

# Technical Document RA23016

## Part 2 — Technical Requirements



Application under the Agricultural Operation Practices Act for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

NRCB USE ONLY			Application number	Legal land description
<input checked="" type="checkbox"/> Approval	<input type="checkbox"/> Registration	<input type="checkbox"/> Authorization	RA23016	NE6-47-9W4M
<input type="checkbox"/> Amendment				Sec. 6-47-9 W4M

### APPLICATION DISCLOSURE

This information is collected under the authority of the Agricultural Operation Practices Act (AOPA), and is subject to the provisions of the Freedom of Information and Protection of Privacy Act. This information is public unless the NRCB grants a written request that certain sections remain private.

**Any construction prior to obtaining an NRCB permit is an offence and is subject to enforcement action, including prosecution.**

I, the applicant, or applicant's agent, have read and understand the statements above, and I acknowledge that the information provided in this application is true to the best of my knowledge.

Oct 27/23  
Date of signing  
Hutterian Brethren Church of Holt  
Corporate name (if applicable)

[Redacted]  
Signature  
Joke L Tschetter  
Print name

### GENERAL INFORMATION REQUIREMENTS

**Proposed facilities:** list all proposed confined feeding operation facilities and their dimensions. Indicate whether any of the proposed facilities are additions to existing facilities. (attach additional pages if needed)

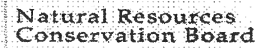
Proposed facilities	Dimensions (m) (length, width, and depth)
New Construction of Feed. Yard (Feedlot) To Replace existing Feedyard (Relocate)	244 X 92
Catch Basin	50 X 50 X 2

**Existing facilities:** list ALL existing confined feeding operation facilities and their dimensions

Existing facilities	Dimensions (m) (length, width, and depth)	NRCB USE ONLY
Feedyard	900ft X 150ft	To be decommissioned
Hog Barn 180 X 300	54.9 X 91.4 m.	Verified
Cell #1 Lagoon	68.6 X 54.9 m X 3	Verified

NRCB USE ONLY

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[illegible]



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If a new facility is replacing an old facility, please explain what will happen to the old facility and when. ☐ N/A

Plans are to dismantle old facility and reclaim site.

Construction completion date for proposed facilities 2025

### Additional information

**Livestock numbers:** Complete only if livestock numbers are different from what was identified in the Part 1 application. Note: if livestock numbers increase in your Part 2 application, a new Part 1 application must be submitted which may result in a loss of priority for minimum distance separation (MDS).

Livestock category and type (Available in the Schedule 2 of the Part 2 Matters Regulation)	Permitted number	Proposed increase or decrease in number (if applicable)	Total
AO Note: The applicant provided the following livestock numbers in their Part 1 application.			
Beef Finishers	600	900	1500
Milking cows	130	0	130
Sows farrow to finish	400	0	400
Layers	5000	0	5000
Broilers	9275	0	9275
Turkeys	1300	0	1300
Ducks	1200	0	1200
Geese	300	0	300

Last updated February 26, 2021

## Part 2 – Technical Requirements



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### DECLARATION AND ACKNOWLEDGMENT OF APPLICANT CONCERNING WATER ACT LICENCE

issued by Alberta Environment and Parks (AEP) for a confined feeding operation (CFO)

Date and sign one of the following four options

#### **OPTION 1: Applying through the NRCB for both the AOPA permit and the Water Act licence**

I **DO** want my water licence application coupled to my AOPA permit application.

Signed this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Signature of Applicant or Agent

#### **OPTION 2: Processing the AOPA permit and Water Act licence separately**

1. I (we) acknowledge that the CFO will need a new water licence from AEP under the *Water Act* for the development or activity proposed in this AOPA application.
2. I (we) request that the NRCB process the AOPA application **independently** of AEP's processing of the CFO's application for a water licence.
3. In making this request, I (we) recognize that, if this AOPA application is granted by the NRCB, the NRCB's decision will not be considered by AEP as improving or enhancing the CFO's eligibility for a water licence under the *Water Act*.
4. I (we) acknowledge that any construction or actions to populate the CFO with livestock pursuant to an AOPA permit in the absence of a *Water Act* licence will **not** be relevant to AEP's consideration of whether to grant the *Water Act* licence application.
5. I (we) acknowledge that any such construction or livestock populating will be at the CFO's sole risk if the *Water Act* licence application is denied or if the operation of the CFO is otherwise deemed to be in violation of the *Water Act*. This risk includes being required to depopulate the CFO and/or to cease further construction, or to remove "works" or "undertakings" (as defined in the *Water Act*).
6. **AS RELEVANT:** I (we) acknowledge that the CFO is located in the South Saskatchewan River Basin and that, pursuant to the *Bow, Oldman and South Saskatchewan River Basin Water Allocation Order* [Alta. Reg. 171/2007], this basin is currently closed to new surface water allocations.

Signed this 23 day of June, 2023.

\_\_\_\_\_  
Signature of Applicant or Agent

#### **OPTION 3: Additional water licence not required**

1. I (we) declare that the CFO will not need a new licence from AEP under the *Water Act* for the development or activity proposed in this AOPA application.

Signed this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Signature of Applicant or Agent

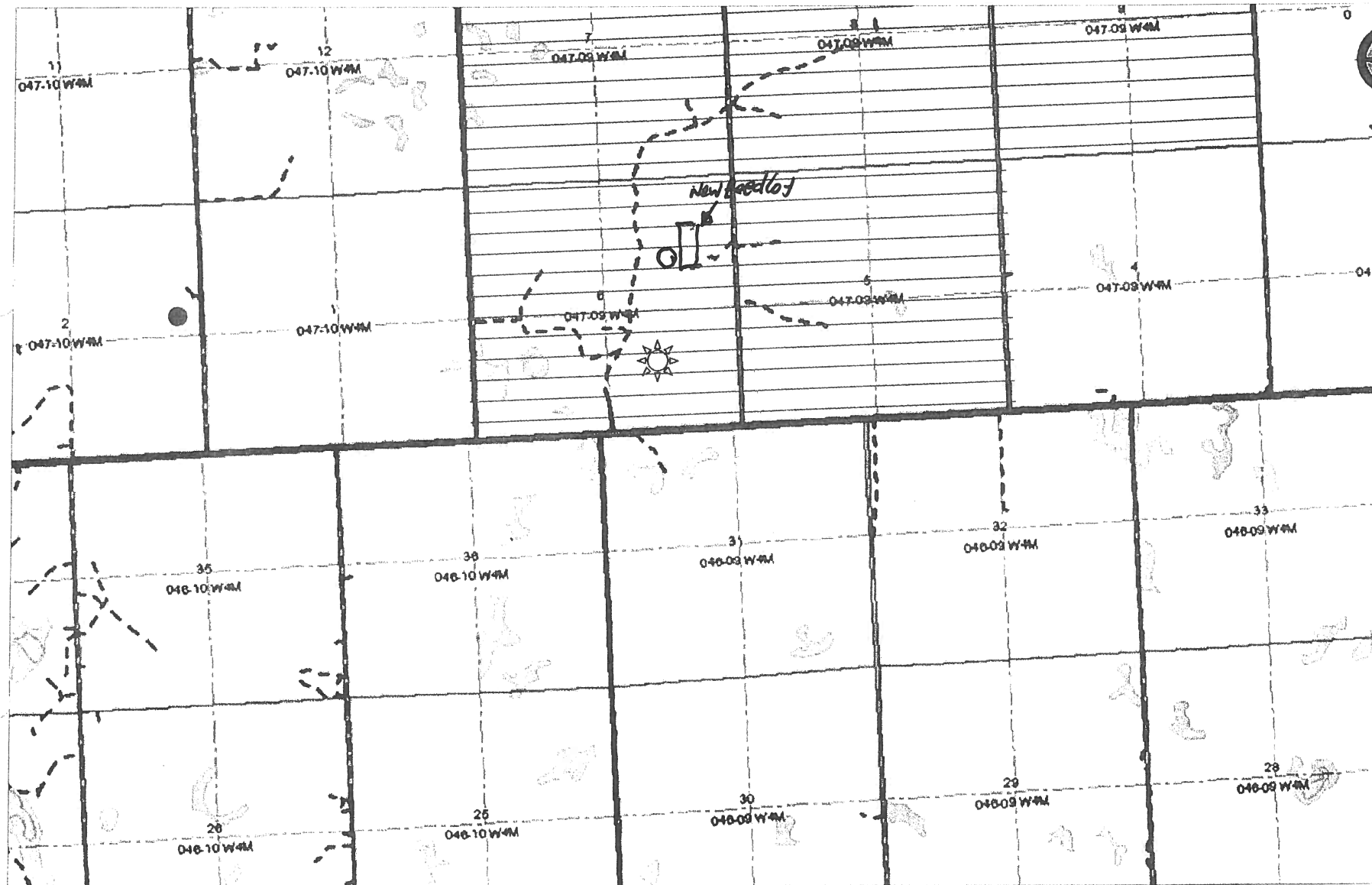
#### **OPTION 4: Uncertain if Water Act licence is needed; acknowledgement of risk (for existing CFOs only)**

1. At this time, I (we) do not know whether a new water licence is needed from AEP under the *Water Act* for the development or activity proposed in this AOPA application.
2. If a new *Water Act* licence is needed, I (we) request that the NRCB process the AOPA application **independently** of AEP's processing of the CFO's application for a water licence.
3. In making this request, I (we) recognize that, if this AOPA application is granted by the NRCB, the NRCB's decision will not be considered by AEP as improving or enhancing the CFO's eligibility for a water licence under the *Water Act*.
4. I (we) acknowledge that any construction or actions to populate the CFO with additional livestock pursuant to an AOPA permit in the absence of a *Water Act* licence will **not** be relevant to AEP's consideration of whether to grant my *Water Act* licence application, if a new water licence is needed.
5. I (we) acknowledge that any such construction or livestock increase will be at the CFO's sole risk if the *Water Act* licence application is denied or if the operation of the CFO is otherwise deemed to be in violation of the *Water Act*. This risk includes being required to depopulate the CFO and/or to cease further construction, or to remove "works" or "undertakings" (as defined in the *Water Act*).
6. **AS RELEVANT:** I (we) acknowledge that the CFO is located in the South Saskatchewan River Basin and that, pursuant to the *Bow, Oldman and South Saskatchewan River Basin Water Allocation Order* [Alta. Reg. 171/2007], this basin is currently closed to new surface water allocations.

Signed this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Signature of Applicant or Agent

# Area Plan for Proposed Expansion located at SE-6-47-9-w4



## Legend

Proposed development



Residence

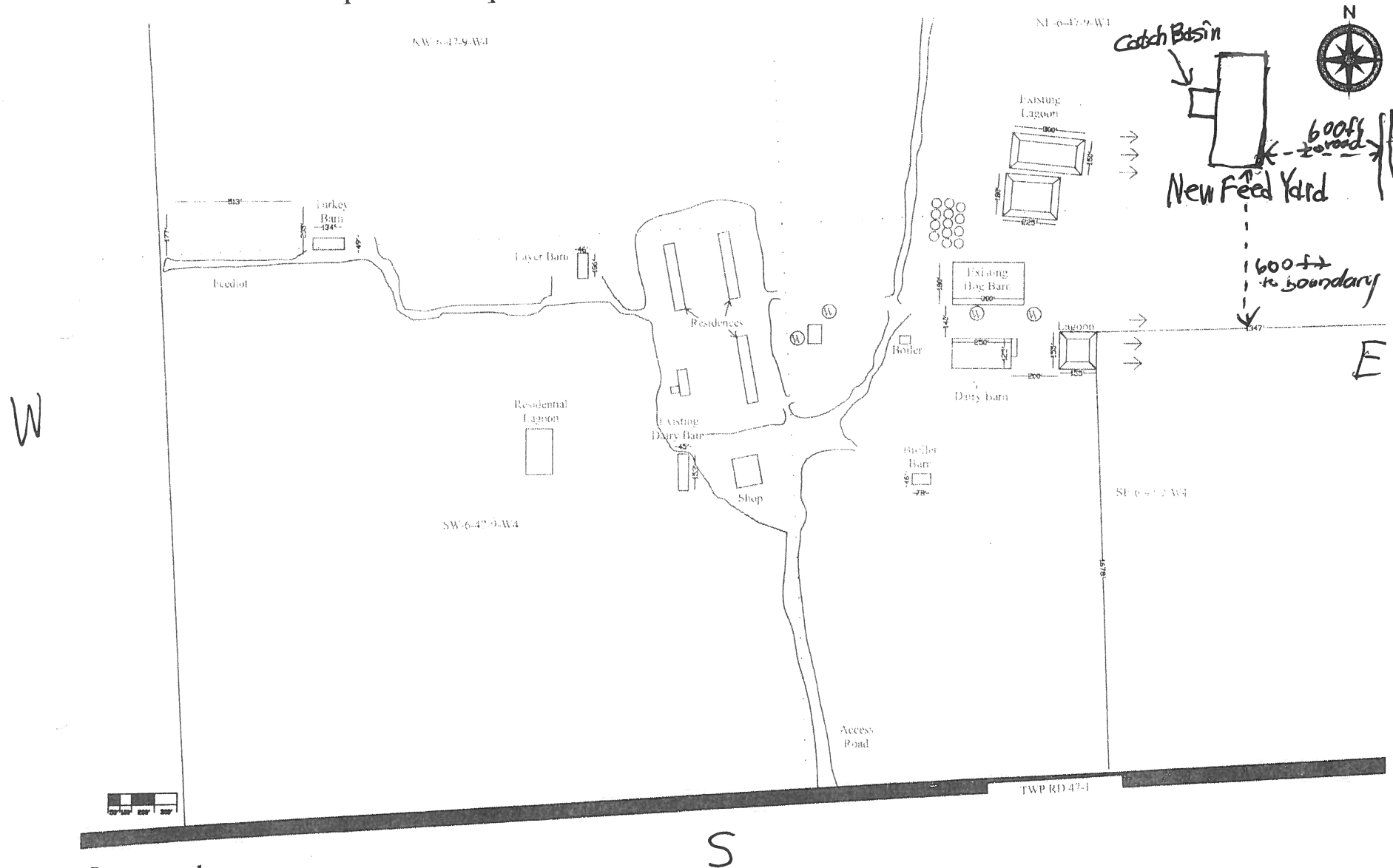
NE-2-47-10-W4 (Herbert Smith)



Manure Spreading land



# Site Plan for Proposed Expansion located at SE-6-47-9-W4



## Legend

Water Well



General Run off  
direction









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### GENERAL ENVIRONMENTAL INFORMATION

(complete this section for the worst case of the existing facility which is the closest to water bodies or water wells and for each of the proposed facilities)

Facility description / name (as indicated on site plan)

Existing: Dairy Barn

Proposed 1: Feed Yard

Proposed 2: Catch Basin

Proposed 3: \_\_\_\_\_

Facility and environmental risk information		Facilities				NRCB USE ONLY	
		Existing	Proposed 1	Proposed 2	Proposed 3	Meets requirements	Comments
Flood plain information	What is the elevation of the floor of the lowest manure storage or collection facility above the 1:25 year flood plain or the highest known flood level?	<input checked="" type="checkbox"/> >1 m <input type="checkbox"/> ≤ 1 m	<input checked="" type="checkbox"/> >1 m <input type="checkbox"/> ≤ 1 m	<input checked="" type="checkbox"/> >1 m <input type="checkbox"/> ≤ 1 m	<input type="checkbox"/> > 1 m <input type="checkbox"/> ≤ 1 m	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES with exemption	>1 m above floodplain
	How many springs are within 100 m of the manure storage facility or manure collection area?	0	0	0		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES with exemption	No springs noticed during site visits
Surface water information	How many water wells are within 100 m of the manure storage facility or manure collection area?	2	0	0		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES with exemption	No WWs located w/in 100m of the proposed feedlot pens
	What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)	1000 M	1000 M	1000 M		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES with exemption	>1000 m
Groundwater information	What is the depth to the water table?		More than 2 M	More than 2 M		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES with exemption	Water table >3 m
	What is the depth to the groundwater resource/aquifer you draw water from?	33 M	33 M	33 M		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES with exemption	UGR identified at 18.6 m in WW ID# 247685

Additional information (attach supporting information, e.g. borehole logs, records, etc. you consider relevant to your application)



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### NRCB USE ONLY

### ENVIRONMENTAL RISK SCREENING INFORMATION

ERST for proposed facilities

Facility	Groundwater score	Surface water score	File number
Feedlot pens	Low	Low	RA23016
Catch basin	Low	Low	RA23016

ERST for existing facilities

Facility	Groundwater score	Surface water score	File number
Hog lagoons	Low	Low	RA23016
dairy lagoon	Low	Low	RA23016
Hog barns	Low	Low	RA23016
Dairy Barn	Low	Low	RA23016

ERST related comments:

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Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

### NRCB USE ONLY

#### WATER WELL AND SURFACE WATER INFORMATION

Well IDs: 262106, 288830, 2907963, 2907963 and No. 7 (no log)

Surface water related concerns from directly affected parties or referral agencies: ☐ YES ☒ NO

Groundwater related concerns from directly affected parties or referral agencies: ☐ YES ☒ NO

**Water wells** ☒ N/A

If applicable, exemption for 100 m distance requirements applied: ☐ YES ☐ NO Condition required: ☐ YES ☐ NO

**Surface water** ☒ N/A

If applicable, exemption for 30 m distance requirements applied: ☐ YES ☐ NO Condition required: ☐ YES ☐ NO

**Water Well Exemption Screening Tool** ☒ N/A

Water Well ID	Preliminary Screening Score	Secondary Screening Score	Facility

Groundwater or surface water related comments:



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### DISTANCE OF ANY MANURE STORAGE FACILITY (EXISTING OR PROPOSED) TO NEIGHBOURING RESIDENCES

Neighbour name(s)	Legal land description	Distance (m)	NRCB USE ONLY			
			Zoning (LUR) category	MDS category (1-4)	Distance (m)	Meets regulations
Herbert Smith	NE 2 47 10 W of 4th	1600 m	Agriculture	1	1,700	Yes

### LAND BASE FOR MANURE AND COMPOST APPLICATION (complete only if an increase in livestock or manure production will occur)

Name of land owner(s)*	Legal land description	Usable area** (ha)	Soil zone ***	NRCB USE ONLY	
				Usable area (ha)	Agreement attached (if required)
Holt Colony	A11 6 47 9 W 4	590	Black		
"	A11 7 47 9 W 4	610	"		
"	A11 5 47 9 W 4	620	"		
"	A11 8 47 9 W 4	624	"		
"	A11 9 47 9 W 4	615	"		
Total				3,059 acres	

\* If you are **not** the registered landowner, you must attach copies of land use agreements signed by all landowners.

\*\* Available manure spreading area (excluding setback areas from residences, common bodies of water, water wells, etc. as identified in Agdex 096-5 Manure Spreading Regulations)

\*\*\* Brown, dark brown, black, grey wooded, or irrigated

**Additional information (attach any additional information as required)**

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### NRCB USE ONLY

#### MINIMUM DISTANCE SEPARATION

Methods used to determine distance (if applicable): Aerial photos

Margin of error (if applicable): \_\_\_\_\_

Requirements (m): Category 1: 723 Category 2: 964 Category 3: 1,206 Category 4: 1,929

Technology factor: ☐ YES ☒ NO

Expansion factor: ☐ YES ☒ NO

MDS related concerns from directly affected parties or referral agencies: ☐ YES ☒ NO

#### LAND BASE FOR MANURE AND COMPOST APPLICATION

Land base required: 453 Hectares

Land base listed: 1,239 hectares

Area not suitable: Excess land base provided

Available area 1,239 hectares

Requirement met: ☒ YES ☐ NO

Land spreading agreements required: ☐ YES ☒ NO

Manure management plan: ☐ YES ☒ NO

If yes, plan is attached: ☐

#### PLANS

Submitted and attached construction plans: ☒ YES ☐ NO

Submitted aerial photos: ☒ YES ☐ NO

Submitted photos: ☐ YES ☒ NO

#### GRANDFATHERING

Already completed: ☒ YES ☐ NO ☐ N/A

If already completed, see Approval RA08046



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### NRCB USE ONLY

#### ALL SIGNATURES IN FILE

☒ YES ☐ NO

#### DATES OF APPROVAL OFFICER SITE VISITS

October 27, 2023	
February 16, 2024	

#### CORRESPONDENCE WITH MUNICIPALITIES AND REFERRAL AGENCIES

Date deeming letters sent: January 5, 2024

**Municipality:** MD of Wainwright

☒ letter sent ☒ response received ☒ written/email ☐ verbal ☐ no comments received

**Alberta Health Services:**

☒ letter sent ☒ response received ☒ written/email ☐ verbal ☐ no comments received

**Alberta Environment and Parks:** ☐ N/A

☒ letter sent ☒ response received ☒ written/email ☐ verbal ☐ no comments received

**Alberta Transportation:** ☒ N/A

☐ letter sent ☐ response received ☐ written/email ☐ verbal ☐ no comments received

**Alberta Regulatory Services:** ☒ N/A

☐ letter sent ☐ response received ☐ written/email ☐ verbal ☐ no comments received

**Other:** Pine Cliff Energy ☐ N/A

☒ letter sent ☒ response received ☒ written/email ☐ verbal ☐ no comments received

**Other:** Atco Gas and Pipelines ☐ N/A

☒ letter sent ☐ response received ☐ written/email ☐ verbal ☒ no comments received

## Part 2 — Technical Requirements

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### SOLID MANURE, COMPOST, & COMPOSTING MATERIALS: Barns, feedlots, & storage facilities - Concrete liner

(complete a copy of this section for **EACH** barn, feedlot, and storage facility for solid manure, composting materials, or compost with a concrete liner)

Facility description / name (as indicated on site plan) 1. Feed Yard (Feedlot)  
2. \_\_\_\_\_

#### Manure storage capacity

	Length (m)	Width (m)	Depth below grade to the bottom of the liner (m)	<b>NRCB USE ONLY</b> Estimated storage capacity (m <sup>3</sup> )
1.	244	92	0	9 months
2.				
TOTAL CAPACITY				

☒ I plan to use a short-term solid manure storage (STMS) as part of my manure storage and handling plan for this CFO. The AOPA requirements for STMS are set out in the NRCB Short-Term Solid Manure Storage Requirements Fact Sheet.

#### Surface water control systems

Describe the run-on and runoff control system

Build catch basin

#### Liner protection

Describe how the physical integrity of the liner will be maintained

Inspect for cracks everytime we clean manure

#### **NRCB USE ONLY**

Requirements met: ☒ YES ☐ NO



## Part 2 — Technical Requirements

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### SOLID MANURE, COMPOST, & COMPOSTING MATERIALS: Barns, feedlots, & storage facilities - Concrete liner (cont.)

#### Concrete liner details

Concrete thickness <b>6 inches</b>	Method of sulphate protection: <b>Type 50</b>
Concrete strength <b>25 MPA</b>	Concrete reinforcement size and spacing <b>18 inches on centre</b>

Concrete requirements can be found in Technical Guideline Agdex 096-93

Guideline minimums:

Solid manure: 25MPa (D)

Solid manure (wet): 30MPa (C)

Method of sulphate protection:

Type 50 or Type 10 with fly ash or equivalent

#### NRCB USE ONLY

Requirements met: ☒ YES ☐ NO

Condition required: ☒ YES ☐ NO

Report attached: ☐ YES ☒ NO

#### Additional information (attach as required)

#### NRCB USE ONLY

Nine month manure storage volume requirements met ☐ YES ☒ YES With STMS ☐ NO

Depth to water table: >3 m Requirements met: ☒ YES ☐ NO

Depth to Uppermost groundwater resource: 18.6 m Requirements met: ☒ YES ☐ NO

ERST completed: ☒ see ERST page for details

#### Surface water control systems

Requirements met: ☒ YES ☐ NO Details/comments:

#### Concrete liner details

A condition will be included in the approval requiring the permit holder to provide written proof that the constructed concrete liner meets Technical Guideline Agdex 096-93 - Non Engineered Concrete Liners for Manure Collection and Storage Areas

Leakage detection system required: ☐ YES ☒ NO If yes, please explain why.

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### RUNOFF CONTROL CATCH BASIN: Naturally occurring protective layer

(complete a copy of this section for **EACH proposed** runoff control catch basin with a naturally occurring protective layer)

Facility description / name (as indicated on site plan)

1. Catch Basin
2. \_\_\_\_\_
3. \_\_\_\_\_

#### Determination of runoff area

Provide a plan and show how you calculated the area contributing to runoff for each catch basin

See catch basin calculator attached

#### Catch basin capacity

	Length (m)	Width (m)	Total depth (m)	Depth below ground level (m)	Slope run:rise			NRCB USE ONLY Calculated storage capacity (excl. 0.5 m freeboard) (m <sup>3</sup> )
					Inside end walls	Inside side walls	Outside walls	
1.	<u>50</u>	<u>50</u>	<u>2</u>	<u>2</u>	<u>3-1</u>	<u>3-1</u>	<u>4-1</u>	2,720
2.								
3.								
TOTAL CAPACITY								2,720

#### Naturally occurring protective layer details

Thickness of naturally occurring protective layer	<u>1.57</u> (m)	Provide details (as required)	
Soil texture	<u>34.7</u> % sand	<u>26.0</u> % silt	<u>38.8</u> % clay
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested <u>3.05m clay</u>	Hydraulic conductivity (cm/s) <u>3.13 X 10<sup>-7</sup></u>	Describe test standard used <u>Shelby tube</u>

Catch Basin – Design and management requirements can be found in Technical Guideline Agdex 096-101

If soil info differs per facility include additional soils page.

#### NRCB USE ONLY

Requirements met: ☒ YES ☐ NO  
 Condition required: ☒ YES ☐ NO  
 Report attached: ☒ YES ☐ NO



## Part 2 — Technical Requirements

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### RUNOFF CONTROL CATCH BASIN: Naturally occurring protective layer (cont.)

#### NRCB USE ONLY

Catch basin calculator. Total volume @ freeboard level: 2,720 m<sup>3</sup> Runoff capacity requirements met: ☒ YES ☐ NO

Calculation of the volume attached: ☒ YES ☐ NO

Depth to water table: \_\_\_\_\_ > 3m \_\_\_\_\_

Requirements met: ☒ YES ☐ NO

Depth to uppermost groundwater resource: 18.6 m

Requirements met: ☒ YES ☐ NO

ERST completed: ☒ See ERST page for details

Protective layer specification comments (e.g. sand lenses; layering uniform or irregular; number and location of boreholes):

Total area = (244 m x 92 m = 22,448 m<sup>2</sup>)

Catchment area runoff for paved area (Wainwright) = 1,684 m<sup>2</sup>

Leakage detection system required: ☐ YES ☒ NO

If yes, please explain.

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<b>NRCB USE ONLY</b>	
<b>RUNOFF CONTROL CATCH BASIN CAPACITY SUMMARY (if applicable)</b>	
<b>Facility 1</b>	
Name / description Catch basin	Capacity 2,720 m <sup>3</sup>
<b>Facility 2</b>	
Name / description	Capacity
<b>Facility 3</b>	
Name / description	Capacity
<b>Facility 4</b>	
Name / description	Capacity
<b>TOTAL CAPACITY</b>	2,720 m <sup>3</sup>
<b>RUNOFF VOLUME FROM CONTRIBUTING AREAS</b>	1,684 m <sup>3</sup>
<b>MEETS AOPA RUNOFF CONTROL VOLUME REQUIREMENTS</b>	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO



# Catch Basin Dimension Calculator

For more information on runoff control catch basin design consideration including liner options, catch basin protection, etc., check out the catch basin [factsheet](#).

Name

Holt Colony

Land Location

Within N.E. 1/4 of 06-47-09 W4

Estimating Runoff Potential

Area	Length (m)	Width (m)	Paved?	Area (m <sup>2</sup> )
1	244	92	YES ▾	22448.00
Total Area				22448.00

Estimation of water runoff to be collected in the catch basin:

1683.6 m<sup>3</sup>

59456 ft<sup>3</sup>

370340 Imp. Gal

Calculating Catch Basin Volume:

Construction Dimensions

Storage Dimensions

Length (m):

45

42.0

Width (m):

45

42.0

Depth (m):

2

1.5

Updated proposed size 50m x 50m x 2m deep

Evacuation Capacity:

3066 m<sup>3</sup>

108275 ft<sup>3</sup>

674427 Imp. Gal

Catch basin volume (minus freeboard):

2120 m<sup>3</sup>

74867 ft<sup>3</sup>

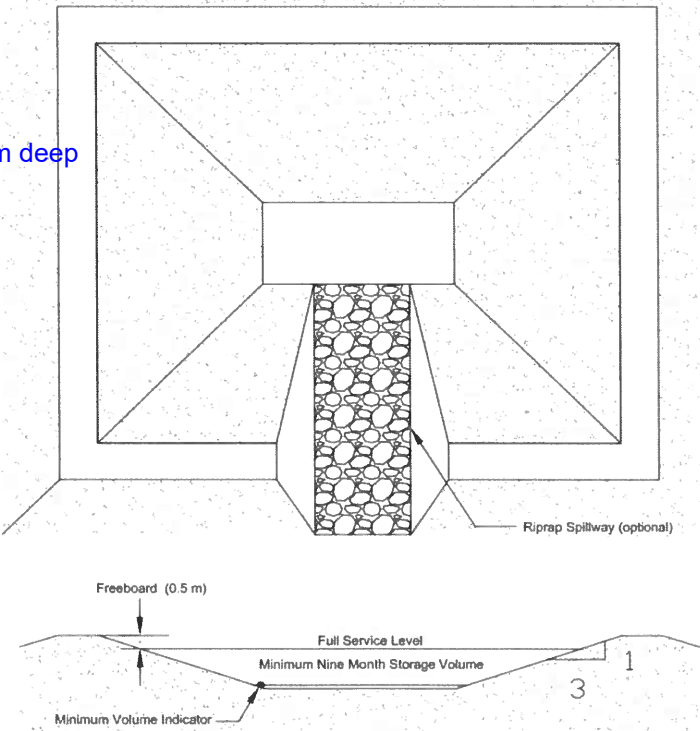
466334 Imp. Gal

Updated volume = 2,720 m<sup>3</sup>

Comparing Catch Basin Volume versus Runoff Potential:

Runoff potential: 1683.6 m<sup>3</sup>

Catch basin volume: 2120 m<sup>3</sup>



The catch basin dimensions meet the design requirements in AOPA

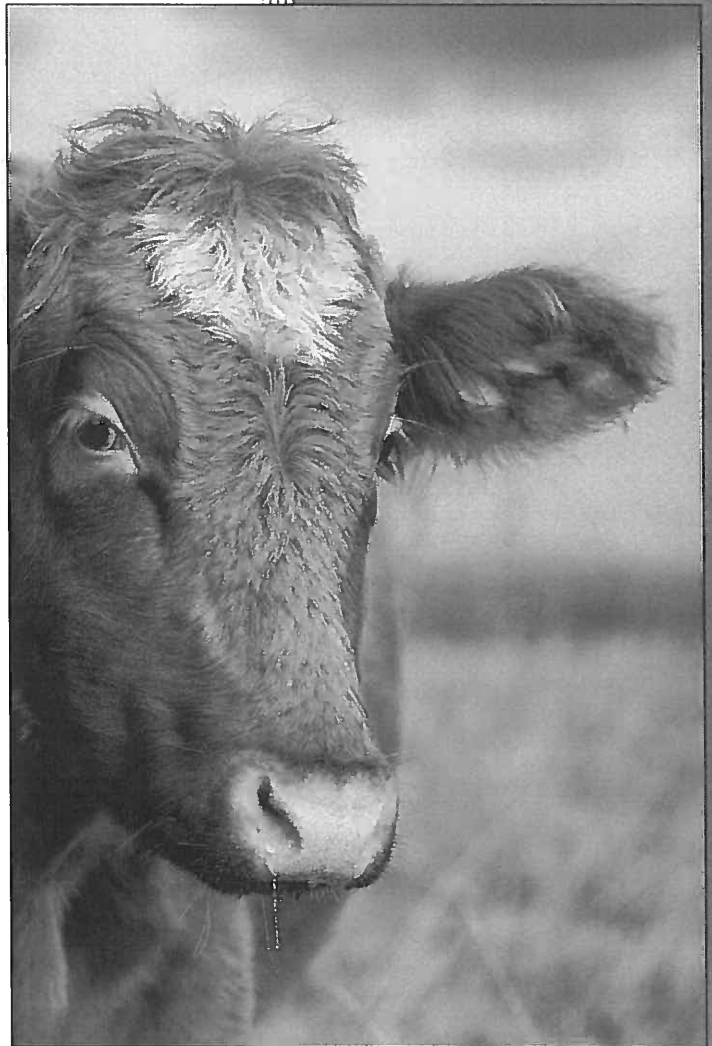
17<sup>th</sup> October, 2023

File No.: USG1728

Revision No. 1

# Geotechnical Investigation

## Holt Colony Catch Basin, Wainwright No. 61



Union Street Geotechnical Ltd.  
4726 - 78A Street Close  
Red Deer, Alberta  
T4P 2J2

Ph.: 403-350-9688  
[www.unionstreetgeo.ca](http://www.unionstreetgeo.ca)

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**ATTACHMENTS****DRAWINGS**

Drawing No. A1 - Site Location Plan

Drawing No. A2 - Borehole Location Plan

**PHOTOGRAPHS**

Photographs No. 1 & 2

**BOREHOLE LOGS**

Boreholes No. BH101 to BH103, inclusive

**LABORATORY TEST RESULTS**

Flexible Wall Permeameter, Sample No. MW10

Flexible Wall Permeameter, Sample No. MW16

**APPENDIX A**

Catch Basin Dimension Calculator Result

## **EXECUTIVE SUMMARY**

Union Street Geotechnical Ltd. performed a geotechnical investigation, on behalf of the Holt Colony, on the 7<sup>th</sup> September, 2023, within the N.E. ¼ of 06-47-09 W4 in the Municipal District of Wainwright No. 61, Alberta, for the proposed construction of a confined feedlot operation. The site, as shown on Drawing No. A1, is located approximately 13.0 km northwest of Irma.

Three boreholes were drilled across the proposed development footprint to aid in the design and construction of the proposed catch basin. The client indicated that the proposed pens, lanes, alleys, etc. would be surfaced with concrete and these areas were not investigated. The encountered stratigraphy generally consisted of, in descending order, a thin layer of topsoil, sand, and till.

Considering the type of facility proposed, the site location, the subsurface soil conditions, and the client's preferred liner system, synthetic, clay liner, and naturally occurring protective layer recommendations have been included. It is assumed, due to the relatively low permeability of the till, that a naturally occurring protective layer will be utilized.

The Scope of Work for this geotechnical investigation was outlined in Union Street Geotechnical Ltd.'s proposal, PN1795, Rev. 1, issued to the client on the 21<sup>st</sup> August, 2023.

## **LIMITATIONS**

Union Street Geotechnical Ltd. prepared this report for the exclusive use of the Holt Colony, and their agents, to aid in the proposed construction of a confined feedlot operation located within the N.E. ¼ of 06-47-09 W4 in the Municipal District of Wainwright No. 61, Alberta. The content reflect Union Street's best judgement available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third party and Union Street accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions made based on this report.

Our recommendations and conclusions are based upon the information obtained from the subsurface exploration. The borings and associated laboratory testing indicate

subsurface conditions only at the time and to the depth, of the specific boring location investigated and only for the soil properties tested. The subsurface conditions may vary between the boreholes, across the site, and over time. The interpretation of subsurface conditions provided is a professional opinion of encountered conditions and is not a certification or guarantee of site conditions. If variations, or other latent conditions become evident, Union Street should be notified immediately so that our conclusions and recommendations can be re-evaluated. Although subsurface conditions have been explored, we have not conducted investigations, sampling, field or laboratory testing, evaluations, or modelling of the site or subsurface conditions with respect to the presence of contaminated soil or groundwater or slope stability conditions.

This report contains the results of our geotechnical investigation as well as certain recommendations arising from our investigation. The recommendations herein do not constitute a design, in whole or in part, of any of the structural elements of the proposed work. Incorporation of any or all of our recommendations into the design of any such element does not constitute us as designers or co-designers of such elements, nor does it mean that such design is appropriate in geotechnical terms. The designers of such elements must consider the appropriateness of our recommendations in light of all design criteria known to them, many of which are not known by us. Our mandate has been to perform a geotechnical investigation and recommend, which we have completed by means of this report. We have had no mandate to design, or review the design of any elements of the proposed work and accept no responsibility for such design or design review.

This report has been prepared in accordance with generally accepted geotechnical engineering practice common to the local area. No other warranty, expressed or implied, is made.

This document, and the information contained within, are the confidential property of the Holt Colony and any disclosure of same is governed by the provisions of each of the applicable provincial or territorial Freedom of Information legislation, the Privacy Act (Canada) 1980-81-82-83, c.111, Sch. II "2", and the Access to Information Act (Canada) 1980-81-82-83, c.111, Sch. I "1", as such legislation may be amended or replaced from time to time.



## **1 INTRODUCTION**

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### **1.1 BACKGROUND**

Union Street Geotechnical Ltd. (Union Street) was retained by the Holt Colony to perform a field investigation, and subsequent laboratory testing on the subgrade, to aid in the design and construction of a proposed confined feedlot facility, specifically the catch basin, located within the N.E.  $\frac{1}{4}$  of 06-47-09 W4 in the Municipal District of Wainwright No. 61, Alberta, as shown on Drawing No. A1. Three boreholes were advanced in the proposed catch basin development footprint for liner design purposes. Based on the boreholes advanced, it was determined that the upper subgrade is predominantly composed of till.

### **1.2 OBJECTIVES**

The objectives of the geotechnical investigation were to:

- define the subsurface soil strata, their properties, and existing conditions;
- determine the groundwater depth;
- provide recommendations for cut/fill excavations and slopes;
- provide liner recommendations;
- identify potential geotechnical problems related to excavations and catch basin construction; and,
- provide recommendations on pertinent geotechnical issues identified during the subsurface investigation.

## **2 DESCRIPTION OF THE PROJECT AND SITE**

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### **2.1 SITE DESCRIPTION**

The site, consisting of a portion of the N.E.  $\frac{1}{4}$  of 06-47-09 W4, is located northwest of Irma, approximately 1.15 km northwest of the intersection of Township Road 470 and Range Road 95, as shown on Drawing No. A1. The approximately 1.0 ha site was vacant and undeveloped and being utilized for agricultural purposes at the time of

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drilling. Organic growth was observed across the site, covering a majority of the surface. The site appeared to be relatively level with no obvious drainage, but Borehole BH101 (highest elevation) was visually approximately 1.0 m higher than the elevation of Borehole BH103 (lowest elevation).

The site was bordered by agricultural land on all four sides with the Holt Colony (middle of colony) located approximately 850 m to the southwest and Range Road 95 located approximately 275 m to the east. Photographs depicting the site at the time of drilling are appended to this report.

## **2.2 PROPOSED DEVELOPMENT**

The proposed development consists of a confined feedlot operation containing pens, alleyways, lanes, catch basin, and associated infrastructure typical to a project of this type. It is understood that the pens, lanes, and alleyways will be concrete surfaced and geotechnical recommendations were not requested relative to those portions of the development. Specific development details are unknown at the time of this report writing but are assumed to be typical to those in the area and for developments of this nature.

Recommendations contained in this report have been given for catch basin portion of the above-described development and those typical of a development of this nature. If there are any changes to the proposed development, or its locations, these changes should be reviewed by Union Street personnel to confirm the applicability of this report to the revised development plans.

## **3 FIELD INVESTIGATION AND LABORATORY ANALYSIS**

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The field investigation program included drilling three boreholes at the locations shown on Drawing No. A2. The borehole locations were established by Union Street personnel based on utility clearance, access, and an on-site meeting with the client. No formal surveying of the borehole locations, or site, were completed and all drawings, locations, measurements, and legal descriptions are approximate and conceptual in nature.

On 7<sup>th</sup> September, 2023, three boreholes (designated as BH101 to BH103) were advanced using a track-mounted auger drill utilizing 150 mm diameter, continuous flight augers, operated by Stoney Street Drilling Ltd. The boreholes were advanced to depths of 5.79 m (Borehole BH103) and 9.14 m (Boreholes BH101 and BH102) below ground surface.

Supervision of the drilling, soil sampling, and logging of the various soil strata were performed by Union Street personnel. All soil samples and auger cuttings were visually examined and classified in the field in accordance with the Modified Unified Soil Classification System. The Borehole Logs are appended.

The soil sampling and testing sequences which are shown on the borehole logs consisted of:

- Disturbed ('grab') samples obtained at a depth interval of 1.52 m for moisture content determinations. The moisture contents are shown on the logs; and,
- Shelby tubes were pushed in Boreholes BH102 and BH103 to obtain undisturbed samples to perform permeability analysis on. The Shelby tube sampling locations are shown on the borehole logs.

Seepage was encountered in Borehole BH102 at 4.57 m below surface but observable sloughing was not encountered while drilling. Following drilling activities, piezometers were installed in all three boreholes.

Subsequent to the drilling operations, laboratory analyses were performed to determine visual soil classification and in-situ water contents of all collected samples. Modified Unified Soils Classifications (MUSC), permeability, and particle size analyses were performed on select soil samples. Observations made during the field investigation, visual descriptions of the soils, and the results of laboratory tests are presented in the appended Borehole Logs and Laboratory Test Results.



## 4 ANALYSIS AND DISCUSSION

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### 4.1 GENERAL STRATIGRAPHY

- The subsurface conditions were relatively uniform in all three borehole locations relative to the proposed development. In general, and to the depths drilled, the stratigraphy encountered at the borehole locations generally consisted of, in descending order, topsoil, sand, and till. The soil is relatively uniform with little variations and the following soil properties depict the average observed characteristics. Till extended to the maximum exploration depth in all three boreholes. Detailed soil descriptions are provided in the Borehole Logs, appended to this report.

#### 4.1.1 Topsoil

A layer of topsoil, ranging from 203 mm to 229 mm with an average approximately thickness of 212 mm, was encountered at surface in all three boreholes. Based on a visual observation, topsoil covers a majority of the site.

#### 4.1.2 Sand

Sand, with an average thickness of 0.85 m, was encountered underlying the topsoil in Boreholes BH101 and BH103. The sand generally contained trace to some clay and trace to some silt. It was yellowish brown (10YR 5/4) to brown, oxidized, dry, loose, massive, contained gravel inclusions, and was calcareous.

The moisture content of a sand sample obtained from Borehole BH103 indicated a moisture content of 6.2%.

#### 4.1.3 Till

Till was the predominant subgrade soil encountered during drilling. It was encountered underlying the topsoil in Borehole BH102 and underlying the sand stratum in Boreholes BH101 and BH103 at an average depth of 0.78 m below grade. The till extended to the maximum exploration depth in all three boreholes. The till was comprised of varying quantities of clay, silty, sand, and gravel but was generally composed of clay and sand, some silt, and trace gravel. It was brown (10YR 4/3) to very dark grey (10YR 3/1), oxidized to non-oxidized, moist, firm to very stiff, massive, contained sand and silt pocket inclusions, and was calcareous.

The moisture content of the till samples ranged from 13.0% to 21.6% with an average moisture content of 15.0%.

Pocket Penetrometer (PP) readings of the till samples ranged from 36 kPa to 144 kPa indicating an average undrained shear strength of 68 kPa. This corresponds to a soil with a stiff consistency.

Sample MW10, obtained from Borehole BH102 at 4.57 m below grade, was submitted for hydraulic conductivity testing which indicated a permeability value of  $8.39 \times 10^{-9}$  cm/s. Additionally, a second sample, Sample MW16, obtained from Borehole BH103 at 3.05 m below grade, was submitted for hydraulic conductivity testing which indicated a permeability value of  $3.13 \times 10^{-8}$  cm/s.

Three MUSC tests were performed on till samples obtained from all three boreholes. The MUSC results are summarized in Table 4.1.

**TABLE 4.1: SUMMARY OF TILL MUSC TEST RESULTS**

Sample No. and Depth	Borehole No.	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Moisture Content (%)	MUSC – Soil Type
MW1 - 0.76 m	BH101	41.0	10.3	30.7	13.2	CI
MW8 - 2.29 m	BH102	38.8	10.5	28.3	15.5	CI
MW15 - 2.29 m	BH103	38.5	11.2	27.3	13.9	CI
<b>Average:</b>		<b>39.4</b>	<b>10.6</b>	<b>28.8</b>	<b>14.2</b>	<b>CI</b>

Based on the results in Table 4.1 the till has an average MUSC of “CI” - Sandy Clay of medium plasticity.

Three Mechanical Wash Sieves (MWSs) and a Particle Size Analysis (PSA) were performed on till samples obtained from all three boreholes. The MWS and PSA results are summarized in Table 4.2

**TABLE 4.2: SUMMARY OF TILL MUSC SIEVE AND PSA RESULTS**

Sample No. and Depth	Borehole No.	Gravel Content (%)	Sand Content (%)	Silt Content (%)	Clay Content (%)
MW1 - 0.76 m	BH101	1.3	41.3	57.4	
MW8 - 2.29 m	BH102	2.6	39.9	57.5	
MW15 - 2.29 m	BH103	5.4	37.3	57.3	
MW17 - 3.81 m	BH103	0.5	34.7	26.0	38.8
<b>Average:</b>		<b>2.4</b>	<b>38.3</b>	<b>59.3</b>	

Based on the identical MUSC soil types, similar liquid limits, till characteristics as identified by the MWS and PSA results, and visual observations, it is the author's opinion that the till encountered in all three boreholes is quite similar and will offer a similar permeability throughout as recorded on Sample MW10.

Cobbles and boulders were not encountered during drilling in Boreholes BH101 and BH102, but as till is a heterogeneous mixture of all grain sizes, cobbles and boulders may be encountered during construction. Drilling refusal was encountered in Borehole BH103, possibly due to a cobble or boulder, but this was not confirmed.

## 4.2 GROUNDWATER

Seepage was encountered in Borehole BH102 at an approximate depth of 4.57 m below ground surface during drilling. Piezometers were installed in all three boreholes following drilling and the groundwater elevations were recorded on the 4<sup>th</sup> October, 27 days following drilling. The monitoring results are summarized in Table 4.3, below.

**TABLE 4.3: SUMMARY OF GROUNDWATER MEASUREMENTS**

Borehole No.	Borehole Depth (m)	Water Level <sup>1</sup> (m), 4 <sup>th</sup> October, 2023
BH101	9.14	5.79
BH102	9.14	2.76
BH103	5.79	3.46
<b>Average:</b>		<b>4.00</b>

**Notes:**

1 - Below existing grade.



Based on seepage encountered during drilling and piezometer readings, the groundwater table is likely (approx.) 3.0 m to 4.0 m below ground surface throughout a majority of the site. Groundwater levels are subject to meteorological events, seasonal variations, site gradient, and other salient factors resulting in the water table varying with time.

#### 4.3 REFERENCES

The following was referenced while composing this letter:

- Province of Alberta, “*Agricultural Operation Practices Act and Regulations*”, Revised Statutes of Alberta 2000, Chapter A-7, Alberta Queen’s Printer, 2010;
- Province of Alberta, “*Agricultural Operation Practices Act and Regulations*”, Standards and Administration Regulation, Alberta Queen’s Printer, 2017;
- Alberta Government, “*Catch Basin Design and Management*”, Technical Guideline Agdex 096-101, August 2012; and,
- Natural Resources Conservation Board, “*Determining Equivalent Protective Layers and Constructed Liners*”, Technical Guideline Agdex 096-61, Updated June 2022.

## 5 CATCH BASIN

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### 5.1 CAPACITY

For design purposes, the design volume of the catch basin must have a storage capacity that can accommodate a 1 in 30 year rainfall. For the Wainwright region a 1 in 30 year event equates to approximately 75 mm of rainfall. The drainage area of the feedlot (244 m by 92 m), including the proposed catch basin, is approximately 24,473 m<sup>2</sup>. The following was utilized to determine the catch basins minimum required capacity.

$$V_{30} = D_A \times R_{30} \times C_R$$

Where:

$V_{30}$  = One Day Rainfall Volume ( $m^3$ );

$D_A$  = Drainage Area ( $m^2$ );

$R_{30}$  = One Day Rainfall (m); and,

$C_R$  = Runoff Coefficient (1.0 for a paved area).

Based on the referenced formula, it has been determined that the expected one-day rainfall volume for the site (feedlot and catch basin), is approximately 1,835.5  $m^3$ . However, to ensure the liners integrity due to drying out and cracking, to increase the timeframe between emptying, to accommodate future expansion or minor changes in the feedlot size during permitting, etc., it is recommended that the design capacity of the catch basin be greater than the 1 in 30 year rainfall minimum volume requirement. Union Street recommends increasing the total volume capacity by a minimum 10% of the 1 in 30 year rainfall, which would increase the catch basin's volume to approximately 2,019  $m^3$ .

The size and capacity of the catch basin may change depending on the liner option selected as, for example, a synthetic liner will allow a deeper catch basin, allowing a reduced footprint, reducing the required capacity. Therefore, although the general footprint will remain similar, the size and location of the catch basin shown on the attached drawing may slightly differ from that actually constructed.

The catch basin must have a marker that is clearly visible at all times indicating the minimum volume required to accommodate a 1 in 30 year one day rainfall event.

## 5.2 SIZING & LOCATION

Based on a client directed feedlot area of approximately 244 m by 92 m, a catch basin with dimensions of 45 m by 45 m by 2.0 m deep is recommended. From top of berm, utilizing a 0.5 m freeboard, 1.5 m effluent depth, and 3H:1V side slopes, the catch basin was calculated to have a design capacity of approximately 2,120  $m^3$  as shown on the attached Catch Basin Dimension Calculator results in Appendix A.

The proposed catch basin location is shown on Drawing No. A2. This location was selected by the client based on topography, separation distances, and future proposed development.

### **5.3 STRIPPING**

All organic soil and vegetation should be stripped from the catch basin footprint prior to the start of catch basin construction activities.

### **5.4 CATCH BASIN EXCAVATION**

All till material from the catch basin excavation that is determined to be suitable for reuse should be stockpiled. If encountered, the sand encountered in Borehole BH101 and BH103 will need to be excavated and replaced with till.

The banks of the catch basin should be cut at no steeper than 3H:1V. The capacity of the catch basin should be designed to ensure a minimum 0.5 m freeboard. It is the responsibility of the contractor to remove water from trenches and excavations, regardless of origin. If while constructing the slopes of the catch basin subsurface, groundwater begins eroding the slopes and entering the catch basin, construction will need to be halted immediately and dewatering techniques will need to be implemented before construction continues. It is anticipated that potential groundwater problems can be resolved with well graded ditching and the installation of subgrade sumps around the perimeter of the site. If extreme groundwater seepage becomes present, more advanced dewatering techniques can be implemented. Although possible, it is not expected that seepage and sloughing will be encountered during construction unless the excavation exceeds 2.75 m in depth.

Pumps and other materials necessary to keep the excavation free of water while work is in progress should be provided. Provisions should be made in case of accidental stoppage of dewatering equipment to prevent damage to the work area. The excavations must be protected against flooding and damage from surface run-off. Water removed from the site is to be disposed of in a manner that will not damage the work area or other property or persons.

Materials will be excavated and removed to the depths necessary for the construction of the structure and drainage system. Care must be taken to minimize the disturbance

to the supporting soil. After the excavation has been shaped, any over-excavated areas will be backfilled and compacted to a density equal to or greater than the undisturbed soil. All slopes in the subgrade are to be uniform and in a condition suitable for a catch basin.

## 5.5 EMBANKMENTS AND FILL

An embankment/berm is recommended to be constructed around the perimeter of the feedlot development to divert and minimize surface runoff from outside the operation from flowing into the catch basin. Additionally, a berm is recommended along the perimeter of the catch basin to prevent accidental effluent release outside of the operation and ensure a minimum 0.5 m freeboard. The exterior slope of a catch basin wall should be no steeper than 4H:1V. Any fills required can be constructed from the till subgrade encountered on-site. If an insufficient quantity of suitable on-site subgrade fill is not available, it will have to be analysed, imported, and compacted.

Areas requiring fills will be uniformly graded, scarified and re-compacted to the necessary density prior to being filled. Common excavated materials will be placed in the embankments, and in over-excavations if approved by the Geotechnical Engineer. Fills should be placed in lifts not exceeding 200 mm and compacted to minimum density of 1,838 kg/m<sup>3</sup> at an optimum moisture content of 17.0%, or within +2% of that moisture content. Fill material may require moisture conditioning prior to compaction.

## 5.6 LINER

### 5.6.1 *Naturally Occurring Soil Liner*

Following a review of the referenced NRCB documentation, it is understood that a naturally occurring protective layer for a catch basin must have a minimum thickness of 5.0 m and a hydraulic conductivity of not more  $1.0 \times 10^{-6}$  cm/s. Additionally, the groundwater table must be at least 1.0 m below the bottom of the naturally occurring liner. Laboratory testing was conducted on two undisturbed till samples obtained from Boreholes BH102 and BH103 with the lower hydraulic conductivity of  $3.13 \times 10^{-8}$  cm/s being utilized for the design. However, NRCB requires laboratory permeability results to be reduced by an order of magnitude to account for the fact that the laboratory sample only represents a small section of the total depth of a

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naturally occurring protective layer. When reduced by this magnitude, the design hydraulic conductivity of the till in the catch basin location is assumed to be  $3.13 \times 10^{-7}$  cm/s. Based on the average thickness of the till stratum encountered in all three boreholes and the factored hydraulic conductivity of the till, minimum of 7.25 m and  $3.13 \times 10^{-7}$  cm/s, a naturally occurring till layer 1.57 m thick with a permeability of  $3.13 \times 10^{-7}$  cm/s offers equivalent protection as a 5.0 m thick layer with a permeability of  $1.0 \times 10^{-6}$  cm/s. Therefore, if utilized, a minimum naturally occurring protective layer with a thickness of 1.57 m is required.

If a naturally occurring soil liner is utilized, the NRCB requires the bottom of the layer to be equal or greater than 1.0 m from the groundwater table at the time of construction.

#### 5.6.2 *Compacted Soil Liner*

Following a review of the referenced NRCB documentation, it is understood that a constructed clay liner for a catch basin must have a minimum thickness of 1.0 m and a hydraulic conductivity of not more  $5.0 \times 10^{-7}$  cm/s. Based on the factored hydraulic conductivity of the till, a constructed clay liner 0.63 m thick with a permeability of  $3.13 \times 10^{-7}$  cm/s offers equivalent protection than a 1.0 m thick clay liner with a permeability of  $5.0 \times 10^{-7}$  cm/s. A constructed liner must be no less than 0.63 m thick as measured perpendicular to the excavation face.

If a clay liner is utilized, or where excavation of the sand and replacement with the lower permeability till is required in the liner area, the constructed liner should be a minimum 0.63 m thick and constructed by placing till lifts not exceeding 200 mm and compacted to minimum density of  $1,896 \text{ kg/m}^3$  at an optimum moisture content of 15.8%, or within +2% of that moisture content, perpendicular to the excavation face.

If a naturally occurring soil liner is utilized, the NRCB requires the bottom of the soil liner to be equal or greater than 1.0 m from the groundwater table at the time of construction.

### 5.6.3 *Geomembrane*

If a catch basin with a great depth is required, to reduce the overall footprint, scheduling conflicts, or the owner simply elects too, a synthetic liner can be used. If utilized, all geomembrane products should be handled, stored, and placed in accordance with the manufacturer's recommendations. Materials should be stored so that they do not come into contact with substances that may affect their physical or chemical properties such as fuel, exhausts, or petroleum products.

The installation contractor should be a contractor approved by the civil engineer who is trained to install the manufacturer's geomembrane. Installation should be performed by personnel experienced in seaming the materials under the constant supervision of the manufacturer. It is recommended that the installation contractor provide a written report on the completed installation certifying that the liner was installed in accordance with the requirements of the manufacturer's specifications, the liner is ready for operation, and the warranty is in effect.

Geotextiles should be sufficiently anchored and deployed in a manner that will reduce folds and wrinkles. In the presence of wind, geotextiles should be weighted with sandbags or equivalent ballast. Geotextiles are to be cut using an approved cutter. Care should be taken in the installation process not to entrap excessive dust or stones that could damage the geomembrane.

The contractor should submit a panel layout proposal for the geomembrane to the engineer prior to the geomembrane placement. Care should be taken in the method used to unroll the panels so that damage to the liner or the supporting soil and/or geomembrane. Sand bags or equivalent ballast that will not damage the liner should be placed on the liner to prevent uplift. No equipment or tools that could damage the liner or underlying surfaces by handling or other means should be used. No personnel working on the liner will wear damaging shoes or engage in activities that could harm the liner, including smoking. All defects and damage will be documented and marked for repair. Repairs will be conducted in a manner suitable to the geomembrane manufacturer.

No NRCB technical specifications regarding synthetic liner were found. If utilized, it is recommended to discuss the liner requirements with the manufacturer and once a product has been selected, to discuss the technical specifications with the NRCB.

Pumping may be required during liner placement if the excavation starts to fill with groundwater. It is recommended that the means be available to prevent “bubbling” of the liner if groundwater starts to form below the liner in the catch basin footprint.

Seepage and sloughing may be encountered in the till subgrade depending upon the base elevation of the catch basin.

If a synthetic liner is utilized, the NRCB requires the bottom of the liner to be equal or greater than 1.0 m from the groundwater table at the time of construction.

#### **5.7 QUALITY CONTROL / QUALITY ASSURANCE**

As part of the quality control program, it is recommended that a geotechnical engineer or representative be on-site to inspect the excavation and compaction required. The geotechnical engineer will be able to provide immediate on-site recommendations to potential difficulties that may arise during construction.

#### **5.8 INLET PIPE**

It is understood that an inlet pipe may be utilized for the construction of the catch basin. The inlet pipe must be sealed to ensure liquid doesn't seep back along the pipe extrusion, creating a potential source of contamination. Bentonite chips or concrete are typically utilized around the inlet pipe to create the required seal.

#### **5.9 EROSION**

Due to the catch basin's size, these measures may not be necessary, but unchecked erosion can lead to slope and berm failure and erosion preventative measures may be required. Placing riprap is normally the most cost effective erosion protection material, placed on the waterward side, due to its effectiveness, durability and availability.

Additionally, exposed soil should be graded to the required slope, overlain with topsoil, and seeded or hydroseeded with grass. Trees and shrubs planting is not

recommended as tree roots detrimentally affect berms by root penetration and shrubs cause obstructions in viewing piping, seepage, and burrowing animals. The vegetation will serve to protect the upper portions of the slope from erosion by surface runoff water and will also increase the stability of the slope. The grass should be trimmed regularly as to not obstruct the inspector's view.

#### **5.10 FENCE**

It is recommended that continuous fencing around the perimeter of the catch basin is constructed. A fence will help prevent unauthorized entry to the catch basin and will also help reduce the detrimental effects of burrowing animals such as beavers, muskrats, gophers, etc.

#### **5.11 INSPECTIONS**

It is the responsibility of the owner to conduct routine and periodic inspections and to maintain and repair the catch basin to acceptable standards. It is recommended that the catch basin is inspected on a regular basis or as per the Natural Resources Conservation Board. The inspector shall note, but not be limited to noting, the presence or absence of settlement, seepage, burrowing animals, erosion, freeboard level, erosion protection performance and condition, fence condition, vegetation growth that may lead to a decreased performance of the liner, and general berm and catch basin condition.



## 6 CLOSURE

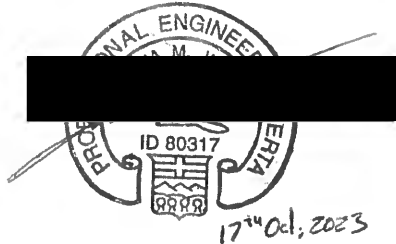
Union Street Geotechnical Ltd. prepared this report for the use of the Holt Colony, and their agents, for the design and construction of the proposed catch basin as part of a confined feedlot development located within the N.E. ¼ of 06-47-09 W4 in the Municipal District of Wainwright No. 61, Alberta.

Samples obtained from this geotechnical investigation will be retained in our laboratory for 30 days following the date of the final report. Should no instructions be received to the contrary, these samples will then be discarded.

Respectfully,

Union Street Geotechnical Ltd.


Prepared By:



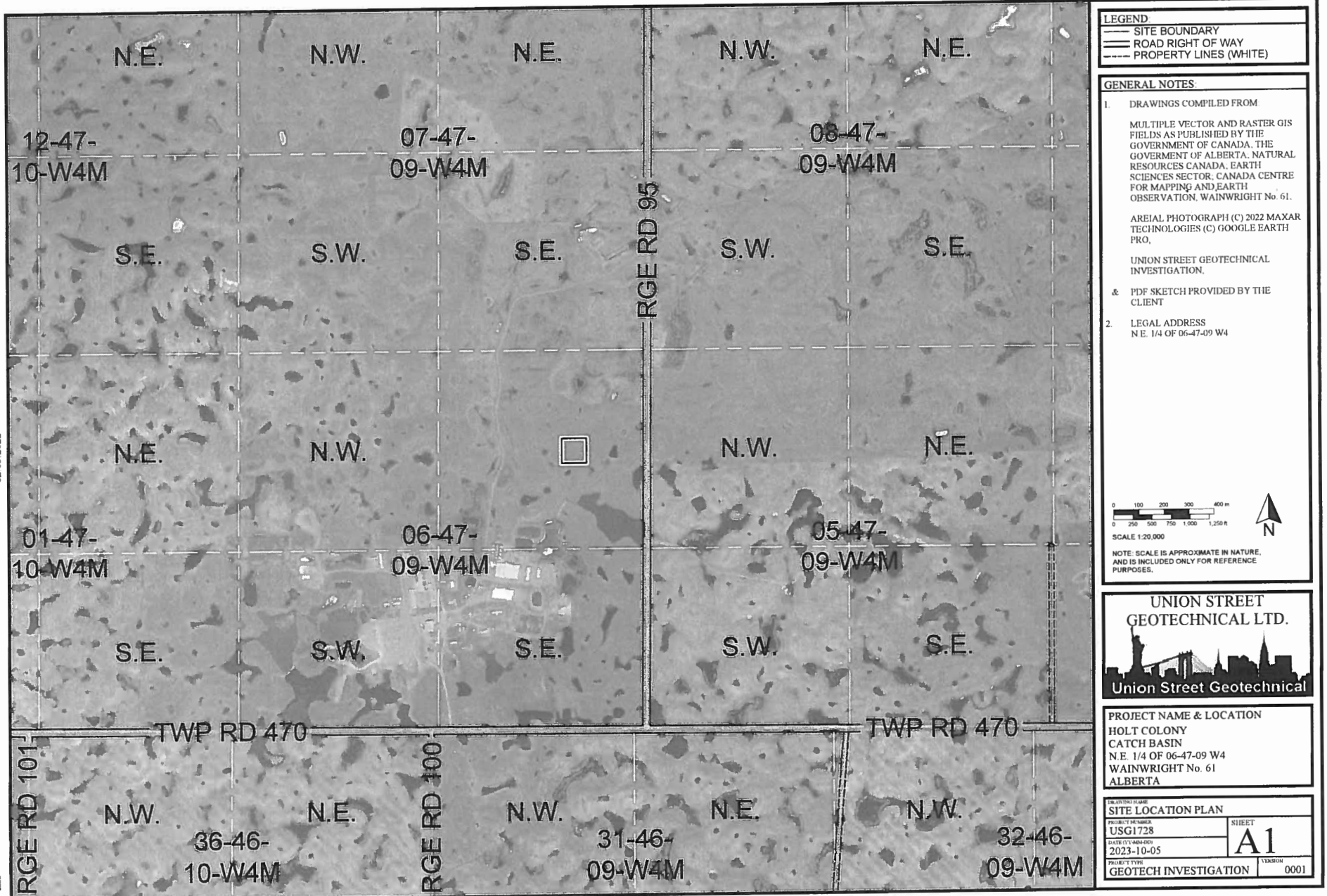
Joshua Wilson, P.Eng.  
Project Engineer

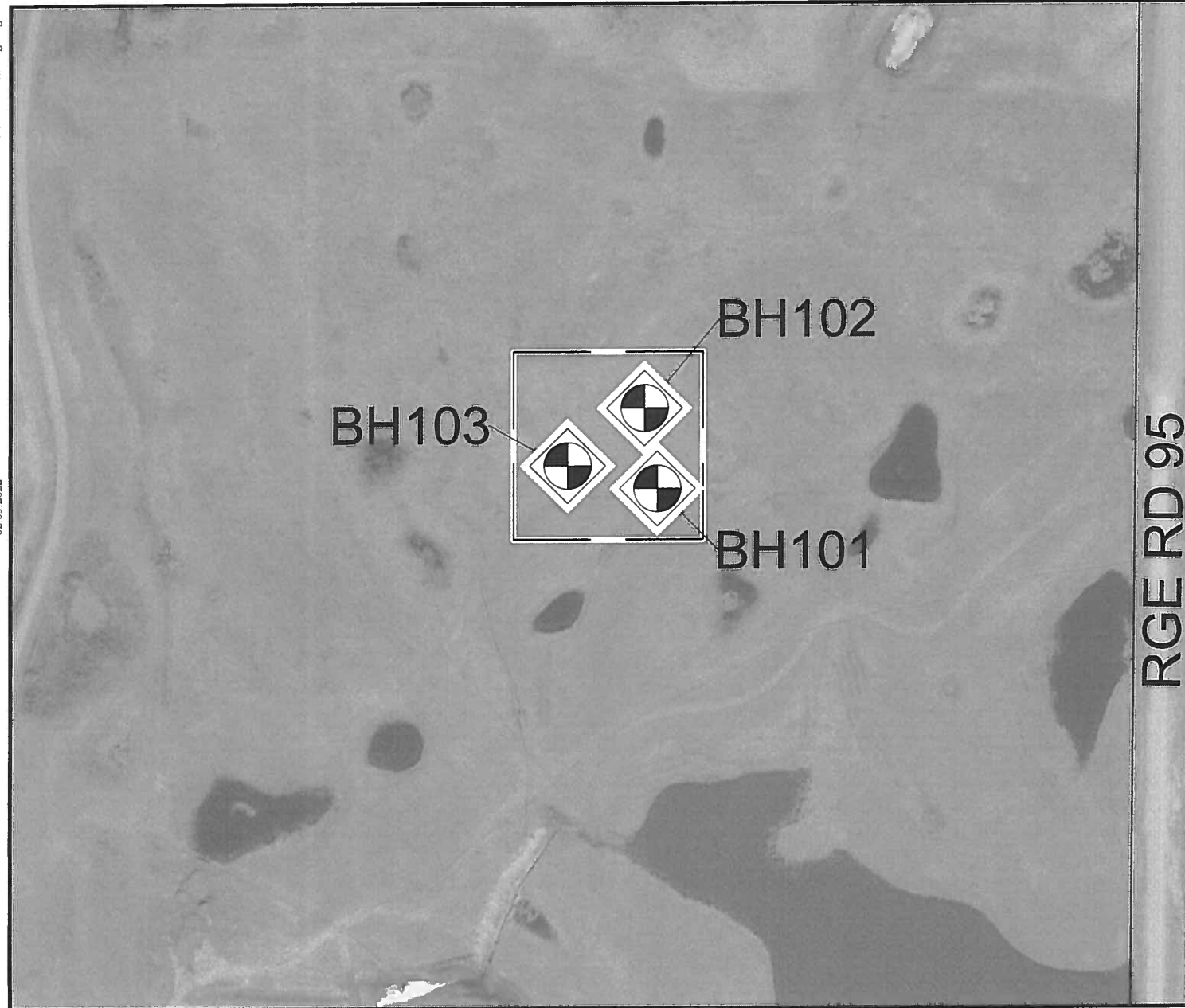
Reviewed By:

Neil Tomaszewski, P.Eng.  
Project Engineer

<b>PERMIT TO PRACTICE</b>	
<b>Union Street Geotechnical Ltd.</b>	
RM SIGNATURE:	
RM APEGA ID#:	80317
DATE:	17th Oct, 2023
<b>PERMIT NUMBER: P12644</b>	
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)	



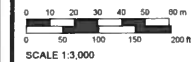


**LEGEND:**

SITE BOUNDARY  
 ROAD RIGHT OF WAY  
 PROPOSED CATCH BASIN

**GENERAL NOTES:**

- DRAWINGS COMPILED FROM:  
 MULTIPLE VECTOR AND RASTER GIS  
 FIELDS AS PUBLISHED BY THE  
 GOVERNMENT OF CANADA, THE  
 GOVERNMENT OF ALBERTA, NATURAL  
 RESOURCES CANADA, EARTH  
 SCIENCES SECTOR, CANADA CENTRE  
 FOR MAPPING AND EARTH  
 OBSERVATION, WAINWRIGHT No. 61.  
 AERIAL PHOTOGRAPH (C) 2022 MAXAR  
 TECHNOLOGIES (C) GOOGLE EARTH  
 PRO.  
 UNION STREET GEOTECHNICAL  
 INVESTIGATION,  
 & PDF SKETCH PROVIDED BY THE  
 CLIENT
- LEGAL ADDRESS  
 N.E. 1/4 OF 06-47-09 W4



SCALE 1:3,000

NOTE: SCALE IS APPROXIMATE IN NATURE,  
 AND IS INCLUDED ONLY FOR REFERENCE  
 PURPOSES.



UNION STREET  
 GEOTECHNICAL LTD.

**PROJECT NAME & LOCATION**

HOLT COLONY  
 CATCH BASIN  
 N.E. 1/4 OF 06-47-09 W4  
 WAINWRIGHT No. 61  
 ALBERTA

**BOREHOLE LOCATION PLAN**

PROJECT NUMBER

USG1728

DATE (Y-M-D)

2023-10-05

SHEET

A2

PROJECT TYPE

GEOTECH INVESTIGATION

VERSION

0001





## Photographs

**Photographs - Geotechnical Investigation**  
**Within the N.E. ¼ of 06-47-07 W4**  
**Municipal District of Wainwright No. 61, Alberta**




**Photograph No. 1:** Photograph taken from near the site's southeast corner, facing northwest, showing the proposed development footprint, vegetation, site grading, and general site conditions observed on the 4<sup>th</sup> October, 2023.

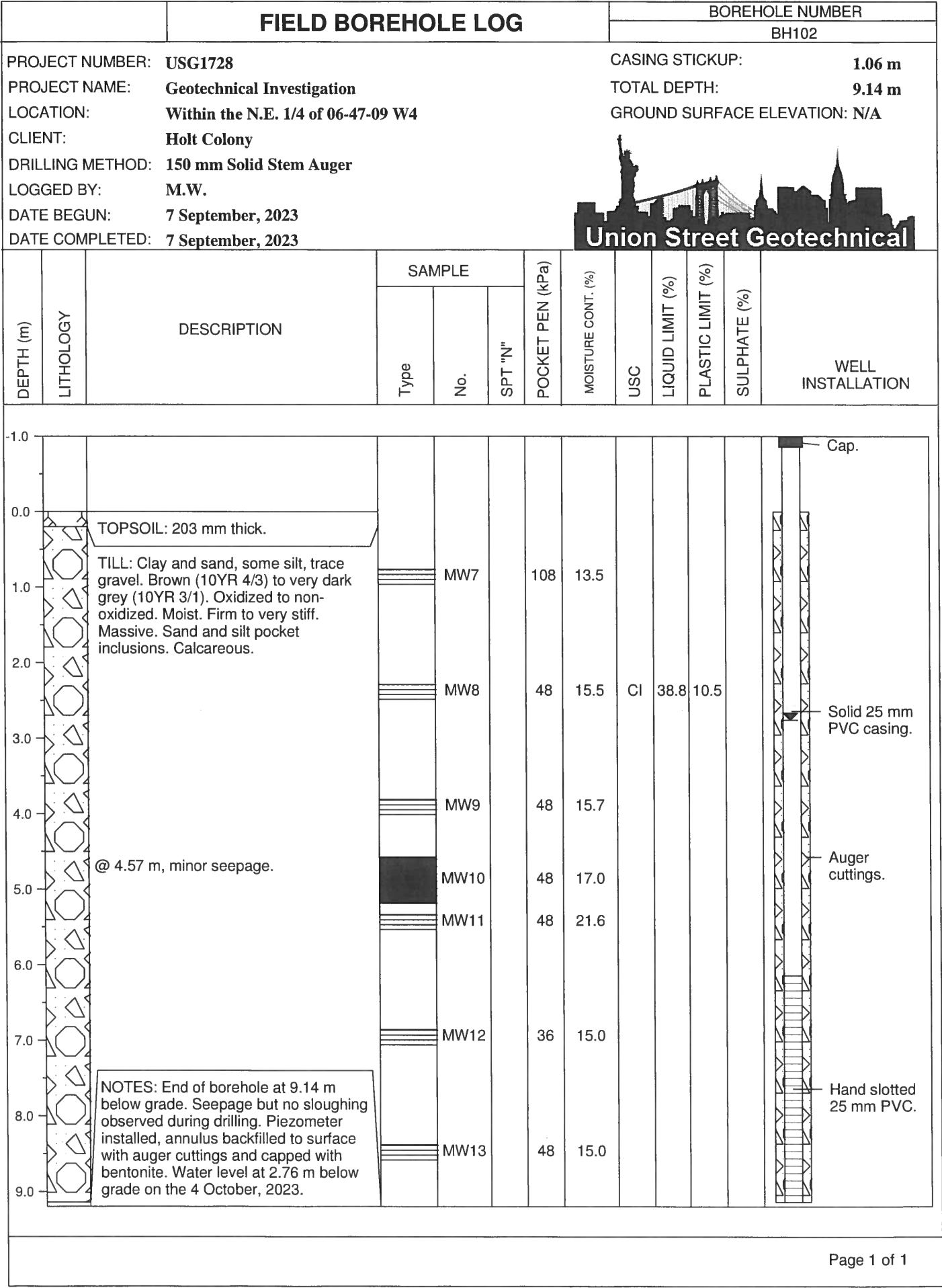



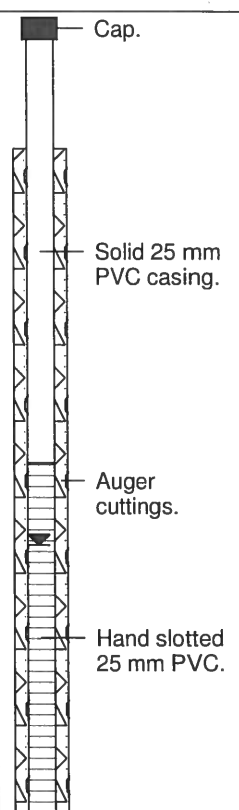
**Photograph No. 2:** Photograph taken from near the site's northwest corner, facing southeast, showing the gently undulating site, three piezometers, and general site conditions observed on the 4<sup>th</sup> October, 2023.



		FIELD BOREHOLE LOG			BOREHOLE NUMBER							
					BH101							
PROJECT NUMBER:		USG1728			CASING STICKUP:		0.77 m					
PROJECT NAME:		Geotechnical Investigation			TOTAL DEPTH:		9.14 m					
LOCATION:		Within the N.E. 1/4 of 06-47-09 W4			GROUND SURFACE ELEVATION:		N/A					
CLIENT:		Holt Colony										
DRILLING METHOD:		150 mm Solid Stem Auger										
LOGGED BY:		M.W.										
DATE BEGUN:		7 September, 2023										
DATE COMPLETED:		7 September, 2023										
DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE			POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
			Type	No.	SPT "N"							
0.0		TOPSOIL: 203 mm thick.										
1.0		SAND: Trace to some clay, trace to some silt. Brown. Oxidized. Dry. Loose. Massive.		MW1		96	13.2	CI	41.0	10.3		
2.0		TILL: Clay and sand, some silt, trace gravel. Brown (10YR 4/3) to very dark grey (10YR 3/1). Oxidized to non-oxidized. Moist. Firm to stiff. Massive. Sand and silt pocket inclusions. Calcareous.		MW2		84	14.0					
3.0				MW3		72	14.4					
4.0				MW4		48	15.3					
5.0				MW5		48	13.6					
6.0												
7.0				MW6		48	13.0					
8.0		NOTES: End of borehole at 9.14 m below grade. No seepage or sloughing observed during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings and capped with bentonite. Water level at 5.79 m below grade on the 4 October, 2023.										
9.0												





		FIELD BOREHOLE LOG				BOREHOLE NUMBER						
						BH103						
PROJECT NUMBER:		USG1728				CASING STICKUP:		1.15 m				
PROJECT NAME:		Geotechnical Investigation				TOTAL DEPTH:		5.79 m				
LOCATION:		Within the N.E. 1/4 of 06-47-09 W4				GROUND SURFACE ELEVATION:		N/A				
CLIENT:		Holt Colony				 Union Street Geotechnical						
DRILLING METHOD:		150 mm Solid Stem Auger										
LOGGED BY:		M.W.										
DATE BEGUN:		7 September, 2023										
DATE COMPLETED:		7 September, 2023										
DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE			POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
			Type	No.	SPT "N"							
-1.0												 Cap. Solid 25 mm PVC casing. Auger cuttings. Hand slotted 25 mm PVC.
0.0		TOPSOIL: 229 mm thick.										
1.0		SAND: Trace to some clay, trace to some silt. Yellowish brown (10YR 5/4). Oxidized. Dry. Loose. Massive. Gravel inclusions. Calcareous.		MW14		-	6.2					
2.0		TILL: Clay and sand, some silt, trace gravel. Dark brown (10YR 3/3) to very dark grey (10YR 3/1). Oxidized to non-oxidized. Moist. Stiff to very stiff. Massive. Sand and silt pocket inclusions. Calcareous.		MW15		96	13.9	CI	38.5	11.2		
3.0				MW16		144	15.8					
4.0				MW17		72	15.4					
5.0												
6.0				MW18		72	14.1					
7.0		NOTES: End of borehole at 5.79 m below grade due to drilling refusal. No seepage or sloughing observed during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings and capped with bentonite. Water level at 3.46 m below grade on the 4 October, 2023.										
8.0												

Page 1 of 1



## Laboratory Test Results

Project Name:	2023 Geotechnical Inv.	Depth:	4.57 m
Project Number:	USG1728	Testing Company:	Union Street Geo.
Client:	Holt Colony	Field Technician:	M.W.
Testhole:	BH102	Sample Date:	7 September, 2023
Location:		Lab Technician:	B.B.
Sample Number:	MW10	Date Tested:	21 September, 2023

## Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

### Material and Test Description

#### Material Description:

Till -clay and silt, some sand, olive grey

Test Type:	Constant Head	Remoulding Details	
Mould Size:	Flexible Wall	Max Dry Density (kg/m <sup>3</sup> ):	-
Sample Source:	Shelby Tube (Un-Disturbed)	Proctor ID:	-
Fluid Used:	Deaired Water	Percent Max (%):	-
Fluid Reservoir:	Burrettes	Target Dry Density (kg/m <sup>3</sup> ):	-

### Initial Sample Characteristics

Water Content		Sample Size				
Wet + Tare (g):	684.9	Trial	1	2	3	4
Dry + Tare (g):	586.9	Diameter (mm):	72.1	72.4	71.9	72.3
Tare (g):	11.9	Length (mm):	76.4	76.2	76.3	76.3
Water Content (%):	17.0%	Weight (g)	671.5			
Area (cm <sup>2</sup> ):	40.9	Specific Gravity (Note 2):	2.70			
Volume (cm <sup>3</sup> ):	312.2	Void Ratio:	47.1%			
Wet Density (kg/m <sup>3</sup> ):	2151	Saturation:	97.8%			
Dry Density (kg/m <sup>3</sup> ):	1838	Porosity:	32.0%			

### Final Sample Characteristics

Water Content		Sample Size				
Wet + Tare (g):	511.6	Trial	1	2	3	4
Dry + Tare (g):	436.8	Diameter (mm):	72.5	72.6	72.1	72.2
Tare (g):	11.8	Length (mm):	76	76.1	75.9	76
Water Content (%):	17.6%	Weight (g)	673.1			
Area (cm <sup>2</sup> ):	41.1	Specific Gravity (Note 1):	2.70			
Volume (cm <sup>3</sup> ):	312.5	Void Ratio:	47.6%			
Wet Density (kg/m <sup>3</sup> ):	2154	Saturation:	100.0%			
Dry Density (kg/m <sup>3</sup> ):	1832	Porosity:	32.3%			

Note 1: Specific gravity for final sample characteristics calculation adjusted to result in 100.0% saturation.

Note 2: Specific gravity for initial sample characteristics calculation set equal to that of the final.



Project Name: 2023 Geotechnical Inv.  
 Project Number: USG1728  
 Client: Holt Colony  
 Testhole: BH102  
 Location:  
 Sample Number: MW10

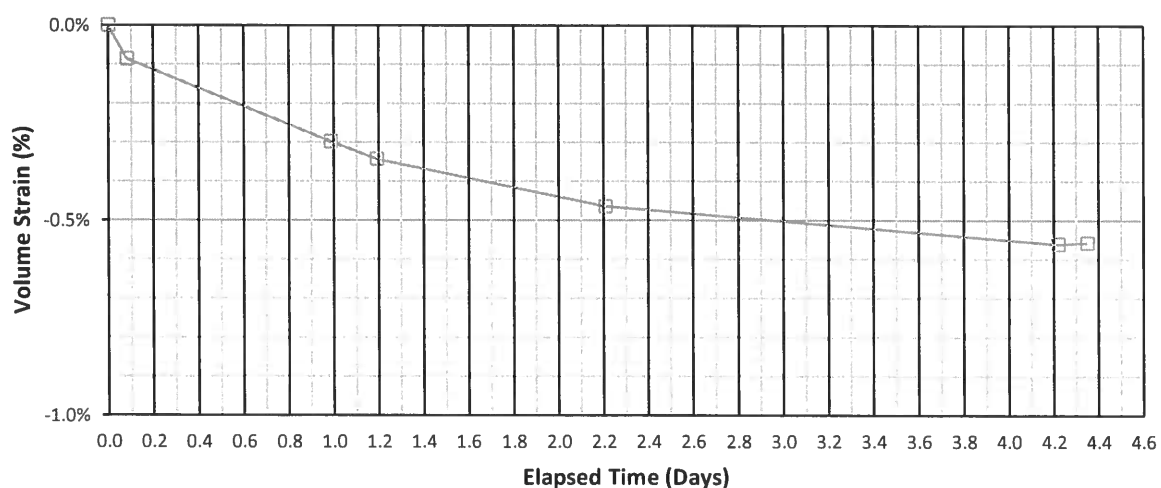
Depth: 4.57 m  
 Testing Company: Union Street Geo.  
 Field Technician: M.W.  
 Sample Date: 7 September, 2023  
 Lab Technician: B.B.  
 Date Tested: 21 September, 2023

## Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

### Saturation Data

Cell Pressure (kPa):		160.0		Top Pressure (kPa):		130.0	
Bottom Pressure (kPa):		130.0		Pressure Difference (kPa):		-	
Date & Time	Elapsed Time (Days)	Room Temp (°C)	Top Buret (mL)	Bottom Buret (mL)	Cell (mL)	Total Vol. Change (mL)	Volume Strain (%)
9/21/23 7:46	0.00	20.0	4.5	4.5	14.2	0	0.00%
9/21/23 9:44	0.08	20.0	4.5	4.5	14.5	-0.27	-0.09%
9/22/23 7:25	0.99	20.0	4.5	4.2	15.4	-0.93	-0.30%
9/22/23 12:20	1.19	20.0	4.6	4.2	15.5	-1.07	-0.34%
9/23/23 12:45	2.21	20.0	4.6	4.3	15.8	-1.45	-0.46%
9/25/23 13:01	4.22	20.0	4.6	4.3	16.0	-1.75	-0.56%
9/25/23 16:08	4.35	20.0	4.6	4.3	16.0	-1.74	-0.56%
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-



Project Name: 2023 Geotechnical Inv.  
 Project Number: USG1728  
 Client: Holt Colony  
 Testhole: BH102  
 Location:  
 Sample Number: MW10

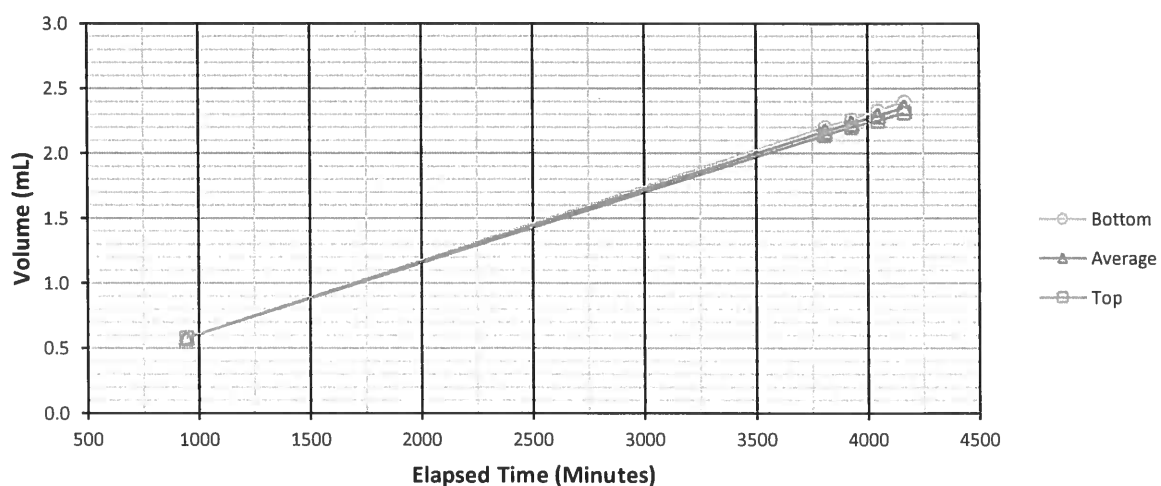
Depth: 4.57 m  
 Testing Company: Union Street Geo.  
 Field Technician: M.W.  
 Sample Date: 7 September, 2023  
 Lab Technician: B.B.  
 Date Tested: 21 September, 2023

## Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

### Permeation Data

Cell Pressure (kPa):		160.0		Top Pressure (kPa):		120.0	
Bottom Pressure (kPa):		140.0		Pressure Difference (kPa):		20.0	
Date & Time	Elapsed Time (Minutes)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Top Vol. Change (mL)	Bottom Vol. Change (mL)	Average Vol. Change (mL)
9/25/23 16:13	0	21.0	9.71	0.07	0.00	0.00	0.00
9/26/23 7:55	942	21.0	9.13	0.65	0.58	0.58	0.58
9/28/23 7:38	3805	20.0	7.57	2.27	2.14	2.20	2.17
9/28/23 9:38	3925	21.0	7.51	2.33	2.20	2.26	2.23
9/28/23 11:36	4043	21.0	7.46	2.40	2.25	2.33	2.29
9/28/23 13:36	4163	21.0	7.40	2.47	2.31	2.40	2.36
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
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-	-	-	-	-	-	-	-



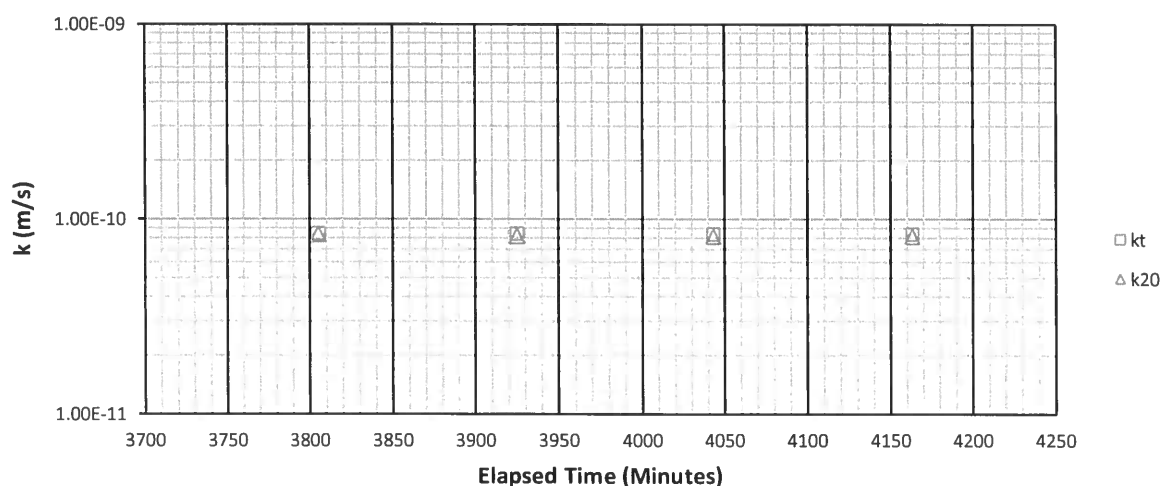
Project Name:	2023 Geotechnical Inv.	Depth:	4.57 m
Project Number:	USG1728	Testing Company:	Union Street Geo.
Client:	Holt Colony	Field Technician:	M.W.
Testhole:	BH102	Sample Date:	7 September, 2023
Location:		Lab Technician:	B.B.
Sample Number:	MW10	Date Tested:	21 September, 2023

## Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

### Permeation Data

Head Difference (m):		2.0		Area of Sample (m <sup>2</sup> )		4.101E-03	
Length of Sample (m):		7.615E-02		Gradient, i		2.677E+01	
Elapsed Time (Minutes)	Average Volume Change (mL)	Average Temperature (°C)	k <sub>t</sub> (m/s)	R <sub>T</sub>		k <sub>20</sub> (m/s)	
3805	2.17	20.5	8.429E-11	0.988		8.328E-11	
3925	2.23	21.0	8.395E-11	0.976		8.194E-11	
4043	2.29	21.0	8.369E-11	0.976		8.169E-11	
4163	2.36	21.0	8.364E-11	0.976		8.163E-11	
-	-	-	-	-		-	
-	-	-	-	-		-	
-	-	-	-	-		-	
-	-	-	-	-		-	
-	-	-	-	-		-	
-	-	-	-	-		-	
-	-	-	-	-		-	
-	-	-	-	-		-	
-	-	-	-	-		-	
-	-	-	-	-		-	
-	-	-	-	-		-	
-	-	AVERAGE	8.389E-11			8.213E-11	



Project Name: 2023 Geotechnical Inv.  
 Project Number: USG1728  
 Client: Holt Colony  
 Testhole: BH103  
 Location:  
 Sample Number: MW16

Depth: 3.05 m  
 Testing Company: Union Street Geo.  
 Field Technician: M.W.  
 Sample Date: 7 September, 2023  
 Lab Technician: B.B.  
 Date Tested: 16 September, 2023

## Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

### Material and Test Description

#### Material Description:

Till -clay and silt, sandy, olive grey

Test Type:	Constant Head
Mould Size:	Flexible Wall
Sample Source:	Shelby Tube (Un-Disturbed)
Fluid Used:	Deaired Water
Fluid Reservoir:	Burrettes

Remoulding Details	
Max Dry Density (kg/m <sup>3</sup> ):	-
Proctor ID:	-
Percent Max (%):	-
Target Dry Density (kg/m <sup>3</sup> ):	-

### Initial Sample Characteristics

Water Content		Sample Size					
Wet + Tare (g):	611.8	Trial	1	2	3	4	Average
Dry + Tare (g):	530.1	Diameter (mm):	71.8	72.3	72.0	71.7	72.0
Tare (g):	11.8	Length (mm):	75.5	75.3	75.3	75.4	75.4
Water Content (%):	15.8%	Weight (g)	672.5				
Area (cm <sup>2</sup> ):	40.7	Specific Gravity (Note 2):	2.72				
Volume (cm <sup>3</sup> ):	306.5	Void Ratio:	43.5%				
Wet Density (kg/m <sup>3</sup> ):	2194	Saturation:	98.5%				
Dry Density (kg/m <sup>3</sup> ):	1896	Porosity:	30.3%				

### Final Sample Characteristics

Water Content		Sample Size					
Wet + Tare (g):	688.2	Trial	1	2	3	4	Average
Dry + Tare (g):	595.6	Diameter (mm):	72	71.8	71.8	72.3	72.0
Tare (g):	13.6	Length (mm):	75.3	75.4	75.3	75.4	75.4
Water Content (%):	15.9%	Weight (g)	674.8				
Area (cm <sup>2</sup> ):	40.7	Specific Gravity (Note 1):	2.72				
Volume (cm <sup>3</sup> ):	306.6	Void Ratio:	43.3%				
Wet Density (kg/m <sup>3</sup> ):	2201	Saturation:	100.0%				
Dry Density (kg/m <sup>3</sup> ):	1899	Porosity:	30.2%				

Note 1: Specific gravity for final sample characteristics calculation adjusted to result in 100.0% saturation.

Note 2: Specific gravity for initial sample characteristics calculation set equal to that of the final.



Project Name: 2023 Geotechnical Inv.  
 Project Number: USG1728  
 Client: Holt Colony  
 Testhole: BH103  
 Location:  
 Sample Number: MW16

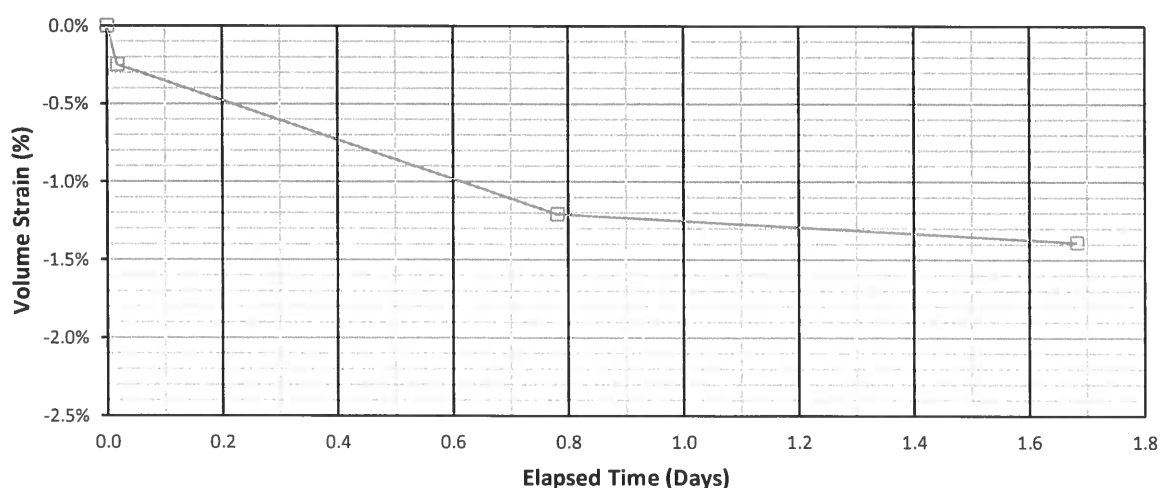
Depth: 3.05 m  
 Testing Company: Union Street Geo.  
 Field Technician: M.W.  
 Sample Date: 7 September, 2023  
 Lab Technician: B.B.  
 Date Tested: 16 September, 2023

## Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

### Saturation Data

Cell Pressure (kPa):		160.0		Top Pressure (kPa):		130.0	
Bottom Pressure (kPa):		130.0		Pressure Difference (kPa):		-	
Date & Time	Elapsed Time (Days)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Cell (mL)	Total Vol. Change (mL)	Volume Strain (%)
9/16/23 15:10	0.00	23.0	4.5	4.5	13.6	0	0.00%
9/16/23 15:36	0.02	21.0	4.6	4.5	14.3	-0.76	-0.25%
9/17/23 9:54	0.78	21.0	4.1	4.4	17.8	-3.70	-1.21%
9/18/23 7:33	1.68	20.0	4.0	4.4	18.4	-4.25	-1.39%
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
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-	-	-	-	-	-	-	-



Project Name: 2023 Geotechnical Inv.  
 Project Number: USG1728  
 Client: Holt Colony  
 Testhole: BH103  
 Location:  
 Sample Number: MW16

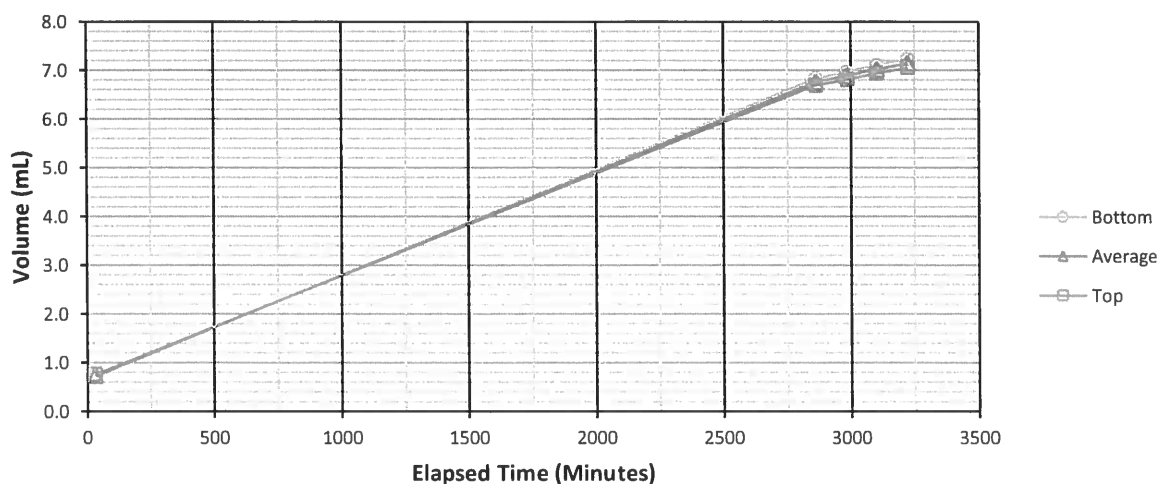
Depth: 3.05 m  
 Testing Company: Union Street Geo.  
 Field Technician: M.W.  
 Sample Date: 8 September, 2023  
 Lab Technician: B.B.  
 Date Tested: 16 September, 2023

## Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

### Permeation Data

Cell Pressure (kPa):		160.0		Top Pressure (kPa):		120.0	
Bottom Pressure (kPa):		140.0		Pressure Difference (kPa):		20.0	
Date & Time	Elapsed Time (Minutes)	Room Temp (°C)	Top Buret (mL)	Bottom Buret (mL)	Top Vol. Change (mL)	Bottom Vol. Change (mL)	Average Vol. Change (mL)
9/18/23 7:45	0	21.0	9.73	0.15	0.00	0.00	0.00
9/18/23 8:15	30	21.0	8.97	0.86	0.76	0.71	0.74
9/20/23 7:27	2862	20.0	3.04	6.98	6.69	6.83	6.76
9/20/23 9:28	2983	21.0	2.92	7.11	6.81	6.96	6.89
9/20/23 11:27	3102	21.0	2.79	7.25	6.94	7.10	7.02
9/20/23 13:28	3223	21.0	2.67	7.38	7.06	7.23	7.15
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-



Project Name: 2023 Geotechnical Inv.  
 Project Number: USG1728  
 Client: Holt Colony  
 Testhole: BH103  
 Location: Holt Colony  
 Sample Number: MW16

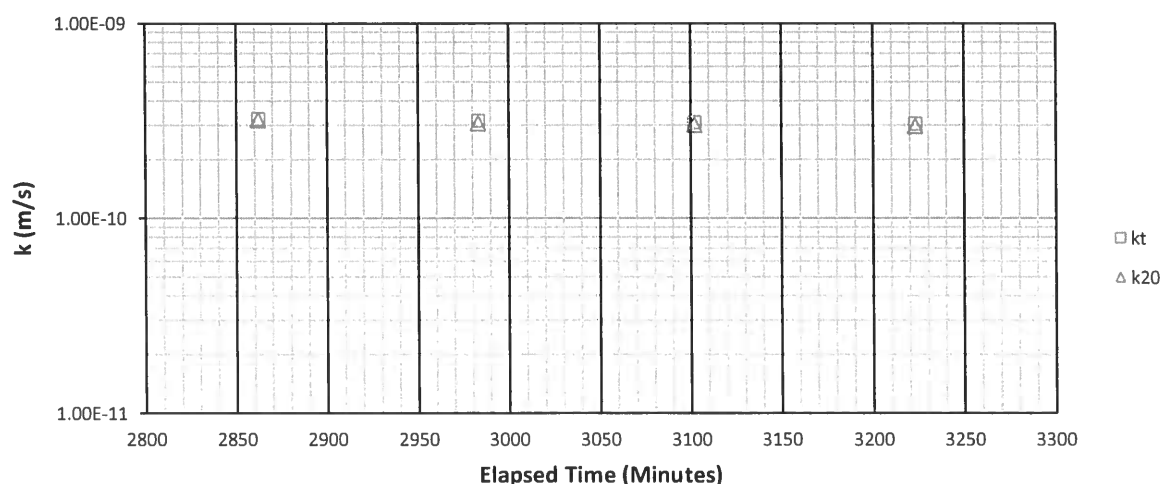
Depth: 3.05 m  
 Testing Company: Union Street Geo.  
 Field Technician: M.W.  
 Sample Date: 7 September, 2023  
 Lab Technician: B.B.  
 Date Tested: 16 September, 2023

## Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

### Permeation Data

Head Difference (m):		2.0		Area of Sample (m <sup>2</sup> )		4.067E-03	
Length of Sample (m):		7.536E-02		Gradient, i		2.705E+01	
Elapsed Time (Minutes)	Average Volume Change (mL)	Average Temperature (°C)		k <sub>t</sub> (m/s)	R <sub>T</sub>	k <sub>20</sub> (m/s)	
2862	6.76	20.5		3.222E-10	0.988	3.184E-10	
2983	6.89	21.0		3.154E-10	0.976	3.079E-10	
3102	7.02	21.0		3.099E-10	0.976	3.024E-10	
3223	7.15	21.0		3.041E-10	0.976	2.968E-10	
-	-	-		-	-	-	
-	-	-		-	-	-	
-	-	-		-	-	-	
-	-	-		-	-	-	
-	-	-		-	-	-	
-	-	-		-	-	-	
-	-	-		-	-	-	
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-	-	-		-	-	-	
-	-	AVERAGE		3.129E-10	-	3.064E-10	





## Appendix A



# Catch Basin Dimension Calculator

For more information on runoff control catch basin design consideration including liner options, catch basin protection, etc., check out the catch basin [factsheet](#).

Name

Holt Colony

Land Location

Within N.E. 1/4 of 06-47-09 W4

Estimating Runoff Potential

Area	Length (m)	Width (m)	Paved?	Area (m <sup>2</sup> )
1	244	92	YES ▾	22448.00
Total Area				22448.00

Estimation of water runoff to be collected in the catch basin:

1683.6 m<sup>3</sup>  
59456 ft<sup>3</sup>  
370340 Imp. Gal

Calculating Catch Basin Volume:

Construction Dimensions      Storage Dimensions

Length (m):

45

42.0

Width (m):

45

42.0

Depth (m):

2

1.5

Evacuation Capacity:

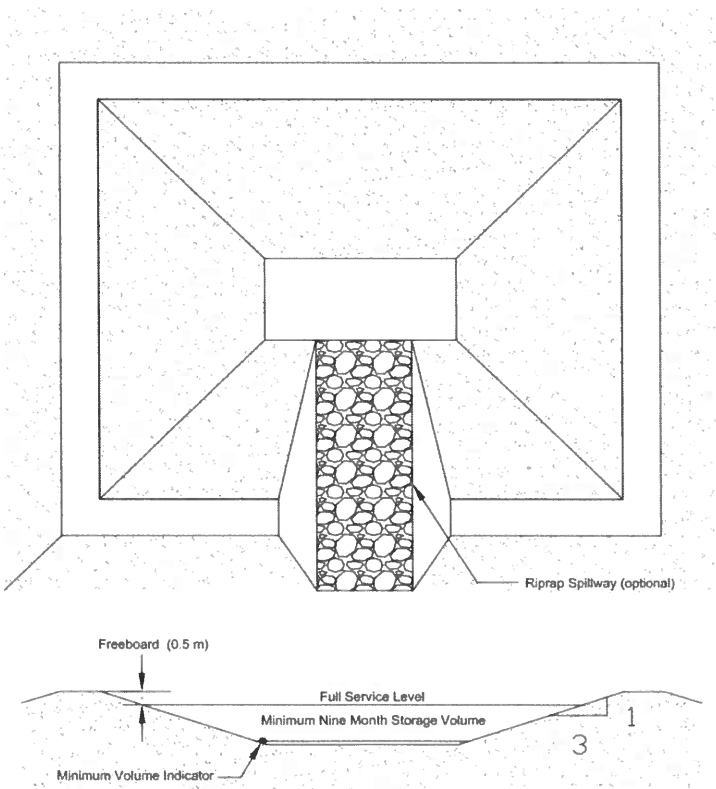
3066 m<sup>3</sup>  
108275 ft<sup>3</sup>  
674427 Imp. Gal

Catch basin volume (minus freeboard):

2120 m<sup>3</sup>  
74867 ft<sup>3</sup>  
466334 Imp. Gal

Comparing Catch Basin Volume versus Runoff Potential:

Runoff potential: 1683.6 m<sup>3</sup>  
Catch basin volume: 2120 m<sup>3</sup>



The catch basin dimensions meet the design requirements in AOPA