the Oldman Region, County of Lethbridge" (February 1987) document. This study provides valuable information relative to this site.

Figure 5.0 – Aerial Photo

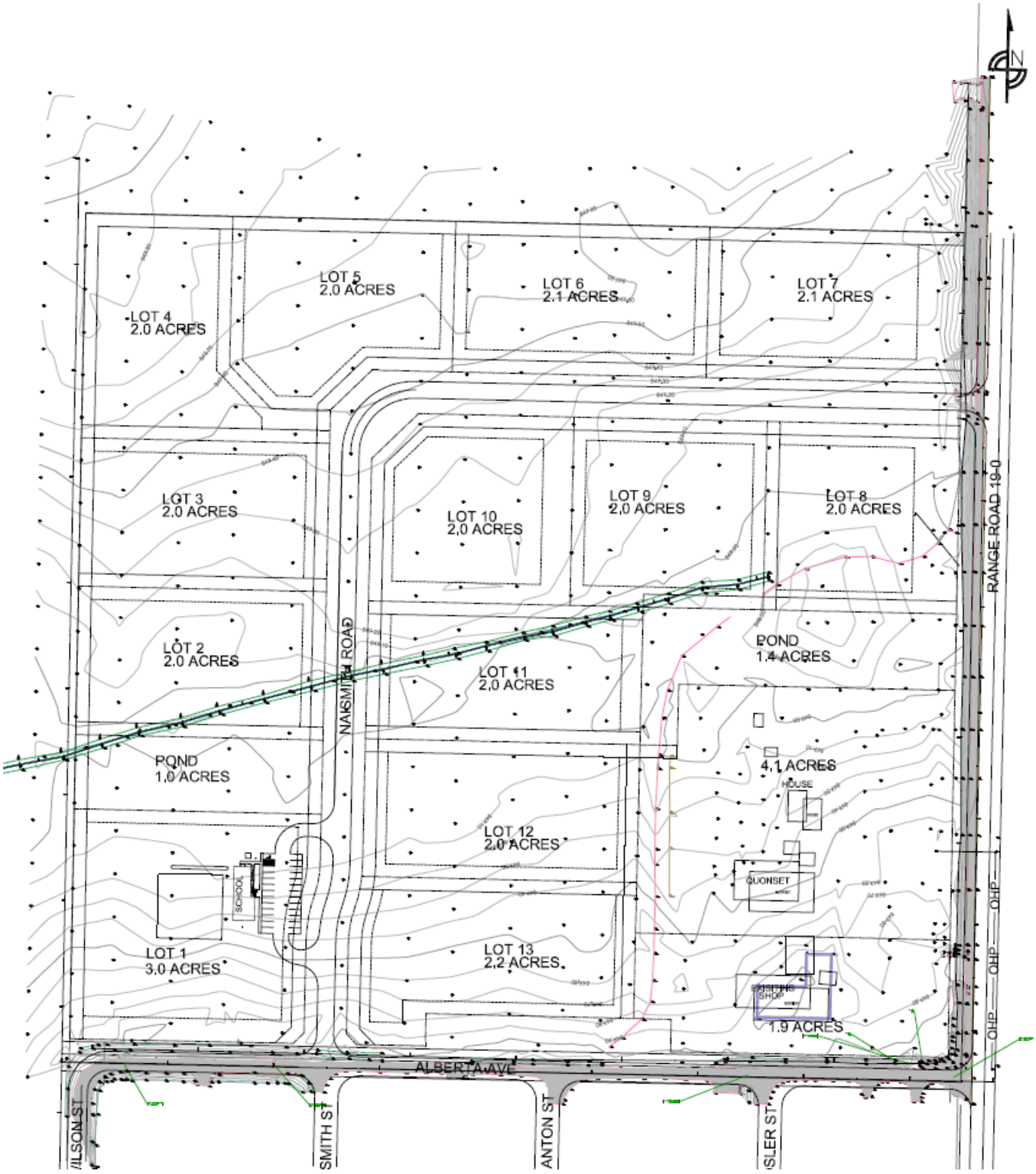


Figure 6.0 – Spencer Geometrics
Topographical Survey

The figures contained in the study revealed that the subject property is outside of any of the noted sensitive areas. The site has historically been used for agriculture and is located away from the edge of the river valley which comprises the most archaeologically significant area. See **Figure 7.0 – Environmentally Significant Areas.**

3.1.5 Opportunities and Constraints

3.1.5.1 Opportunities

This property offers an excellent opportunity for rural residential living. It's proximity to Coaldale offers convenience for daily necessities as well as a short bus ride for children attending schools.

There is increasing demand for labour in the immediate area given the expansion of the McCain's food plant to the west as well as the expanded irrigation acres by St. Mary's River Irrigation District.

Vital utilities such as natural gas and electricity are readily available adjacent to the property which will facilitate servicing convenience.

3.1.5.2 Constraints

The site has limited agricultural viability given the irregular shape coupled with lack of irrigation access.

Access to Potable Water

The Hamlet of Chin does not have sanitary sewer infrastructure which limits the residential parcel size to a minimum of 2.0 acres for future development in order to accommodate a septic field/mound system.

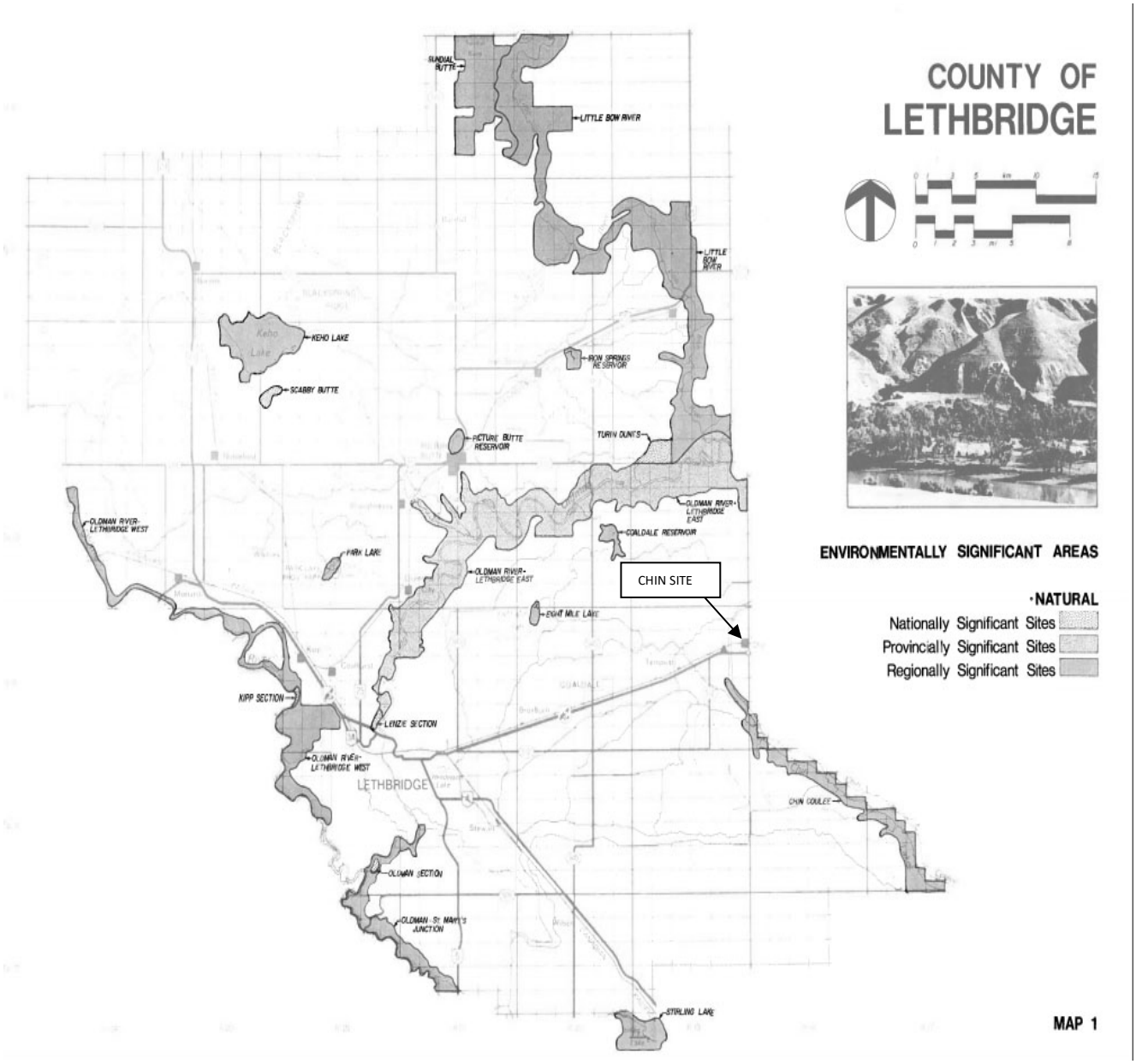


Diagram sourced from Environmentally Significant Areas in the Oldman River Region, County of Lethbridge, February 1987; prepared by Cottonwood Consultants Ltd.

Figure 7.0 – Environmentally Significant Areas

4. PROPOSED LAND AND DEVELOPMENT CONCEPT

4.1 DEVELOPMENT CONCEPT

The concept for the proposed lot layout is illustrated in **Figure 8.0 - Subdivision Layout**. The development proposal consists of 13 lots. Lot number 1 will be occupied by the Southern Alberta Christian Learning Centre as per Development Permit # 2023-112 and will remain as currently zoned – Rural Urban Fringe (RUF). See **Figure 9.0 School Development Permit.**

The remainder of the proposed residential lots will be zoned Grouped Country Residential (GCR) as governed by the Lethbridge County Land Use Bylaw. A gravel surface road is proposed to connect Alberta Ave with Range Road 19-0. The existing tire shop site would also be rezoned from Rural Urban Fringe (RUF) to Business Light Industrial (BLI).

4.2 CROWN LOT CONSOLIDATION

The CPR and Alberta Railway and Irrigation Company registered four lots on the north side of Alberta Ave. with the legal descriptions:

Lot 1	Block 7	Plan 899AA
Lot 2	Block 7	Plan 899AA
Lot 31	Block 6	Plan 899AA
Lot 32	Block 6	Plan 899AA

The lots are currently owned by the Crown and front onto Nanton St. See **Figure 10.0 – Hamlet Plan with Existing Lot Layout**. In the event that this Area Structure Plan is adopted, steps will be taken to have these lots turned over to Lethbridge County and consolidate them with proposed lot #13 at the appropriate cost.
A partial road closure of Nanton St. as well as the adjacent lane ways will also need to be undertaken.

4.3 DEVELOPMENT AGREEMENT

As stipulated by the Land Use Bylaw, the Developer will enter into a Development Agreement with the Lethbridge County. The development agreement will outline specific conditions for development of the site. It is expected that these will include:

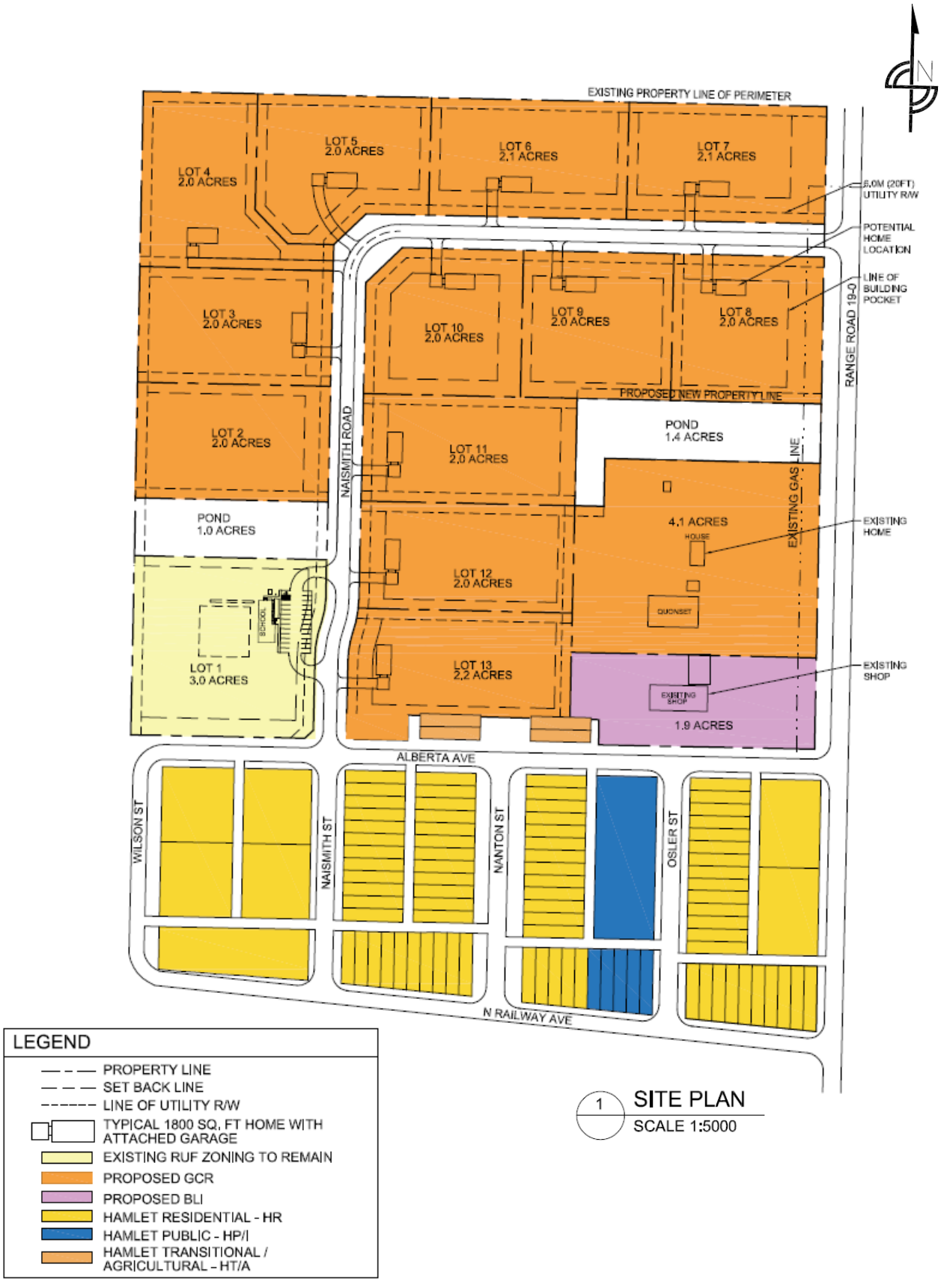


Figure 8.0 – Subdivision Layout

LETHBRIDGE COUNTY

Lethbridge County
#100, 905 - 4th Ave S
Lethbridge, AB T1J 4E4
403-328-5525

FORM B

LETHBRIDGE COUNTY
DEVELOPMENT PERMIT

Pursuant to Land Use Bylaw No. 1404

Development Permit No: 2023-112

Applicant: Southern Alberta Christian Learning Centre, Box 1033, Coaldale, Alberta, T1M 1M8

In respect of works consisting of: Public / Institutional (School - 4,000 sq. ft.) with Accessory Structure (Playground – 14,400 sq. ft.)

On land located at: Plan 899AA Block A (94048 RR 190) and as described on plans submitted by the applicant.

This permit refers only to works outlined in Development Application No. 2023-112 and is **subject to the conditions contained herein**:

- The School and Playground shall be located as per the submitted site plan.
- The applicant shall enter into a Dust Control Agreement to apply Dust Control to Alberta Avenue on an annual basis.
- The area surrounding the playground shall be fenced, to the satisfaction of the Development Authority, to ensure that users do not present a hazard to traffic.
- Any signage on this parcel shall require a new Development Permit.
- Approval of all Building Permits (includes Plumbing, Electrical, Gas permits, and Private Sewage Disposal Systems) must be obtained ***prior*** to commencement. Building Permits are obtained through **Park Enterprises**, #10, 491 W.T. Hill Blvd. South, Lethbridge. Phone - (403) 329-3747.
- Any planned work in the County right-of-way (driveway, approaches, etc.) requires separate approval from the County Director of Public Operations (call 403-328-5525).

INFORMATIVE: Alberta Transportation and Economic Corridors has provided comment on this development, stating that a Roadside Development Permit is required for this development. See attached correspondence for details.

Date of Decision: July 25, 2023

Appeal Period Expiry Date: August 15, 2023

The above-mentioned permit is subject to an appeal period. Any person affected by a decision regarding a Development Permit may file an appeal with the Development Appeal Board within twenty-one (21) days of the date of decision (section 686 of the Municipal Government Act).

Figure 9.0 – School Development Permit

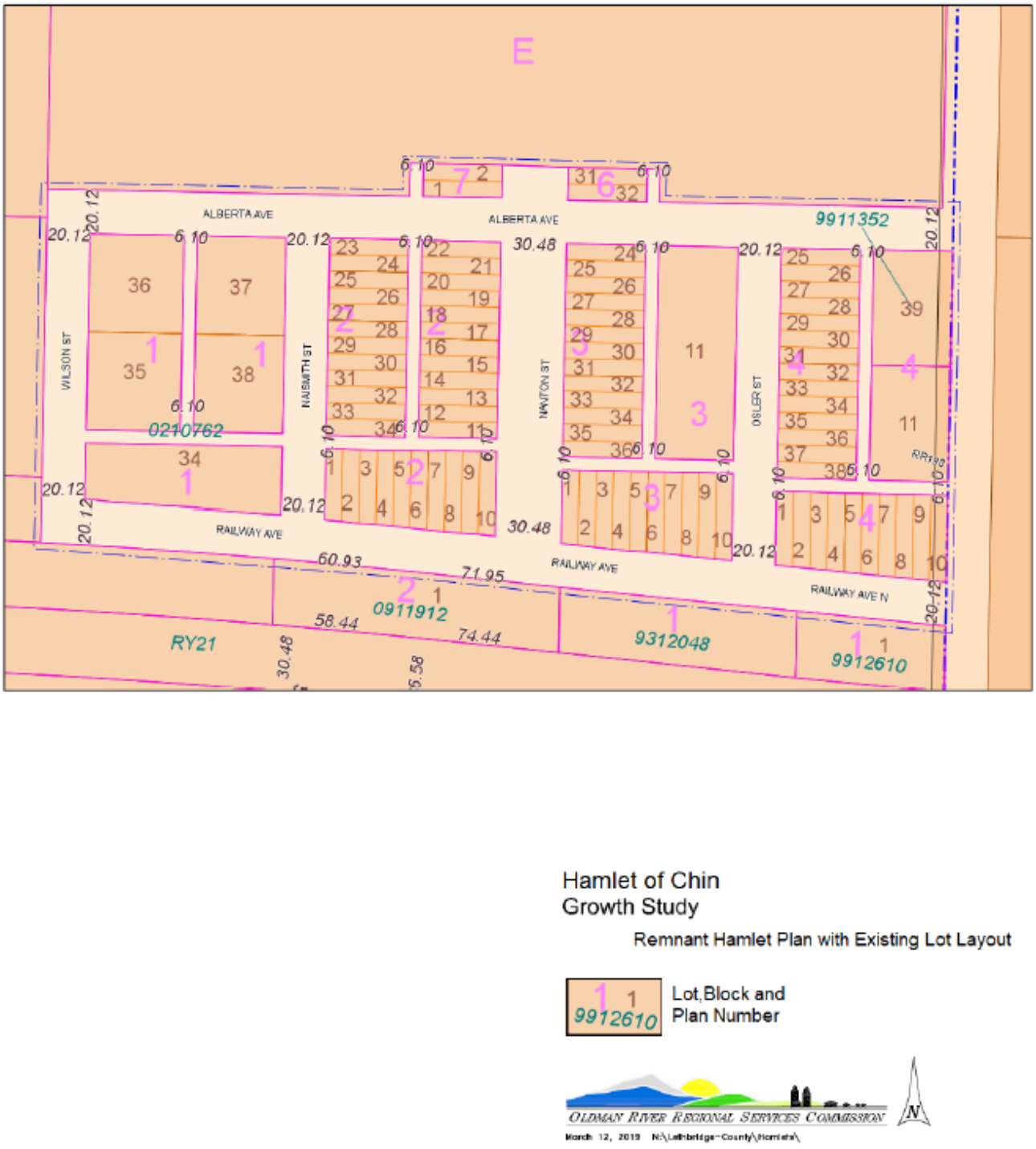


Diagram sourced from Lethbridge County - Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission

Figure 10.0 – Hamlet Plan with Existing Lot Layout

- Standards and requirements for municipal infrastructure that will be constructed by the Developer and turned over to the County.
- Any other improvements deemed necessary to support the development.
- Timelines for completion of Developer-led improvements.

4.4 BUILDING SETBACKS

The useable building envelope within each lot will depend on the setbacks imposed by the County Land Use Bylaw and are summarized in the following table:

Criteria	**County Land Use Bylaw**
Building setback from centreline of a rural road	38.1 m (125 ft)
Front yard setback	15.2 m (50 ft)
Rear yard setback	6.1 m (20 ft)

Where Range Road 19-0 is considered a rural road, the building setbacks imposed by Schedule 6 of the Land Use Bylaw will govern the adjacent boundary of the proposed lots. The proposed front yard setback of the lots will be 15.2 m (50 ft). See **Figure 8.0 – Subdivision Layout**.

Shallow utility easements will be registered against the property to protect these installations. No building development will occur on these easements.

4.5 MUNICIPAL RESERVES

Municipal reserve will be owing on the parcel as cash in lieu of land.

4.6 DESIGN POPULATION AND DENSITY

For the purpose of this Area Structure Plan, the development population has been estimated using an assumed population of 3 persons per household (pph) and a total of 14 new residential lots. Therefore, the ultimate population for the development is:

14 lots x 3 pph = 42 persons

The overall population density is calculated by:

42 persons/11.33 = 3.7 persons per ha

The school will be occupied by some 70 students and 6 teachers from 8:30 am – 4:30 pm, Monday to Friday. Students will arrive and depart via school bus. Staff will travel to and from school by car.

4.7 PHASING

This development will be serviced and built out as one single phase. All improvements will be constructed and installed in a timely fashion as per the terms in the development agreement, should approval for this ASP be granted.

5. PROPOSED INFRASTRUCTURE

5.1 TRANSPORTATION

The developer is proposing that all 13 lots be serviced via a new gravel surface road with access off of RR 19-0 from the east and Alberta Ave from the south. New approaches for the access road will be constructed to meet Lethbridge County criteria. Culverts will be sized to meet County standards to ensure proper drainage along each side of the road. See **Figure 11.0 – Road Design.**

5.1.1 Traffic Generation

ISL Engineering has provided a Traffic Memo which reports that traffic generated from this proposed development will not negatively impact the existing infrastructure and further that current roads have the capacity for the additional traffic. See **Appendix B – Trip Generation Letters for both 19-0 and Highway 3 corridor.**

5.1.2 School Bus Routes

Access for school buses is provided by Alberta Ave and Range Road 19-0 which is located in the Municipal District of Taber.

5.1.3 Parking

It is assumed that all parking requirements will be satisfied on the individual lots.

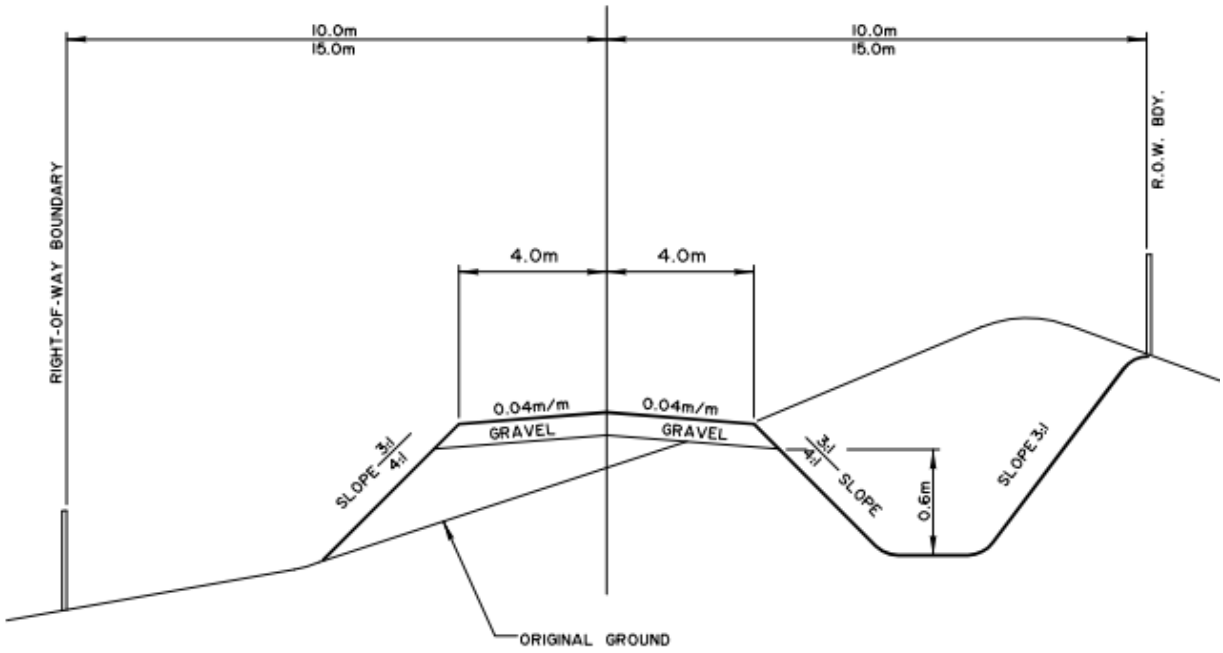
5.1.4 Range Road 19-0

The Municipal District of Taber was invited to make comment on this proposed development since it is adjacent to their boundary and Range Road 19-0 is in the Municipal District of Taber. On February 5th, 2024, the MD of Taber Development Authority made the following.

RESOLUTION #: 2024-0-036

That the Subdivision and Development Authority authorizes Administration to respond to the Lethbridge County advising Lethbridge County ensure the following are addressed within the proposed Area Structure Plan: Chin Grouped Country Residential:

- No additional approaches will be permitted off of Rge Rd 19-0
- Require a minimum 15m radius on all intersecting roads to Rge Rd 19-0



SURFACE WIDTH (m)	R.O.W. REQUIRED (m)	NORMAL SIDE SLOPE	MAXIMUM SIDE SLOPE	NORMAL BACK SLOPE	MAXIMUM BACK SLOPE	MINIMUM CURVE RADIUS (m)	MAXIMUM SUPER ELEVATION (m/m)	MAXIMUM GRADIENT (%)
8.0	20.0 - 30.0	4:1	3:1	3:1	3:1	300	0.08	7.0

NOTES:

1. IF ADDITIONAL RIGHT-OF-WAY IS REQUIRED, TRY TO OBTAIN BY BACKSLOPING AGREEMENT, OTHERWISE PURCHASE.

LETHBRIDGE COUNTY	TITLE: GRAVEL ROAD STANDARD CROSS–SECTION WITHIN A SUBDIVISION DEVELOPMENT	SCALE: N.T.S DATE: SEPTEMBER 2019 STD. DWG NO. G–114 APPROVED BY: DIRECTOR OF MUNICIPAL SERVICES

Diagram sourced from Lethbridge County – Engineering Guidelines & Minimum Servicing Standards, September 2019; prepared by WSP

Figure 11.0 Road Design

Access to all of the proposed lots will be provided via the proposed new Naismith Street which eliminates any need for additional access points into Range Rd 19-0. The intersection of Naismith Street and RR 19-0 will have 15.0m radius surface. This Area Structure Plan therefore supports the comments from the MD of Taber.

5.2 MUNICIPAL SERVICING

5.2.1 Potable Water Supply

It is envisioned that domestic potable water will be supplied to the lots in one or a combination of the following 3 alternatives:

1. Cisterns could be installed below grade or within the basement of the homes as a vessel to store water. Potable water would be delivered by truck.
2. The Hamlet of Chin is serviced by the County of Lethbridge Rural Water Association. The association has acknowledged that the system is currently at capacity and that no further units are available in the foreseeable future. See **Figure 11.a - County of Lethbridge Rural Water Association letter**. The developer is providing a 10.0m (32'-10") utility right of way at the front of each lot to allow for future installation of a potable water pipeline should capacity become available.

It should be noted that all of the proposed lots are conditionally sold to buyers who are in agreement with cisterns as the method of providing potable water.

5.2.2 Domestic Wastewater

Domestic wastewater will be managed by means of individual on-site wastewater treatment systems for each lot. The geotechnical investigation completed by BDT Engineering Ltd. (attached as **Appendix A – Geotechnical Investigation**) and the report by Osprey Engineering Ltd. (**See Appendix C – Osprey's Septic Report**) confirms the feasibility of individual on-site wastewater treatment systems and provides general recommendations for their design and construction. Lot purchasers will be responsible for the installation of on-site wastewater treatment systems in accordance with the Alberta Private Sewage Systems Standard of Practice (2021).

RE: County of Lethbridge Rural Water Association Availability of Units in Chin

O

Sid Bilcik via colrwa.onmicrosoft.com Thu, Dec 7, 11:55 AM (13 days ago)

to Douglas

Hi Doug,
As to our conversation, the County of Lethbridge Rural Water Association currently does not have any water units available anywhere in our system.
I can not speculate if there will be any units available or upgrades in the future.

Sid Bilcik
Manager
County of Lethbridge Water Association
403-380-9791

Figure 11.a COLRWA Letter

5.2.3 Storm Water Drainage

The proposed development area is virtually flat which presents considerable challenges in terms of drainage. Storm water naturally flows into the parcel from the north and then migrates west via a natural low area near the centre of the site. This low point has very little grade which causes the storm water to naturally pond in this location.

The lack of natural grading on the site led to a solution of two storm ponds since water naturally collects in the centre of the site. The ponds are designed to store a 1:100 year storm event and equipped with a pump system to drain the ponds after the storm event subsides. See **Figure 12.0 and Appendix F – Stormwater Drainage Concept.**

Storm water will drain through the site via grassed swales and a below grade pipe joining the ponds. These swales, along with the storm ponds, will be registered as easements and Public Utility lots respectively in favor of the County. Pumped storm water will migrate westerly via natural drainage channels as per pre-development conditions and eventually drain into the Chin Reservoir. See **Appendix D – Martin Geomatic Consultants Ltd. Stormwater Management Plan.**

There was no groundwater detected by the Geotechnical investigation which included five boreholes drilled to a depth of 5.0 metres. (see **Appendix A – Geotechnical Investigation**) Excavation and soils logs performed by Osprey Engineering do not indicate continued or frequent saturation of the natural depression areas. The proposed development greatly reduces the volume of storm water egressing the site given that it is stored and then released gradually.

Buildings adjacent to the existing and proposed drainage swale should be constructed with main floor and entrances above the 100-year maximum depth of ponding (elevation of 847.00m). The storm water plan will be formalized with the detailed engineering should this ASP be adopted.

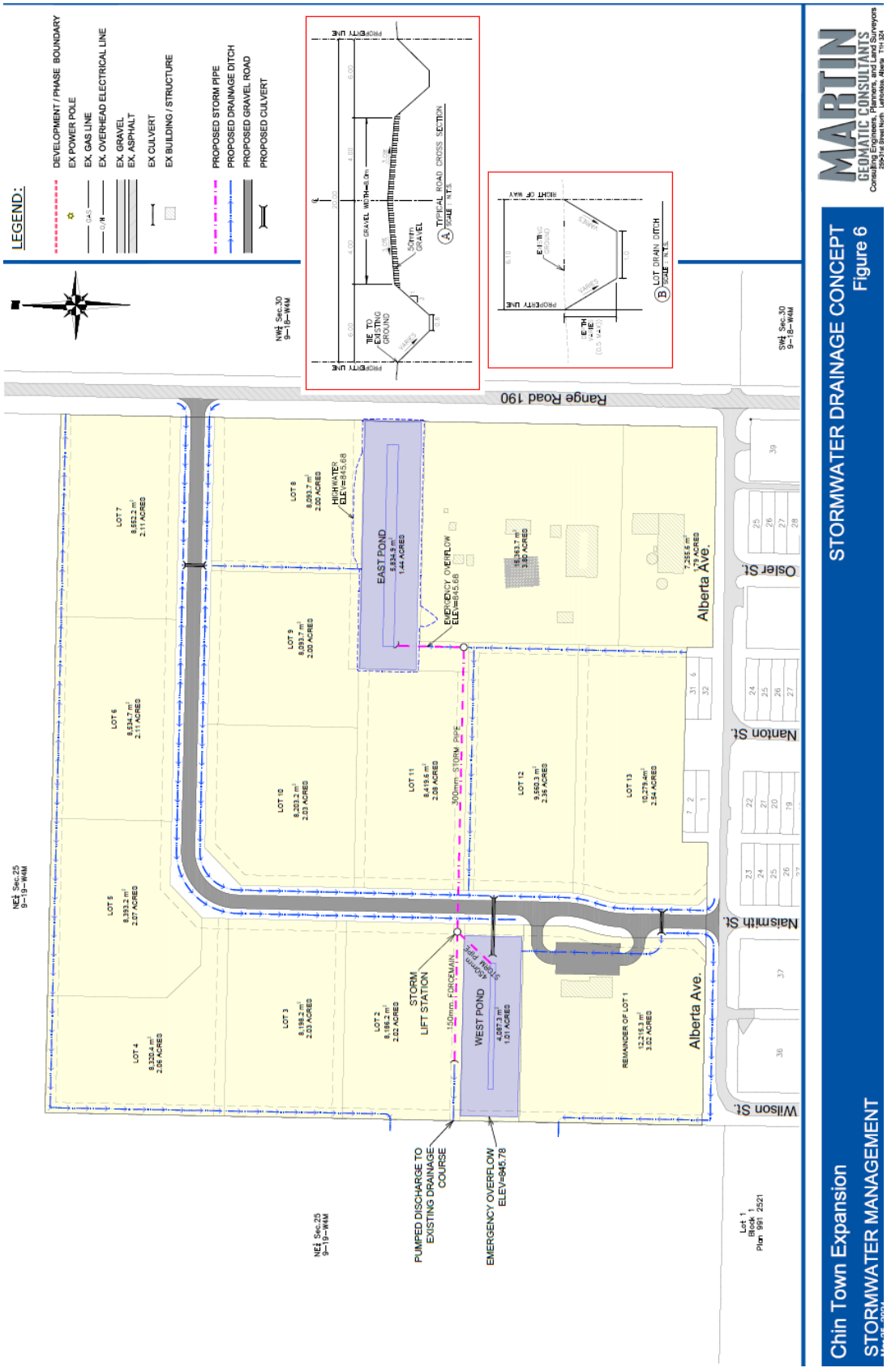


Figure 12.0 Stormwater Drainage Concept

5.2.4 Sewage Treatment and Dispersal

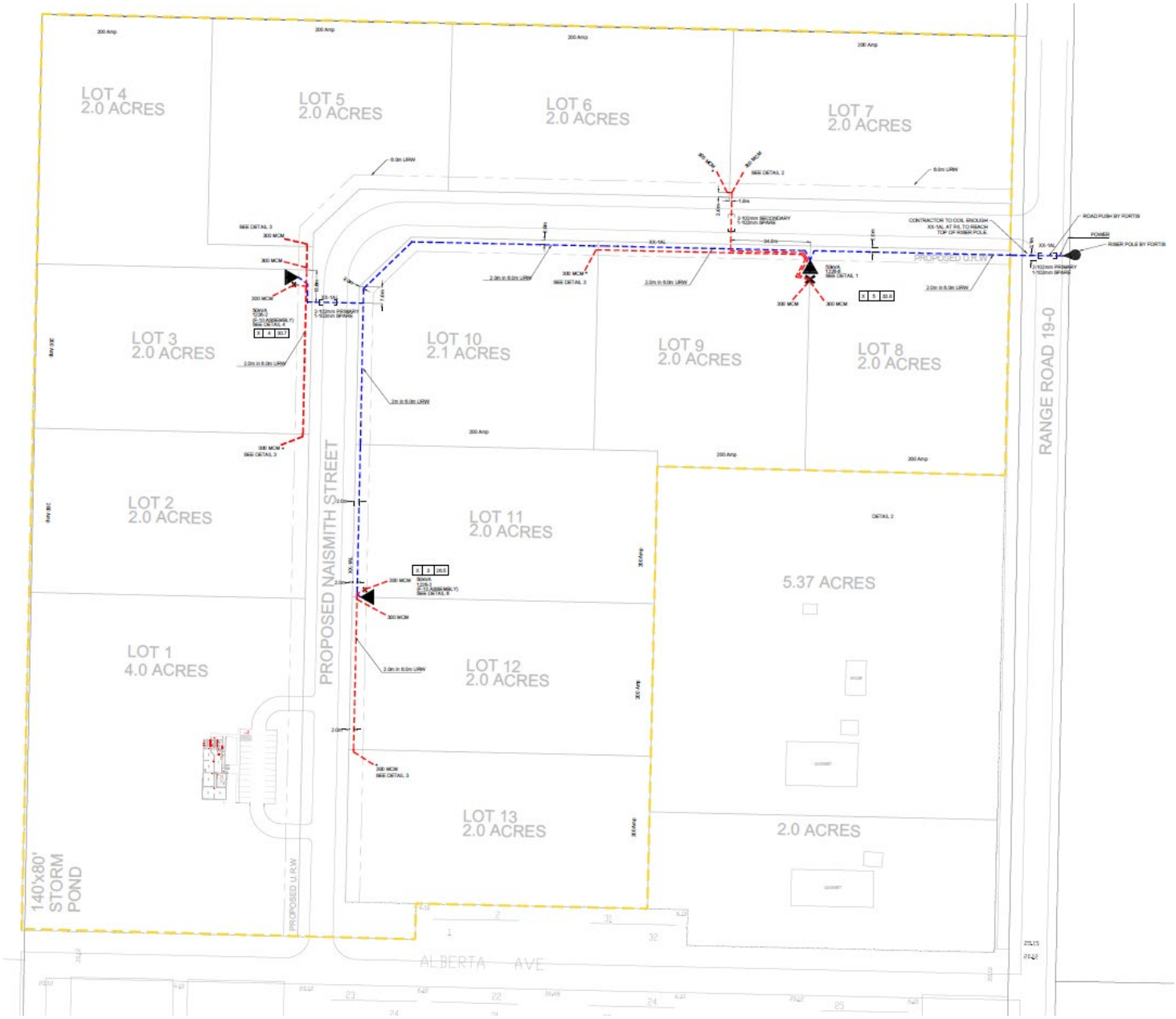
A Private Sewage Treatment Systems (PSTS) will be installed on each lot. Sizing of the system will be determined by the number of occupants in the residence as it relates to the Alberta Private Sewage Systems Standard of Practice (Safety Codes Council 2021).

Osprey Engineering Inc. was retained to evaluate each site relative to its suitability for a PSTS. BDT Engineering's soils report was relied on and supplemented by onsite excavations for this evaluation. See **Appendix C – Osprey's Septic Report**.

5.3 PUBLIC UTILITIES

5.3.1 Electricity

Existing one-wire, single phase overhead power lines operated by Fortis Alberta are present along the east side of Range Road 19-0. Fortis has confirmed that their infrastructure is adequate to support the proposed development and that they are receptive to the development proposal. Service would be provided to each lot by means of underground infrastructure and pad mounted transformers. See **Figure 13.0 - Existing FORTIS Facilities**.



LEGEND:

- Single Phase Padmount Transformer
- 3–Compartment Power Pedestal
- Side box, power only
- CABLE, Primary (#1AL)
- CABLE, Secondary (300MCM)
- * Worst case voltage drop
- Duct, PVC, Type DBII

Figure 13.0 – Existing FORTIS Facilities

5.3.2 Natural Gas

ATCO Gas has advised that there is an existing distribution line along the east side of Range Road 19-0. See **Figure 14.0 – ATCO Infrastructure**. Preliminary discussions with ATCO have suggested that their infrastructure can support the development. Details regarding the extension of natural gas distribution infrastructure will be confirmed following approval of the Area Structure Plan.

5.3.3 Telecommunication

Telus has advised that they have existing infrastructure along Range Road 19-0. Preliminary discussions with Telus have suggested that their existing facilities can support the proposed development. Details for extension of their infrastructure will be confirmed following approval of the Area Structure Plan.

Shaw Cable has advised that they do not have existing infrastructure in the area immediately surrounding the site. Shaw has provided a preliminary estimate of the cost to extend their infrastructure to the site which is prohibitive. Shaw cable will therefore not be provided to the development.

Wireless communications services are also available in the area.

5.3.4 Right of Way

A 6.0m (20.0ft) right of way will be registered parallel to the front property line to accommodate shallow utilities. This right of way will provide ample room should a domestic water pipeline be considered at a future date.

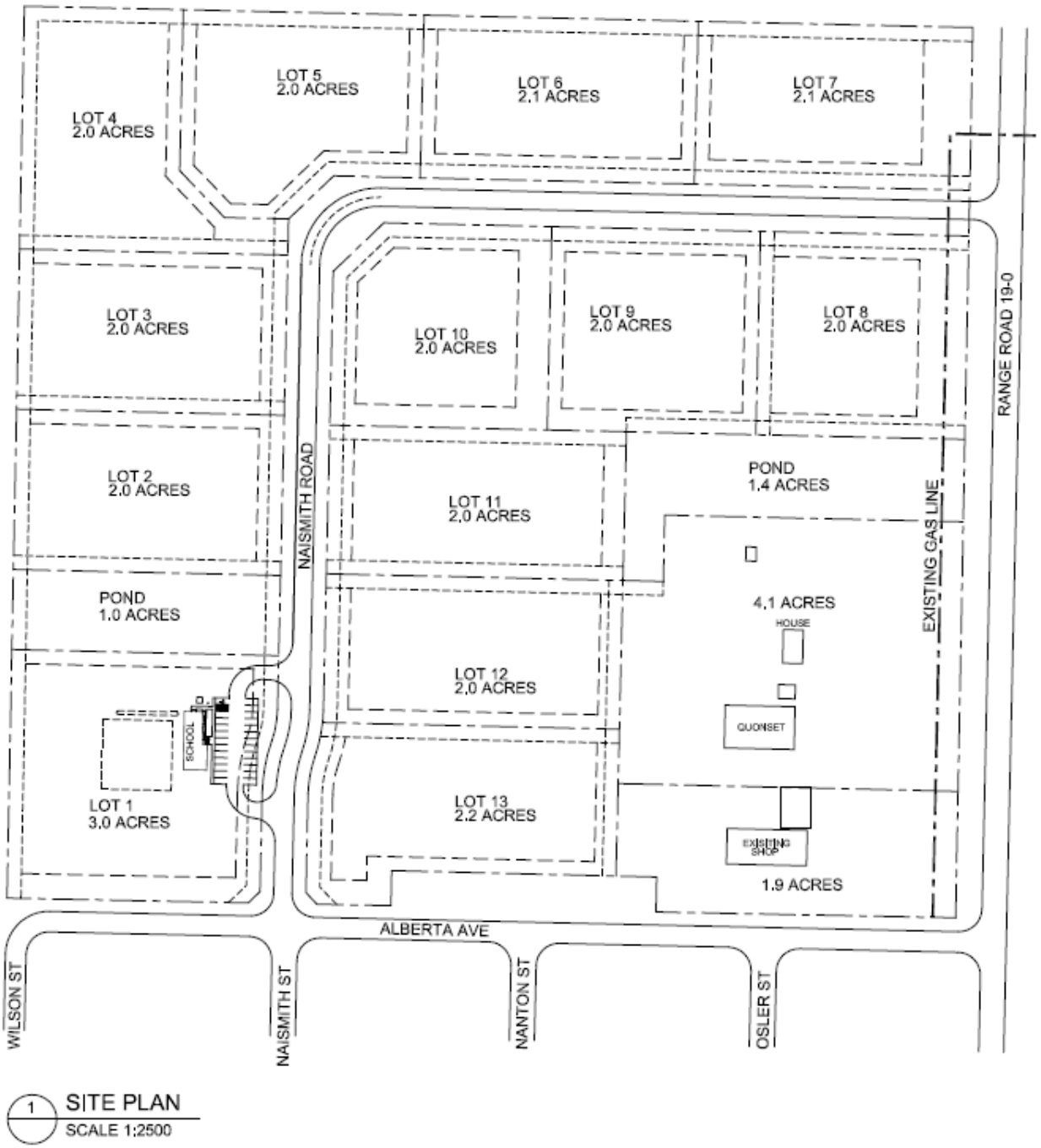


Figure 14.0 – ATCO Infrastructure

5.4 PROTECTIVE SERVICES

5.4.1 Fire

Response to fire emergencies would be dispatched by the City of Lethbridge Emergency Dispatch Centre through the 911 system. The site is located within the Coaldale Rural Emergency Service Zone (ESZ) of the County and therefore the Coaldale Fire Department will respond to emergency calls.

5.4.2 Police

Police service in the area of the development is provided by the Royal Canadian Mounted Police (RCMP) from the Coaldale Detachment. Response to emergencies would be dispatched through the 911 system.

5.4.3 Ambulance

Emergency medical transport services in the area of the development are operated by Alberta Health services and would be dispatched through the 911 system. Ambulance services base stations are located in the City of Lethbridge, Town of Picture Butte and Town of Coaldale.

5.5 OTHER SERVICES

5.5.1 Solid Waste

Lot owners will be responsible for solid waste collection. The Lethbridge County operates a solid waste transfer station located in Coaldale. Lot owners also have the option to transport waste to the Lethbridge Regional Landfill. Alternatively, lot owners may contract with a private waste collection company for solid waste removal and disposal.

5.5.2 Mail Service

Application will be made to Canada Post for postal service to the new lots following approval of the Area Structure Plan.

6. ARCHITECTURAL CONTROLS

The proposed development will form a northerly exterior of the Hamlet of Chin as described in the Lethbridge County Hamlet of Chin Growth Study of June 2020, prepared by Lethbridge County and Oldman River Regional Services Commission.

It is therefore desirable that the architectural fabric of the proposed development be in keeping with that of existing conditions. The Hamlet of Chin is not subject to any Architectural Controls and therefore there are none proposed for this development.

7. IMPLEMENTATION AND DEVELOPMENT CONTROL

- This Area Structure Plan will become a Lethbridge County bylaw should it be adopted. Amendment to the Land Use Bylaw will follow accordingly.
- One the Area Structure Plan is adopted, a subdivision application in keeping with the Area Structure Plan will be filed with Lethbridge County.
- Landowners will be responsible to acquire all permits required to further develop their lot including: Development Permit, Building Permit, Private Sewage Permit along with other utility permits required by the province.

8. ADJACENT LANDOWNER CONSULATION AND OTHER CORRESPONDENCE

Notices were hand delivered to all residents of the Hamlet of Chin as well as other adjacent landowners inviting them to an open house held on December 19th, 2023. The open house ran from 5:00pm to 7:00 pm at the Peace Valley Church.

Neighbouring landowners were generally in favor with the proposed development.

9. MARKET DEMAND

The developer has received very favorable response to the marketing of the lots. All proposed lots have been conditionally sold subject to approvals.

10. CONCLUSION

This Area Structure Plan has been prepared and submitted to support the proposal of creating 13 Grouped Country Residential parcels and a school site north of the Hamlet of Chin for consideration by the Lethbridge County Council by way of an application for amendment of the Lethbridge County Land Use Bylaw. The proposed amendment would be supported by the formal adoption of this ASP by County Council. The proponents believe this proposal establishes the highest and best use of the property as 12 residential lots and one school site since a productive farming operation is not viable on the property.

This document has been drafted and assembled in consultation with local authorities as well as experts in the area of civil and geotechnical engineering. The ASP outlines the result of considerable consultation with the many stakeholders and we trust provides Lethbridge County with the information required to consider a request for reclassification of the lands.

APPENDIX A

Geotechnical Investigation

GEOTECHNICAL EVALUATION
CHIN MEADOWS
CHIN, ALBERTA

Prepared for: Douglas J. Bergen & Associates Ltd.
2023-139
August, 2023

BDT Engineering Ltd.
thurberbruce@outlook.com

1 CONTENTS

1.0 INTRODUCTION

This report presents the results of a geotechnical evaluation conducted by BDT Engineering Ltd. (BDT) for the proposed residential lands located east of Range Road 19-0 and north of Chin, AB.

The scope of work for this evaluation was outlined in a discussion and email with Douglas Bergen. The objective of this evaluation was to determine the general subsurface conditions in the area of the proposed development and provide recommendations for the geotechnical aspects of design and construction.

Authorization to proceed with this work was received from Mr. Bergen on August 10, 2023.

2.0 PROJECT DETAILS AND SCOPE OF WORK

Based on the information provided, the proposed development will consist of approximately 13 lots between about 2.0 acres to 4.1 acres. An internal access roadway is also envisioned.

The scope of work for this evaluation included drilling five (5) boreholes, a laboratory program to assist in classifying subsurface soils and a report providing the following design and construction recommendations:

- Design parameters for shallow foundations.
- Recommendations for Backfill materials and compaction.
- Design and construction provisions for control of groundwater and mitigation, if required.
- Concrete type for structural elements in contact with soils.
- Trench excavation recommendations as well as backfill materials, compaction and moisture content requirements.
- Recommendations for Seismic design

3.0 GEOTECHNICAL FIELD AND LABORATORY WORK

The fieldwork for this evaluation was carried out on August 21, 2023, using a truck mounted solid stem auger drill rig contracted from Chilako Drilling Services Ltd. of Coaldale, Alberta. The drill rig was equipped with 150 mm diameter solid stem continuous flight augers. The borehole locations are presented on Figure 1 in Appendix A.

Five boreholes, (BH001 to BH005), were drilled at locations across the development area.

Disturbed grab samples were obtained from each borehole at 0.75 m intervals. All soil samples were visually classified in the field, and the individual soil strata and the interface between them were noted. The borehole logs are presented in Appendix B. An explanation of the terms and symbols used on the borehole logs is also included in Appendix B.

A slotted 25 mm diameter PVC standpipe was installed in each of the boreholes to monitor groundwater levels. Auger cuttings were used to backfill around the standpipes and the boreholes were sealed at the surface with approximately 600 mm of bentonite chips.

Classification tests including natural moisture content, Atterberg Limits were subsequently performed on the collected borehole samples at BDT's Lethbridge Laboratory to aid in the determination of engineering properties. Laboratory results are noted on the borehole logs in Appendix B.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 SITE CONDITIONS

The site is located west of Range Road 19-0 and north of Chin, AB. At the time of the field drilling the lands were agricultural in nature. The site generally slopes to the south and west.

4.2 SOIL CONDITIONS

It should be noted that geological conditions are innately variable. At the time of preparation of this report, information on subsurface stratigraphy was available only at discreet borehole locations. In order to develop recommendations from this information, it is necessary to make some assumptions concerning conditions other than at the borehole locations. Adequate field reviews should be provided during construction to check that these assumptions are reasonable.

The general subsurface stratigraphy comprised surficial layer of topsoil, underlain by native clay and clay till in descending order. The following sections provide a summary of the soils encountered in the borehole logs. A more detailed description is provided on the borehole logs in Appendix B.

4.2.1 TOPSOIL

A layer of topsoil was encountered in all boreholes. The topsoil was consistently 100 mm thick across the site.

4.2.2 CLAY

Clay was encountered beneath the topsoil in all boreholes. The clay ranged in thickness from 600 mm to 800 mm. The clay was described as silty, sandy, firm to stiff, low plastic, damp and light brown. A gravelly sand layer about 300 mm thick was encountered in BH005 below the clay.

4.2.3 CLAY TILL

Clay till was encountered beneath the clay in all boreholes and present to the maximum depths drilled. The clay till was silty, sandy, with gravel. The clay till was firm to stiff, generally increasing slightly with depth, low to medium plastic, and damp to very moist. The clay till was olive brown. White precipitates, oxide stains and coal specks were noted in the clay till.

4.3 GROUNDWATER CONDITIONS

At the time of drilling, some sloughing and no seepage was encountered in the boreholes. The groundwater levels were measured on August 30, 2023. Table 4.3 summarizes the groundwater monitoring data.

Table 4.3 Groundwater Monitoring Data August 30, 2023

Borehole Number	Depth of Standpipe below Ground Surface (m)	Depth to groundwater from ground surface (m)
BH001	4.42	Dry
BH002	5.03	Dry
BH003	4.27	Dry
BH004	5.03	Dry
BH005	3.96	Dry

Groundwater is not expected to impact the proposed development. It is noted that groundwater levels will fluctuate seasonally in response to climatic conditions and may be at a different depth when construction commences. Groundwater levels should be monitored prior to development. The intent is to provide an early indication of dewatering requirements during excavations for underground utilities and foundations.

5.0 GEOTECHNICAL RECOMMENDATIONS

5.1 GENERAL

The recommendations that follow offer options intended to aid in the development of the area. The recommendations are provided on the understanding and condition that BDT will be retained to review the relevant aspects of the final design drawings and specifications and will be retained to conduct such field reviews as are necessary to ensure compliance with geotechnical aspects of the Building Code, this report, and final plans and specifications. BDT accepts no liability for any use of this report in the event that BDT is not retained to provide these review services.

Recommendations are provided for shallow footings, grade supported floor slabs, below grade construction, general site development and lot grading, trench excavation and backfill, backfill materials and compaction, roadway design considerations and concrete type.

Shallow footings are generally feasible for residential and light commercial/institutional buildings in all areas of the proposed development area. Further recommendations are provided in Section 5.10. However, because footings may be placed within areas of general engineered fill, quality assurance monitoring by geotechnical personnel is recommended during fill placement. It is noted that placement of foundations on engineering cohesive fill thicknesses greater than 1.5 m may require special consideration regarding long-term consolidation of the fill and subsequent performance issues with the foundations / floor slabs-on-grade.

Slabs-on-grade construction for the development area should consider the precautions recommended for slabs-on-grade, including the subgrade preparation measures intended to improve slab performance.

All foundation recommendations presented in this report are based on the assumption that an adequate level of monitoring will be provided during construction and that all construction will be carried out by suitably qualified contractors, experienced in foundation and earthworks construction. An adequate level of monitoring is considered to be:

- For earthworks, and underground utility construction, full-time monitoring and compaction testing.
- For shallow foundations and slabs, inspection of bearing surfaces prior to placement of concrete of mudslabs, and design review during construction.

All such monitoring should be carried out by suitably qualified persons, independent of the contractor. One of the purposes of providing an adequate level of monitoring is to check those recommendations, based on information collected at discrete borehole locations, are applicable to other areas of the site.

5.2 Site Preparation

Subgrade preparation is required in all lots, where there will be grade changes, as well as all paved areas. This includes stripping of topsoil and deleterious fill materials, scarification, moisture conditioning, and compaction. The native clay and clay till soils are suitable for site grading purposes. The clay soils appear to be below the optimum moisture content (OMC) at shallower depths, and it is expected that moisture conditioning consisting of wetting and/or mixing will be required to reduce the swelling potential of this soil and to achieve the compaction standards recommended. Proof-rolling within roadways to detect soft areas is also recommended. The contractor should expect soil moisture variability across the site.

5.3 Site Grading

All lots, in the vicinity of the buildings, should be graded for drainage at a minimum of 2.0 %. The existing surficial site soils comprising clay and clay till are suitable for use as landscape fill materials or for use as general engineered fill materials for general grading. The moisture content of the site soils at surface generally appear to be slightly below their OMC and may require some wetting and/or mixing to achieve their anticipated OMC. General engineered fill materials for lot grading should be moisture conditions to within a range of -1 % to +2% of the OMC prior to compaction and compacted to a minimum of 98 % of SPD.

Further recommendations regarding backfill materials and compaction are in Appendix C.

5.4 CONSTRUCTION EXCAVATIONS

Excavations should be carried out in accordance with the Alberta Occupational Health and Safety (OH&S) Regulations. For this project, the depth for the majority of the excavations is assumed to be less than 3.0 m below existing ground surface. Excavations to deeper depths require special considerations. The following recommendations notwithstanding, the responsibility of trench and all excavation cutslopes resides with the Contractor and should take into consideration site-specific conditions concerning soil stratigraphy and groundwater. All excavations should be reviewed by a geotechnical engineer prior to personnel working within the base of the excavation.

Temporary excavations within stiff clay or clay till soils which are to be deeper than 1.5 m should have the sides shored and braced or the slopes should be cut back no steeper than 1.0 horizontal to 1.0 vertical (1H:1V)

Flatter sideslopes may be required in some areas where groundwater is encountered within sand layers, which may cause local sloughing and instability of the excavation sidewalls. In these instances, the excavation configuration design should be reviewed by experienced personnel, prior to allowing personnel to enter the base of the excavation. Vertical trench cuts using trench box wall support are not recommended for this project due to the inherent difficulty in compacting the backfill materials to an engineered standard, as well as the potential of cave-ins of the excavation sidewalls against the utility box.

Any encountered groundwater seepage should be directed towards sumps for removal. Conventional construction sump pumps should be capable of groundwater control.

Temporary surcharge loads, such as spill piles, should not be allowed within a distance equal to the depth of the excavation from an unsupported excavation face or 3.0m, whichever is greater, while mobile equipment should be kept back at least 3.0m. All excavation sideslopes should be checked regularly for signs of sloughing, especially after rainfall periods. Small earth falls from the sideslopes are a potential source of danger to workmen and must be guarded against.

General recommendations regarding construction excavations are included in Appendix C.

5.5 TRENCH EXCAVATION AND BACKFILL

The moisture content of the clay and clay till soils encountered across the site is generally below the anticipated optimum moisture content. It is expected that such soils will require slight wetting to achieve desired moisture content and proper compaction.

Trenches must be backfilled in such a way as to minimize the potential differential settlement and/or frost heave movements. A minimum density of 98% of Standard Proctor Density (SPD) is recommended for all trenches. Clay backfill should be uniformly moisture conditioned to between ± 2% of optimum moisture content (OMC). The compacted thickness of each lift of backfill should not exceed 150 mm. In order to achieve this uniformity, the lift thickness and compaction criteria must be strictly enforced.

General recommendations for trench excavation and backfill are included in Appendix C.

5.6 SUBGRADE PREPARATION

For all roadways the upper 300 mm of clay or clay till soils should be scarified and uniformly moisture conditioned to between -1% of optimum and 2% over OMC. The subgrade should then be uniformly compacted to a minimum of 98% of SPD.

All deleterious and unsuitable materials, including any sand pockets, if encountered, should be excavated from under proposed fill areas during the reconstruction operations.

The clay, clay till soils encountered are acceptable for subgrade construction. Sand layers if encountered should be removed. Proof-rolling to detect soft areas once the subgrade preparation activities are completed is also recommended.

5.7 ROADWAY DESIGN RECOMMENDATIONS

The roadway design section for gravel 'Local' roadways, is recommended as follows:

Design Roadway Section	
Material Type	**Gravel Surfaced**
Granular Base Course	200 mm
Subgrade Preparation	300 mm

The above recommended pavement layer thicknesses generally refer to average values and recognize typical construction variability. As such, constructed layer thicknesses should satisfy the thickness tolerances identified in the City of Lethbridge Engineering Standards for granular materials.

The roadway design should include provisions for subsurface drainage of the pavement granular layers. It is understood that the roadway cross section for this development contemplates a semi-rural cross section. Therefore, the granular layers should daylight to the ditches where possible.

5.8 CEMENT TYPE

Based on BDT's local experience with the local soils, as well as the laboratory testing conducted to determine soluble sulphate levels, the properties of concrete for foundations in contact with soil or groundwater shall meet the requirements of CSA A23.1-14 Class S-2 exposure and have a minimum specified 56-day compressive strength of 32 MPa.

For this exposure classification, alternatives include the usage of Type HS Portland cement or blends of cement and supplementary cementing materials conforming to Type HS and/or Type HSb cements.

5.9 LIMIT STATES DESIGN

The design parameters provided in the following sections may be used to calculate the ultimate foundation capacity in each case. For Limit States Design (LSD) methodology, in order to calculate the factored load capacity, the appropriate Soil Resistance Factors must be applied to each loading conditions as follows:

Factored Capacity = Ultimate Capacity X Soil Resistance Factors

In general, the following soil resistance factors in Table 5.9 must be incorporated into the foundation design. These factors are considered to be in accordance with the CFEM (2006).

Table 5.9 Soil Resistance Factors

Item	Soil Resistance Factor
Shallow Foundations	
Bearing Resistance	0.5
Passive Resistance	0.5
Horizontal resistance (sliding)	0.8

5.10 SHALLOW FOUNDATIONS

Shallow foundations, should be constructed a minimum of 1.4 m below the final design ground surface (frost protection requirements). Based on the soil stratigraphy and conditions on this site, it is recommended that shallow footings be founded on the clay or clay till.

The ultimate static bearing pressure for the design of strip and spread footings at these depths may be taken as 200 KPa for the clay or clay till. Factoring should be considered as noted in section 5.9. Footing dimensions should be in accordance with the minimum requirements of the Building Code.

Bearing certification by a geotechnical engineer is recommended to ensure that the shallow foundations are placed on competent native soils. If softer native soils are encountered at footing level, recommendations may be provided to lower the footing elevations to materials satisfying the design bearing capacity or to widen the footings within these areas. This should be a field determination at the time of bearing observation.

The anticipated foundation soils are of a low to medium plasticity, and therefore, are prone to volume changes (both heave and settlement) with varying moisture content. Exposed soils beneath building structures must be protected against changes in moisture content during construction to reduce the risk of heaving. A permanent weeping tile system is also recommended around the outside perimeter of any structure at the foundation elevation to maintain a consistent moisture profile of the foundation soils.

Settlement of footings designed and constructed in accordance with the above recommendations should be well within the normally tolerated values of 25 mm total and 15 mm differential at factored loading. If this range of settlement is not tolerable, then a pile foundation system may be considered for the building.

Further recommendations regarding shallow foundations are presented in Appendix C.

5.11 FLOOR SLABS-ON-GRADE

For construction of floor slabs-on-grade for buildings in the development area the subgrade should be scarified to a minimum depth of 300 mm, and moisture conditioned to within –1% to +2% of the OMC. The minimum compaction should be 98% of SPD. The prepared subgrade

should be proof-rolled and any soft or loose pockets detected should be reconditioned as recommended above or over-excavated and replaced with general engineered fill.

A levelling course of clean well-graded crushed gravel, at least 150 mm in compacted thickness, is recommended directly beneath the slabs-on-grade, unless a thicker course is required for structural purposes. The subgrade beneath slabs-on-grade should be protected at all times from moisture or exposure which may cause softening or disturbance of the subgrade soils. This applies during and after the construction period (and before and after replacement of the required general engineered fill). Should the exposed surface become saturated or disturbed, it should be reworked to achieve the above standards. If the subgrade is properly prepared as noted above, floor slab movements should be limited to less than approximately 25 mm. Slabs-on-grade should be separated from bearing members to allow some differential movement. If this range of differential movement is unacceptable, the owner should consider a structurally supported floor.

Recommended procedures for proof-rolling and backfill materials and further recommendations for slabs-on-grade construction are included in Appendix C.

5.12 Below Grade Walls

All below-grade walls should be designed to resist lateral earth pressure in an “at-rest” condition. This condition assumes a triangular pressure distribution and may be calculated using the following expression:

$$P_o = K_o (\gamma H + Q)$$

Where: P_o = Lateral earth pressure “at-rest” condition (no wall movement occurs at a given depth)

K_o = Coefficient of earth pressure “at-rest” condition (use 0.5 for cohesive backfill and 0.45 for sand and gravel backfill)

γ = Bulk unit weight of backfill soil (use 19 or 21 kN / m^3 for cohesive or granular backfill, respectively).

H = Depth below final grade (m).

Q = Surcharge pressure at ground level (kPa).

It is assumed that drainage is provided for all below-grade walls through the installation of the weeping tile, and hydrostatic pressure will not be a factor in design. An acceptable weeping tile system should consist of a perforated weeping tile wrapped in a geosock or geotextile fabric, in turn surrounded with a minimum of 150 mm thick covering of washed rock (maximum size 25 mm). The weeping tile should have a minimum 0.5 % slope leading to a sump. The preferred method would be to have the sump discharge any water accumulation remotely from the building footprint towards ditches or other stormwater conveyance features. Based on site conditions it is anticipated that the sump pump will run intermittently and more often during and after rain events.

Backfill around concrete walls should not commence before the concrete has reached a minimum two-thirds of its design strength and the walls are laterally braced. Only hand-operated compaction equipment should be employed within 600 mm of the concrete walls. Caution should be used when compacting backfill to avoid high lateral loads caused by excessive compactive effort. A compaction standard of 95 % Standard Procter Density is recommended. To avoid differential wall pressures, the backfill should be brought up evenly around the walls. A minimum 600 mm thick clay cap should be placed at the ground surface to reduce the infiltration of surface water.

5.13 Frost Protection

For protection against frost-action, perimeter footings in heated structures should be extended to such depths as to provide a minimum soil cover of 1.4 m. Isolated or exterior footings in unheated structures should have a minimum soil cover of 2.1 m unless provided with equivalent insulation.

Pipes buried with less than 2.1 m of soil cover should be protected with insulation to avoid frost effects that might cause damage to or breakage of the pipes. Rigid insulation place under areas subject to vehicular wheel loadings should be provided with a minimum thickness of 600 mm of compacted granular base.

5.14 Septic Fields

The Safety Codes Council's, Alberta Private Sewage Systems Standard of Practice, 2021, notes that percolation testing can be used in support of a design that used site specific investigation. Previous percolation testing conducted on similar soils indicated percolation rates close to 24 mins/cm (clay), which indicates the area surficial soils may be suitable for septic field development.

For design purposes, groundwater is expected to be measured below 4.5 m from the ground surface and is not expected to impact the design of the fields. The slopes of the area are less than 10 %. Soils within the top 900 mm of the surface are generally considered to be a clay (C) or silty clay (SIC). The topsoil encountered on the site, may be considered a silty clay loam. Surface water features are located beyond the 100 m threshold and there are no bedrock outcrops in the area.

During installation of the weeping trenches, the installer should pay close attention to the soil conditions encountered, to define the extent of any silt or sand pockets (areas subject to faster percolation rates) or medium to high plastic clays (areas of slower percolation rates). These should be immediately reported to the disposal field designer for review prior to completion of the septic disposal field.

5.15 Seismic Design

The site classification recommended for seismic site response is Classification D, as noted in Table 4.1.8.4a of the NBCC.

6.0 DESIGN AND CONSTRUCTION GUIDELINES

General design and construction guidelines are provided in Appendix D, under the following supplemental heading:

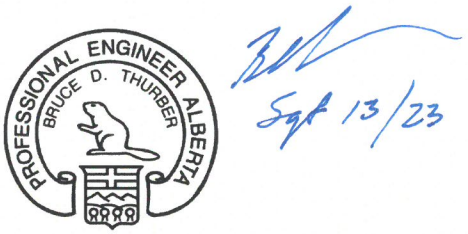
- Shallow Foundations
- Floor Slabs-on-Grade
- Backfill Materials and Compaction
- Construction Excavations
- Proof Rolling

These guidelines are intended to present standards of good practice. Although supplemental to the main text of this report, they should be interpreted as part of the report. Design recommendations presented herein are based on the premise that these guidelines will be followed. The design and construction guidelines are not intended to represent detailed specifications for the works although they may prove useful in the preparation of such specifications. In the event of any discrepancy between the main text of this report and Appendix D, the main text should govern.

7.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully Submitted



Sept 13/23

Bruce D. Thurber, P.Eng.
BDT Engineering Ltd. P13556

APPENDIX A – SITE PLAN SHOWING BOREHOLE LOCATIONS

Figure 1 – Site Plan
Borehole Location

APPENDIX B – BOREHOLE LOGS

TERMS USED ON BOREHOLE LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on 0.075mm sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in situ tests.

DESCRIPTIVE TERM	RELATIVE DENSITY	N (blows per 0.3m)
Very Loose	0 TO 20%	0 to 4
Loose	20 TO 40%	4 to 10
Compact	40 TO 75%	10 to 30
Dense	75 TO 90%	30 to 50
Very Dense	90 TO 100%	greater than 50

The number of blows, N, on a 51mm O.D. split spoon sampler of a 63.5kg weight falling 0.76m, required to drive the sampler a distance of 0.3m from 0.15m to 0.45m.

FINE GRAINED SOILS (major portion passing 0.075mm sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in situ tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH (KPA)
Very Soft	Less than 25
Soft	25 to 50
Firm	50 to 100
Stiff	100 to 200
Very Stiff	200 to 400
Hard	Greater than 400

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil.

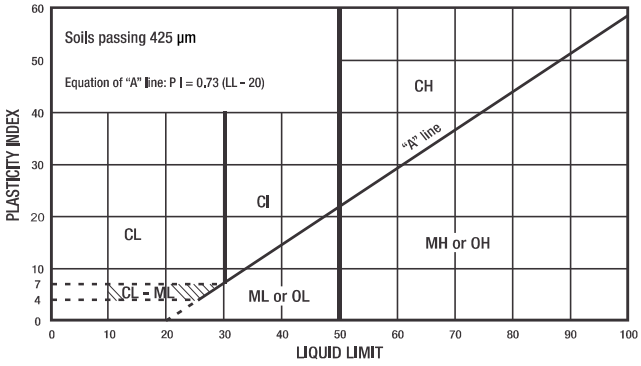
GENERAL DESCRIPTIVE TERMS

Slickensided - having inclined planes of weakness that are slick and glossy in appearance.
Fissured - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated - composed of thin layers of varying colour and texture.
Interbedded - composed of alternate layers of different soil types.
Calcareous - containing appreciable quantities of calcium carbonate.;
Well graded - having wide range in grain sizes and substantial amounts of intermediate particle sizes.
Poorly graded - predominantly of one grain size, or having a range of sizes with some intermediate size missing.

MODIFIED UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA		
COARSE-GRAINED SOILS More than 50% retained on 75 µm sieve*	GRAVELS 50% or more of coarse fraction retained on 4.75 mm sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines: Less than 5% Pass 75 µm sieve; More than 12% Pass 75 µm sieve; 5% to 12% Pass 75 µm sieve	$C_U = D_{60} / D_{10}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	GW, GP, SW, SP GM, GC, SM, SC Borderline Classification requiring use of dual symbols	Not meeting both criteria for GW	
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above "A" line or plasticity index greater than 7	
	SANDS More than 50% of coarse fraction passes 4.75 mm sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines		$C_U = D_{60}/D_{10}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above "A" line or plasticity index greater than 7	
FINE-GRAINED SOILS (by behavior) 50% or more passes 75 µm sieve*	SILTS Liquid limit <50		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands of slight plasticity	For classification of fine-grained soils and fine fraction of coarse-grained soils.		
	SILTS Liquid limit >50		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
	CLAYS Above "A" line on plasticity chart negligible organic content Liquid limit <30		CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays			
	CLAYS Above "A" line on plasticity chart negligible organic content Liquid limit 30-50		CI	Inorganic clays of medium plasticity, silty clays			
	CLAYS Above "A" line on plasticity chart negligible organic content Liquid limit >50		CH	Inorganic clays of high plasticity, fat clays			
	ORGANIC SILTS AND CLAYS Liquid limit <50		OL	Organic silts and organic silty clays of low plasticity			
	ORGANIC SILTS AND CLAYS Liquid limit >50		OH	Organic clays of medium to high plasticity			
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils			

PLASTICITY CHART



*Based on the material passing the 75 mm sieve
Reference: ASTM Designation D2487, for identification procedure see D2488. USC as modified by PFRA

SOIL COMPONENTS

FRACTION	SIEVE SIZE PASSING	SIEVE SIZE RETAINED	DEFINING RANGES OF PERCENTAGE BY MASS OF MINOR COMPONENTS PERCENTAGE	DESCRIPTOR
GRAVEL				
coarse	75 mm	19 mm	>35 %	"and"
fine	19 mm	4.75 mm	21 to 35 %	"y-adjective"
SAND				
coarse	4.75 mm	2.00 mm	10 to 20 %	"some"
medium	2.00 mm	425 µm		
fine	425 µm	75 µm	>0 to 10 %	"trace"
SILT (non plastic) or CLAY (plastic)	75 µm		as above but by behavior	

OVERSIZE MATERIAL

Rounded or subrounded

COBBLES	75 mm to 300 mm
BOULDERS	> 300 mm

Not rounded

ROCK FRAGMENTS	>75 mm
ROCKS	> 0.76 cubic metre in volume

Project: Chin Meadows		BOREHOLE NO: **BH001**
Client: Douglas J. Bergen & Associates Ltd.		PROJECT NO: 2023-139
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0		Topsoil (100mm)						
		Clay - silty, sandy, firm, damp, low plastic, light brown.						
		Clay Till - silty, sandy, trace gravel, firm, damp to moist, low plastic, olive brown with coal inclusions and oxide stains.		B1				
1		- moist						
				S1	2-2-4			
2				B2				
3		- some sand, inclusions of bedrock / mudstone		S2	2-3-5			
				B3				
4								
				S3	4-5-6			
5		End of borehole at 5.03 m, 0.61 m sloughing from surface topsoil and no seepage. Standpipe installed to 4.42 m. Standpipe dry when monitored on August 30, 2023.						
6								
7								
8								

PLASTIC — M.C. — LIQUID (20 40 60 80)

▲ VANE SHEAR (kPa) ▲ (100 200 300 400)

■ BLOW COUNT ■ (20 40 60 80)

◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400)

● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400)

LOGGED BY: CA	COMPLETION DEPTH: 5.03 m
REVIEWED BY: BDT	COMPLETION DATE: 8-21-23
	Page 1 of 1

AB TRANS BOREHOLE LOG CHIN MEADOWS.GPJ AB_TRANS.GDT 8-30-23

Project: Chin Meadows		BOREHOLE NO: **BH002**
Client: Douglas J. Bergen & Associates Ltd.		PROJECT NO: 2023-139
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	PLASTIC M.C. LIQUID (20 40 60 80)	▲ VANE SHEAR (kPa) ▲ (100 200 300 400) / ■ BLOW COUNT ■ (20 40 60 80) / ◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400) / ● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400)	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0		Topsoil (100mm)								
		Clay - silty, sandy, firm, damp, low plastic, light brown.								
1		Clay Till - silty, sandy, trace gravel, firm, damp to moist, low plastic, olive brown with coal inclusions and oxide stains.		B1						
				S1	4-7-11					
2				B2						
3		- inclusions of bedrock		S2	3-4-4					
				B3						
4										
				S3	4-5-7					
5		End of borehole at 5.03 m, no sloughing and seepage. Standpipe installed to 5.03 m. Standpipe dry when monitored on August 30, 2023.								
6										
7										
8										

LOGGED BY: CA	COMPLETION DEPTH: 5.03 m
REVIEWED BY: BDT	COMPLETION DATE: 8-21-23
	Page 1 of 1

AB TRANS BOREHOLE LOG CHIN MEADOWS.GPJ AB_TRANS.GDT 8-30-23

Project: Chin Meadows		BOREHOLE NO: **BH003**
Client: Douglas J. Bergen & Associates Ltd.		PROJECT NO: 2023-139
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	PLASTIC M.C. LIQUID (20 40 60 80)	▲ VANE SHEAR (kPa) ▲ (100 200 300 400) / ■ BLOW COUNT ■ (20 40 60 80) / ◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400) / ● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400)	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0		Topsoil (100mm)								
		Clay - silty, sandy, firm, damp, low plastic, light brown.		B1						
1		Clay Till - silty, sandy, trace gravel, firm, damp to moist, low plastic, olive brown with coal inclusions and oxide stains.								
				S1	5-6-9					
2				B2						
3				S2	3-4-5					
				B3						
4										
				S3	3-8-5					
5		End of borehole at 5.03 m, 0.76 m sloughing and no seepage. Standpipe installed to 4.27 m. Standpipe dry when monitored on August 30, 2023.								
6										
7										
8										

LOGGED BY: CA	COMPLETION DEPTH: 5.03 m
REVIEWED BY: BDT	COMPLETION DATE: 8-21-23
	Page 1 of 1

AB TRANS BOREHOLE LOG CHIN MEADOWS.GPJ AB_TRANS.GDT 8-30-23

Project: Chin Meadows		BOREHOLE NO: **BH004**
Client: Douglas J. Bergen & Associates Ltd.		PROJECT NO: 2023-139
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm
0		Topsoil (100mm)			
		Clay - silty, sandy, firm, damp, low plastic, light brown.			
		Clay Till - silty, sandy, trace gravel, firm, damp to moist, low plastic, olive brown with coal inclusions and oxide stains.		B1	
1					
				S1	3-5-7
2				B2	
		- inclusions of bedrock / mudstone			
3				S2	2-3-5
				B3	
4					
				S3	3-4-5
5		End of borehole at 5.03 m, no sloughing or seepage. Standpipe installed to 5.03 m. Standpipe dry when monitored on August 30, 2023.			
6					
7					
8					

PLASTIC — M.C. — LIQUID (20 40 60 80)

▲ VANE SHEAR (kPa) ▲ (100 200 300 400)

■ BLOW COUNT ■ (20 40 60 80)

◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400)

● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400)

OTHER DATA

SLOTTED PIEZOMETER

Elevation (m)

LOGGED BY: CA	COMPLETION DEPTH: 5.03 m
REVIEWED BY: BDT	COMPLETION DATE: 8-21-23
	Page 1 of 1

AB TRANS BOREHOLE LOG CHIN MEADOWS.GPJ AB_TRANS.GDT 8-30-23

Project: Chin Meadows		BOREHOLE NO: **BH005**
Client: Douglas J. Bergen & Associates Ltd.		PROJECT NO: 2023-139
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0		Topsoil (100mm)						
		Clay - silty, sandy, firm, damp, low plastic, light brown.						
		Sand - gravvely, some clay and silt, loose, damp, fine grained, brown, poorly graded.		B1				
1		Clay Till - silty, sandy, trace gravel, firm, damp to moist, low plastic, olive brown with coal inclusions and oxide stains.		S1	7-8-11			
2				B2				
3				S2	4-5-7			
				B3				
4				S3	3-4-5			
5		End of borehole at 5.03 m, 1.07 m sloughing and no seepage. Standpipe installed to 3.96 m. Standpipe dry when monitored on August 30, 2023.						
6								
7								
8								

PLASTIC — M.C. — LIQUID (20 40 60 80)

▲ VANE SHEAR (kPa) ▲ (100 200 300 400)

■ BLOW COUNT ■ (20 40 60 80)

◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400)

● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400)

LOGGED BY: CA	COMPLETION DEPTH: 5.03 m
REVIEWED BY: BDT	COMPLETION DATE: 8-21-23
	Page 1 of 1

AB TRANS BOREHOLE LOG CHIN MEADOWS.GPJ AB_TRANS.GDT 8-30-23

APPENDIX C – GENERAL CONSTRUCTION GUIDELINES

Shallow Foundations

Design and construction of shallow foundations should comply with relevant Building Code requirements.

The term ‘shallow foundations’ includes strip and spread footings, mat slab and raft foundations. Minimum footing dimensions in plan should be 0.45m and 0.9m for strip and square footings respectively.

No loose, disturbed or sloughed material should be allowed to remain in open foundation excavations.

Hand cleaning should be undertaken to prepare an acceptable bearing surface. Recompaction of disturbed or loosened bearing surface may be required.

Foundation excavations and bearing surfaces should be protected from rain, snow, freezing temperatures, excessive drying and the ingress of free water before, during and after footing construction.

Footing excavations should be carried down into the designated bearing stratum.

After the bearing surface is approved, a mud slab should be poured to protect the soil and provide a working surface for construction, should immediate foundation construction not be intended.
All constructed foundations should be placed on unfrozen soils, which should be at all times protected from frost penetration.

All foundation excavations and bearing surfaces should be inspected by a qualified geotechnical engineer to check that the recommendations contained in this report have been followed.

Where over-excavation has been carried out through a weak or unsuitable stratum to reach into a suitable bearing stratum or where a foundation pad is to be placed above stripped natural ground surface such over-excavation may be backfilled to subgrade elevation utilizing either structural fill or lean-mix concrete. These materials are defined under the separate heading ‘Backfill Materials and Compaction’.

Floor Slabs-on-Grade

All soft, loose or organic material should be removed from beneath slab areas. If any local 'hard spots' such as old basement walls are revealed beneath the slab area, these should be over-excavated and removed to not less than 0.9 m below underside of slab level. The exposed soil should be proof-rolled and the final grade restored by general engineered fill placement. If proof-rolling reveals any soft or loose spots, these should be excavated and the desired grade restored by general engineered fill placement. Proof-rolling should be carried out in accordance with the recommendations given elsewhere in this Appendix. The subgrade should be compacted to a depth of not less than 0.3m to a density of not less than 98 percent Standard Proctor Maximum Dry Density (ASTM Test Method D698).

A levelling course of 20mm crushed gravel at least 150 mm in compacted thickness, is recommended directly beneath all slabs-on-grade. Alternatively, a minimum thickness of 150mm of pit-run gravel overlain by a minimum thickness of 50 mm of 20mm crushed gravel may be used. Very coarse material (larger than 25 mm diameter) should be avoided directly beneath the slab-on-grade to limit potential stress concentrations within the slab. All levelling courses directly under floor slabs should be compacted to 100 percent of Standard Proctor maximum dry density.

General engineered fill, pit-run gravel and crushed gravel are defined under the heading 'Backfill Materials and Compaction' elsewhere in this Appendix.

The slab should be structurally independent from walls and columns supported on foundations. This is to reduce any structural distress that may occur as a result of differential soil movements. If it is intended to place any internal non-load bearing partition walls directly on a slab-on-grade, such walls should also be structurally independent from other elements of the building founded on a conventional foundation system so that some relative vertical movement of the walls can occur freely.

The excavated subgrade beneath slabs-on-grade should be protected at all times from rain, snow, freezing temperatures, excessive drying and the ingress of free water. This applies during and after the construction period.

A minimum slab concrete thickness of 100mm is recommended. Control joints should be provided in all slabs. Typically for a 125mm slab thickness; control joints should be placed on a 3 m square grid, should be sawn to a depth of one-quarter the slab thickness and have a width of approximately 3 mm.

Wire mesh reinforcement, 150 mm square grid, should be provided to reduce the possibility of uncontrolled slab cracking. The mesh should be adequately supported and should be located at mid-height of the slab with adequate cover.

Backfill Materials and Compaction

1.0 Definitions

“Landscape fill” is typically used in areas such as berms and grassed areas where settlement of the fill and noticeable surface subsidence can be tolerated. “Landscape fill” may comprise soils without regard to engineering quality.

“General engineered fill” is typically used in areas where a moderate potential for subgrade movement is tolerable, such as asphalt (i.e., flexible) pavement areas. “General engineered fill” should comprise clean, granular or clay soils.

“Select engineered fill” is typically used below slabs-on-grade or where high volumetric stability is desired, such as within the footprint of a building. “Select engineered fill” should comprise clean, well-graded granular soils or inorganic low to medium plastic clay soils.

“Structural engineered fill” is used for supporting structural loads in conjunction with shallow foundations. “Structural engineered fill” should comprise clean, well-graded granular soils.

“Lean-mix concrete” is typically used to protect a subgrade from weather effects including excessive drying or wetting. “Lean-mix concrete” can also be used to provide a stable working platform over weak subgrades. “Lean-mix concrete” should be low strength concrete having a minimum 28-day compressive strength of 3.5 MPa. Standard Proctor Density (SPD) as used herein means Standard Proctor Maximum Dry Density (ASTM Test Method D698). Optimum moisture content is defined in ASTM Test Method D698.

2.0 General Backfill and Compaction Recommendations

Exterior backfill adjacent to abutment walls, basement walls, grade beams, pile caps and above footings, and below highway, street, or parking lot pavement sections should comprise “general engineered fill” materials as defined above. Exterior backfill adjacent to footings, foundation walls, grade beams and pile caps and within 600 mm of final grade should comprise inorganic, cohesive “general engineered fill”. Such backfill should provide a relatively impervious surficial zone to reduce seepage into the subsoil against the structure.

Backfill should not be placed against a foundation structure until the structure has sufficient strength to withstand the earth pressures resulting from placement and compaction. During compaction, careful observation of the foundation wall for deflection should be carried out continuously. Where deflections are apparent, the compactive effort should be reduced accordingly.

In order to reduce potential compaction induced stresses, only hand-held compaction equipment should be used in the compaction of fill within 1 m of retaining walls or basement walls. If compacted fill is to be placed on both sides of the wall, they should be filled together so that the level on either side is within 0.5 m of each other.

All lumps of materials should be broken down during placement. Backfill materials should not be placed in a frozen state, or placed on a frozen subgrade.

Where the maximum-sized particles in any backfill, material exceed 50 percent of the minimum dimension of the cross-section to be backfilled (e.g., lift thickness), such particles should be removed and placed at other more suitable locations on site or screened off prior to delivery to site.

Bonding should be provided between backfill lifts. For fine-grained materials, the previous lift should be scarified to the base of the desiccated layer, moisture-conditioned, and recompacted and bonded thoroughly to the succeeding lift. For granular materials, the surface of the previous lift should be scarified to about a 75 mm depth followed by proper moisture-conditioning and recompaction.

3.0 COMPACTION AND MOISTURE CONDITIONING

"Landscape fill" material should be placed in compacted lifts not exceeding 300 mm and compacted to a density of not less than 90 percent of SPD unless a higher percentage is specified by the jurisdiction.

"General engineered fill" and "select engineered fill" materials should be placed in layers of 150 mm compacted thickness and should be compacted to not less than 98 percent of SPD. Note that the contract may specify higher compaction levels within 300 mm of the design elevation. Cohesive materials placed as "general engineered fill" or "select engineered fill" should be compacted at 0 to 2 percent above the optimum moisture content. Note that there are some silty soils which can become quite unstable when compacted above optimum moisture content.

Granular materials placed as "general engineered fill" or "select engineered fill" should be compacted at slightly below (0 to 2%) the optimum moisture content. "Structural engineered fill" material should be placed in compacted lifts not exceeding 150 mm in thickness and compacted to not less than 100 percent of SPD at slightly below (0 to 2%) the optimum moisture content.

4.0 "GENERAL ENGINEERED FILL"

Low to medium plastic clay is considered acceptable for use as "general engineered fill," assuming this material is inorganic and free of deleterious materials. Materials meeting the specifications for "select engineered fill" or "structural engineered fill" as described below would also be acceptable for use as "general engineered fill."

5.0 "SELECT ENGINEERED FILL"

Low to medium plastic clay with the following range of plasticity properties is generally considered suitable for use as "select engineered fill":

Liquid Limit	=	20 to 40%
Plastic Limit	=	10 to 20%
Plasticity Index	=	10 to 30%

Test results should be considered on a case-by-case basis.

"Pit-run gravel" and "fill sand" are generally considered acceptable for use as "select engineered

fill." See exact project or jurisdiction for specifications. The "pit-run gravel" should be free of any form of coating and any gravel or sand containing clay, loam or other deleterious materials should be rejected. No material oversize of the specified maximum sieve size should be tolerated. This material would typically haves a fines content of less than 10%. The materials above are also suitable for use as "general engineered fill."

Construction Excavations

Construction should be in accordance with good practice and comply with the requirements of the responsible regulatory agencies.

All excavations greater than 1.5m deep should be sloped or shored for worker protection.

Shallow excavations up to about 3m depth may use temporary sideslopes of 1H:1V. A flatter slope of 2H:1V should be used if groundwater is encountered. Localized sloughing can be expected from these slopes.

Deep excavations or trenches may require temporary support if space limitations or economic considerations preclude the use of sloped excavations.

For excavations greater than 3m depth, temporary support should be designed by a qualified geotechnical engineer. The design and proposed installation and construction procedures should be submitted to BDT for review.

The construction of a temporary support system should be monitored. Detailed records should be taken of installation methods, materials, in situ conditions and the movement of the system. If anchors are used, they should be load tested. BDT can provide further information on monitoring and testing procedures if required.

Attention should be paid to structures or buried service lines close to the excavation. For structures, a general guideline is that if a line projected down, at 45 degrees from the horizontal from the base of foundations of adjacent structures intersects the extent of the proposed excavation, these structures may require underpinning or special shoring techniques to avoid damaging earth movements. The need for any underpinning or special shoring techniques and the scope of monitoring required can be determined when details of the service ducts and vaults, foundation configuration of existing buildings and final design excavation levels are known.

No surface surcharges should be placed closer to the edge of the excavation than a distance equal to the depth of the excavation, unless the excavation support system has been designed to accommodate such surcharge.

Proof Rolling

Proof-rolling is a method of detecting soft areas in an 'as-excavated' subgrade for fill, pavement, floor or foundations or detecting non-uniformity of compacted embankment. The intent is to detect soft areas or areas of low shear strength not otherwise revealed by means of test holes, density testing, or visual examination of the site surface and to check that any fill placed or subgrade meets the necessary design strength requirements.

Proof-rolling should be observed by qualified geotechnical personnel.

Proof-rolling is generally accomplished by the use of a heavy (15 to 60 tonne) rubber-tired roller having 4 wheels abreast on independent axles with high contact wheel pressures (inflation pressures ranging from 550 kPa (80psi) up to 1030 kPa (150 psi).

A heavily loaded tandem axle gravel truck may be used in lieu of the equipment described in the paragraph above. The truck should be loaded to approximately 10 tonnes per axle and a minimum tire pressure of 550 kPa (80 psi). Ground speed - maximum 8 km/hr recommended 4 km/hr.

The recommended procedure is two complete coverages with the proof-rolling equipment in one direction and a second series of two coverages made at right angles to the first series; one 'coverage' means that every point of the proof-rolled surface has been subjected to the tire pressure of a loaded wheel. Less rigorous procedures may be acceptable under certain conditions subject to the approval of an engineer.

Any areas of soft, rutted or displaced materials detected should be either recompacted with additional fill or the existing material removed and replaced with general engineered fill, or properly moisture conditioned as necessary.

The surface of the grade under the action of the proof-roller should be observe, noting; visible deflection and rebound of the surface, formation of a crack pattern in the compacted surface or shear failure in the surface or granular soils as ridging between wheel tracks.

If any part of an area indicates significantly more distress than other parts, the cause should be investigated, by, for example, shallow auger holes.

In the case of granular subgrades, distress will generally consist of either compression due to insufficient compaction or shearing under the tires. In the first case, rolling should be continued until no further compression occurs. In the second case, the tire pressure should be reduced to a point where the subgrade can carry the load without significant deflection and subsequently gradually increased to it specified pressure as the subgrade increases in shear strength under this compaction.

APPENDIX B

Trip Generation Letters

4105 7 Street SE Calgary, AB T2G 2Y9 T: 403.254.0544 F: 403.254.9186

October 5, 2023

Our Reference: 28449

Douglas Bergen & Associates Ltd.
PO Box 1667
Coaldale, Alberta
T1M 1N3

Attention: Douglas Bergen

Dear Sir:

Reference: Chin Subdivision Trip Generation

1.0 Introduction

ISL Engineering and Land Services Ltd. (ISL) was retained by Douglas Bergen & Associates Ltd. to determine the trip generation of a 12-lot country residential and school development in the Hamlet of Chin, Municipal District (MD) of Taber, Alberta. The school will have 70 students and 6 teachers.

The development is located just north of Highway 3 and west of Range Road 19-0. As part of the development, Naismith Street is proposed to be extended north and access to each lot is off the extended segment of Naismith Street. Figure 1 shows the site plan.

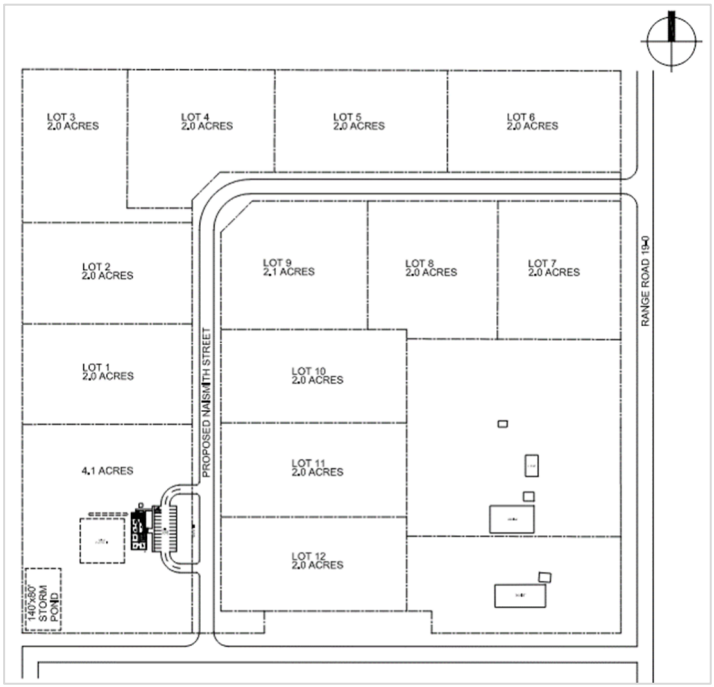


Figure 1: Site Plan

2.0 Analysis

In the MD's General Standards of Development in Schedule 5 of the Land Use Bylaw No. 1677, the guideline does not indicate when a TIA is required to be undertaken. Per typical engineering standards, a site that generates less than 100 trips during the commuter peak hour (between 7-9 AMand 4-6 PM) does not require a TIA.

For the 12 residential lots, the single-family trip generation rates from the ITE Trip Generation Manual, 11th Edition, was referenced. This manual is an industry accepted manual to estimate traffic.

- Single Family Residential (ITE Rates):
  - **AM Peak: 0.70 trips / hour / unit: 9 trips per hour**
  - **PM Peak: 0.94 trips / hour / unit: 12 trips per hour**

As there are no trip generation rates for rural schools in the ITE Manual, the following were assumed. The school times are 8:30 AM to 3:00 PM. Due to the rural location of the school, 90% of the students (63 students) are expected to be bussed to school on 2 buses while 10% of the students (7 students) are expected to be dropped off.

- School AM Start:
  - 2 buses: 2 trips in and 2 trips out
  - 6 teachers: 6 trips in
  - 7 student Drop offs: 7 trips in and 7 trips out
  - **AM Peak Total: 24 trips (15 trips in, 9 trips out)**
- School PM End:
  - As the school hours end outside of the typical PM commuter peak (4-6 PM), no trips are generated in the PM peak.
  - **PM Peak Total: 0 trips**

In total, there are **33 trips in the AM peak and 12 trips in the PM peak**. This is a negligible amount of traffic and will have minimal impact on existing traffic operations.

3.0 Closing

From the transportation review of the proposed 12 country residential homes and school, the following conclusions are drawn:

- The development generates at most 33 and 12 additional trips per hour in the AM and PM peaks, respectively. The amount of traffic generated is negligible and will have minimal impact on existing traffic operations.

If any additional information is required, please contact the undersigned at your convenience.

Sincerely,

Alex Ho, P.Eng., PTOE
Manager, Traffic Engineering

4105 7 Street SE Calgary, AB T2G 2Y9 T: 403.254.0544 F: 403.254.9186

February 15, 2024

Our Reference: 28449

Douglas Bergen & Associates Ltd.
PO Box 1667
Coaldale, Alberta
T1M 1N3

Attention: Douglas Bergen

Dear Sir:

Reference: Chin Subdivision Trip Generation

1.0 Introduction

ISL Engineering and Land Services Ltd. (ISL) was retained by Douglas Bergen & Associates Ltd. to determine the trip generation of a 12-lot country residential and school development in the Hamlet of Chin, Municipal District (MD) of Taber, Alberta. The school will have 70 students and 6 teachers.

The development is located just north of Highway 3 and west of Range Road 19-0. As part of the development, Naismith Street is proposed to be extended north and access to each lot is off the extended segment of Naismith Street. Figure 1 shows the site plan.

The lots, roads and school are anticipated to be constructed in September 2024. The houses on the residential lots will be built when a buyer purchases the lot.

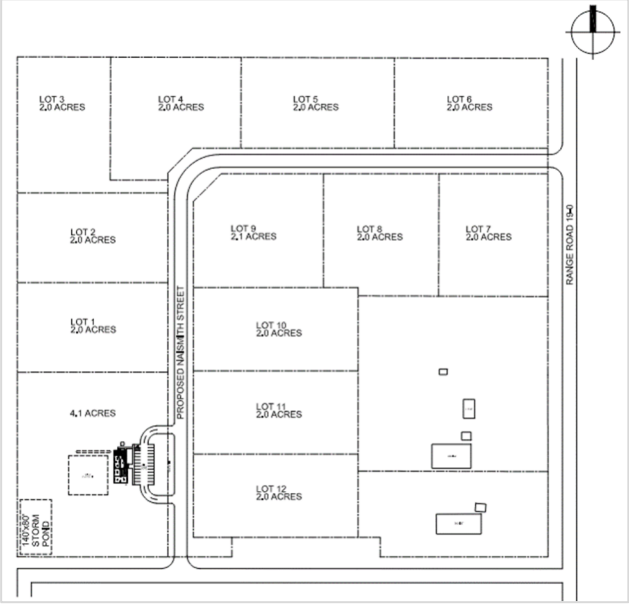


Figure 1: Site Plan

2.0 Trip Generation

In the MD's General Standards of Development in Schedule 5 of the Land Use Bylaw No. 1677, the guideline does not indicate when a TIA is required to be undertaken. Per typical engineering standards, a site that generates less than 100 trips during the commuter peak hour (between 7-9 AMand 4-6 PM) does not require a TIA.

For the 12 residential lots, the single-family trip generation rates from the ITE Trip Generation Manual, 11th Edition, was referenced. This manual is an industry accepted manual to estimate traffic.

- Single Family Residential (ITE Rates):
  - **AM Peak: 0.70 trips / hour / unit: 9 trips per hour**
  - **PM Peak: 0.94 trips / hour / unit: 12 trips per hour**

As there are no trip generation rates for rural schools in the ITE Manual, the following were assumed. The school times are 8:30 AM to 3:00 PM. Due to the rural location of the school, 90% of the students (63 students) are expected to be bussed to school on 2 buses while 10% of the students (7 students) are expected to be dropped off.

- School AM Start:
  - 2 buses: 2 trips in and 2 trips out
  - 6 teachers: 6 trips in
  - 7 student Drop offs: 7 trips in and 7 trips out
  - **AM Peak Total: 24 trips (15 trips in, 9 trips out)**
- School PM End:
  - As the school hours end outside of the typical PM commuter peak (4-6 PM), no trips are generated in the PM peak.
  - **PM Peak Total: 0 trips**

In total, there are **33 trips in the AM peak and 12 trips in the PM peak**. This is a negligible amount of traffic and should have minimal impact on existing traffic operations.

3.0 Highway Traffic

The latest traffic volumes on Highway 3 at Range Road 19-0 were downloaded from Alberta Transportation and Economic Corridors' (ATEC) website. In 2022, the Average Annual Daily Traffic (AADT) was 8,080 vehicles per day (vpd) while the Average Summer Daily Traffic (ASDT) was 8,860 vpd. As compared to the 10-year traffic history in 2012, the AADT (8,100 vpd) declined by -0.02% per year while the ASDT (8,650 vpd) grew by 0.24% per year. Based on the preceding, there is very minimal growth on Highway 3 at Range Road 19-0.

As compared to the Highway 3 peak hour traffic volumes (857 and 860 vehicles per hour in the AM and PM, respectively), the development will increase the traffic on Highway 3 by 4% and 1% in the AM and PM peak, respectively. This is a negligible amount and should have minimal impact on Highway 3, thus upgrades to the highway are not required.

4.0 Closing

From the transportation review of the proposed 12 country residential homes and school, the following conclusions are drawn:

- The development generates at most 33 and 12 additional trips per hour in the AM and PM peaks, respectively. The amount of traffic generated is negligible and will have minimal impact on existing traffic operations.
- On Highway 3 at Range Road 19-0, there has been minimal growth over the last 10 years.
- The development will increase the traffic on Highway 3 by 4% and 1% in the AM and PM peak, respectively. This is a negligible amount and should have minimal impact on Highway 3, thus upgrades to the highway are not required.

If any additional information is required, please contact the undersigned at your convenience.

Sincerely,

Alex Ho, P.Eng., PTOE
Manager, Traffic Engineering

APPENDIX C

Osprey Engineering Septic Report

OSPREY ENGINEERING INC.
BOX 1367 · BLACK DIAMOND, ALBERTA · T0L 0H0 CANADA
TEL: 403.933.2226 · EMAIL: ospreyeng@gmail.com

27 November 2023 Our file: 230876

Douglas J. Bergen Associates Ltd.
Box 1667
Coaldale, AB, T1M 1N3

Attention: Douglas Bergen, CET

RE: Chin Area Structure Plan
North Side of Alberta Avenue, Hamlet of Chin (Blocks A, B & E, Plan 899 AA, NE25-9-19-4)
Private Sewage Treatment Systems (PSTS) Assessment

Dear Douglas,

The following Private Sewage Treatment Systems Assessment was performed in support of an application for subdivision of the above-noted parcel in August 2023. *The proposed lots were found to be suitable for private sewage treatment systems (PSTS) with limitations noted.*
The site investigation and report were performed and prepared consistent with the following documents:

- (Safety Codes Council, 2021), *Alberta Private Sewage Standard of Practice*, Alberta Municipal Affairs, Edmonton ["SOP 2021"],
- (Alberta Association of Municipal Districts & Counties in parthnership with Alberta Municipal Affairs, 2011) Alberta Association of Municipal Districts and Counties [AAMDC] 2011, *Model Process for Subdivision Approval and Private Sewage* ["Model Process"] and related documents.

I. PROJECT BACKGROUND

The subject parcel is located on the west side of Range Road 190, and north of Alberta Avenue, in The Hamlet of Chin. The area of the subject parcel is 15.9 ha [39.4 acres] more or less. The location of the parcel is shown on Figure 1. The parcel is presently a farming field with no existing dwellings or buildings.

The owners propose to subdivide twelve country residential lots and one larger lot for a school. The proposed country residential lots will be 0.8 ha [2.0 ac]. The school lot will be 1.7 ha [4.1 ac]. The proposed lots will be accessed by extending the existing Naismith Street. The preferred lot layout is shown on Figure 2.

The proposed lots will be served by private water cisterns. The proposed lots are intended to be served by new private sewage systems.

II. METHODOLOGY AND LIMITATION

In support of a subdivision, Lethbridge County has requested that a private sewage treatment systems (PSTS) assessment be completed to justify that wastewater from dwellings on the proposed lots can be treated and dispersed on site consistent with relevant safety codes. Methodology in describing acceptable conditions for adequate operation of private sewage treatment systems (PSTS) is consistent with (Safety Codes Council, 2021).
As such, all loading rates are as per SOP 2021. No percolation tests were performed as these are no longer considered acceptable evidence in support of the selection of soil loading rates in SOP 2021.
Observations were taken from publicly available background information and field assessments noted:

- 28 August 2023: Osprey soil observations.

Observation and recording of the soil profiles was performed as directed in SOP 2021 using forms based on those provided by Alberta Municipal Affairs. Soil samples from the test pits were submitted to Down to Earth Labs of Lethbridge for texture analysis. These results are appended.
This report is to be used by the owners of the parcels noted and Lethbridge County in support of the area structure plan and eventual subdivision of the subject parcel, as described in the Model Process. It is not intended as a full system design. Full design and site investigation (including digging additional test holes or other tests as may be required) by a licensed installer consistent with the relevant standard of practice in force at the time is still assumed to be required as part of the permit process.

III. DESCRIPTION

This description is based on information provided by the owners of the parcel and information obtained from various public sources. Topography of the parcel based on a recent survey (performed by Mike Spencer Geomatics in September 2023) is included showing existing surface features within and immediately surrounding the subject parcel.

A. Density and Cumulative Impact

The surrounding quarter sections have 3 or fewer parcels per quarter section. The quarter sections to the south which includes The Hamlet of Chin has approximately 89 parcels within the quarter section. Figure 3 indicates the number of parcels in each of the surrounding quarter-sections based on cadastral data provided by AltaLIS and is current to the date of this report.
All country residential parcels in the area are assumed to be served by individual private sewage systems with water services from private water cisterns. Wells noted in the provincial database for the surrounding area are listed in Appendix C.
The cumulative impact due to additional density due to the proposed subdivision does not extend beyond the lot boundaries for the following reasons:

- Parcel sizes are sufficient and area density is low to moderate. As such, there will be adequate dilution due to precipitation such that nutrient loading due to the additional wastewater generated will not result in nutrient concentrations greater than CCME guidelines. Given this, no additional source water quality impact assessment is justified for this subdivision.

B. Topography, Surface Water and Vegetation

Surface features are shown on Figure 4. The site encompasses undulating, low relief terrain.
The subject parcel does not contain any steep slopes. The average slope of the parcel is 1%.
A depression and manmade swale crosses Lots 1, 7, 8, 10, 11, and the school. These areas could be subject to overland flows and pooling water, and it may be prudent to locate PSTS outside of this area. If the depression has a defined "shoreline" per the SOP, then a setback of 15.0 m [50 ft] would be prescribed from this shoreline. If no shoreline is noted, then no setback is applicable. These do not have a defined shoreline; therefore no setback is applicable.
An irrigation canal exists to the west but is more than 1000 m from the subject parcel.
No rivers, lakes, creeks, or streams affect the parcel.
No springs or wells using shallow groundwater (GWUDI) for domestic purposes were noted within 150 m (500 feet) of the subject parcel. No dugouts or surface water bodies were noted as being used for domestic purposes within 150 m (500 feet) of the subject parcel.

Vegetation across the subject parcel is as follows:

- Crops

Generally, the vegetation on site does not indicate features that would limit PSTS.

C. Encumbrances

No rights-of-way exist within the subject parcel. A pipeline right-of-way (011 3349) and a waterline right-of-way (011 0603) exist to the north of the subject parcel.
Standard setback (horizontal separation) distances for various PSTS components as per SOP 2021 are as follows:

- All soil-based treatment components (fields, mounds, etc…) must be **100 m** from a licensed municipal water well.
- All soil-based treatment components (fields, mounds, etc…) must be **90 m** from a lake, river, stream, or creek *unless* "…a principal building or other development feature is located between the soil based treatment system and the lake, river, stream or creek such that a failure causing effluent on the ground will be obvious and create an undesirable impact on the owner…" (SOP 2021, Art. 2.1.2.4). Generally, if the dwelling is constructed between the stream and the soil based treatment component, this is acceptable and the setbacks to a water source or water course as noted below are applicable;
- Septic tanks, settling tanks and effluent tanks:
  - 10 m from a water source,
  - 10 m from a water course,
  - 1 m from a property line and
  - 1 m from a building.
- Packaged (secondary) treatment plants and settling tanks which include pre-aeration:
  - Same as for septic tanks *except*
  - 6 m from a property line.
- Sand filters (to foot of berm):
  - Same as for septic tanks.
- Recirculating gravel filters (to foot of berm):
  - Same as for septic tanks *except*
  - 3 m from property line.
- Treatment field (edge of weeping lateral trench):
  - 15 m from a water source,
  - 15 m from a water course (unless building is located between water course and field),
  - 1.5 m from a property line,
  - 10 m from a basement, cellar, or crawl space,
  - 1 m from a building without a permanent foundation,
  - 5 m from a building with a permanent foundation but without a basement cellar or crawl space (e.g. slab-on-grade) and
  - 5 m from a septic tank or packaged sewage treatment plant.
- Treatment mound (from point where side slope of mound berm intersects natural soil contour):
  - Same as for a treatment field *except*
  - 3 m from a property line,

- 3 m from a septic tank,
- 10 m from a basement, cellar, or crawl space and
- 10 m from a building with a permanent foundation but without a basement cellar or crawl space (e.g. slab-on-grade).

D. Soils

According to the Alberta Soil Information Viewer (soil polygons 1337 and 1334) (Government of Alberta, 2023), the following soil series may be present in the subject parcel.

- Cranford (CFD): Orthic brown chernozem with medium textured soils (loam, silty loam, and very fine sandy loam) on medium or fine textured till.
- Chin (CHN): Orthic brown chernozem with medium textured soil (loam, silty loam, and very fine sandy loam) on medium textured sediments (loam to very fine sandy loam) deposited by wind and water.

CFD, and CHN would be *generally* amenable to PSTS.
General limitations for PSTS due to soil conditions include possible lower loading rates for dispersing effluent on fine-textured soil (e.g. clay loam or finer) or coarse textured soils (e.g. sand, loamy sand, or sandy loam) with weak or poor structure, restricting soil horizons which limit downward movement and high groundwater or seasonal high groundwater conditions.

All systems dispersing primary treated (septic tank) effluent (Effluent Level 1 per SOP 2021) to the soil via treatment fields must maintain a vertical separation of at least 1.5 m [5 ft] to restricting soil horizons, groundwater, and seasonal high groundwater. Systems dispersing secondary-treated (Effluent Level 2 or better per SOP 2021), including all treatment mounds, must maintain a vertical separation of at least 0.9 m [3 ft] to restricting soil horizons.

Soil profiles were developed for thirteen test pits. One test pit was excavated within each proposed lot, as shown on Figure 4. As noted, detailed soil profiles and laboratory texture analyses are appended.

Soils were generally consistent with the soil series noted for this area.

- Lot 1: A brown loam A-horizon (Ap) to approximately 23 cm [9"] overlays a pale brown loam Bm-horizon to approximately 130 cm [51"] which transitions to a brown loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying). No groundwater was found.
- Lot 2: A yellowish brown loam A-horizon (Ap) to approximately 20 cm [8"] overlays a pale brown loam Bm-horizon to approximately 84 cm [33"] which transitions to a dark yellowish brown loam Bm-horizon to approximately 102 cm [40"] which transitions to a brown loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 3: A dark yellowish brown clay loam A-horizon (Ap) to approximately 25 cm [10"] overlays a brown clay loam Bm-horizon to approximately 69 cm [27"] which transitions to a brown clay loam Bm-horizon to approximately 89 cm [35"] which transitions to a dark yellowish brown clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 4: A dark yellowish brown clay loam A-horizon (Ap) to approximately 23 cm [9"] overlays a brown clay loam Bm-horizon to approximately 84 cm [33"] which transitions

to a dark yellowish brown clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.

- Lot 5: A brown loam A-horizon (Ap) to approximately 3 cm [13"] overlays a pale brown to brown loam Bm-horizon to approximately 97 cm [38"] which transitions to a brown clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 6: A brown clay loam A-horizon (Ap) to approximately 18 cm [7"] overlays a brown to light yellowish brown clay loam Bm-horizon to approximately 114 cm [45"] which transitions to a dark grayish brown to dark yellowish brown clay loam Ck-horizon below. Evidence of seasonal saturation (mottling) was observed below 191 cm [75"]. No groundwater was found.
- Lot 7: A brown clay loam A-horizon (Ap) to approximately 23 cm [9"] overlays a brown to pale brown clay loam Bm-horizon to approximately 196 cm [77"] which transitions to a light olive brown coarse sandy loam Ck-horizon below. Evidence of seasonal saturation (mottling) was observed below 196 cm [77"]. No groundwater was found.
- Lot 8: A brown loam A-horizon (Ap) to approximately 25 cm [13"] overlays a light yellowish brown to a light olive brown sandy clay loam Bm-horizon to approximately 127 cm [50"] which transitions to a light olive brown and yellowish brown loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 9: A brown loam A-horizon (Ap) to approximately 30 cm [12"] overlays a brown and light olive brown clay loam Bm-horizon to approximately 81 cm [32"] which transitions to a light olive brown and brown clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 10: A brown loam A-horizon (Ap) to approximately 15 cm [6"] overlays a yellowish brown and brown clay loam Bm-horizon to approximately 84 cm [33"] which transitions to a yellowish brown and brown loam and clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 11: A brown clay loam A-horizon (Ap) to approximately 15 cm [6"] overlays an olive brown and light yellowish brown clay loam Bm-horizon to approximately 109 cm [43"] which transitions to a dark yellowish brown and brown clay loam Ck-horizon below. Evidence of seasonal saturation (mottling) was observed below 193 cm [76"]. No groundwater was found.
- Lot 12: A brown clay loam A-horizon (Ap) to approximately 20 cm [8"] overlays a light yellowish brown and light olive brown clay loam Bm-horizon to approximately 109 cm [43"] which transitions to a dark yellowish brown clay loam Ck-horizon below. Evidence of seasonal saturation (mottling) was observed below 208 cm [82"]. No groundwater was found.
- School Lot: A brown clay loam A-horizon (Ap) to approximately 15 cm [6"] overlays a pale brown and brown clay loam Bm-horizon to approximately 132 cm [52"] which transitions to a dark brown clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.

IV. ESTIMATE OF SYSTEM DAILY FLOWS

Houses are predicted to be at least four bedrooms and generally include additional fixtures that can increase peak daily flows.

As such, a peak daily flow rate of 2300 L/day [500 gal/day] is used (a four-bedroom house with allowance for *some* extra fixture units). The installation of such fixtures as garbage grinders, large soaker tubs and other high-volume and/or high-strength effluent producing fixtures requires special consideration because:

- these increase the PSTS soil component size required and
- the possible lack of space for adequately sized soil treatment components and reserve field areas to accommodate such features.

Water treatment components (such as water softeners and iron filters) can generate large flows of clear water. When connected to private sewage systems, these large flows can cause treatment components to fail and become saturated. It is strongly recommended that backflush and overflow from water treatment components be directed elsewhere.

The school is predicted to be 35 students. As per the SOP 2021, a peak daily flow per student is 70 L/day/student [15 gal/day/student]. The total peak daily rate is 2450 L/day [525 gal/day].

Actual size of system components is the responsibility of the system installer and will be determined prior to obtaining permits based on the proposed house size and design.

V. INFILTRATION COMPONENT SIZING

Based on the site assessment, the following types of soil-based effluent treatment and dispersal systems are not appropriate for the proposed parcel:

- Lagoons due to limited distance to property boundaries,
- Open discharge due to limited distance to property boundaries and area density and
- LFH at-grade systems except in forested areas where LFH layers of 50 mm [2"] or deeper can be demonstrated.

Treatment fields receiving primary (Level 1) or secondary (Level 2) treated effluent or treatment mounds receiving primary (Level 1) or secondary (Level 2) treated effluent are suitable for the proposed lots. Suitability of any given proposed PSTS is subject to the design judgement of the installer and the standard of practice in effect at the time of installation. Soils can vary throughout a parcel and such variation can affect the suitability of land for PSTS.

For the purposes of this report, the infiltration component assumes the following:

- Pressure distributed treatment fields receiving primary treated (Level 1) effluent.
- The required vertical separation to a restricting condition for a treatment field is 1.5 m [5 ft] from trench bottom. Given the soil profile observed on these lots, this can be achieved.

Footprints for such systems are shown on Figure 4 and on Table 1. Footprints are approximate and will depend on dwelling size and type of PSTS ultimately chosen by the owner and installer based on detailed soil analysis at the time of the design, as well as other factors. Other designs and arrangements are possible for the proposed infiltration components. Decisions relating to a final design are the responsibility of the landowner, their system installer, and the safety codes officer (SCO) inspecting the installation.

VI. SUSTAINABILITY OF PRIVATE SEWAGE

If installed by a qualified installer as recommended in this report, and properly operated and maintained, the proposed lots can support viable PSTSs for the long term.

VII. CONCLUSIONS

If installed and maintained using accepted best practices, there is more than adequate space on the proposed lots to install compliant and functioning PSTSs.

If you require anything further, please contact the undersigned.

Yours truly,

Responsible member for
OSPREY ENGINEERING INC.
APEGA Permit to Practice No. P10743

Michael A. Kitchen, P.Eng.
Alberta Municipal Affairs, Certificate of Competency **PS 8926**, Private Sewage Installer; Group I
President

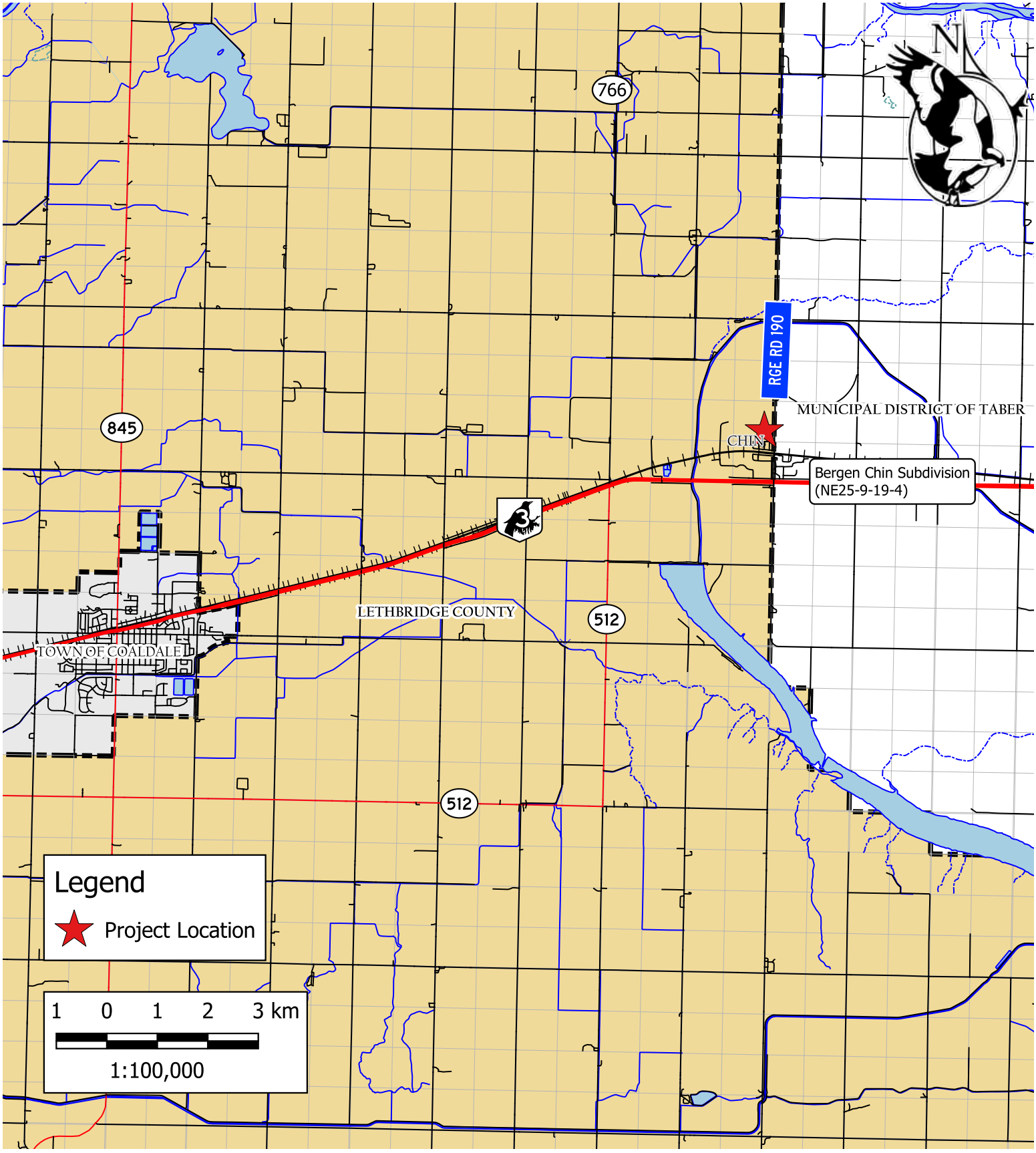
MAK/

Encl.

cc.

FIGURES

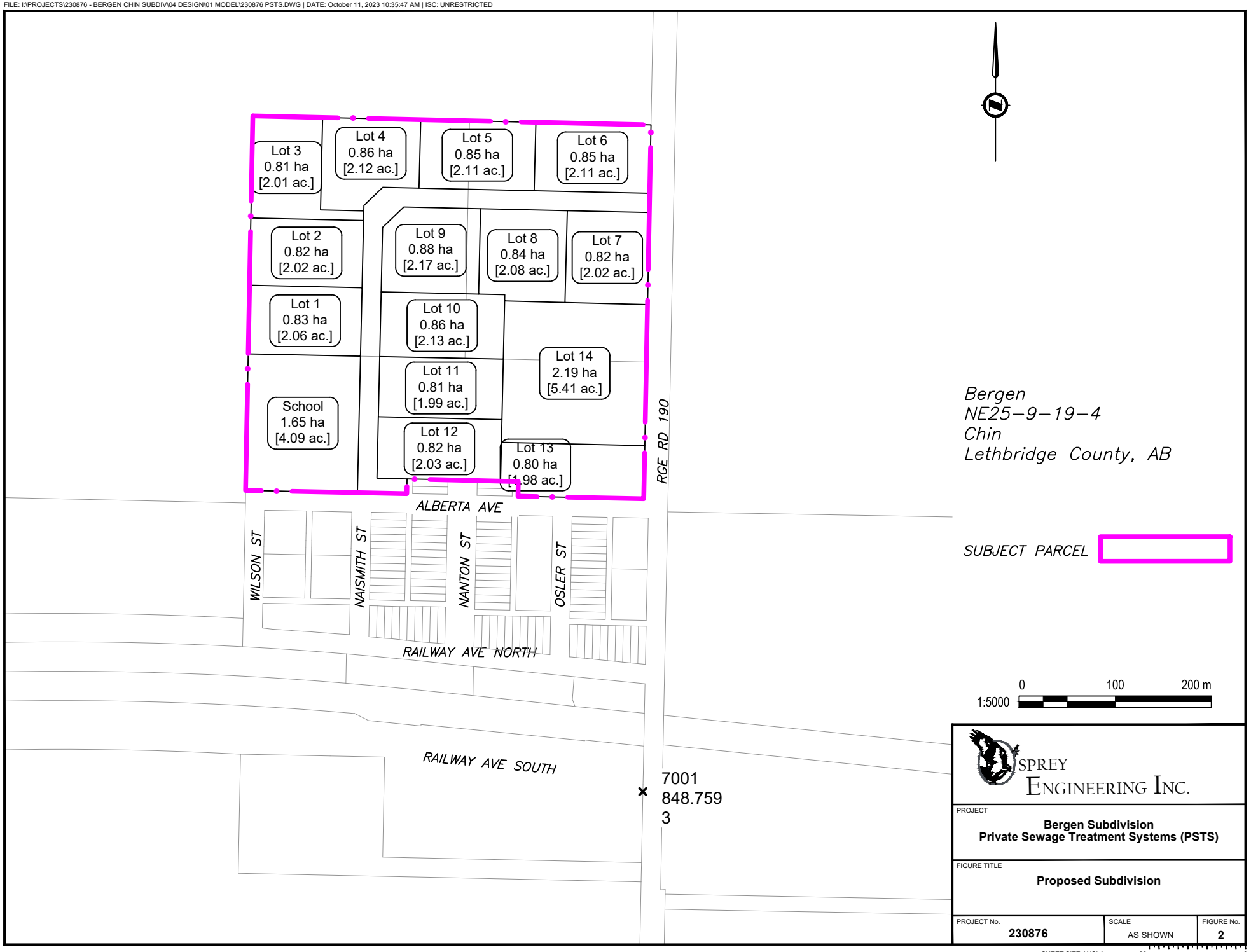
The following figures are referenced in the report.



SPREY ENGINEERING INC.

Bergen Chin Subdivision
Private Sewage Treatment Systems (PSTS)
Assessment

Figure 1 - Location



SPREY ENGINEERING INC.

PROJECT
Bergen Subdivision
Private Sewage Treatment Systems (PSTS)

FIGURE TITLE
Proposed Subdivision

PROJECT No.	SCALE	FIGURE No.
230876	AS SHOWN	2

SHEET SIZE ANSI A
20 mm
0

SW36–9–19–4
1 parcel

SE36–9–19–4
1 parcel

SW31–9–18–4
1 parcel

CANAL

NE25–9–19–4
3 parcels (EX)
13 parcels (PROP)

RGE RD 190

NW25–9–19–4
2 parcels

NW30–9–18–4
1 parcel

ALBERTA AVE

WILSON ST

NAISMITH ST

NANTON ST

OSLER ST

RAILWAY AVE NORTH

RAILWAY AVE SOUTH

7001
848.759
3

SW25–9–19–4
3 parcels

SW30–9–18–4
4 parcels

SE25–9–19–4
~89 parcels

5510
850.593
IP

CROWSNEST HWY

HWY 3

0 200 400 m
1:10 000

SUBJECT PARCEL

Bergen
NE25–9–19–4
Chin
Lethbridge County, AB

OSPREY ENGINEERING INC.

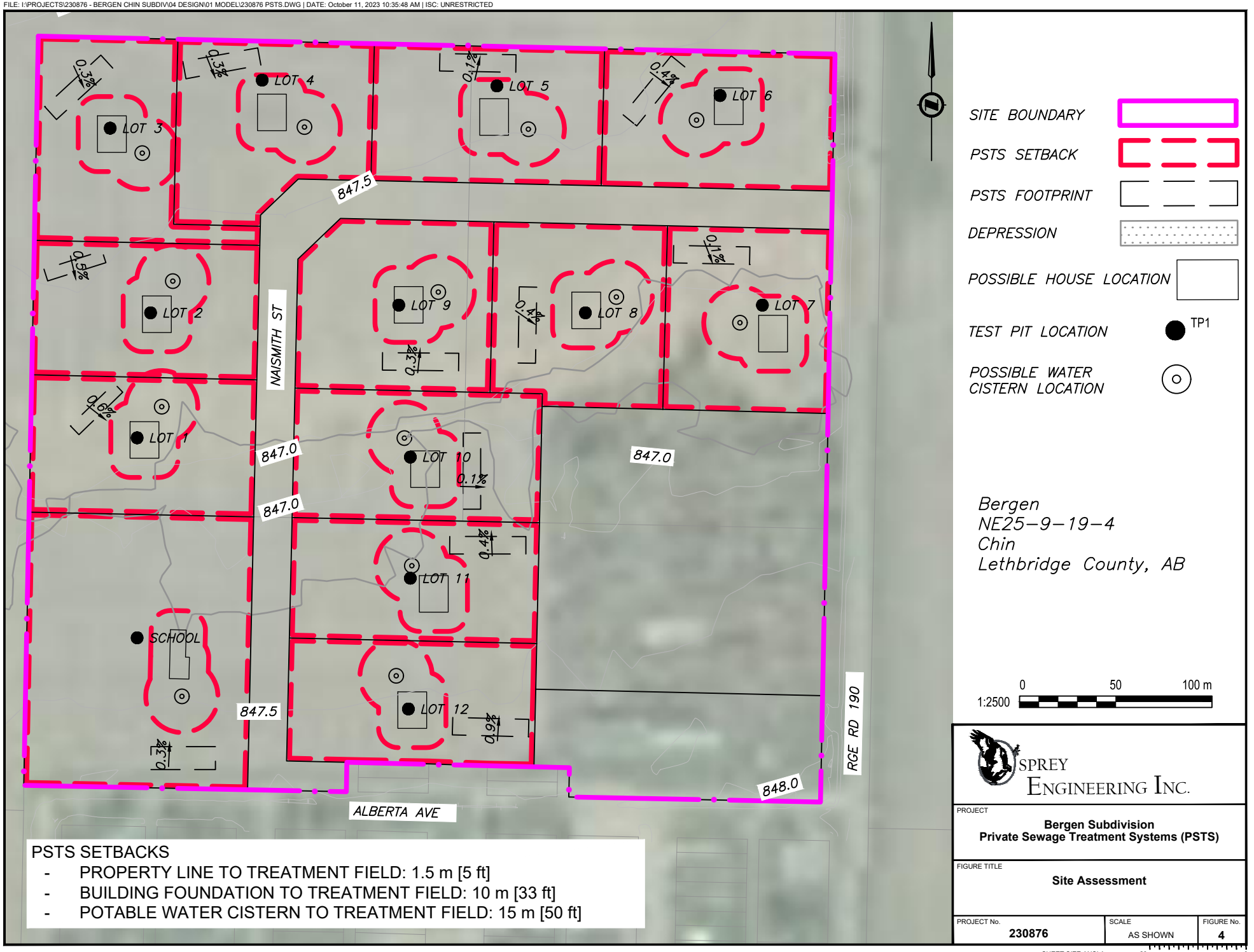
PROJECT
Bergen Subdivision
Private Sewage Treatment Systems (PSTS)

FIGURE TITLE
Area Density

PROJECT No.	SCALE	FIGURE No.
230876	AS SHOWN	3

SHEET SIZE ANSI B 20 mm 0

FILE: I:\PROJECTS\230876 - BERGEN CHIN SUBDIV\04 DESIGN\01 MODEL\230876 PSTS.DWG | DATE: October 11, 2023 10:35:48 AM | ISC: UNRESTRICTED



PSTS SETBACKS
- PROPERTY LINE TO TREATMENT FIELD: 1.5 m [5 ft]
- BUILDING FOUNDATION TO TREATMENT FIELD: 10 m [33 ft]
- POTABLE WATER CISTERN TO TREATMENT FIELD: 15 m [50 ft]

SPREY ENGINEERING INC.

PROJECT
Bergen Subdivision
Private Sewage Treatment Systems (PSTS)

FIGURE TITLE
Site Assessment

PROJECT No.	SCALE	FIGURE No.
230876	AS SHOWN	4

SHEET SIZE ANSI A

	Proposed Lot 1	Proposed Lot 2	Proposed Lot 3	Proposed Lot 4	Proposed Lot 5
Texture	Very: loam	Very: loam	Moderate to good: clay loam	Moderate to good: clay loam	Moderate to good: clay loam, and loam
Structure	Moderate to well: granular (grade 2) structure	Moderate: granular (grade 2) structure	Moderate: granular (grade 2) structure	Moderate: granular (grade 2) structure	Moderate: granular (grade 2) structure
Hydraulic Capability of Soil (Drainage)	Very: well drained to >2.5 m	Very: well drained to >2.5 m	Very: well drained to >2.5 m	Very: well drained to >2.5 m	Very: well drained to >2.5 m
Depth of Suitable Soil	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m
Depth to Water Table	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils
Topography	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat
Flooding	Moderate: depression within parcel could be subject for pooling water. Area not suitable for PSTS. See Figure 4	Very: moderate to good surface drainage. No surface water within parcel	Very: moderate to good surface drainage. No surface water within parcel	Very: moderate to good surface drainage. No surface water within parcel	Very: moderate to good surface drainage. No surface water within parcel
Density	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section
Encumbrances	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS
Parcel Size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size
Surface Water	Very: none within parcel	Very: none within parcel	Very: none within parcel	Very: none within parcel	Very: none within parcel
Overall	Very	Very	Very	Very	Very
Recommended System Type	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent
Test Pit	Lot 1 - TP	Lot 2 - TP	Lot 3 - TP	Lot 4 - TP	Lot 5 - TP
Limiting soil type	Loam, granular (grade 2) structure	Loam, granular (grade 2) structure	Clay loam, granular (grade 2) structure		Clay loam, granular (grade 2) structure
Applicable Loading Rates	HLR: 22.0 L/m²/day [0.45 gal/ft²/day]	HLR: 22.0 L/m²/day [0.45 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]
	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions
Approximate System footprint	31.7 m × 6.4 m [104.0 ft × 21.0 ft]	31.7 m × 6.4 m [104.0 ft × 21.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]

	Proposed Lot 6	Proposed Lot 7	Proposed Lot 8	Proposed Lot 9	Proposed Lot 10
Texture	Moderate to good: clay loam	Moderate to good: sandy clay loam, and clay loam	Moderate to good: sandy clay loam, and loam	Moderate to good: clay loam	Moderate to good: clay loam, and loam
Structure	Moderate to well: granular (grade 2) structure	Moderate: granular (grade 2) structure	Moderate: blocky (grade 2) structure	Moderate: blocky (grade 2) structure	Moderate: blocky (grade 2) structure
Hydraulic Capability of Soil (Drainage)	Moderate: well drained above 1.8 m	Moderate: well drained above 2.0 m	Very: well drained to >2.5 m	Very: well drained to >2.5 m	Very: well drained to >2.5 m
Depth of Suitable Soil	Moderate: suitable above 1.8 m	Moderate: suitable above 2.0 m	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m
Depth to Water Table	Moderate: evidence of seasonally saturated soils below 1.8 m	Moderate: evidence of seasonally saturated soils below 2.0 m	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils
Topography	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat
Flooding	Very: moderate to good surface drainage. No surface water within parcel	Moderate: depression within parcel could be subject for pooling water. Area not suitable for PSTS. See Figure 4	Moderate: depression within parcel could be subject for pooling water. Area not suitable for PSTS. See Figure 4	Very: moderate to good surface drainage. No surface water within parcel	Moderate: depression within parcel could be subject for pooling water. Area not suitable for PSTS. See Figure 4
Density	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section
Encumbrances	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS
Parcel Size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size
Surface Water	Very: none within parcel	Very: none within parcel	Very: none within parcel	Very: none within parcel	Very: none within parcel
Overall	Moderate to very	Moderate to very	Very	Very	Very
Recommended System Type	Shallow treatment field receiving primary treated effluent	Shallow treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent
Test Pit	Lot 6 - TP	Lot 7 - TP	Lot 8 - TP	Lot 9 - TP	Lot 10 - TP
Limiting soil type	Clay loam, granular (grade 2) structure	Sandy clay loam, granular (grade 2) structure	Sandy clay loam, blocky (grade 2) structure	Clay loam, blocky (grade 2) structure	Clay loam, blocky (grade 2) structure
Applicable Loading Rates	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]
	LLR: N/A, no restricting conditions within < 60 inches	LLR: N/A, no restricting conditions within < 60 inches	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions
Approximate System footprint	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]

	Proposed Lot 11	Proposed Lot 12	Proposed School Lot
Texture	Moderate: clay loam	Moderate: clay loam	Moderate to good: clay loam
Structure	Moderate to well: granular (grade 2) structure	Moderate: granular (grade 2) structure	Moderate: granular (grade 2) structure
Hydraulic Capability of Soil (Drainage)	Moderate: well drained above 2.0 m	Moderate: well drained above 2.0 m	Very: well drained to >2.5 m
Depth of Suitable Soil	Moderate: suitable soil above 2.0 m	Moderate: suitable soil above 2.0 m	Very: suitable soil to >2.5 m
Depth to Water Table	Moderate - evidence of saturated soils below 2.0 m	Moderate - evidence of saturated soils below 2.0 m	Very: no evidence of water table or saturated soils
Topography	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat
Flooding	Very: moderate to good surface drainage. No surface water within parcel	Very: moderate to good surface drainage. No surface water within parcel	Moderate: depression within parcel could be subject for pooling water. Area not suitable for PSTS. See Figure 4
Density	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section
Encumbrances	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS
Parcel Size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size
Surface Water	Very: none within parcel	Very: none within parcel	Very: none within parcel
Overall	Moderate	Moderate	Very
Recommended System Type	Shallow treatment field receiving primary treated effluent	Shallow treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent
Test Pit	Lot 11 - TP	Lot 12 - TP	School - TP
Limiting soil type	Clay loam, granular (grade 2) structure	Clay loam, granular (grade 2) structure	Clay loam, granular (grade 2) structure
Applicable Loading Rates	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]
	LLR: N/A, no restricting conditions within <60"	LLR: N/A, no restricting conditions within <60"	LLR: N/A, no restricting conditions
Approximate System footprint	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	33.5 m × 11.9 m [110.0 ft × 39.0 ft]

APPENDIX A – SOIL PROFILES

The following pages contain the soil profile from the site assessment conducted by Osprey Engineering Inc. on 28 August 2023. Samples of soil from the most-limiting soil horizons were taken from the test pits and submitted to Down to Earth Labs of Lethbridge. Laboratory soil texture results are included. Based on the observed conditions, conclusions were made as to allowable soil loading rates and sizes of dispersal areas needed for the treatment fields.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395699 m	5513599 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 1	O.BLC	Glacial Till	Good	20 in.	60 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-9	L	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	0%
Bm	9-51	L	Lab	10YR 6/3	none	none	Granular	2	Friable	Dry	0%
Ck	51-100	L	Lab	10YR 5/3	none	none	Granular	2	Loose	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 51 inches. Weak to strong effervescence throughout. Minor white precipitates below 51 inches.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395706 m	5513664 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 2	O.BLC	Glacial Till	Good	25 in.	45 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-8	L	HT	10YR 5/4	none	none	Granular	2	Friable	Dry	0%
Bm	8-33	L	Lab	10YR 6/3	none	none	Blocky	2	Friable	Dry	3%
Bm	33-40	L	Lab	10YR 4/4	none	none	Granular	2	Friable	Dry	1%
Ck	40-95	L	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	1%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 40 inches. Strong effervescence below 8 inches. Minor white precipitates from 8 inches to 40 inches. Minor orange precipitates below 33 inches. Coarse fragments are < 1 inch to 2 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395685 m	5513760 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 848 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 3	O.BLC	Glacial Till	Good	5 in.	40 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-10	CL	Lab	10YR 4/4	none	none	Blocky	2	Friable	Dry	0%
Bm	10-27	CL	HT	10YR 5/3	none	none	Granular	2	Friable	Dry	0%
Bm	27-35	CL	Lab	10YR 5/3	none	none	Granular	2	Friable	Dry	15%
Ck	35-100	CL	HT	10YR 4/4	none	none	Granular	2	Friable	Dry	2%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 35 inches. Strong effervescence below 10 inches. Minor white precipitates from 10 inches to 27 inches and 35 inches to 100 inches. Minor orange precipitates below 35 inches. Minor coal fragments below 45 inches. Coarse fragments are 1 inch to 3 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395764 m	5513785 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 848 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 4	O.BLC	Glacial Till	Good	20 in.	40 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-9	CL	HT	10YR 4/4	none	none	Blocky	2	Friable	Dry	0%
Bm	9-26	CL	Lab	10YR 5/3	none	none	Granular	2	Friable	Dry	0%
Bm	26-33	CL	HT	10YR 5/3	none	none	Granular	2	Friable	Dry	15%
Ck	33-52	CL	Lab	10YR 4/4	none	none	Granular	2	Friable	Dry	2%
Ck	52-100	CL	HT	10YR 4/4	none	none	Granular	2	Friable	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 33 inches. Strong effervescence below 9 inches. Minor white precipitates from 9 inches to 26 inches and 52 inches to 100 inches. Minor orange precipitates from 26 inches to 52 inches. Minor coal fragments from 33 inches to 52 inches. Coarse fragments are 1 inch to 3 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395886 m	5513782 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 848 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 5	O.BLC	Glacial Till	Good	25 in.	60 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-13	L	HT	10YR 5/3	none	none	Blocky	2	Friable	Dry	0%
Bm	13-32	L	Lab	10YR 6/3	none	none	Blocky	2	Friable	Dry	0%
Bm	32-38	L	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	15%
Ck	38-52	CL	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	2%
Ck	52-100	CL	Lab	10YR 5/3	none	none	Granular	2	Loose	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 33 inches. Strong effervescence below 9 inches. Minor white precipitates from 9 inches to 26 inches and 52 inches to 100 inches. Minor orange precipitates from 26 inches to 52 inches. Minor coal fragments from 33 inches to 52 inches. Coarse fragments are 1 inch to 3 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				396002 m	5513777 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 6	O.BLC	Glacial Till	Good	5 in.	35 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-7	CL	Lab	10YR 4/3	none	none	Blocky	2	Friable	Dry	0%
Bm	7-31	CL	HT	2.5Y 6/3	none	none	Blocky	2	Friable	Dry	0%
Bm	31-45	CL	Lab	10YR 4/3	none	none	Blocky	2	Friable	Dry	5%
Ck	45-75	CL	HT	10YR 4/2	none	none	Blocky	2	Friable	Dry	1%
Ck	75-100	CL	HT	10YR 4/4 & 10YR 5/8	none	few, fine, faint	Blocky	2	Loose	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	Clay loam, blocky (grade 2) structure. Few, fine, faint mottles.
Depth to Seasonally Saturated Soil	75 inches	Depth to restrictive Soil Layer	75 inches
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 45 inches. Strong effervescence below 7 inches. Minor white precipitates from 7 inches to 75 inches. Minor orange precipitates from 31 inches to 75 inches. Coarse fragments are 1 inch to 2 inches, sub-rounded. Can be a treatment field if lateral depth is 12 inches.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				396024 m	5513668 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 7	O.BLC	Glacial Till	Good	15 in.	30 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-9	CL	Lab	10YR 5/3	none	none	Blocky	3	Friable	Dry	0%
Bm	9-25	CL	HT	10YR 6/3	none	none	Blocky	2	Friable	Dry	0%
Bm	25-77	SCL	Lab	10YR 5/3	none	none	Granular	2	Friable	Dry	0%
Ck	77-90	COSL	HT	2.5Y 5/4 & 10YR 5/8	none	few, fine, faint	Granular	2	Loose	Dry	25%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	Coarse sandy loam, granular (grade 2) structure. Few, fine, faint mottles.
Depth to Seasonally Saturated Soil	77 inches	Depth to restrictive Soil Layer	77 inches
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, blocky (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	Very few roots below 25 inches. No roots below 77 inches. Weak to strong effervescence from 0 inches to 77 inches. Minor white precipitates from 9 inches to 25 inches. Coarse fragments are < 1 inch to 4 inches, sub-rounded. Can be a treatment field if lateral depth is 12 inches.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395932 m	5513664 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 8	O.BLC	Glacial Till	Good	20 in.	55 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-13	L	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	0%
Bm	13-26	SCL	Lab	2.5Y 6/3	none	none	Blocky	2	Friable	Dry	0%
Bm	26-50	SCL	HT	2.5Y 5/4	none	none	Blocky	2	Friable	Dry	0%
Ck	50-61	L	Lab	10YR 5/4	none	none	Granular	2	Friable	Dry	0%
Ck	61-105	L	HT	2.5Y 5/4	none	none	Granular	2	Friable	Dry	5%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Sandy clay loam, blocky (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 61 inches. Weak to strong effervescence throughout. Minor white precipitates from 26 inches to 50 inches. Minor orange precipitates below 61 inches. Coarse fragments are 1 inch to 2 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395835 m	5513668 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 848 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 9	O.BLC	Glacial Till	Good	15 in.	65 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-12	L	HT	10YR 4/3	none	none	Granular	3	Friable	Dry	0%
Bm	12-21	CL	Lab	10YR 4/3	none	none	Blocky	3	Friable	Dry	0%
Bm	21-32	CL	HT	2.5Y 5/4	none	none	Granular	2	Friable	Dry	0%
Ck	32-45	CL	HT	2.5Y 5/4	none	none	Granular	2	Friable	Dry	0%
Ck	45-63	CL	HT	10YR 5/3	none	none	Granular	2	Loose	Dry	0%
Ck	63-105	CL	Lab	2.5Y 4/3	none	none	Granular	2	Loose	Dry	3%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, blocky (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	Few roots below 45 inches. No roots below 63 inches. Weak to strong effervescence throughout. Minor white precipitates from 21 inches to 45 inches. Coarse fragments are 1 inch to 2 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395841 m	5513589 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 10	O.BLC	Glacial Till	Good	30 in.	50 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-6	L	HT	10YR 4/3	none	none	Granular	3	Friable	Dry	0%
Bm	6-19	CL	HT	10YR 5/4	none	none	Blocky	3	Friable	Dry	0%
Bm	19-33	CL	Lab	10YR 4/3	none	none	Blocky	2	Friable	Dry	0%
Ck	33-45	L	HT	10YR 5/4	none	none	Blocky	2	Friable	Dry	0%
Ck	45-61	L	Lab	10YR 5/3	none	none	Granular	2	Friable	Dry	0%
Ck	61-110	CL	HT	10YR 4/3	none	none	Granular	2	Loose	Dry	3%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, blocky (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 45 inches. Moderate to strong effervescence below 19 inches. Minor white precipitates below 33 inches. Minor orange precipitates below 61 inches. Coarse fragments are 1 inch to 2 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395841 m	5513526 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 11	O.BLC	Glacial Till	Good	5 in.	50 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-6	CL	Lab	10YR 4/3	none	none	Granular	3	Friable	Dry	0%
Bm	6-21	CL	HT	2.5Y 6/3	none	none	Blocky	3	Friable	Dry	0%
Bm	21-43	CL	HT	2.5Y 4/3	none	none	Granular	2	Friable	Dry	5%
Ck	43-76	CL	Lab	10YR 4/4	none	none	Granular	2	Loose	Dry	1%
Ck	76-105	CL	HT	10YR 4/3 & 10YR 5/8	none	few, fine, distinct	Granular	2	Loose	Dry	1%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	Clay loam, granular (grade 2) structure. Few, fine, distinct mottles.
Depth to Seasonally Saturated Soil	76 inches	Depth to restrictive Soil Layer	76 inches
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	Few roots below 43 inches. No roots below 76 inches. Weak to strong effervescence throughout. Minor white precipitates from 21 inches to 76 inches. Coarse fragments are 1 inch to 3 inches, sub-rounded. Can be a treatment field if lateral depth is 12 inches.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395840 m	5513458 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 846 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 12	O.BLC	Glacial Till	Good	15 in.	35 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-8	CL	HT	10YR 4/3	none	none	Granular	3	Friable	Dry	0%
Bm	8-22	CL	Lab	2.5Y 6/3	none	none	Blocky	3	Friable	Dry	0%
Bm	22-43	CL	Lab	2.5Y 5/4	none	none	Granular	2	Friable	Dry	5%
Ck	43-82	CL	HT	10YR 3/4	none	none	Granular	2	Loose	Dry	1%
Ck	82-105	CL	HT	10YR 4/4 & 10YR 5/8	none	few, medium, distinct	Granular	2	Loose	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	Clay loam, granular (grade 2) structure. Few, medium, distinct mottles.
Depth to Seasonally Saturated Soil	82 inches	Depth to restrictive Soil Layer	82 inches
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	Few roots below 43 inches. No roots below 82 inches. Weak to strong effervescence throughout. Minor white precipitates from 22 inches to 82 inches. Coarse fragments are 1 inch to 3 inches, sub-rounded. Can be a treatment field if lateral depth is 12 inches.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395699 m	5513495 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
SCHOOL TP	O.BLC	Glacial Till	Good	25 in.	55 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-6	CL	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	0%
Bm	6-20	CL	HT	10YR 6/3	none	none	Blocky	2	Friable	Dry	3%
Bm	20-52	CL	Lab	10YR 4/3	none	none	Granular	2	Friable	Dry	1%
Ck	52-100	CL	Lab	10YR 3/3	none	none	Granular	2	Friable	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 52 inches. Weak to strong effervescence throughout. Minor white precipitates below 6 inches. Coarse fragments are 1 inch to 4 inches, sub-rounded.

Down To Earth Labs Inc.

The Science of Higher Yields

Osprey Engineering Inc

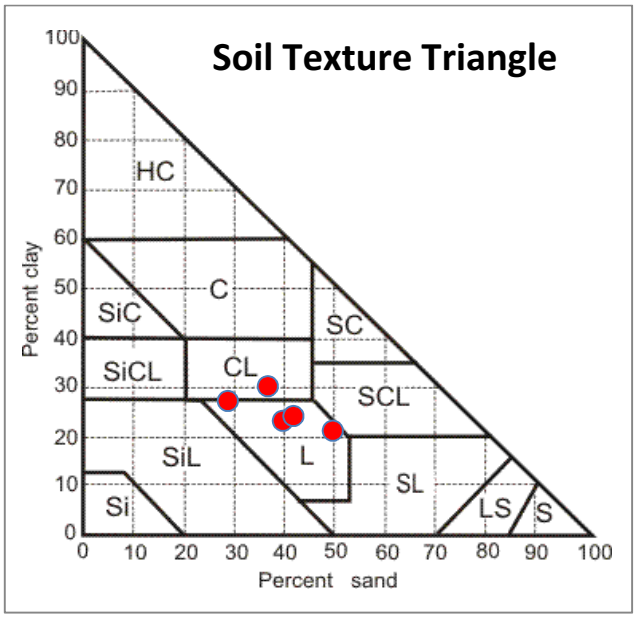
3510 6th Ave North
Lethbridge, AB T1H 5C3
403-328-1133
www.downtoearthlabs.com
info@downtoearthlabs.com

Report #: 159426
Report Date: 2023-09-05
Received: 2023-08-31
Completed: 2023-09-05
Test Done: ST

Project : Bergen

PO:

		Sample ID:	230831K014	230831K015	230831K016	230831K017	230831K018
		Cust. Sample ID:	Lot 1- S1	Lot 1- S2	Lot 2- S1	Lot 2- S2	Lot 3- S1
Analyte	**Units**		20	60	25	45	5
Sand	%		39.9	49.9	28.9	42.0	36.9
Silt	%		37.2	29.2	44.2	34.1	33.2
Clay	%		22.9	20.9	26.9	23.9	29.9
Soil Texture	-		Loam	Loam	Loam	Loam	Clay Loam



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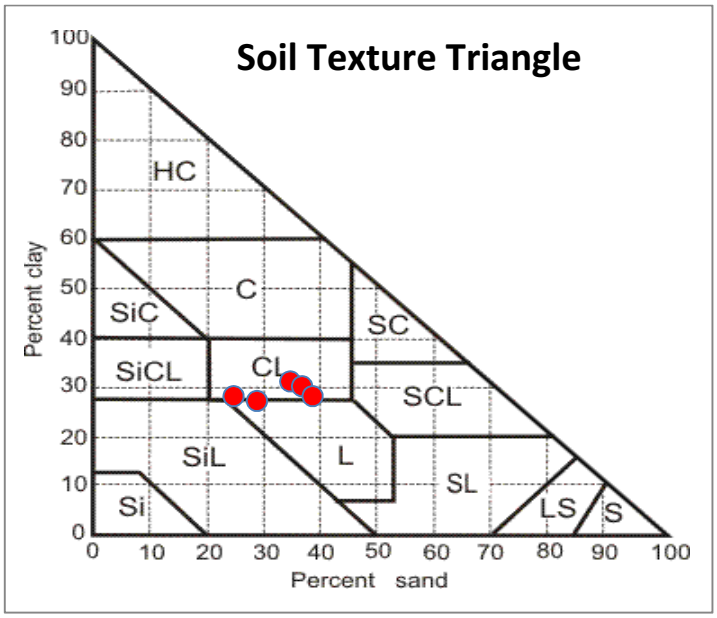
Test Done: ST

Project : Bergen

PO:

Analyte	Units	Sample ID: 230831K019 Cust. Sample ID: Lot 3- S2 40	230831K020 Lot 4- S1 20	230831K021 Lot 4- S2 40	230831K022 Lot 5- S1 25	230831K023 Lot 5- S2 60
Sand	%	34.9	24.9	37.0	29.0	38.9
Silt	%	34.2	47.2	33.1	44.1	33.2
Clay	%	30.9	27.9	29.9	26.9	27.9
Soil Texture	-	Clay Loam	Clay Loam	Clay Loam	Loam	Clay Loam



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Received: 2023-08-31
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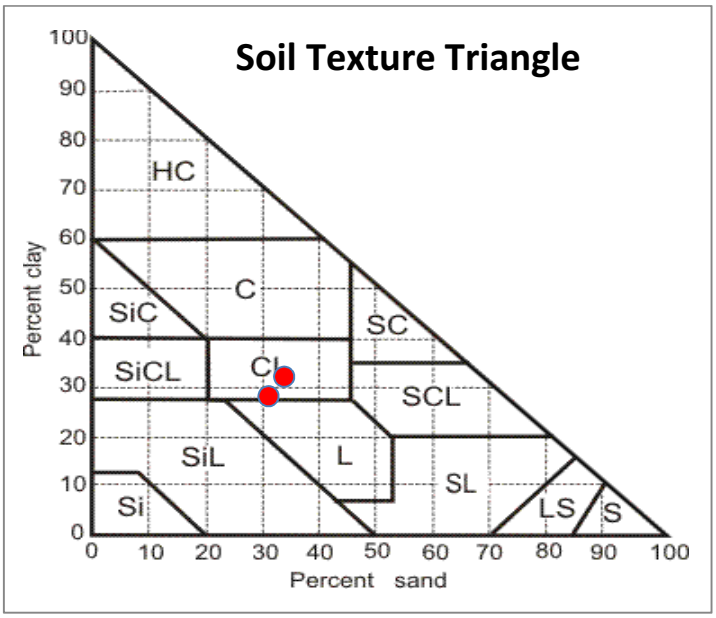
Test Done: ST

Project : Bergen

PO:

		Sample ID:	230831K024	230831K025
		Cust. Sample ID:	Lot 6- S1	Lot 6- S2
Analyte	**Units**		5	35
Sand	%		31.2	34.0
Silt	%		40.9	34.1
Clay	%		27.9	31.9
Soil Texture	-		Clay Loam	Clay Loam



Raygan Boyce - Chemist

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Osprey Engineering Inc

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Project : Bergen

PO:

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Lethbridge, AB T1H 5C3
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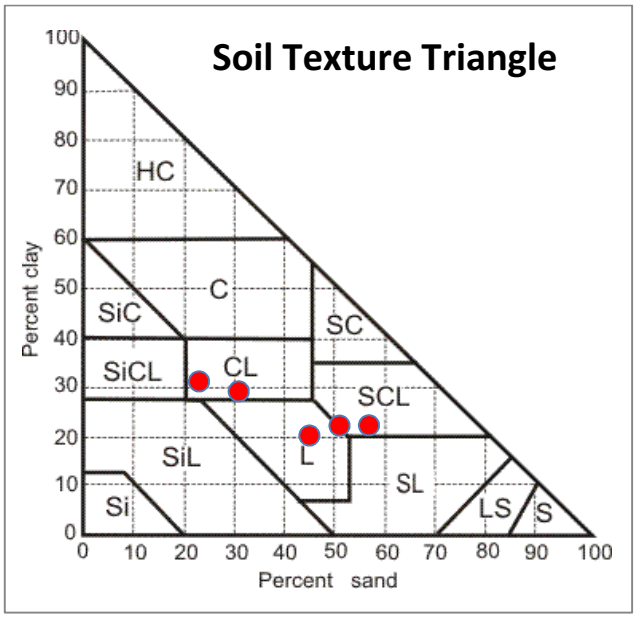
info@downtoearthlabs.com

Sample ID:		230831L001	230831L002	230831L003	230831L004	230831L005
Cust. Sample ID:		Lot 7- S1	Lot 7- S2	Lot 8- S1	Lot 8- S2	Lot 9- S1
Analyte	**Units**	15	30	20	55	15
Sand	%	31.1	57.1	51.2	45.2	23.2
Silt	%	40.0	20.9	26.9	34.9	45.9
Clay	%	28.9	22.0	21.9	19.9	30.9
Soil Texture	-	Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Loam	Clay Loam



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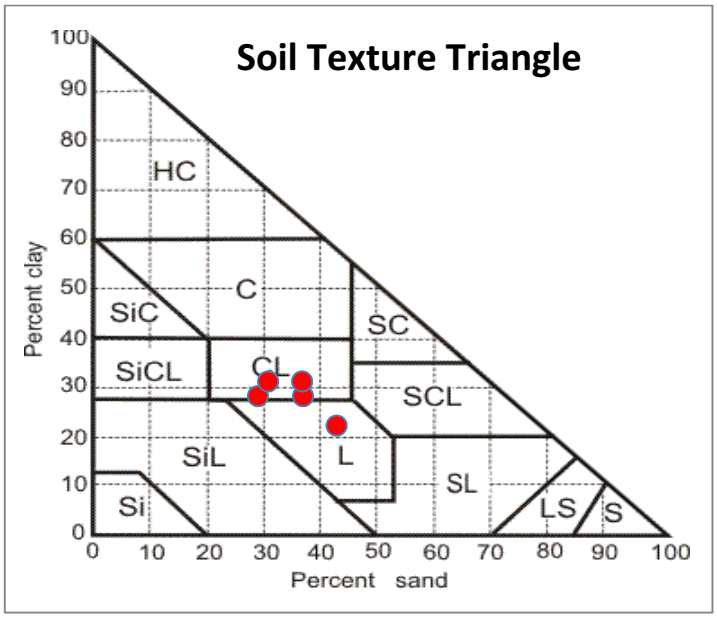
Report #: 159427
Report Date: 2023-09-05
Received: 2023-08-31
Completed: 2023-09-05
Test Done: ST

Project : Bergen

PO:

Sample ID:		230831L006	230831L007	230831L008	230831L009	230831L010
Cust. Sample ID:		Lot 9- S2	Lot 10- S1	Lot 10- S2	Lot 11- S1	Lot 11- S2
Analyte	**Units**	65	30	50	5	50
Sand	%	37.2	29.2	43.1	31.0	37.0
Silt	%	34.9	42.9	35.0	38.1	32.1
Clay	%	27.9	27.9	21.9	30.9	30.9
Soil Texture	-	Clay Loam	Clay Loam	Loam	Clay Loam	Clay Loam



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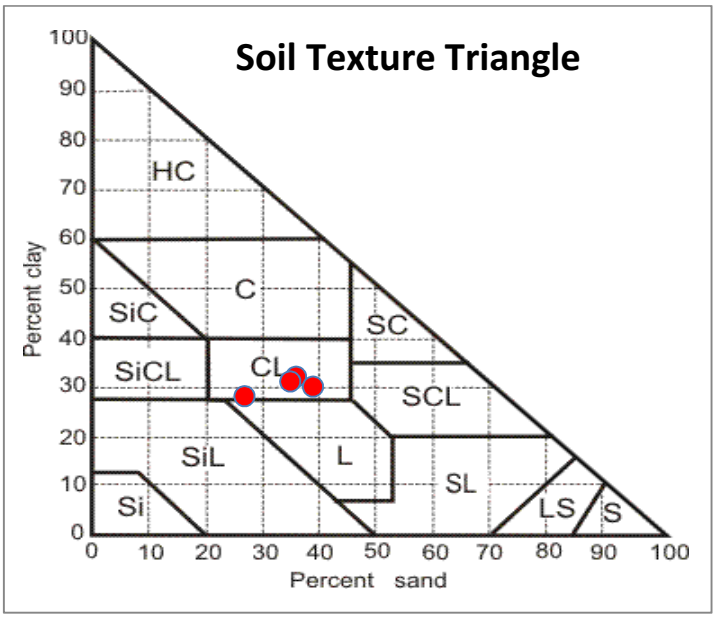
Received: 2023-08-31
Completed: 2023-09-05
Test Done: ST

Project : Bergen

PO:

Sample ID:		230831L011	230831L012	230831L013	230831L014
Cust. Sample ID:		Lot 12- S1	Lot 12- S2	School TP- S1	School TP- S2
Analyte	**Units**	15	35	25	55
Sand	%	27.0	36.1	35.1	39.1
Silt	%	45.1	32.0	34.0	31.0
Clay	%	27.9	31.9	30.9	29.9
Soil Texture	-	Clay Loam	Clay Loam	Clay Loam	Clay Loam



Raygan Boyce - Chemist

APPENDIX B – WELL INFORMATION

The following records are from the Alberta Well Information Database (Alberta Environment and Parks, 2023) for the area within Section 25-9-19-4. It must be noted that well locations are often not described exactly, and the locations noted in this database are often for the centroid of the parcel, legal subdivision (LSD) or quarter-section in which the well is located.

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID 106250
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1984/09/12

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
KIENTOPP, WILLIAM					

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	SE	25	9	19	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 49.760440 Longitude -112.448856
How Location Obtained
Map

Elevation ft
How Elevation Obtained
Not Obtained

Drilling Information

Method of Drilling
Not Applicable

Proposed Well Use
Domestic & Stock

Type of Work
Chemistry

Formation Log

Measurement in Imperial

Depth from ground level (ft)	Water Bearing	Lithology Description

Yield Test Summary

Measurement in Imperial

Recommended Pump Rate 0.00 igpm

Test Date	Water Removal Rate (igpm)	Static Water Level (ft)
1984/09/11		45.00

Well Completion

Measurement in Imperial

Total Depth Drilled	Finished Well Depth	Start Date	End Date
47.00 ft			

Borehole

Diameter (in)	From (ft)	To (ft)
0.00	0.00	47.00

Surface Casing (if applicable)

Size OD : 0.00 in
Wall Thickness : 0.000 in
Bottom at : 0.00 ft

Well Casing/Liner

Size OD : 0.00 in
Wall Thickness : 0.000 in
Top at : 0.00 ft
Bottom at : 0.00 ft

Perforations

From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)

Perforated by

Annular Seal

Placed from 0.00 ft to 0.00 ft
Amount

Other Seals

Type	At (ft)

Screen Type

Size OD : 0.00 in

From (ft)	To (ft)	Slot Size (in)

Attachment
Top Fittings
Bottom Fittings

Pack

Type
Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
UNKNOWN DRILLER

Copy of Well report provided to owner

Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 106250
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1984/09/12

GOWN ID

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
KIENTOPP, WILLIAM					

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	SE	25	9	19	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 49.760440 Longitude -112.448856
How Location Obtained: Map

Elevation ft
How Elevation Obtained: Not Obtained

Additional Information

Measurement in Imperial

Distance From Top of Casing to Ground Level in
Is Artesian Flow
Rate igpm
Is Flow Control Installed
Describe

Recommended Pump Rate 0.00 igpm
Recommended Pump Intake Depth (From TOC) 0.00 ft
Pump Installed
Type
Depth ft
Make
H.P.
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS)
Depth ft
Gas
Depth ft
Well Disinfected Upon Completion
Geophysical Log Taken
Remedial Action Taken
Submitted to ESRD

Sample Collected for Potability
Submitted to ESRD Yes

Additional Comments on Well

Yield Test

Taken From Ground Level
Measurement in Imperial

Test Date	Start Time	Static Water Level
1984/09/11	12:00 AM	45.00 ft

Depth to water level

Pumping (ft)	Elapsed Time Minutes:Sec	Recovery (ft)

Method of Water Removal

Type
Removal Rate igpm
Depth Withdrawn From 0.00 ft

If water removal period was < 2 hours, explain why

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
UNKNOWN DRILLER

Copy of Well report provided to owner

Date approval holder signed

REFERENCES

Alberta Association of Municipal Districts & Counties in parthnership with Alberta Municipal Affairs. (2011). *The Model Process for Subdivision Approval and Private Sewage, The Suitability and Viability of Subdivisions Relying on Private Sewage Systems.* Edmonton: Alberta Association of Municipal Districts and Counties.

AltaLIS JV. (2020). Lidar15 Digital Elevation Model. Edmonton, Alberta, Canada.

Government of Alberta. (2023). *Alberta Soil Information Viewer*. Retrieved from Government of Alberta: https://soil.agric.gov.ab.ca/agrasidviewer/

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Rural Municipalities of Alberta. (2011). *Model Process for Subdivision Approval and Private Sewage.* Nisku: Rural Municipalities of Alberta.

Safety Codes Council. (2021). *Alberta Private Sewage Systems Standard of Practice.* Edmonton: Government of Alberta.

APPENDIX D

Martin Geomatic Consultants Ltd. Stormwater Management Plan

STORMWATER MANAGEMENT PLAN

CHIN MEADOWS GROUP COUNTRY RESIDENTIAL SUBDIVISION

Legal Description:	**Blocks A, B, & E, Plan 899 AA, NE1/4 25-9-19-4**
Municipality:	**Hamlet of Chin, Lethbridge County, AB**
Prepared for:	**Douglas Bergen and Associates Ltd.**
File Number:	**240761CE**
Dated:	**April 17, 2024**

Prepared By:

Martin Geomatic Consultants Ltd.
255 – 31st Street No.
Lethbridge, AB T1H 3Z4
403-329-0050
geomart@mgcl.ca

April 17, 2024

File: 229729CE

Douglas Bergen and Associates Ltd.
Box 1667
Coaldale, AB T1M 1N3

Dear Doug,

Re: Stormwater Management Plan
Proposed Subdivision in NE ¼ Sec 25-9-19-W4M, Blk. A,B &E, Plan 899AA

We are pleased to submit the Stormwater Management Plan for the Proposed Subdivision in NE ¼ Sec 25-9-19-W4M. This report examines the stormwater management requirements to subdivide the subject property located in the Hamlet of Chin, AB.

We trust that this report meets with your needs.

Yours truly,

MARTIN GEOMATIC CONSULTANTS LTD.

PROFESSIONAL ENGINEERS ALBERTA
RAY E. MARTIN
2024-04-17

PERMIT TO PRACTICE
Martin Geomatic Consultants Ltd.
Signature:
Date: 2024-04-17
PERMIT NUMBER: P 5852
The Association of Professional Engineers and Geoscientists of Alberta

Ray Martin, P.Eng.
Senior Project Manager

Enclosure

CORPORATE AUTHORIZATION

This report has been prepared by Martin Geomatic Consultants Ltd. (MGCL) under the authorization of Doug Bergen & Associates Ltd.. The material in this report represents the best Judgement of MGCL given the available information. Any use that a third party makes of this report, or reliance on or decisions made base upon it is the responsibility of the third party. MGCL accepts no responsibility for damages, if any, suffered by a third party, as a result of decisions made, or actions taken based upon this report. This report is to be used by the clients noted and the authority having jurisdiction for the purposes noted.

Should any questions arise regarding the content of this report, please contact the undersigned.

MARTIN GEOMATIC CONSULTANTS LTD.

Ray Martin, P.Eng.
Senior Project Manager

Table of Contents

List of Tables

Appendix

1.0 Background

A. General

The Chin Grouped Country Residential Area Structure plan proposes amendments to the land use for the area located on the north side of the Hamlet of Chin; north of Alberta Avenue and west of Range Road 190 occupying an area of approximately 39.42 acres. The legal description of the proposed land occupied is included in Blocks A, B, & E; Plan 899AA (NE1/4 Sec.25-9-19-4), and is located in Lethbridge County adjacent to the west corporate limit of the Municipal District of Taber. **Figure 1 – Project Location** shows the project location**.**

The proposed amendment would allow the subdivision of:

- 12 additional group country residential lots (min. 2 acres each)
- 1 - school lot (approx.. 2.7acres)
- 2 – Stormwater dry ponds (approx. 1.38 acres and 1.33 acres) - PUL
- The remainder of the land (5.99 acres) to be subdivided into an additional 2.0 acre parcel, leaving 3.99 acres for the existing house and auxiliary buildings.

A public road is proposed to extend north of Naismith Street and loop east to Range Road 19.0. The proposed lot layout is shown in **Figure 3 - Land Use.**

B. Existing Site Drainage and Features

The existing site is generally undeveloped and mainly flat with some rolling slopes with a couple of trapped low depressions and a mixed vegetated ground cover of natural grass and agricultural crops. The combined drainage area considered in this stormwater analysis is approximately 98.38 ha which consists of 4 sub-catchment areas draining to two natural depressions located in the middle of the areas and connected by a poorly defined swale cascading to the S.W. through other natural depressions finally discharging approx. 1.4km downstream into the Canadian Pacific Railway ROW and on another 300m out falling into the Saint Mary's Irrigation District Canal (SMRID).

Average longitudinal slopes within the drainage swale range from 0% to 0.2% with slopes in the depressions storage areas ranging from 0.2 – 1.8%. High points in the depression storage areas pond the runoff to depths of approximately 0.5m with the elevation of the final discharge off the development area at 845.75. Existing soil descriptions for the area include loam (L) and silt loam Orthic Dark Brown Chernozem on medium textured (L, SiL) sediments deposited by wind and water (LET), as defined in soil polygon 1334 and 1337 which encompasses an area of 988 ha[1]. **Appendix B – Soil Information.**

[1] *Alberta Soil Information Viewer*, Alberta Agriculture and Forestry, http://www4.agric.gov.ab.ca/agrasidviewer

Soil logs performed by Osprey Engineering Inc. in September of 2023 do not indicate continued or frequent saturation.

Visual inspection of air photos (dating back to 1985) of the overall development area and west, do not show long term ponding or wetlands. However, there is some evidence of minor localized ponding in the area on the north side of the existing buildings along Range road 190. The existing sub-catchment areas are shown on the attached **- Figure 7 – Pre-Development Sub-Catchments.**

C. Previous reports and Purpose

Based on comments and recommendations by Lethbridge County and the proposed lot layouts, onsite storage and ponding is required to be restricted to defined ponds to minimize impact on available developable areas. Martin Geomatic Consultants Ltd. (MGCL) was engaged to provide a stormwater management plan to reflect the requirements for storage and controlled release of all the onsite drainage.

Osprey Engineering Inc. completed a Private Sewage Treatment Systems Assessment (PSTS) on November 27, 2023[2] intensity and the soil logs were used as reference in MGCL's modelling.

2.0 Methodology and Assumptions

A. Proposed Site Drainage

The proposed ASP land development project includes the addition of 12 group country residential lots, a school, 2 subdivided parcels of land with existing buildings and landscaping, and 2 PUL dry ponds. The total developed area including asphalt roads and ditches will include approximately 39.42 acres of land at full build out. The proposed stormwater management system includes underground pipe between ponds and grass swales for overland flows, culverts, and a stormwater lift station to discharge the stored stormwater at a rate less than pre-development rates.

Site grading of the land will direct runoff away from the buildings and into swales to convey water towards the designated constructed storage facilities. The constructed storage facilities will be sized to contain the runoff from a 1:100 year – 24 hour storm event with a controlled release of approximately 9 l/s, discharging to a dispersion ditch located on the N.W. corner of the west dry pond. The proposed stormwater system is shown on the attached **Figure 8 – Post Development sub-catchments**.

2 Osprey Engineering Inc., Private Sewage Treatment Systems Assessment (PSTS), November 27, 2023

B. Methodology

Drainage analysis of the proposed development has been completed to determine runoff, storage, and discharge rates for pre and post-development conditions.

Single-event modelling was used to determine maximum flow rates and storage volumes. Modelling was conducted using the United States Environmental Protection Agency Storm water Management Model (EPA-SWMM5) – version 5.2.4[3].

Existing site analysis (pre-development) has been analyzed to determine a benchmark for allowable release rates at the post development conditions if allowed. A stormwater management model has been built to assist with the analysis. The following parameters are included in the modeling:

1. Rainfall time step = 5 minutes
2. Simulation duration = 24 hrs
3. Routing Method: Dynamic Wave
4. No effect of Evaporation and Groundwater
5. Total Catchment area = 82.7 ha
6. Infiltration Method: Green Ampt
7. Manning's N Impervious = 0.015
8. Manning's N Pervious = 0.15 (undeveloped), 0.1 (developed)
9. Depression Storage Pervious = 5mm (undeveloped), 3.8mm (developed)
10. Depression Storage Impervious = $0.77*(S\%)^{-0.49}$

For single-event modeling, the design storm distribution employed for this study is the Chicago distribution using the City of Lethbridge[4] intensity-duration-frequency (IDF) curves of the form:

$i = a/(t+b)^c$ where

i is the rainfall intensity for a given return period at a given storm duration in mm/hr,
t is the duration of the storm in minutes,
a, b, c are parameters defining the curve for a given return period.

IDF curves used for this study are for the 100-year return period with a 24 hour duration (t_d) of the storm. The following parameters were used:

Table 1 – IDF Parameters for City of Lethbridge Design Storm

Return period	a	b	c
100 years	1019.2	0	0.731

[3] EPA Storm Water management Model – Version 5.0 (Build 5.2.4)
[4] *City of Lethbridge Design Standards 2021 Edition*

The following assumptions and parameters have been used in the stormwater model sub-catchments:

Table 2 – SWMM5 Model Pre-Development Sub-catchment Parameters[5]

Catchment ID	Area ha	Lenth m	Slope %	Soil texture	H. Con mm/hr	S.Head mm	D. store.Imperv mm
S1	23.305	495	0.68	L, SCL, CL	1.95	172.97	0.93
S2	38.593	914	1.8	L, SCL, CL	1.95	172.97	0.58
S3	15.383	328	0.68	L, SCL, CL	1.95	172.97	0.93
S4	9.118	222	1.3	L, SCL, CL	1.95	172.97	0.68
S5	11.927	291	1.06	L, SCL, CL	1.95	172.97	0.75
Total :	98.33						

Table 3 – SWMM5 Model Post Development Sub-catchment Parameters[6]

Catchment ID	Area ha	Lenth m	Slope %	Soil texture	H. Con mm/hr	S.Head mm	D. store.Imperv mm
S1	24.142	496	0.68	L, SCL, CL	1.95	172.97	0.93
S2	38.612	906	1.2	L, SCL, CL	1.95	172.97	0.70
S3	2.775	296	0.57	L, SCL, CL	1.95	172.97	1.01
S4	3.091	222	1.36	SC, CL	1.95	172.97	0.66
S5	11.5525	282	1.32	L, SCL, CL	1.95	172.97	0.67
S6	1.429	473	1.1	L, SCL, CL	1.95	172.97	0.73
S7	2.452	168	0.35	L, SCL, CL	1.95	172.97	1.29
S8	2.842	214	2.1	L, SCL, CL	1.95	172.97	0.54
S9	1.864	136	0.9	L, SCL, CL	1.95	172.97	0.81
S10	0.3644	182	1	L, SCL, CL	1.95	172.97	0.77
S11	1.4081	117	1.1	L, SCL, CL	1.95	172.97	0.73
S12	0.786	267	0.9	L, SCL, CL	1.95	172.97	0.81
S13	6.382	212	1.3	SC, CL	1.95	172.97	0.68
S14	0.609	405	0.5	L, SCL, CL	1.95	172.97	1.08
Total :	103.56						

[5] http://help.xpsolutions.com/display/xps2015/Infiltration

[6] http://help.xpsolutions.com/display/xps2015/Infiltration

Table 4 – SWMM5 Model Soil Characteristics Parameters[7]

Soil Texture Class	Hydraulic Conductivity (mm/hr)	Suction Head (mm)	Porosity (fraction)	Field Capacity (fraction)	Wilting Point (fraction)
Loam	3.3	88.9	0.463	0.232	0.116
Sandy Clay Loam	1.52	219.96	0.398	0.244	0.136
Clay Loam	1.02	210.06	0.464	0.31	0.187
Avg Loam/Sandy Clay Loam / Clay Loam	1.95	172.975	0.445	0.265	0.146

C. Rainfall Runoff Results

The following table summarizes the sub-catchment runoff for the pre-development 100 year – 24 hour design storm as illustrated in **Figure 7 – Pre-Development Sub-Catchments**.

Table 5 – Pre-Development 100 year-24 hour Storm Sub-catchment Runoff

Name	Area (ha)	Imperv. (%)	Precip. (mm)	Infiltration (mm)	Runoff Depth (mm)	Runoff Volume (ML)	Peak Runoff (m^3/s)
S1	23.31	0	120.15	70.0	44.96	10.48	0.66
S2	38.59	0	120.15	70.1	44.04	17.00	0.99
S3	15.38	15	120.15	59.17	59.09	9.09	2.30
S4	9.12	25	120.15	49.25	70.49	6.43	2.73
S5	11.93	1	120.15	68.81	50.05	5.97	0.61

[7] http://support.chiwater.com/support/solutions/articles/35660-soil-characteristics

The post-development sub-catchment runoff for 100 year – 24 hour design storm is listed in **Table 6** and illustrated in **Figure 8 – Post-Development Sub-Catchments**.

Table 6 – Post-Development 100 year-24 hour Storm Sub-catchment Runoff

Name	Area (ha)	Imperv. (%)	Precip. (mm)	Infiltration (mm)	Runoff Depth (mm)	Runoff Volume (ML)	Peak Runoff (m^3/s)
S1	24.14	0	120.15	69.87	46.23	11.16	0.79
S2	38.61	0	120.15	70.08	44.19	17.06	1.01
S3	2.78	15	120.15	56.08	62.71	1.74	0.52
S4	3.09	20	120.15	51.62	68.42	2.11	1.26
S5	11.55	1	120.15	68.08	51.50	5.95	0.78
S6	1.43	15	120.15	60.08	50.39	0.72	0.20
S7	2.45	15	120.15	56.69	62.87	1.54	0.47
S8	2.84	40	120.15	36.97	81.58	2.32	1.34
S9	1.86	15	120.15	55.55	64.21	1.20	0.47
S10	0.36	0	120.15	67.26	52.49	0.19	0.04
S11	1.41	10	120.15	59.69	60.16	0.85	0.32
S12	0.79	15	120.15	56.24	63.6	0.50	0.22
S13	6.38	25	120.15	49.19	70.56	4.50	1.94
S14	0.61	0	120.15	69.63	48.37	0.29	0.03
S15	1.34	25	120.15	50.02	69.71	0.93	0.41

3.0 Stormwater Detention

The existing ground surface data was obtained utilizing Lidar 7.5 DEM data from Altalis, and GPS ground survey[8] overlaid by georeferenced Air photos. Based on discussions with Lethbridge County, onsite stormwater is required to be controlled and contained within easements or a PUL. Therefore, existing onsite low areas and depressions which currently trap and store runoff water will be reshaped and 2 new dry ponds established in the low areas to store and detain the post development runoff. Runoff will be directed in to the storm ponds through grass swallows along property boundaries as well as a underground storm pipe connecting the 2 storm ponds. The following stage storage tables are provided for pre and post development scenarios with the existing topographical depressions and the constructed storage units. Table 5 shows the runoff storage units for the existing (pre-development) topographical depressions in the proposed development area and surrounding land to the west. The existing depressions range in area from approximately 14,000 m^2 to 39,000 m^2, and vary in volume between 2,200 m^3 and 2,900 m^3.

Table 7 – Existing Storage Units Depth - Area - Volumes

Elevation (m)	Depth (m)	Area (m^2)	Incremental Volume (m^3)	Cumulative Volume (m^3)
SU-1Pre (East)				
845.4	0.0	29	0	0
845.6	0.2	924	750	750
845.7	0.3	5,550	1,210	1,960
845.82	0.42	13,864	960	2,920
SU-2Pre(West)				
845.2	0.0	10	0	0
845.4	0.2	900	64	64
845.6	0.4	2,853	336	400
945.8	.6	39,000	1,839	2,239

[8] GPS ground survey completed by Spencer Surveys in September of 2023.

Table 8 presents the proposed storage units to be constructed with the development. East pond and West Ponds are rectangular ponds located in the development area and Storage unit SU-2 is the existing storage depression located downstream of the development. The constructed storage units range in area from approximately 5,600 m^2 to 5,600 m^2, and vary in volume between 5,500 m^3 and 11,000 m^3.

Table 8 – Proposed Storage Units Depth - Area - Volumes

Elevation (m)	Depth (m)	Area (m^2)	Incremental Volume (m^3)	Cumulative Volume (m^3)
East Pond				
842.0	0.0	782	0	0
842.6	0.6	1,394	633	633
843.0	1.0	1,840	645	1,278
843.6	1.6	2,548	1312	2,590
844.0	2.0	3,044	1116	3,706
844.6	2.6	3,831	2055	5,761
845.0	3.0	4,381	1639	7,400
845.6	3.6	5,415	2891	10,291
845.68	3.68	5,774	439	10,730
West-Pond				
842.6	0	233	0	0
842.8	0.2	394	65	65
843	0.4	562	96	161
843.6	1	1116	499	660
844	1.4	1742	526	1186
844.6	2	2201	1111	2297
845	2.4	2692	974	3271
845.6	3	3475	1843	5114
845.79	3.19	3,747	679	5,793
SU-2Post				
845.0	0.0	100	0	0
845.6	0.6	38,394	11,548	11,548
845.8	0.8	69,390	10,778	22,326

Table 9 shows the results of the pre-development runoff scenario for the existing topographical depressions as illustrated in **Figure 7 – Pre-Development Drainage Areas**.

Table 9 – Pre-Development Storage Response to 100 Year Storm

Storage Unit	Max. Volume (ML)	Peak Inflow (m^3/s)	Peak Outflow (m^3/s)	Max Depth (m)	Max. HGL (m)
SU-1Pre	5.246	5.447	1.478	0.60	846.0
SU-2Pre	21.031	2.949	1.282	0.78	845.98

All of the storage units in Table 9 (SU-1Pre and SU-2Pre) are existing topographical depressions where runoff water is trapped and detained on site in the pre-development scenario.

Table 10 shows the results of the post-development runoff scenario for the existing topographical depressions and proposed storage units. Refer to **Figure 8 – Post-Development Catchment Areas** for an illustrative map.

Table 10 – Post-Development Storage Response to 100 Year Storm

Storage Unit	Proposed / Existing	Max. Volume (ML)	Peak Inflow (m^3/s)	Peak Outflow (m^3/s)	Max Depth (m)	Max. HGL (m)
East_Pond	P	9.154	4.251	0.015	3.37	845.37
West_Pond	P	4.380	1.683	0.018	2.71	845.30
SU-2Post	E	12.884	0	1.609	0.40	845.63

4.0 Release Rates

The following table shows a summary of the pre-development and post-development release rates leaving the site during a 100 year storm event. There is one outfall location for the discharge and overland flow leaving the site (refer to attached figures). The pump discharge offsite is located along the west boundary of the site located at the NW corner of the West Pond. No overland flow is expected from the development as the West and East ponds are sized to contain all the runoff from a 1:100 year – 24hour storm event. There will be a storm lift station located at the West Pond and the pump will be sized to drain the two ponds at a rate of approximately 18 l/s during and after the storm event until the ponds are dry. At this rate it is estimated it will take approximately 9 days to pump the ponds down. Larger pumps could be installed if reduced time is required. The pump discharge will be to a lined swale/ditch constructed with rip rap to disperse and fan out the flow into the downstream depression in the cultivated field to the west of the development.

Table 11 – Chin Meadows Release Rates - 100 year / 24 hour

	OF1		OF2	
100 yr / 24 hr Scenario	Overland Q_{peak} (m^3/s)	Volume (ML)	PUMP Q_{peak} (m^3/s)	Volume (ML)
Pre-Development	0.06	3.68	0.0	0.0
Post-Development	0.00	0.00	0.018	13.534

5.0 Conclusions and Recommendations

This letter report summarizes the runoff analysis and stormwater management system for the proposed Chin Meadows Group Country Residential Development in Chin, Alberta.

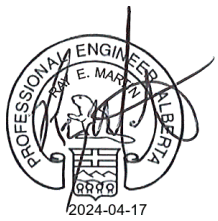
The proposed storage units have been designed and sized to detain runoff water with the purpose of mitigating the effects of runoff from the development to the downstream environment. Based on the hydraulic model, the post-development discharge rate of 0.018 m^3/s leaving the Chin Meadows Development site does not exceed the pre-development rate.

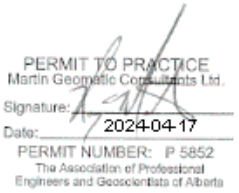
In order to control runoff leaving the site to maintain the pre-development levels or better, the proposed development would require stormwater storage on-site spread out over several ponds to catch the runoff coming from the developed areas. The concept design followed in this report includes two proposed stormwater storage ponds with a combined storage volume of approximately 13,500 m^3.

The EPA-SWMM5 Model files are attached for reference.

Yours truly,

MARTIN GEOMATIC CONSULTANTS LTD.





Ray Martin, P.Eng.
Senior Project Manager

APPENDIX "A"

LIST OF DRAWINGS:

Figure 1 – Project Location

Figure 2 – Ortho Photo

Figure 3 – Land Use

Figure 4 – Existing site Plan

Figure 5 – Pre- Development Drainage Areas

Figure 6 – Stormwater Drainage Concept

Figure 7 – Pre-Construction Drainage Areas

Figure 8 - Post-Construction Drainage Areas

STORMWATER MANAGEMENT PLAN
Boundary encompasses
15.96 ha (39.44 ac.)

NE¼ 25
9-19-W4M

Lot 1
Block 1
Plan 991 2521

Range Road 190

NW¼ 30
9-18-W4M

Lot 1
Block 1
Plan 991 2521

Chin

SW¼ 30
9-18-W4M

Canadian Pacific Railway

McCain
Foods

Highway #3

COUNTY MAP

Chin Town Expansion

STORMWATER MANAGEMENT

Mar 25, 2024

PROJECT LOCATION
Figure 1

240761CE

MARTIN
GEOMATIC CONSULTANTS
Consulting Engineers, Planners, and Land Surveyors
255-31st Street North Lethbridge, Alberta T1H 3Z4
Ph: (403) 329-0050 E-mail: geomart@mgcl.ca Fax: (403) 329-6594

LEGEND:

Chin Town Expansion

STORMWATER MANAGEMENT

Mar 25, 2024

ORTHO PHOTO

Figure 2

240761CE

MARTIN
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LEGEND:

STORMWATER MANAGEMENT PLAN BOUNDARY
Area = 40.06 acres (16.21 ha)

EXISTING:

- URBAN FRINGE (UF)
- HAMLET RESIDENTIAL (HR)
- HAMLET PUBLIC / INSTITUTIONAL (HP/I)
- HAMLET TRANSITIONAL / AGRICULTURAL (HT/A)
- RURAL GENERAL INDUSTRIAL (RGI)

PROPOSED:

- FROM: URBAN FRINGE (UF) TO: GROUPED COUNTRY RESIDENTIAL (GCR)
- FROM: URBAN FRINGE (UF) TO: HAMLET PUBLIC / INSTITUTIONAL (HP/I)

Chin Town Expansion

STORMWATER MANAGEMENT

Mar 25, 2024

LAND USE
Figure 3

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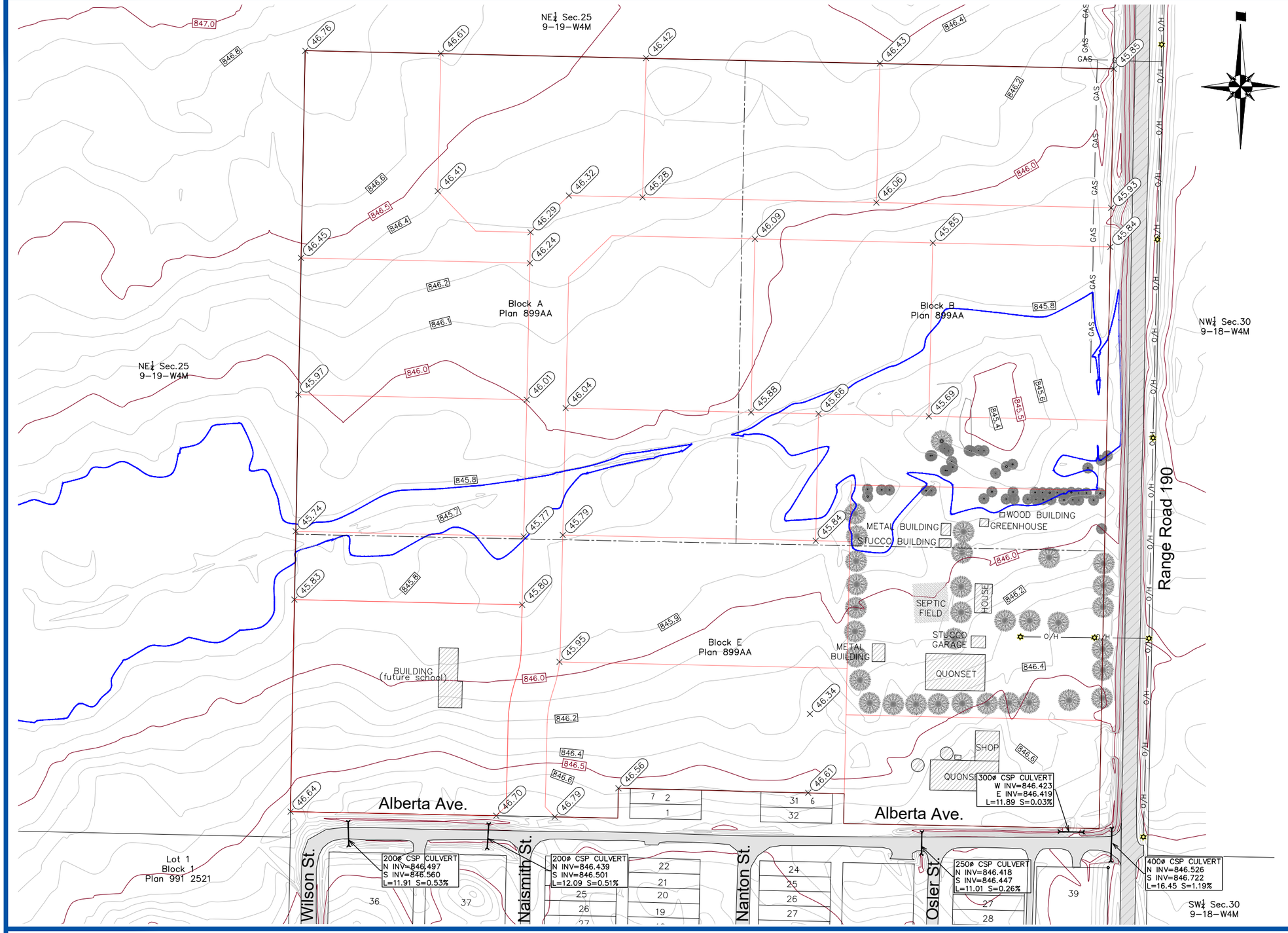

LEGEND:

- DEVELOPMENT / PHASE BOUNDARY
- EX POWER POLE
- EX. GAS LINE
- EX. OVERHEAD ELECTRICAL LINE
- EX. GRAVEL
- EX. ASPHALT
- EX SPOT ELEVATION
- EX MAJOR CONTOURS (0.5m)
- EX MINOR CONTOURS (0.1m)
- EX CULVERT
- APPROXITE LOCATION OF EX TREE
- EX BUILDING / STRUCTURE

Chin Town Expansion

STORMWATER MANAGEMENT

Mar 25, 2024

EXISTING SITE PLAN

Figure 4

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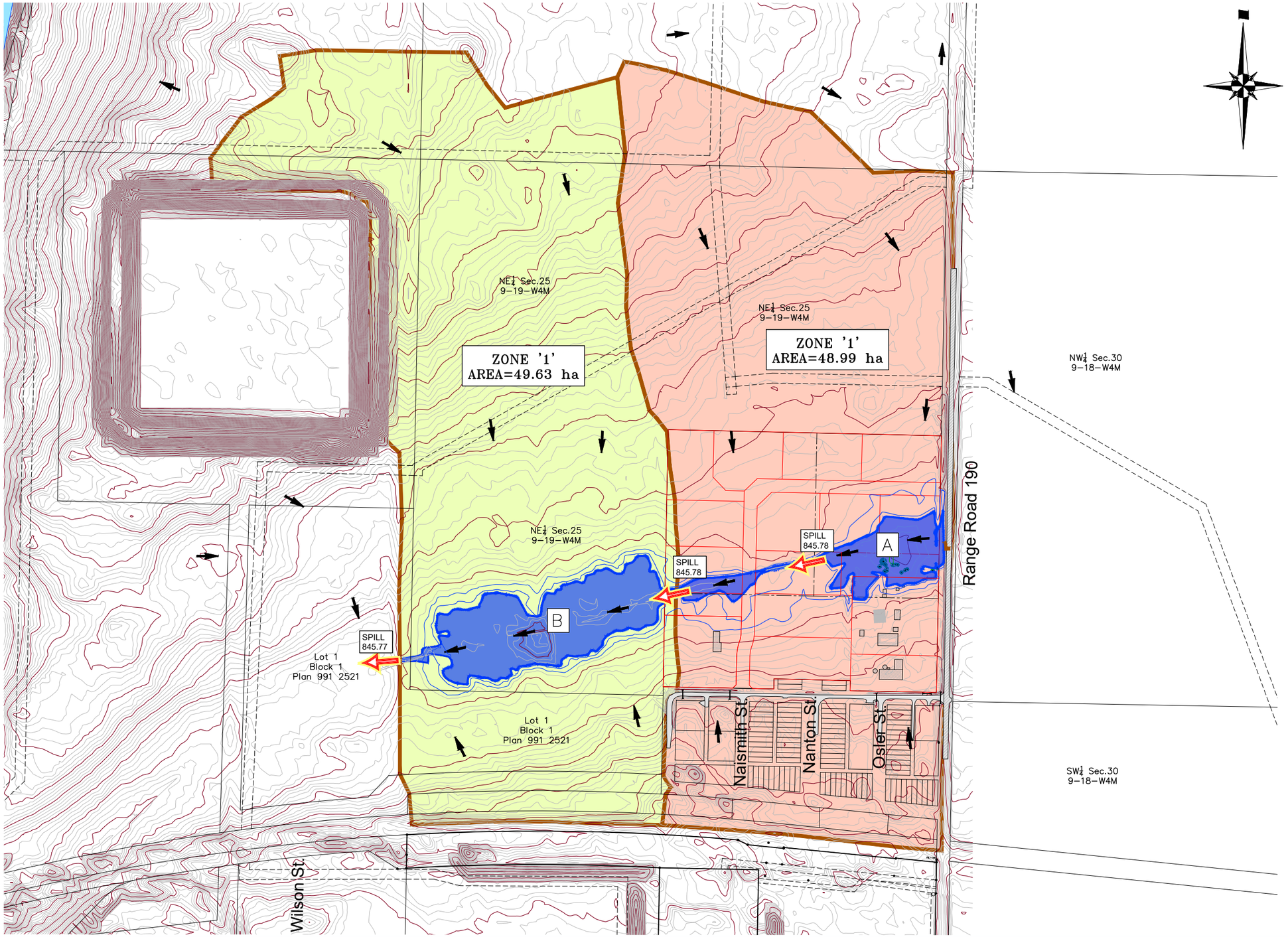

Chin Town Expansion

STORMWATER MANAGEMENT

Mar 25, 2024

PRE-DEVELOPMENT DRAINAGE AREAS

Figure 5

240761CE

MARTIN
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NE¼ Sec.25
9–19–W4M

NE¼ Sec.25
9–19–W4M

NW¼ Sec.30
9–18–W4M

SW¼ Sec.30
9–18–W4M

LOT 4
8,320.4 m²
2.06 ACRES

LOT 5
8,393.2 m²
2.07 ACRES

LOT 6
8,534.7 m²
2.11 ACRES

LOT 7
8,552.2 m²
2.11 ACRES

LOT 3
8,198.2 m²
2.03 ACRES

LOT 10
8,203.2 m²
2.03 ACRES

LOT 9
8,093.7 m²
2.00 ACRES

LOT 8
8,093.7 m²
2.00 ACRES

HIGHWATER
ELEV=845.68

LOT 2
8,186.2 m²
2.02 ACRES

EAST POND
5,834.9 m²
1.44 ACRES

PUMPED DISCHARGE TO
EXISTING DRAINAGE
COURSE

STORM
LIFT STATION

150mm FORCEMAIN

LOT 11
8,419.6 m²
2.08 ACRES

300mm STORM PIPE

EMERGENCY OVERFLOW
ELEV=845.68

WEST POND
4,087.3 m²
1.01 ACRES

450mm
STORM PIPE

EMERGENCY OVERFLOW
ELEV=845.78

LOT 12
9,560.3 m²
2.36 ACRES

15,363.7 m²
3.80 ACRES

REMAINDER OF LOT 1
12,215.3 m²
3.02 ACRES

LOT 13
10,279.4m²
2.54 ACRES

7,255.6 m²
1.79 ACRES

Alberta Ave.

Alberta Ave.

Range Road 190

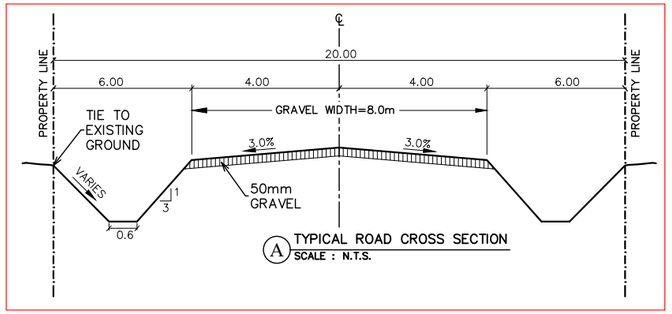
Wilson St.

Naismith St.

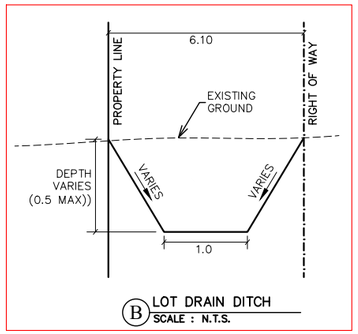
Nanton St.

Osler St.

Lot 1
Block 1
Plan 991 2521



A TYPICAL ROAD CROSS SECTION
SCALE : N.T.S.



B LOT DRAIN DITCH
SCALE : N.T.S.

LEGEND:

- DEVELOPMENT / PHASE BOUNDARY
- EX POWER POLE
- GAS — EX. GAS LINE
- O/H — EX. OVERHEAD ELECTRICAL LINE
- EX. GRAVEL
- EX. ASPHALT
- EX CULVERT
- EX BUILDING / STRUCTURE
- PROPOSED STORM PIPE
- PROPOSED DRAINAGE DITCH
- PROPOSED GRAVEL ROAD
- PROPOSED CULVERT

Chin Town Expansion

STORMWATER MANAGEMENT

Mar 25, 2024

STORMWATER DRAINAGE CONCEPT

Figure 6

240761CE

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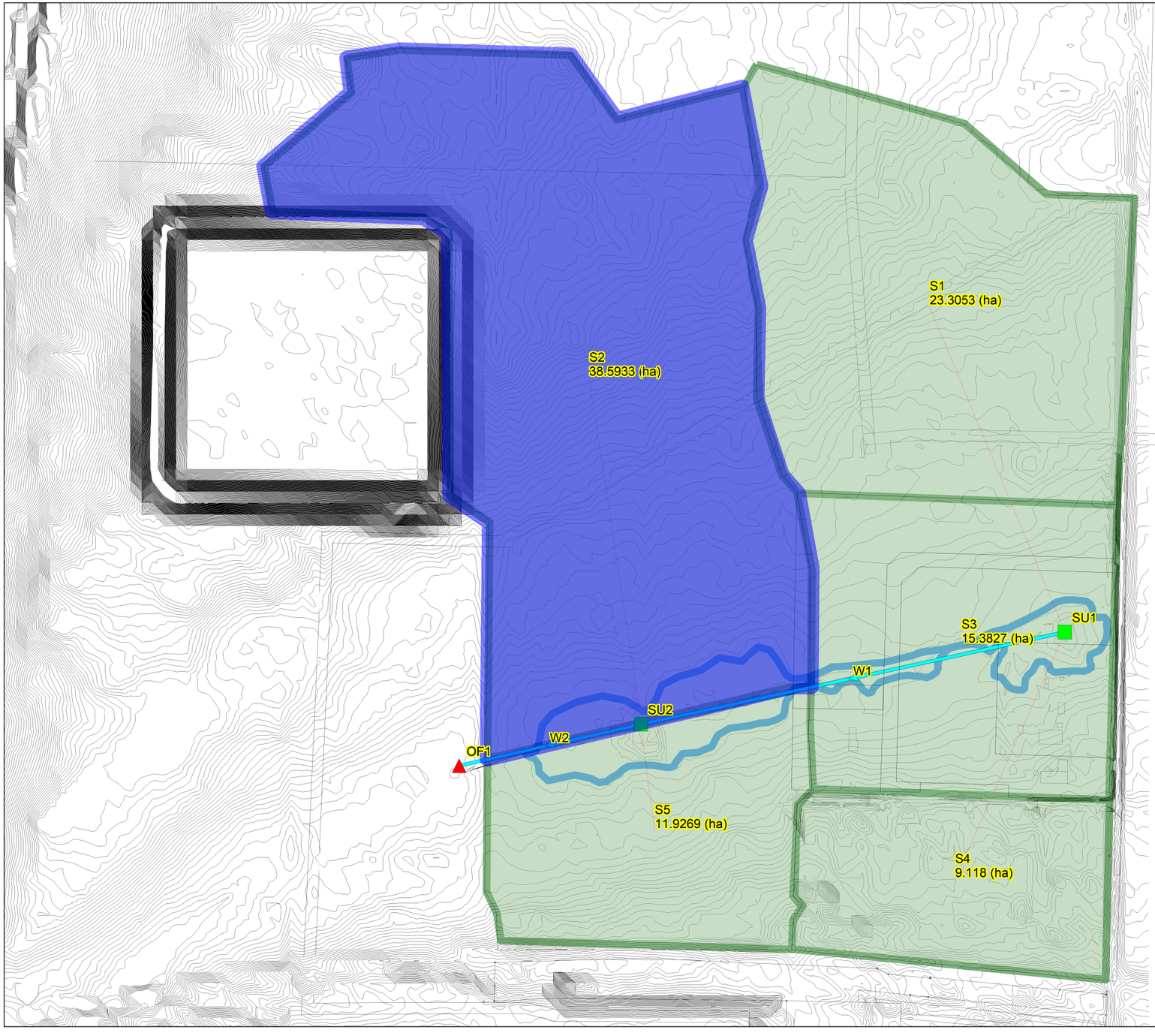


Legend

- Outfalls
- Storages
- Weirs
- Subcatchments
- design
- ponding
- Predevlopment contour 1

Stormwater Management Plan
Chin Meadows Area Structure Plan

PCSWMM Model - Pre-development

Lethbridge 1:100 year Chicago 24 hour Rainfall Event

MARTIN GEOMATIC CONSULTANTS

N

300 m

FIGURE 7 - PRE-DEVELOPMENT CATCHMENT AREAS

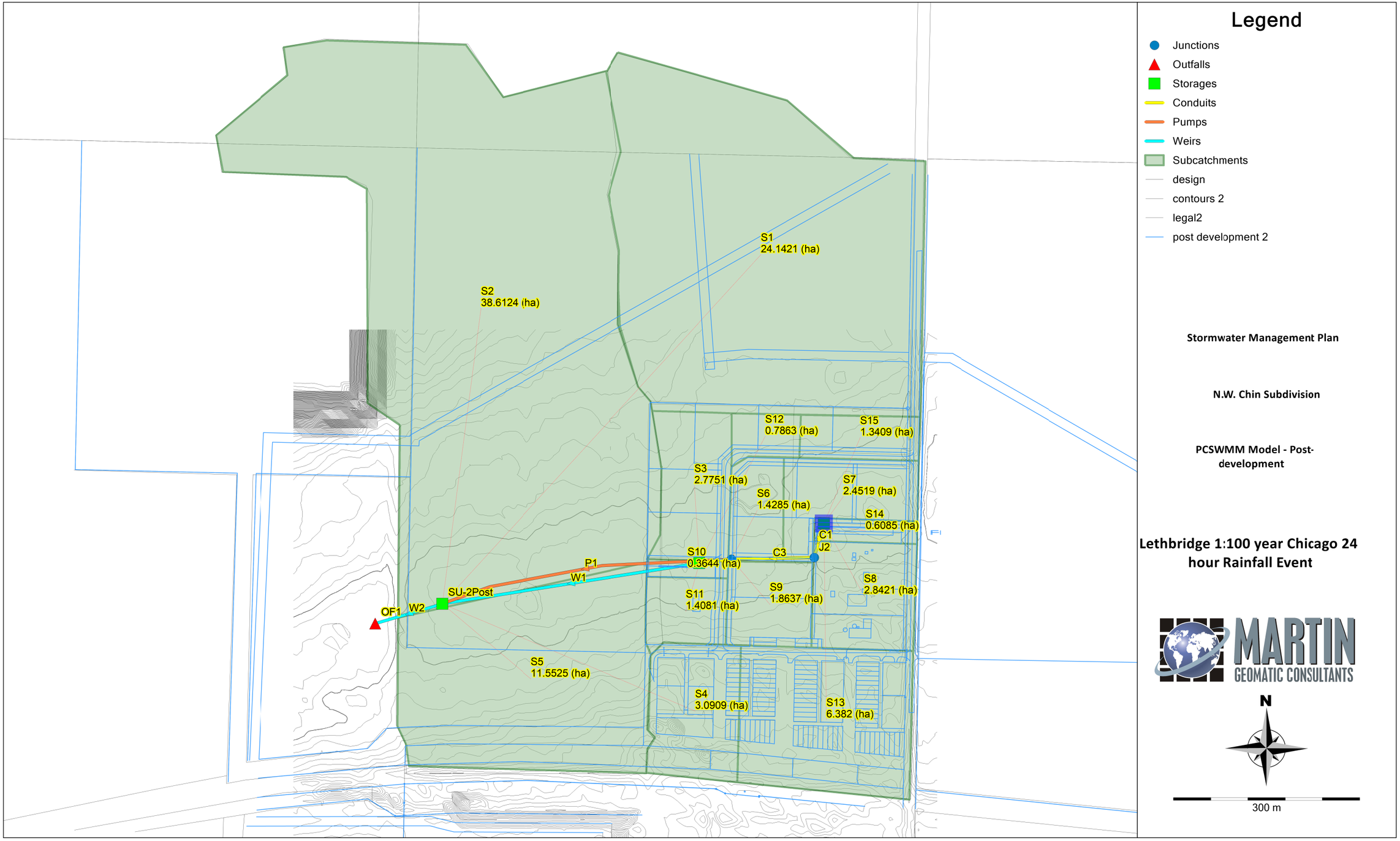
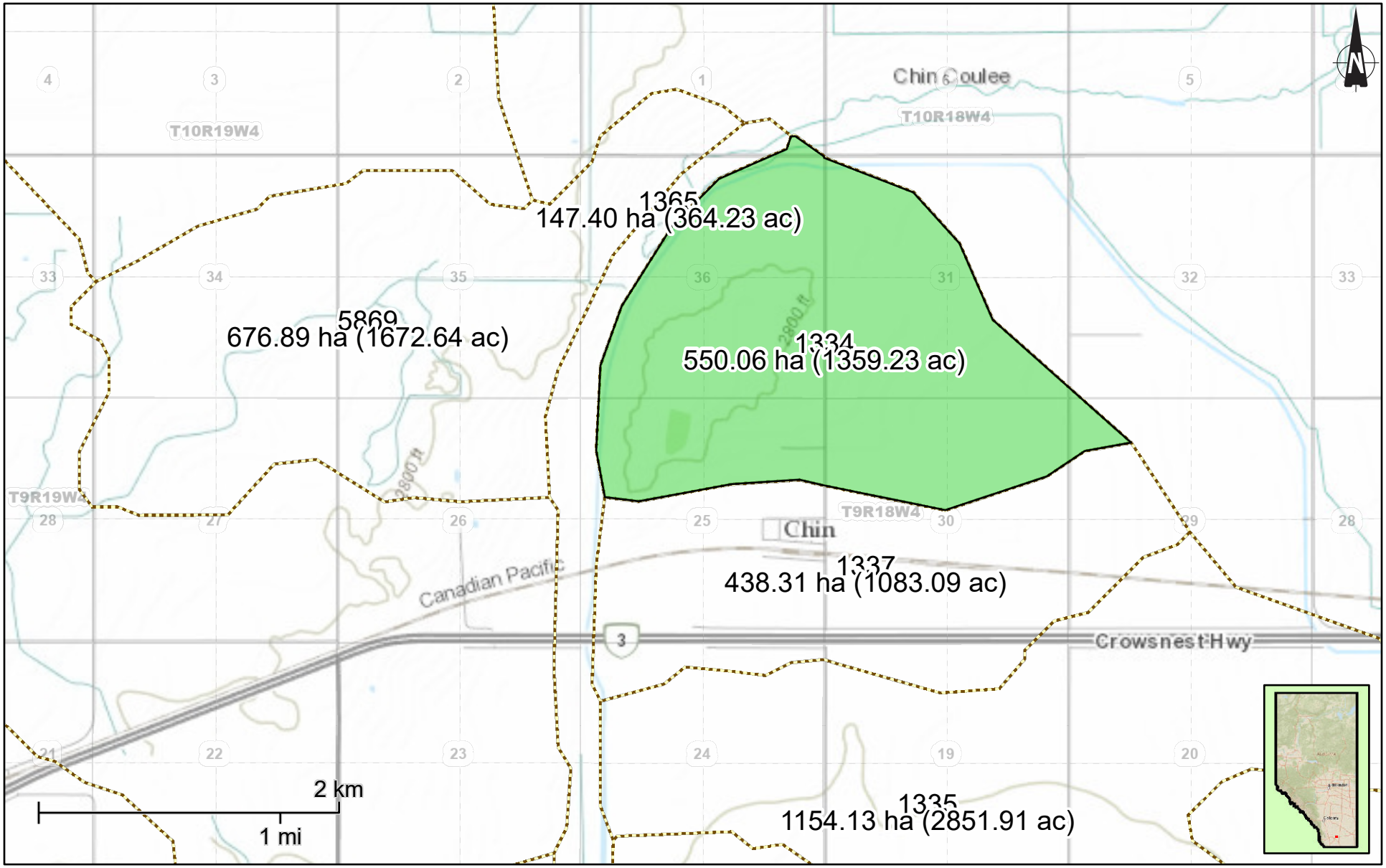


FIGURE 8 - POST-CONSTRUCTION SUB-CATCHMENT AREAS

Appendix B – Soil Information

Hamlet of Chin,AB
Soil Classification



April 17, 2024

Soil Landscape Polygons

Scale 1:36,112
1 inch = 3009.33 feet
1 cm = 361.12 metres
Map centre at latitude +49.769°N and longitude -112.455°E

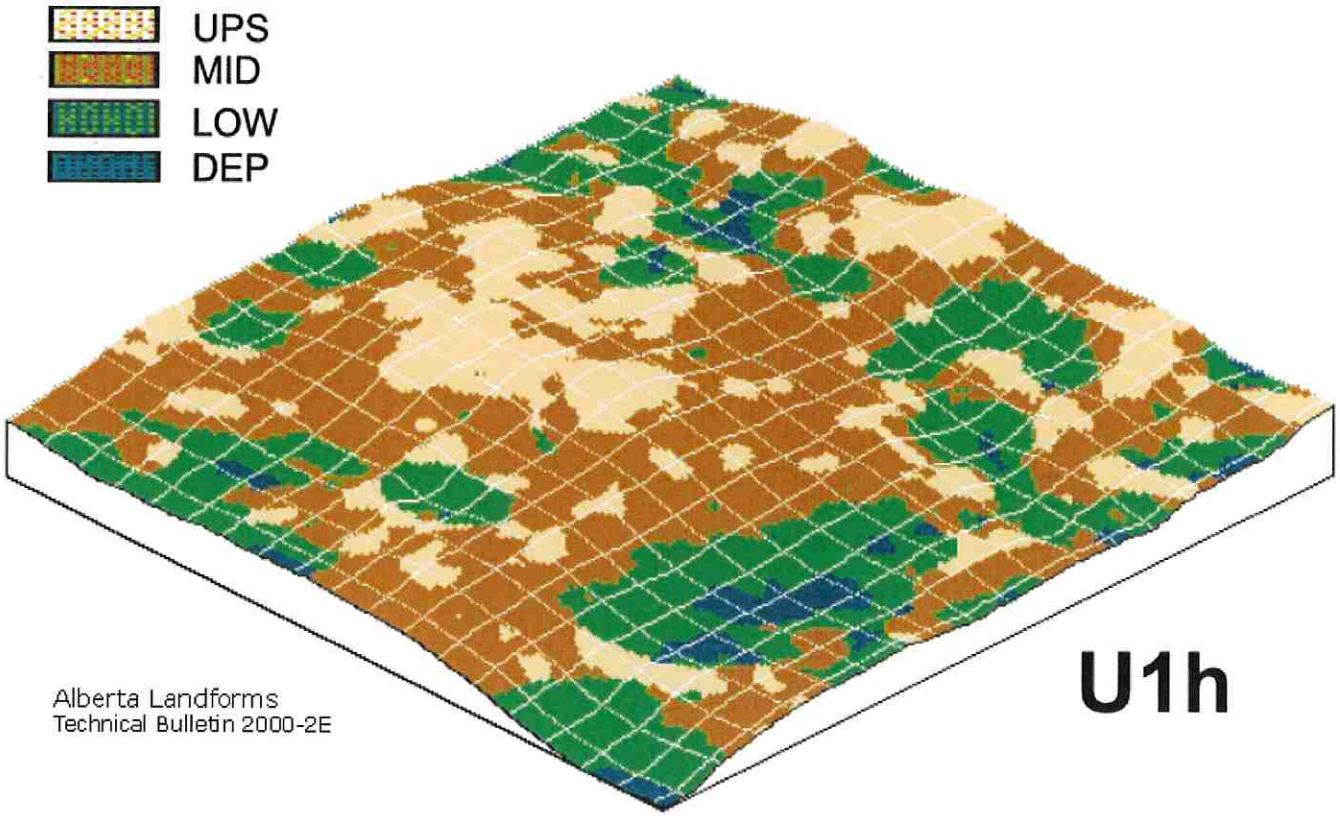
Report on Soil Polygon: 1334

Variable	Value
POLY_ID	1334
Map Unit Name	CFCH1/U1hc
Landform	U1h - undulating - high relief
LSRS Rating (Spring Grains)	4M(10)

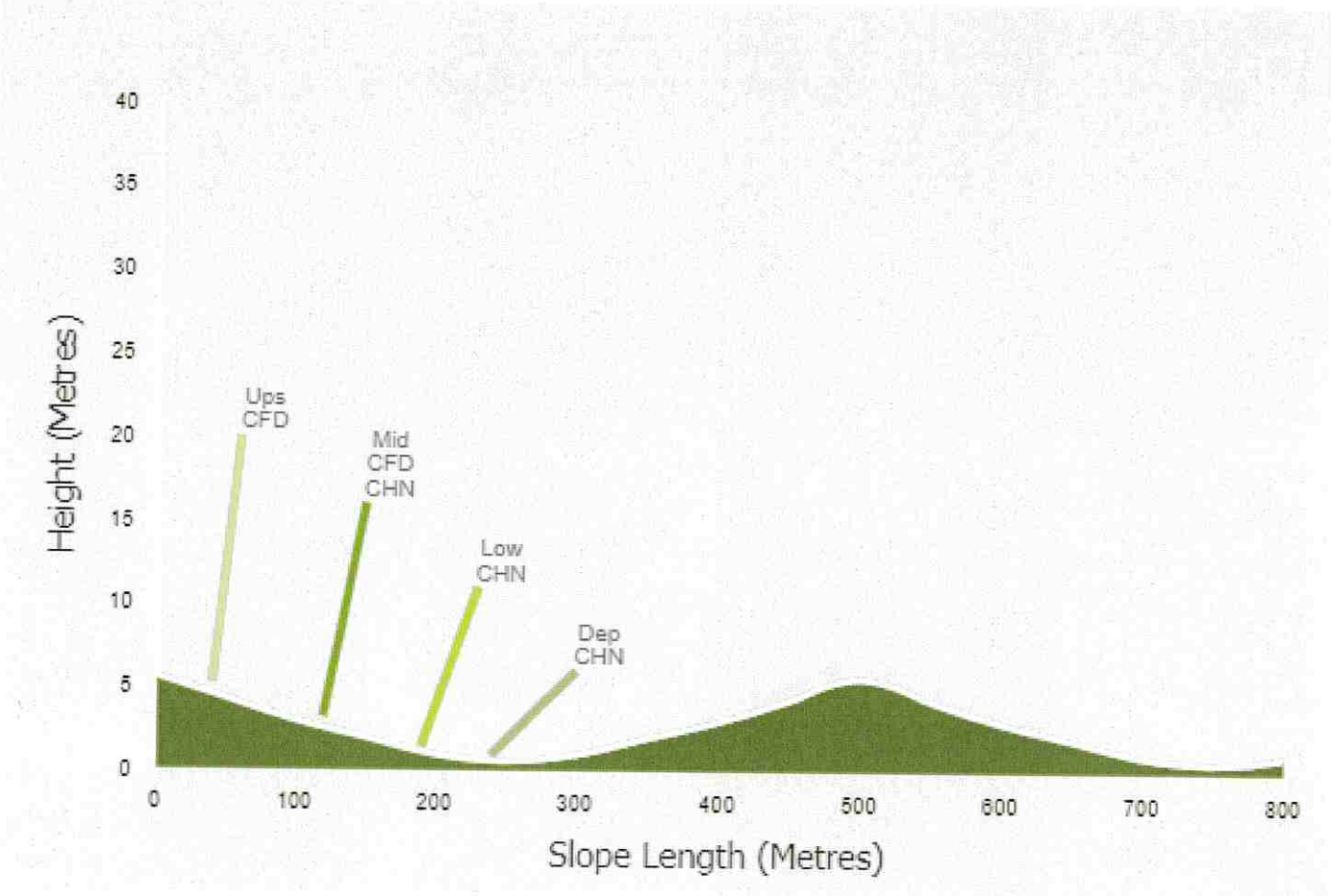
Landscape Model Descriptions:
Orthic Brown Chernozem on medium textured (L, SiCL, CL) materials over medium (L, CL) or fine (C) textured till (CFD).
Orthic Brown Chernozem on medium textured (L, SiL) sediments deposited by wind and water (CHN).
The polygon may include soils that are not strongly contrasting from the dominant or co-dominant soils (1).
Undulating, high relief landform (channeled) with a limiting slope of 4% (U1hc).

Image:

Landform Model:



Landform Profile:



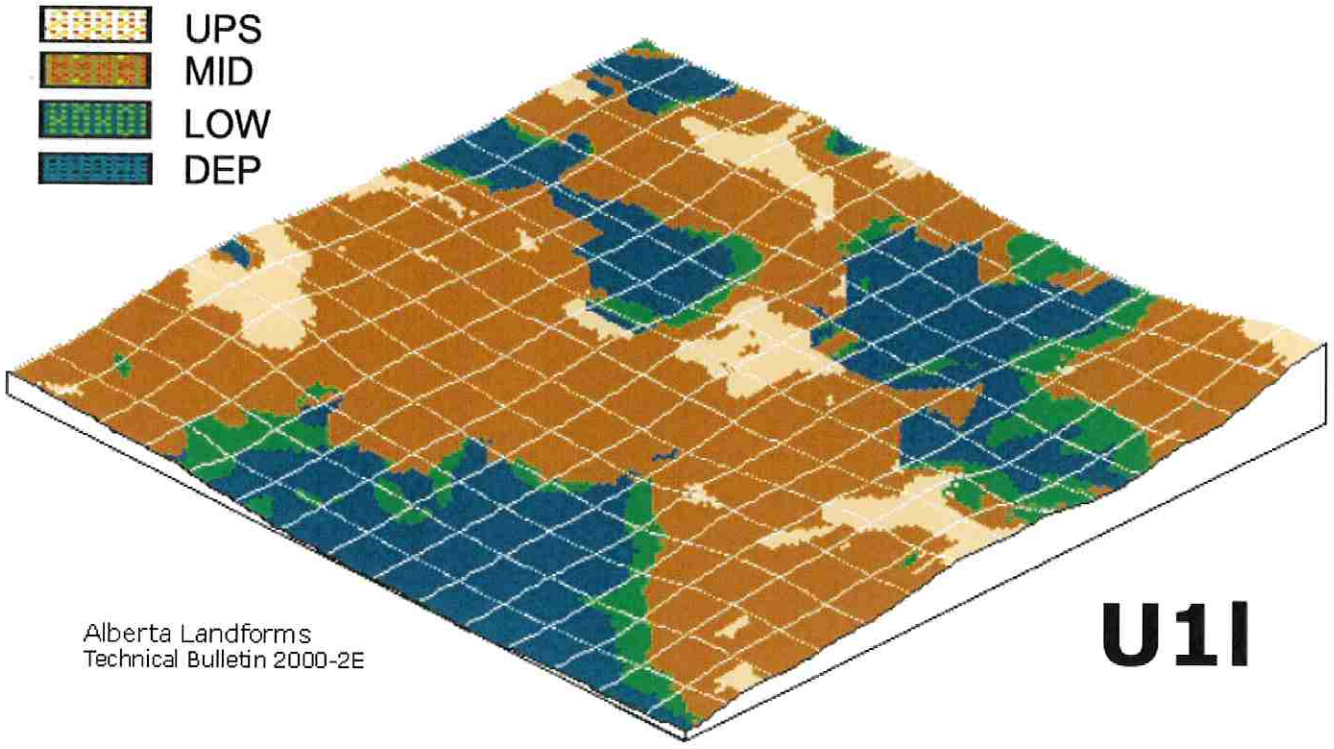
Report on Soil Polygon: 1337

Variable	Value
POLY_ID	1337
Map Unit Name	CFCH1/U1lc
Landform	U1l - undulating - low relief
LSRS Rating (Spring Grains)	4M(10)

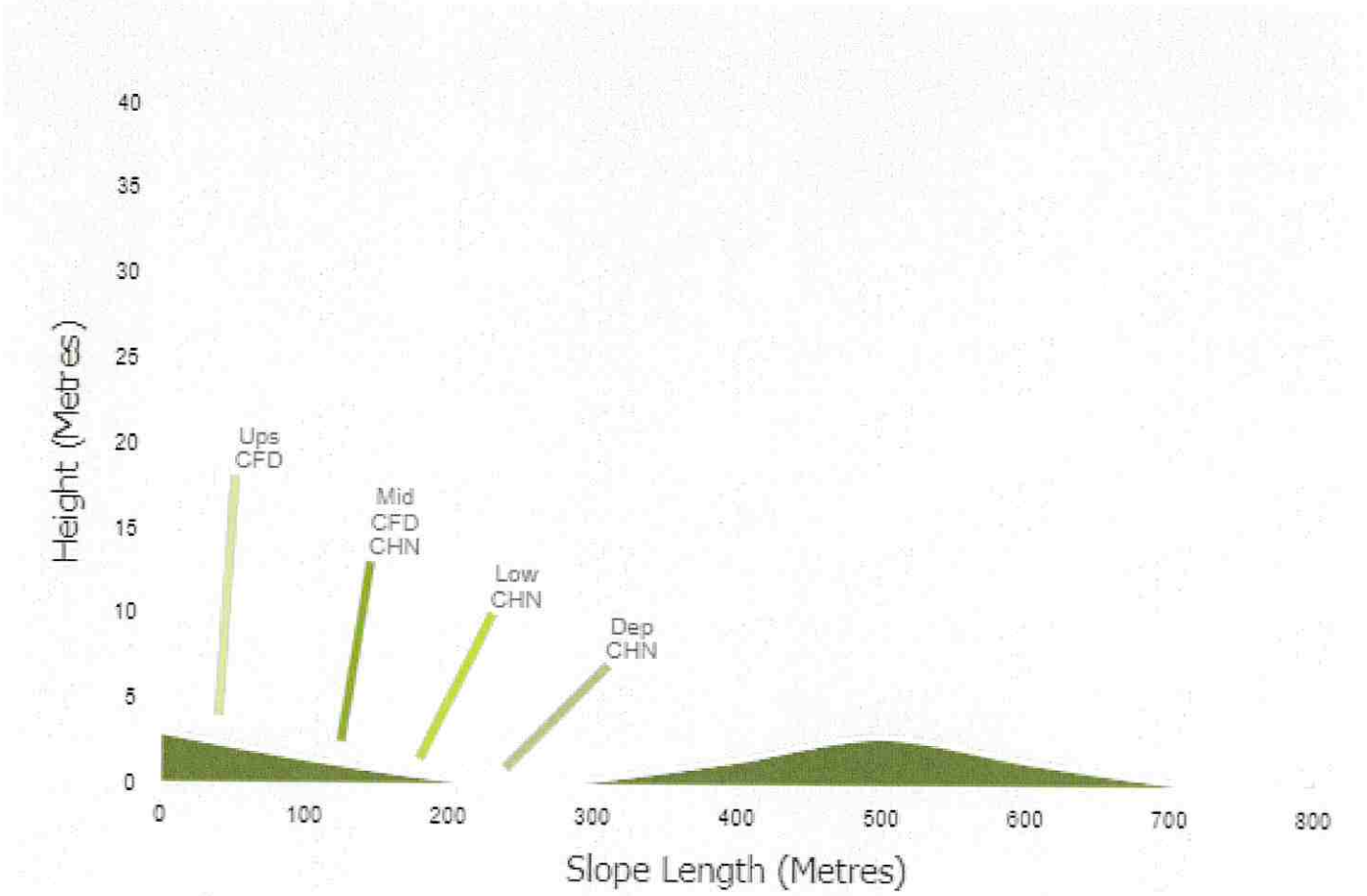
Landscape Model Descriptions:
Orthic Brown Chernozem on medium textured (L, SiCL, CL) materials over medium (L, CL) or fine (C) textured till (CFD).
Orthic Brown Chernozem on medium textured (L, SiL) sediments deposited by wind and water (CHN).
The polygon may include soils that are not strongly contrasting from the dominant or co-dominant soils (1).
Undulating, low relief landform (channeled) with a limiting slope of 2% (U1lc).

Image:

Landform Model:



Landform Profile:



Appendix C – SWMM Model Results

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

North Chin Residential Development

****
Element Count
****
Number of rain gages 3
Number of subcatchments ... 15
Number of nodes 5
Number of links 5
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Chicago_100yr24hr	Chicago_100yr24hr	INTENSITY	5 min.
Chicago_100yr4hr	Chicago_100yr4hr	INTENSITY	5 min.
Chicago_5yr4hr	Chicago_5yr4hr	INTENSITY	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1	24.14	470.00	0.00	0.6800	Chicago_100yr24hr	SU-2Post
S10	0.36	20.00	0.00	1.0000	Chicago_100yr24hr	West_Pond
S11	1.41	120.00	10.00	1.1000	Chicago_100yr24hr	West_Pond
S12	0.79	80.00	15.00	0.9000	Chicago_100yr24hr	West_Pond
S13	6.38	301.00	25.00	1.3000	Chicago_100yr24hr	J1
S14	0.61	15.00	0.00	0.5000	Chicago_100yr24hr	East_Pond
S15	1.34	80.00	25.00	0.9000	Chicago_100yr24hr	East_Pond
S2	38.61	422.00	0.00	1.2000	Chicago_100yr24hr	SU-2Post

S3	2.78	120.00	15.00	0.5700	Chicago_100yr24hr	West_Pond
S4	3.09	410.00	20.00	1.3600	Chicago_100yr24hr	SU-2Post
S5	11.55	409.00	1.00	1.3200	Chicago_100yr24hr	SU-2Post
S6	1.43	100.00	15.00	1.1000	Chicago_100yr24hr	J1
S7	2.45	87.00	15.00	1.0000	Chicago_100yr24hr	East_Pond
S8	2.84	151.00	40.00	2.1000	Chicago_100yr24hr	East_Pond
S9	1.86	140.00	15.00	0.9000	Chicago_100yr24hr	J1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	841.70	4.30	0.0	
OF1	OUTFALL	844.70	0.00	0.0	
East_Pond	STORAGE	842.02	3.66	0.0	
SU-2Post	STORAGE	845.20	0.60	0.0	
West_Pond	STORAGE	842.59	3.21	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	East_Pond	J1	CONDUIT	159.5	0.2194	0.0100
C2	West_Pond	J1	CONDUIT	52.2	1.7013	0.0130
P1	J1	SU-2Post	TYPE2 PUMP			
W1	West_Pond	SU-2Post	WEIR			
W2	SU-2Post	OF1	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.15	0.02	0.04	0.15	1	0.01

```
C2               CIRCULAR            0.45     0.16     0.11     0.45        1     0.37


****************
Analysis Options
****************
Flow Units ..............  CMS
Process Models:
  Rainfall/Runoff ........  YES
  RDII ...................  NO
  Snowmelt ...............  NO
  Groundwater ............  NO
  Flow Routing ...........  YES
  Ponding Allowed ........  NO
  Water Quality ..........  NO
Infiltration Method ......  GREEN_AMPT
Flow Routing Method ......  DYNWAVE
Surcharge Method .........  EXTRAN
Starting Date ............  03/28/2024 00:00:00
Ending Date ..............  03/29/2024 00:00:00
Antecedent Dry Days ......  0.0
Report Time Step .........  00:01:00
Wet Time Step ............  00:05:00
Dry Time Step ............  00:05:00
Routing Time Step ........  5.00 sec
Variable Time Step .......  YES
Maximum Trials ...........  8
Number of Threads ........  1
Head Tolerance ...........  0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......        11.972       120.146
Evaporation Loss .........         0.072         0.726
Infiltration Loss ........         6.506        65.292
Surface Runoff ...........         5.107        51.253
Final Storage ............         0.305         3.057
Continuity Error (%) .....        -0.152
```

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	5.107	51.071
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	3.816	38.163
Flooding Loss	0.125	1.251
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	1.163	11.629
Continuity Error (%)	0.054	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Most Frequent Nonconverging Nodes
****
Convergence obtained at all time steps.

****
Routing Time Step Summary
****
Minimum Time Step : 0.34 sec
Average Time Step : 5.00 sec

```
  Maximum Time Step           :     5.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.01
  % of Steps Not Converging   :     0.01
  Time Step Frequencies       :
      5.000 -  3.155 sec      :    99.99 %
      3.155 -  1.991 sec      :     0.01 %
      1.991 -  1.256 sec      :     0.01 %
      1.256 -  0.792 sec      :     0.00 %
      0.792 -  0.500 sec      :     0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ------------------------------------------------------------------------------------------------------------
-------------
                            Total      Total      Total      Total     Imperv       Perv      Total       Total
Peak  Runoff
                           Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff      Runoff
Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm         mm         mm    10^6 ltr
CMS
  ------------------------------------------------------------------------------------------------------------
-------------
  S1                       120.15       0.00       0.74      69.87       0.00      46.23      46.23       11.16
0.79   0.385
  S10                      120.15       0.00       0.67      67.26       0.00      52.49      52.49        0.19
0.04   0.437
  S11                      120.15       0.00       0.67      59.69      11.86      48.29      60.16        0.85
0.32   0.501
  S12                      120.15       0.00       0.69      56.24      17.80      45.79      63.60        0.50
0.22   0.529
  S13                      120.15       0.00       0.71      49.19      29.84      40.72      70.56        4.50
1.94   0.587
  S14                      120.15       0.00       0.74      69.63       0.00      48.37      48.37        0.29
0.03   0.403
  S15                      120.15       0.00       0.74      50.02      29.83      39.88      69.71        0.93
0.41   0.580
  S2                       120.15       0.00       0.74      70.08       0.00      44.19      44.19       17.06
1.01   0.368
```

S3		120.15	0.00	0.71	56.88	17.86	44.85	62.71	1.74
0.52	0.522								
S4		120.15	0.00	0.66	51.62	23.74	44.68	68.42	2.11
1.26	0.569								
S5		120.15	0.00	0.72	68.08	1.18	50.31	51.50	5.95
0.78	0.429								
S6		120.15	0.00	0.78	60.08	17.89	32.50	50.39	0.72
0.20	0.419								
S7		120.15	0.00	0.70	56.69	17.81	45.06	62.87	1.54
0.47	0.523								
S8		120.15	0.00	0.65	36.97	46.40	35.17	81.58	2.32
1.34	0.679								
S9		120.15	0.00	0.66	55.55	17.81	46.40	64.21	1.20
0.47	0.534								

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	2.90	4.30	846.00	0 07:11	4.30
OF1	OUTFALL	0.00	0.00	844.70	0 00:00	0.00
East_Pond	STORAGE	1.71	2.70	844.72	1 00:00	2.70
SU-2Post	STORAGE	0.31	0.49	845.69	0 07:49	0.49
West_Pond	STORAGE	2.12	3.17	845.76	0 10:52	3.17

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent

J1	JUNCTION	2.612	2.612	0	07:15	6.42	7.17	0.120
OF1	OUTFALL	0.000	2.678	0	07:49	0	38.2	0.000
East_Pond	STORAGE	2.242	2.270	0	07:15	5.09	6.23	0.223
SU-2Post	STORAGE	3.124	3.142	0	07:15	36.3	38.5	0.000
West_Pond	STORAGE	1.098	1.722	0	07:15	3.28	6.6	0.246

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J1	JUNCTION	19.40	3.850	0.000

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 ltr	Maximum Ponded Depth Meters
J1	0.91	1.932	0 07:15	1.251	0.000

****
Storage Volume Summary
****

	Average Volume	Avg Pcnt	Evap Pcnt	Exfil Pcnt	Maximum Volume	Max Pcnt	Time of Max Occurrence	Maximum Outflow

Storage Unit	1000 m³	Full	Loss	Loss	1000 m³	Full	days hr:min	CMS
East_Pond	3.630	33.9	0.0	0.0	6.211	58.1	1 00:00	0.003
SU-2Post	0.466	8.2	0.0	0.0	1.660	29.2	0 07:49	2.678
West_Pond	3.642	61.7	0.0	0.0	5.739	97.2	0 10:52	0.087

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	75.42	0.586	2.678	38.163
System	75.42	0.586	2.678	38.163

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.029	0 07:11	1.66	3.15	1.00
C2	CONDUIT	0.665	0 07:11	4.18	1.79	1.00
P1	PUMP	0.018	0 03:53		1.00	
W1	WEIR	0.087	0 10:52			0.28
W2	WEIR	2.678	0 07:49			0.93

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.12	0.00	0.00	0.84	0.04	0.00	0.00	0.02	0.00
C2	1.00	0.00	0.00	0.00	0.84	0.16	0.00	0.00	0.07	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1	18.45	18.45	19.82	18.50	0.01
C2	16.86	16.86	19.40	0.95	0.01

****
Pumping Summary
****

Pump	Percent Utilized	Number of Start-Ups	Min Flow CMS	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump Curve: Low	High
P1	99.95	1	0.00	0.02	0.02	1.445	3.57	0.0	70.1

Analysis begun on: Wed Apr 17 22:55:49 2024
Analysis ended on: Wed Apr 17 22:55:49 2024
Total elapsed time: < 1 sec

```
 TITLE
  Project Title/Notes
North Chin Residential Development

 OPTIONS
  Option             Value
FLOW_UNITS           CMS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           03/28/2024
START_TIME           00:00:00
REPORT_START_DATE    03/28/2024
REPORT_START_TIME    00:00:00
END_DATE             03/29/2024
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         5
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4
```

```
 EVAPORATION
  Data Source    Parameters
  -------------- ----------------
MONTHLY          0.0    0.0    1      2.5    3.9    4.7    5.4    4.3    2.4    1      0.2    0.0
DRY_ONLY         NO

 RAINGAGES
  Name           Format    Interval SCF      Source
  -------------- --------- -------- -------- ----------
Chicago_100yr24hr INTENSITY 0:05     1.0      TIMESERIES Chicago_100yr24hr
Chicago_100yr4hr INTENSITY 0:05     1.0      TIMESERIES Chicago_100yr4hr
Chicago_5yr4hr   INTENSITY 0:05     1.0      TIMESERIES Chicago_5yr4hr

 SUBCATCHMENTS
  Name           Rain Gage         Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
  -------------- ----------------- ---------------- -------- -------- -------- -------- -------- ----------------
S1               Chicago_100yr24hr SU-2Post         24.1421  0        470      0.68     0
S10              Chicago_100yr24hr West_Pond        0.3644   0        20       1        0
S11              Chicago_100yr24hr West_Pond        1.4081   10       120      1.1      0
S12              Chicago_100yr24hr West_Pond        0.7863   15       80       0.9      0
S13              Chicago_100yr24hr East_Pond        6.382    25       301      1.3      0
S14              Chicago_100yr24hr East_Pond        0.6085   0        15       0.5      0
S15              Chicago_100yr24hr East_Pond        1.3409   25       80       0.9      0
 North Chin Residential Development
S2               Chicago_100yr24hr SU-2Post         38.6124  0        422      1.2      0
S3               Chicago_100yr24hr West_Pond        2.7751   15       120      0.57     0
S4               Chicago_100yr24hr SU-2Post         3.0909   20       410      1.36     0
S5               Chicago_100yr24hr SU-2Post         11.5525  1        409      1.32     0
S6               Chicago_100yr24hr J1               1.4285   15       100      1.1      0
S7               Chicago_100yr24hr East_Pond        2.4519   15       87       1        0
S8               Chicago_100yr24hr East_Pond        2.8421   40       151      2.1      0
S9               Chicago_100yr24hr J1               1.8637   15       140      0.9      0

 SUBAREAS
  Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     Pct ero    RouteTo    PctRouted
  -------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
S1               0.015      0.2        0.93       5          25         OUTLET
S10              0.015      0.15       5          5          0          OUTLET
S11              0.015      0.15       0.73       5          25         OUTLET
S12              0.015      0.15       0.81       5          25         OUTLET
```

S13	0.015	0.15	0.81	3.81	25	OUTLET
S14	0.015	0.15	2	5	25	OUTLET
S15	0.015	0.15	0.81	5	25	OUTLET
S2	0.015	0.2	1	5	25	OUTLET
S3	0.015	0.15	1.01	3.81	10	OUTLET
S4	0.015	0.15	0.66	3.81	25	OUTLET
S5	0.015	0.2	1	5	25	OUTLET
S6	0.015	3.81	0.15	0.73	10	OUTLET
S7	0.015	0.15	1.29	3.81	10	OUTLET
S8	0.015	0.15	4.2	0.54	5	OUTLET
S9	0.015	0.15	0.81	3.81	15	OUTLET

INFILTRATION

Subcatchment	Param1	Param2	Param3	Param4	Param5
S1	172.97	1.95	0.262	0	0
S10	172.973	1.95	0.262	0	0
S11	172.973	1.95	0.262	0	0
S12	172.973	1.95	0.262	0	0
S13	172.973	1.95	0.262	0	0
S14	172.973	1.95	0.262	0	0
S15	172.973	1.95	0.262	0	0
S2	172.97	1.95	0.262	0	0
S3	172.973	1.95	0.262	0	0
S4	172.973	1.95	0.262	0	0
S5	172.973	1.95	0.262	0	0
S6	172.973	1.95	0.262	0	0
S7	172.973	1.95	0.262	0	0
S8	172.973	1.95	0.262	0	0
S9	172.973	1.95	0.262	0	0

JUNCTIONS

Name	Elevation	MaxDepth	InitDepth	SurDepth	Aponded
J1	841.7	4.3	0	0	0
J2	841.9	3.8	0	0	0

OUTFALLS

Name	Elevation	Type	Stage Data	Gated	Route To
OF1	844.7	FREE		NO	

```
 STORAGE
  Name            Elev.    MaxDepth   InitDepth  Shape       Curve Name/Params            SurDepth Fevap    Psi
Ksat     IMD
  -------------- -------- ---------- ---------- ----------- ---------------------------- -------- -------- --------
-------- --------
 1:100yr 24hour Post Development
East_Pond        842      3.68       0          TABULAR     East_Pond_Final              0        0
 1:100yr 24hour Post Development
SU-2Post         845.2    0.6        0          TABULAR     SU-2Post                     0        0
 1:100yr 24hour Post Development
West_Pond        842.588  3.212      0          TABULAR     West_pond_Final              0        0

 CONDUITS
  Name            From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow   MaxFlow
  -------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ---------
-
C1               East_Pond        J2               56.8       0.013      842        841.8      0          0
C2               West_Pond        J1               52.204     0.013      842.588    841.7      0          0
C3               J2               J1               133.382    0.013      841.77     841.7      0          0

 PUMPS
  Name            From Node        To Node          Pump Curve       Status   Startup  Shutoff
  -------------- ---------------- ---------------- ---------------- -------- -------- --------
P1               J1               SU-2Post         18L_per-sec      ON       0        0

 WEIRS
  Name            From Node        To Node          Type         CrestHt    Qcoeff     Gated    EndCon   EndCoeff
Surcharge  RoadWidth  RoadSurf   Coeff. Curve
  -------------- ---------------- ---------------- ------------ ---------- ---------- -------- -------- ----------
---------- ---------- ---------- ----------------
W1               West_Pond        SU-2Post         TRAPE OIDAL  845.7      3.33       YES      0        0
YES
W2               SU-2Post         OF1              TRANSVERSE   845.5      3.33       NO       0        0
YES

 XSECTIONS
  Link            Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
  -------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
C1               CIRCULAR     0.25             0          0          0          1
C2               CIRCULAR     0.45             0          0          0          1
C3               CIRCULAR     0.25             0          0          0          1
```

```
W1               TRAPE OIDAL  0.2              2          0          0
W2               RECT_OPEN    0.2              10         5          5

 LOSSES
  Link            Kentry     Kexit      Kavg       Flap Gate  Seepage
  -------------- ---------- ---------- ---------- ---------- ----------

 CURVES
  Name            Type       X-Value    Y-Value
  -------------- ---------- ---------- ----------
 18 litres per second pump
18L_per-sec      Pump2      0          0
18L_per-sec                 0.4        0.018
18L_per-sec                 2.6        0.018

 9 litres per second pump
9l_per-sec       Pump2      0          0
9l_per-sec                  0.4        0.009
9l_per-sec                  2.6        0.009


dtich-storage    Storage    0          1500
dtich-storage               1          10000

East_Pond_Final  Storage    0          783
East_Pond_Final             0.6        1395
East_Pond_Final             1          1840
East_Pond_Final             1.4        2306
East_Pond_Final             2          3045
East_Pond_Final             3          4381
East_Pond_Final             3.4        4940
East_Pond_Final             3.68       5774

 East trapped low
SU1-pond         Storage    0          1910
SU1-pond                    0.1        2013
SU1-pond                    0.5        2440
SU1-pond                    0.9        2897
SU1-pond                    1.5        3641
SU1-pond                    1.9        4176
SU1-pond                    2.1        4455
SU1-pond                    2.46       4885
```

```
SU1-pond                    2.86       5000

 West trapped low
SU-2Post          Storage   0          100
SU-2Post                    0.4        3039
SU-2Post                    0.57       38189
SU-2Post                    0.6        66022
SU-2Post                    0.65       91758

West_pond_Final   Storage   0          240
West_pond_Final             0.2        394
West_pond_Final             0.6        740
West_pond_Final             1          1115
West_pond_Final             1.4        1525
West_pond_Final             2          2200
West_pond_Final             2.6        2950
West_pond_Final             3          3475
West_pond_Final             3.19       3747

WEST-POND9acre    Storage   0          2
WEST-POND9acre              1          2
WEST-POND9acre              1.15       150
WEST-POND9acre              1.412      483
WEST-POND9acre              2          933
WEST-POND9acre              3          1982
WEST-POND9acre              3.9        3211
WEST-POND9acre              4.2        3630

 TIMESERIES
  Name            Date       Time       Value
  --------------- ---------- ---------- ----------
 Chicago design storm, a   1019.2, b   0, c   0.731, Duration   1440 minutes, r   0.3, rain units   mm/hr.
Chicago_100yr24hr            0:00       1.352
Chicago_100yr24hr            0:05       1.364
Chicago_100yr24hr            0:10       1.376
Chicago_100yr24hr            0:15       1.388
Chicago_100yr24hr            0:20       1.4
Chicago_100yr24hr            0:25       1.413
Chicago_100yr24hr            0:30       1.426
Chicago_100yr24hr            0:35       1.439
Chicago_100yr24hr            0:40       1.453
```

Chicago_100yr24hr	0:45	1.466
Chicago_100yr24hr	0:50	1.48
Chicago_100yr24hr	0:55	1.495
Chicago_100yr24hr	1:00	1.51
Chicago_100yr24hr	1:05	1.525
Chicago_100yr24hr	1:10	1.54
Chicago_100yr24hr	1:15	1.556
Chicago_100yr24hr	1:20	1.572
Chicago_100yr24hr	1:25	1.589
Chicago_100yr24hr	1:30	1.606
Chicago_100yr24hr	1:35	1.624
Chicago_100yr24hr	1:40	1.641
Chicago_100yr24hr	1:45	1.66
Chicago_100yr24hr	1:50	1.679
Chicago_100yr24hr	1:55	1.698
Chicago_100yr24hr	2:00	1.718
Chicago_100yr24hr	2:05	1.739
Chicago_100yr24hr	2:10	1.76
Chicago_100yr24hr	2:15	1.782
Chicago_100yr24hr	2:20	1.804
Chicago_100yr24hr	2:25	1.828
Chicago_100yr24hr	2:30	1.851
Chicago_100yr24hr	2:35	1.876
Chicago_100yr24hr	2:40	1.901
Chicago_100yr24hr	2:45	1.928
Chicago_100yr24hr	2:50	1.955
Chicago_100yr24hr	2:55	1.983
Chicago_100yr24hr	3:00	2.012
Chicago_100yr24hr	3:05	2.042
Chicago_100yr24hr	3:10	2.073
Chicago_100yr24hr	3:15	2.105
Chicago_100yr24hr	3:20	2.138
Chicago_100yr24hr	3:25	2.173
Chicago_100yr24hr	3:30	2.209
Chicago_100yr24hr	3:35	2.247
Chicago_100yr24hr	3:40	2.286
Chicago_100yr24hr	3:45	2.326
Chicago_100yr24hr	3:50	2.369
Chicago_100yr24hr	3:55	2.413
Chicago_100yr24hr	4:00	2.46
Chicago_100yr24hr	4:05	2.508

Chicago_100yr24hr	4:10	2.559
Chicago_100yr24hr	4:15	2.612
Chicago_100yr24hr	4:20	2.669
Chicago_100yr24hr	4:25	2.728
Chicago_100yr24hr	4:30	2.79
Chicago_100yr24hr	4:35	2.856
Chicago_100yr24hr	4:40	2.925
Chicago_100yr24hr	4:45	2.999
Chicago_100yr24hr	4:50	3.077
Chicago_100yr24hr	4:55	3.16
Chicago_100yr24hr	5:00	3.249
Chicago_100yr24hr	5:05	3.344
Chicago_100yr24hr	5:10	3.446
Chicago_100yr24hr	5:15	3.555
Chicago_100yr24hr	5:20	3.673
Chicago_100yr24hr	5:25	3.801
Chicago_100yr24hr	5:30	3.939
Chicago_100yr24hr	5:35	4.091
Chicago_100yr24hr	5:40	4.257
Chicago_100yr24hr	5:45	4.44
Chicago_100yr24hr	5:50	4.642
Chicago_100yr24hr	5:55	4.868
Chicago_100yr24hr	6:00	5.122
Chicago_100yr24hr	6:05	5.409
Chicago_100yr24hr	6:10	5.738
Chicago_100yr24hr	6:15	6.119
Chicago_100yr24hr	6:20	6.565
Chicago_100yr24hr	6:25	7.098
Chicago_100yr24hr	6:30	7.745
Chicago_100yr24hr	6:35	8.553
Chicago_100yr24hr	6:40	9.594
Chicago_100yr24hr	6:45	10.997
Chicago_100yr24hr	6:50	13.01
Chicago_100yr24hr	6:55	16.203
Chicago_100yr24hr	7:00	22.264
Chicago_100yr24hr	7:05	40.822
Chicago_100yr24hr	7:10	314.277
Chicago_100yr24hr	7:15	62.374
Chicago_100yr24hr	7:20	38.336
Chicago_100yr24hr	7:25	28.645
Chicago_100yr24hr	7:30	23.295

Chicago_100yr24hr	7:35	19.837
Chicago_100yr24hr	7:40	17.393
Chicago_100yr24hr	7:45	15.56
Chicago_100yr24hr	7:50	14.128
Chicago_100yr24hr	7:55	12.973
Chicago_100yr24hr	8:00	12.02
Chicago_100yr24hr	8:05	11.217
Chicago_100yr24hr	8:10	10.531
Chicago_100yr24hr	8:15	9.937
Chicago_100yr24hr	8:20	9.416
Chicago_100yr24hr	8:25	8.956
Chicago_100yr24hr	8:30	8.545
Chicago_100yr24hr	8:35	8.177
Chicago_100yr24hr	8:40	7.844
Chicago_100yr24hr	8:45	7.542
Chicago_100yr24hr	8:50	7.265
Chicago_100yr24hr	8:55	7.012
Chicago_100yr24hr	9:00	6.778
Chicago_100yr24hr	9:05	6.563
Chicago_100yr24hr	9:10	6.362
Chicago_100yr24hr	9:15	6.176
Chicago_100yr24hr	9:20	6.002
Chicago_100yr24hr	9:25	5.839
Chicago_100yr24hr	9:30	5.687
Chicago_100yr24hr	9:35	5.543
Chicago_100yr24hr	9:40	5.408
Chicago_100yr24hr	9:45	5.28
Chicago_100yr24hr	9:50	5.159
Chicago_100yr24hr	9:55	5.045
Chicago_100yr24hr	10:00	4.936
Chicago_100yr24hr	10:05	4.833
Chicago_100yr24hr	10:10	4.735
Chicago_100yr24hr	10:15	4.641
Chicago_100yr24hr	10:20	4.552
Chicago_100yr24hr	10:25	4.466
Chicago_100yr24hr	10:30	4.385
Chicago_100yr24hr	10:35	4.307
Chicago_100yr24hr	10:40	4.231
Chicago_100yr24hr	10:45	4.159
Chicago_100yr24hr	10:50	4.09
Chicago_100yr24hr	10:55	4.024

Chicago_100yr24hr	11:00	3.96
Chicago_100yr24hr	11:05	3.898
Chicago_100yr24hr	11:10	3.839
Chicago_100yr24hr	11:15	3.781
Chicago_100yr24hr	11:20	3.726
Chicago_100yr24hr	11:25	3.673
Chicago_100yr24hr	11:30	3.621
Chicago_100yr24hr	11:35	3.571
Chicago_100yr24hr	11:40	3.523
Chicago_100yr24hr	11:45	3.476
Chicago_100yr24hr	11:50	3.43
Chicago_100yr24hr	11:55	3.386
Chicago_100yr24hr	12:00	3.344
Chicago_100yr24hr	12:05	3.302
Chicago_100yr24hr	12:10	3.262
Chicago_100yr24hr	12:15	3.223
Chicago_100yr24hr	12:20	3.185
Chicago_100yr24hr	12:25	3.148
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Chicago_100yr24hr	12:35	3.077
Chicago_100yr24hr	12:40	3.043
Chicago_100yr24hr	12:45	3.01
Chicago_100yr24hr	12:50	2.977
Chicago_100yr24hr	12:55	2.946
Chicago_100yr24hr	13:00	2.915
Chicago_100yr24hr	13:05	2.885
Chicago_100yr24hr	13:10	2.856
Chicago_100yr24hr	13:15	2.827
Chicago_100yr24hr	13:20	2.799
Chicago_100yr24hr	13:25	2.772
Chicago_100yr24hr	13:30	2.745
Chicago_100yr24hr	13:35	2.719
Chicago_100yr24hr	13:40	2.693
Chicago_100yr24hr	13:45	2.669
Chicago_100yr24hr	13:50	2.644
Chicago_100yr24hr	13:55	2.62
Chicago_100yr24hr	14:00	2.597
Chicago_100yr24hr	14:05	2.574
Chicago_100yr24hr	14:10	2.552
Chicago_100yr24hr	14:15	2.53
Chicago_100yr24hr	14:20	2.508

Chicago_100yr24hr	14:25	2.487
Chicago_100yr24hr	14:30	2.466
Chicago_100yr24hr	14:35	2.446
Chicago_100yr24hr	14:40	2.426
Chicago_100yr24hr	14:45	2.407
Chicago_100yr24hr	14:50	2.388
Chicago_100yr24hr	14:55	2.369
Chicago_100yr24hr	15:00	2.35
Chicago_100yr24hr	15:05	2.332
Chicago_100yr24hr	15:10	2.315
Chicago_100yr24hr	15:15	2.297
Chicago_100yr24hr	15:20	2.28
Chicago_100yr24hr	15:25	2.263
Chicago_100yr24hr	15:30	2.247
Chicago_100yr24hr	15:35	2.23
Chicago_100yr24hr	15:40	2.214
Chicago_100yr24hr	15:45	2.199
Chicago_100yr24hr	15:50	2.183
Chicago_100yr24hr	15:55	2.168
Chicago_100yr24hr	16:00	2.153
Chicago_100yr24hr	16:05	2.138
Chicago_100yr24hr	16:10	2.124
Chicago_100yr24hr	16:15	2.11
Chicago_100yr24hr	16:20	2.095
Chicago_100yr24hr	16:25	2.082
Chicago_100yr24hr	16:30	2.068
Chicago_100yr24hr	16:35	2.055
Chicago_100yr24hr	16:40	2.042
Chicago_100yr24hr	16:45	2.029
Chicago_100yr24hr	16:50	2.016
Chicago_100yr24hr	16:55	2.003
Chicago_100yr24hr	17:00	1.991
Chicago_100yr24hr	17:05	1.979
Chicago_100yr24hr	17:10	1.966
Chicago_100yr24hr	17:15	1.955
Chicago_100yr24hr	17:20	1.943
Chicago_100yr24hr	17:25	1.931
Chicago_100yr24hr	17:30	1.92
Chicago_100yr24hr	17:35	1.909
Chicago_100yr24hr	17:40	1.898
Chicago_100yr24hr	17:45	1.887

Chicago_100yr24hr	17:50	1.876
Chicago_100yr24hr	17:55	1.865
Chicago_100yr24hr	18:00	1.855
Chicago_100yr24hr	18:05	1.844
Chicago_100yr24hr	18:10	1.834
Chicago_100yr24hr	18:15	1.824
Chicago_100yr24hr	18:20	1.814
Chicago_100yr24hr	18:25	1.804
Chicago_100yr24hr	18:30	1.795
Chicago_100yr24hr	18:35	1.785
Chicago_100yr24hr	18:40	1.776
Chicago_100yr24hr	18:45	1.766
Chicago_100yr24hr	18:50	1.757
Chicago_100yr24hr	18:55	1.748
Chicago_100yr24hr	19:00	1.739
Chicago_100yr24hr	19:05	1.73
Chicago_100yr24hr	19:10	1.721
Chicago_100yr24hr	19:15	1.713
Chicago_100yr24hr	19:20	1.704
Chicago_100yr24hr	19:25	1.696
Chicago_100yr24hr	19:30	1.687
Chicago_100yr24hr	19:35	1.679
Chicago_100yr24hr	19:40	1.671
Chicago_100yr24hr	19:45	1.663
Chicago_100yr24hr	19:50	1.655
Chicago_100yr24hr	19:55	1.647
Chicago_100yr24hr	20:00	1.639
Chicago_100yr24hr	20:05	1.631
Chicago_100yr24hr	20:10	1.624
Chicago_100yr24hr	20:15	1.616
Chicago_100yr24hr	20:20	1.608
Chicago_100yr24hr	20:25	1.601
Chicago_100yr24hr	20:30	1.594
Chicago_100yr24hr	20:35	1.587
Chicago_100yr24hr	20:40	1.579
Chicago_100yr24hr	20:45	1.572
Chicago_100yr24hr	20:50	1.565
Chicago_100yr24hr	20:55	1.558
Chicago_100yr24hr	21:00	1.551
Chicago_100yr24hr	21:05	1.545
Chicago_100yr24hr	21:10	1.538

Chicago_100yr24hr	21:15	1.531
Chicago_100yr24hr	21:20	1.525
Chicago_100yr24hr	21:25	1.518
Chicago_100yr24hr	21:30	1.512
Chicago_100yr24hr	21:35	1.505
Chicago_100yr24hr	21:40	1.499
Chicago_100yr24hr	21:45	1.493
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Chicago_100yr24hr	21:55	1.48
Chicago_100yr24hr	22:00	1.474
Chicago_100yr24hr	22:05	1.468
Chicago_100yr24hr	22:10	1.462
Chicago_100yr24hr	22:15	1.456
Chicago_100yr24hr	22:20	1.451
Chicago_100yr24hr	22:25	1.445
Chicago_100yr24hr	22:30	1.439
Chicago_100yr24hr	22:35	1.433
Chicago_100yr24hr	22:40	1.428
Chicago_100yr24hr	22:45	1.422
Chicago_100yr24hr	22:50	1.417
Chicago_100yr24hr	22:55	1.411
Chicago_100yr24hr	23:00	1.406
Chicago_100yr24hr	23:05	1.4
Chicago_100yr24hr	23:10	1.395
Chicago_100yr24hr	23:15	1.39
Chicago_100yr24hr	23:20	1.384
Chicago_100yr24hr	23:25	1.379
Chicago_100yr24hr	23:30	1.374
Chicago_100yr24hr	23:35	1.369
Chicago_100yr24hr	23:40	1.364
Chicago_100yr24hr	23:45	1.359
Chicago_100yr24hr	23:50	1.354
Chicago_100yr24hr	23:55	1.349
Chicago_100yr24hr	24:00	0

Chicago design storm, a 1019.2, b 0, c 0.731, Duration 240 minutes, r 0.3, rain units mm/hr.

Chicago_100yr4hr	0:00	5.122
Chicago_100yr4hr	0:05	5.409
Chicago_100yr4hr	0:10	5.738
Chicago_100yr4hr	0:15	6.119
Chicago_100yr4hr	0:20	6.565

Chicago_100yr4hr	0:25	7.098
Chicago_100yr4hr	0:30	7.745
Chicago_100yr4hr	0:35	8.553
Chicago_100yr4hr	0:40	9.594
Chicago_100yr4hr	0:45	10.997
Chicago_100yr4hr	0:50	13.01
Chicago_100yr4hr	0:55	16.203
Chicago_100yr4hr	1:00	22.264
Chicago_100yr4hr	1:05	40.822
Chicago_100yr4hr	1:10	314.277
Chicago_100yr4hr	1:15	62.374
Chicago_100yr4hr	1:20	38.336
Chicago_100yr4hr	1:25	28.645
Chicago_100yr4hr	1:30	23.295
Chicago_100yr4hr	1:35	19.837
Chicago_100yr4hr	1:40	17.393
Chicago_100yr4hr	1:45	15.56
Chicago_100yr4hr	1:50	14.128
Chicago_100yr4hr	1:55	12.973
Chicago_100yr4hr	2:00	12.02
Chicago_100yr4hr	2:05	11.217
Chicago_100yr4hr	2:10	10.531
Chicago_100yr4hr	2:15	9.937
Chicago_100yr4hr	2:20	9.416
Chicago_100yr4hr	2:25	8.956
Chicago_100yr4hr	2:30	8.545
Chicago_100yr4hr	2:35	8.177
Chicago_100yr4hr	2:40	7.844
Chicago_100yr4hr	2:45	7.542
Chicago_100yr4hr	2:50	7.265
Chicago_100yr4hr	2:55	7.012
Chicago_100yr4hr	3:00	6.778
Chicago_100yr4hr	3:05	6.563
Chicago_100yr4hr	3:10	6.362
Chicago_100yr4hr	3:15	6.176
Chicago_100yr4hr	3:20	6.002
Chicago_100yr4hr	3:25	5.839
Chicago_100yr4hr	3:30	5.687
Chicago_100yr4hr	3:35	5.543
Chicago_100yr4hr	3:40	5.408
Chicago_100yr4hr	3:45	5.28

Chicago_100yr4hr	3:50	5.159
Chicago_100yr4hr	3:55	5.045
Chicago_100yr4hr	4:00	0

Chicago design storm, a 440.69, b 0, c 0.696, Duration 240 minutes, r 0.3, rain units mm/hr.

Chicago_5yr4hr	0:00	3.028
Chicago_5yr4hr	0:05	3.19
Chicago_5yr4hr	0:10	3.374
Chicago_5yr4hr	0:15	3.587
Chicago_5yr4hr	0:20	3.836
Chicago_5yr4hr	0:25	4.131
Chicago_5yr4hr	0:30	4.489
Chicago_5yr4hr	0:35	4.934
Chicago_5yr4hr	0:40	5.504
Chicago_5yr4hr	0:45	6.268
Chicago_5yr4hr	0:50	7.356
Chicago_5yr4hr	0:55	9.064
Chicago_5yr4hr	1:00	12.265
Chicago_5yr4hr	1:05	21.818
Chicago_5yr4hr	1:10	143.764
Chicago_5yr4hr	1:15	32.694
Chicago_5yr4hr	1:20	20.578
Chicago_5yr4hr	1:25	15.594
Chicago_5yr4hr	1:30	12.808
Chicago_5yr4hr	1:35	10.992
Chicago_5yr4hr	1:40	9.698
Chicago_5yr4hr	1:45	8.723
Chicago_5yr4hr	1:50	7.957
Chicago_5yr4hr	1:55	7.336
Chicago_5yr4hr	2:00	6.822
Chicago_5yr4hr	2:05	6.388
Chicago_5yr4hr	2:10	6.015
Chicago_5yr4hr	2:15	5.691
Chicago_5yr4hr	2:20	5.407
Chicago_5yr4hr	2:25	5.155
Chicago_5yr4hr	2:30	4.93
Chicago_5yr4hr	2:35	4.727
Chicago_5yr4hr	2:40	4.544
Chicago_5yr4hr	2:45	4.377
Chicago_5yr4hr	2:50	4.224
Chicago_5yr4hr	2:55	4.084

```
Chicago_5yr4hr              3:00       3.954
Chicago_5yr4hr              3:05       3.834
Chicago_5yr4hr              3:10       3.723
Chicago_5yr4hr              3:15       3.619
Chicago_5yr4hr              3:20       3.522
Chicago_5yr4hr              3:25       3.431
Chicago_5yr4hr              3:30       3.345
Chicago_5yr4hr              3:35       3.265
Chicago_5yr4hr              3:40       3.189
Chicago_5yr4hr              3:45       3.117
Chicago_5yr4hr              3:50       3.049
Chicago_5yr4hr              3:55       2.985
Chicago_5yr4hr              4:00       0

 REPORT
  Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

 TAGS

 MAP
DIMENSIONS       394895.55185     5513108.81825    396150.96315     5514452.59475
UNITS            Meters

 COORDINATES
  Node           X-Coord            Y-Coord
  -------------- ------------------ ------------------
J1               395781.885         5513556.779
J2               395915.201         5513559.565
OF1              395208.833         5513453.191
East_Pond        395930.669         5513614.203
SU-2Post         395317.166         5513485.043
West_Pond        395730.066         5513550.567

 VERTICES
  Link           X-Coord            Y-Coord
  -------------- ------------------ ------------------
```

P1	395573.954	5513546.571
P1	395393.224	5513512.538

POLYGONS

Subcatchment	X-Coord	Y-Coord
S1	395599.522	5514372.505
S1	395871.684	5514295.036
S1	395978.715	5514202.276
S1	396093.899	5514197.18
S1	396085.99	5513785.849
S1	395782.22	5513791.586
S1	395654.774	5513795.337
S1	395652.197	5513810.585
S1	395632.025	5513834.614
S1	395603.103	5513931.946
S1	395597.648	5514061.498
S1	395581.284	5514141.957
S1	395603.103	5514211.505
S1	395579.92	5514339.694
S1	395599.522	5514372.505
S10	395776.259	5513525.777
S10	395645.704	5513528.397
S10	395646.693	5513556.649
S10	395776.974	5513553.34
S10	395776.259	5513525.777
S11	395772.714	5513419.022
S11	395672.936	5513422.676
S11	395652.187	5513401.927
S11	395644.081	5513422.982
S11	395644.04	5513484.421
S11	395645.704	5513528.397
S11	395776.259	5513525.777
S11	395772.714	5513419.022
S12	395782.22	5513791.577
S12	395893.808	5513789.045
S12	395891.483	5513720.142
S12	395809.599	5513721.986
S12	395781.993	5513705.422
S12	395782.22	5513791.577
S13	395797.283	5513418.206

S13	396074.493	5513408.976
S13	396068.278	5513169.899
S13	395791.35	5513197.647
S13	395791.596	5513206.485
S13	395791.764	5513212.553
S13	395791.972	5513220.022
S13	395797.283	5513418.206
S14	396080.747	5513602.091
S14	396080.747	5513581.119
S14	395914.84	5513586.108
S14	395916.271	5513623.17
S14	396081.141	5513617.59
S14	396080.747	5513602.091
S15	395893.808	5513789.036
S15	396015.946	5513786.847
S15	396085.99	5513785.84
S15	396083.197	5513715.053
S15	395891.453	5513720.143
S15	395893.808	5513789.036
S2	395604.451	5514212.918
S2	395584.294	5514142.685
S2	395601.651	5514053.732
S2	395599.481	5513934.406
S2	395632.025	5513834.605
S2	395652.197	5513810.576
S2	395669.905	5513705.741
S2	395667.505	5513595.866
S2	395646.586	5513551.692
S2	395640.488	5513550.335
S2	395245.84	5513462.523
S2	395248.54	5513772.393
S2	395196.719	5513807.849
S2	395196.719	5513923.764
S2	395195.355	5514152.866
S2	395161.263	5514171.958
S2	394963.526	5514180.14
S2	394952.616	5514238.78
S2	395067.167	5514335.603
S2	395061.712	5514380.605
S2	395129.898	5514391.514
S2	395354.909	5514384.696

S2	395414.912	5514300.146
S2	395579.92	5514342.421
S2	395604.451	5514212.918
S3	395756.815	5513792.433
S3	395782.22	5513791.586
S3	395782.444	5513725.111
S3	395782.444	5513717.376
S3	395781.742	5513706.677
S3	395776.974	5513553.34
S3	395646.693	5513556.658
S3	395667.505	5513595.857
S3	395669.905	5513705.732
S3	395669.043	5513705.309
S3	395654.774	5513795.328
S3	395733.797	5513793.2
S3	395756.815	5513792.433
S4	395797.283	5513418.206
S4	395797.483	5513418.199
S4	395791.35	5513197.647
S4	395645.634	5513212.999
S4	395646.18	5513247.945
S4	395659.285	5513269.787
S4	395648.91	5513280.707
S4	395652.187	5513401.927
S4	395672.936	5513422.676
S4	395797.283	5513418.206
S5	395646.586	5513551.692
S5	395644.04	5513484.421
S5	395644.081	5513422.982
S5	395653.279	5513402.473
S5	395652.187	5513401.927
S5	395646.726	5513282.892
S5	395658.739	5513268.695
S5	395646.726	5513250.676
S5	395645.088	5513212.453
S5	395263.025	5513223.877
S5	395258.138	5513259.06
S5	395244.456	5513288.378
S5	395245.84	5513462.523
S5	395646.586	5513551.692
S6	395866.153	5513720.721

S6	395865.064	5513552.053
S6	395867.352	5513552.011
S6	395848.759	5513552.284
S6	395818.512	5513552.729
S6	395776.974	5513553.34
S6	395781.993	5513705.422
S6	395809.599	5513721.986
S6	395866.153	5513720.721
S7	396083.197	5513715.053
S7	396081.141	5513617.59
S7	395916.271	5513623.17
S7	395913.497	5513551.332
S7	395865.065	5513552.062
S7	395865.339	5513594.539
S7	395866.153	5513720.73
S7	396083.197	5513715.053
S8	396074.493	5513408.976
S8	395910.745	5513414.438
S8	395913.497	5513551.332
S8	395914.84	5513586.108
S8	396080.747	5513581.119
S8	396074.493	5513408.976
S9	395913.497	5513551.332
S9	395910.745	5513414.438
S9	395772.714	5513419.022
S9	395776.974	5513553.34
S9	395913.497	5513551.332

Storage Node	X-Coord	Y-Coord

SYMBOLS

Gage	X-Coord	Y-Coord

APPENDIX E

Property Ownership

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0020 647 658	899AA;7;1,2	26D73B .

LEGAL DESCRIPTION
PLAN 899AA
BLOCK 7
LOTS 1 AND 2
EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE
ATS REFERENCE: 4;19;9;25;E

MUNICIPALITY: LETHBRIDGE COUNTY

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
26D73B .	20/04/1921			NOT EST-557DA

OWNERS

HER MAJESTY THE QUEEN IN RIGHT OF ALBERTA
OF C/O THE MINISTER OF SUSTAINABLE RESOURCE DEVELOPMENT
9915-108 STREET
EDMONTON
ALBERTA T5K 2C9
(DATA UPDATED BY: CHANGE OF ADDRESS 091061650)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS

NO REGISTRATIONS

TOTAL INSTRUMENTS: 000

(CONTINUED)

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 6 DAY OF SEPTEMBER, 2023 AT 03:39 P.M.

ORDER NUMBER: 48267274

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0020 647 640	899AA;6;31,32	77Z95 .

LEGAL DESCRIPTION
PLAN 899AA
BLOCK 6
LOTS 31 AND 32
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE
ATS REFERENCE: 4;19;9;25;E

MUNICIPALITY: LETHBRIDGE COUNTY

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
77Z95 .	10/04/1948			TAX FOR-7883EX

OWNERS

HER MAJESTY THE QUEEN IN RIGHT OF ALBERTA
AS REPRESENTED BY MINISTER OF MUNICIPAL AFFAIRS
OF 9925-107 ST
EDMONTON
ALBERTA

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS

NO REGISTRATIONS

TOTAL INSTRUMENTS: 000

(CONTINUED)

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 6 DAY OF SEPTEMBER, 2023 AT 03:39 P.M.

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LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0020 786 380	899AA;A,B,E	181 100 853

LEGAL DESCRIPTION

PLAN 899AA
BLOCK "A", "B" AND "E"
EXCEPTING THEREOUT:

PLAN	BLOCK	NUMBER	HECTARES	ACRES MORE OR LESS
ROAD WIDENING	"B"	8010974	0.124	0.31
ROAD WIDENING	"E"	8010974	0.071	0.17

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ATS REFERENCE: 4;19;9;25;E
ESTATE: FEE SIMPLE

MUNICIPALITY: LETHBRIDGE COUNTY

REFERENCE NUMBER: 171 065 962

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
181 100 853	16/05/2018	TRANSFER OF LAND	$380,000	$380,000

OWNERS

PETER KLASSEN

AND
MARIA KLASSEN
BOTH OF:
BOX 99
PURPLE SPRINGS
ALBERTA T0K 1X0
AS JOINT TENANTS

(CONTINUED)

REGISTRATION
NUMBER DATE (D/M/Y) PARTICULARS

191 171 630 23/08/2019 MORTGAGE
MORTGAGEE - FARM CREDIT CANADA.
2ND FLOOR, 12040-149 ST NW
EDMONTON
ALBERTA
ORIGINAL PRINCIPAL AMOUNT: $500,000

TOTAL INSTRUMENTS: 001

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 6 DAY OF SEPTEMBER, 2023 AT 03:39 P.M.

ORDER NUMBER: 48267274

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END OF CERTIFICATE

APPENDIX F

Stormwater Drainage Concept

NE¼ Sec.25
9–19–W4M

NE¼ Sec.25
9–19–W4M

NW¼ Sec.30
9–18–W4M

SW¼ Sec.30
9–18–W4M

LOT 4
8,320.4 m²
2.06 ACRES

LOT 5
8,393.2 m²
2.07 ACRES

LOT 6
8,534.7 m²
2.11 ACRES

LOT 7
8,552.2 m²
2.11 ACRES

LOT 3
8,198.2 m²
2.03 ACRES

LOT 10
8,203.2 m²
2.03 ACRES

LOT 9
8,093.7 m²
2.00 ACRES

LOT 8
8,093.7 m²
2.00 ACRES

HIGHWATER
ELEV=845.68

LOT 2
8,186.2 m²
2.02 ACRES

EAST POND
5,834.9 m²
1.44 ACRES

PUMPED DISCHARGE TO
EXISTING DRAINAGE
COURSE

STORM
LIFT STATION

150mm FORCEMAIN

LOT 11
8,419.6 m²
2.08 ACRES

300mm STORM PIPE

EMERGENCY OVERFLOW
ELEV=845.68

WEST POND
4,087.3 m²
1.01 ACRES

450mm
STORM PIPE

EMERGENCY OVERFLOW
ELEV=845.78

LOT 12
9,560.3 m²
2.36 ACRES

15,363.7 m²
3.80 ACRES

REMAINDER OF LOT 1
12,215.3 m²
3.02 ACRES

LOT 13
10,279.4m²
2.54 ACRES

7,255.6 m²
1.79 ACRES

Alberta Ave.

Alberta Ave.

Range Road 190

Lot 1
Block 1
Plan 991 2521

Wilson St.

Naismith St.

Nanton St.

Osler St.

7 2 1

31 6 32

23 24 25 26 27

22 21 20 19

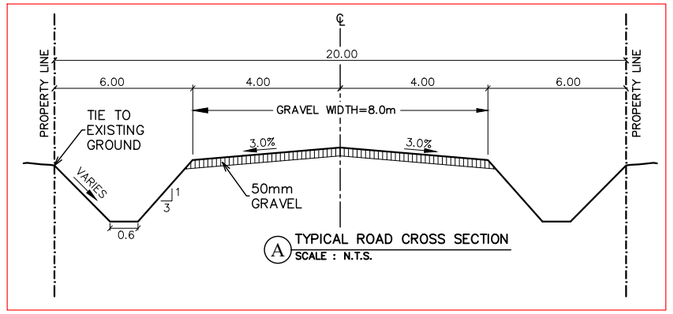
24 25 26 27

25 26 27 28

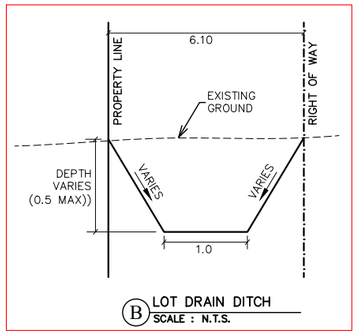
36 37 39

LEGEND:

- DEVELOPMENT / PHASE BOUNDARY
- EX POWER POLE
- GAS — EX. GAS LINE
- O/H — EX. OVERHEAD ELECTRICAL LINE
- EX. GRAVEL
- EX. ASPHALT
- EX CULVERT
- EX BUILDING / STRUCTURE
- PROPOSED STORM PIPE
- PROPOSED DRAINAGE DITCH
- PROPOSED GRAVEL ROAD
- PROPOSED CULVERT



A TYPICAL ROAD CROSS SECTION
SCALE : N.T.S.



B LOT DRAIN DITCH
SCALE : N.T.S.

Chin Town Expansion

STORMWATER MANAGEMENT

Mar 25, 2024

STORMWATER DRAINAGE CONCEPT

Figure 6

240761CE

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