Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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
☐ Approval ☐ Registration ☒ Authorization ☐ Amendment	BA25017	NW 27-60-3 W5M

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.

July 21 2025
Date of signing

[redacted]
Signature

Linquenda Dairy
Corporate name (if applicable)

Jan Otten
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)
Lean to on existing barn (dairy barn addition)	61m 9m (1m deep cross over pit in addition)
FMS expansion	20m x 42m x 5m (exist)
Final new dimensions (75 m x 42 m x 5m deep)	(55m x 42m x 5m)

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

Existing facilities	Dimensions (m) (length, width, and depth)	NRCB USE ONLY
see BA 25011		

NRCB USE ONLY

Existing CFO

Last updated September 11, 2023

Part 2 — Technical Requirements

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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)

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

- lean too on existg barn for space and milking robots.
- clay from existg. lagoon

Construction completion date for proposed facilities end of 2026

Additional information

dairy barn addition attached to existing dairy barn to keep barn working while constructing previously approved BA25011 for new dairy barn.
No change in permitted livestock.

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**

DECLARATION AND ACKNOWLEDGMENT OF APPLICANT CONCERNING *WATER ACT* LICENCE
issued by Alberta Environment and Protected Areas (EPA) 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 EPA 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** EPA'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 EPA 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 EPA'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.
7. **Provide:** Water licence application number(s) _____

Signed this ____ day of _____, 20____. _____
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 EPA under the *Water Act* for the development or activity proposed in this AOPA application.
2. **Provide**: Water license number(s) or water conveyance agreement details _____

Signed this 21 day of July, 2025. [redacted]
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 EPA 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** EPA'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 EPA 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 EPA'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.
7. **Provide**: Water license number(s) or water conveyance agreement details _____

   _____

Signed this _____ day of _____, 20____. _____

Signature of Applicant or Agent

location of new facilities from BA25011, construction hasn't started yet.

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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

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:** lean to

Proposed 2: EMS expansion **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?	☑ >1 m ☐ ≤ 1 m	☑ >1 m ☐ ≤ 1 m	☑ >1 m ☐ ≤ 1 m	☐ > 1 m ☐ ≤ 1 m	☑ YES ☐ NO ☐ YES with exemption	Not in flood plain
Surface water information	How many springs are within 100 m of the manure storage facility or manure collection area?	0	0	0		☑ YES ☐ NO ☐ YES with exemption	None known
	How many water wells are within 100 m of the manure storage facility or manure collection area?	2	0	0		☐ YES ☐ NO ☑ YES with exemption	2 wells within 100m of proposed
	What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)	500	500	500		☑ YES ☐ NO ☐ YES with exemption	dugout/seasonal drain north, 285 m
Groundwater information	What is the depth to the water table?		6	6		☑ YES ☐ NO ☐ YES with exemption	Confirmed
	What is the depth to the groundwater resource/aquifer you draw water from?					☑ YES ☐ NO ☐ YES with exemption	Water well ID 394393, Gray Shale 7.62 m

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

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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

NRCB USE ONLY

ENVIRONMENTAL RISK SCREENING INFORMATION

ERST for **proposed** facilities

Facility	Groundwater score	Surface water score	File number
See Decision Summary BA25017			

ERST for **existing** facilities

Facility	Groundwater score	Surface water score	File number
See Decision Summary BA25011			

ERST related comments:

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NRCB Natural Resources Conservation Board

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: ID 394393

ID 354623

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
ID 354623	17	5	barn addition
ID 394393	17	9	barn addition

Groundwater or surface water related comments:

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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

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

	Neighbour name(s)	Legal land description	Distance (m)	NRCB USE ONLY: Zoning (LUB) category	MDS category (1-4)	Distance (m)	Waiver attached (if required)	Meets regulations
1	Bikker	NE 28-60-3 w5	214+276	Ag	Cat 1	214 & 276	n/a	yes*
2	Bentz	SE 28-60-3 w5	1035	Ag	Cat 1	1035	n/a	Yes
3	Van Leeuwen	NE 21-60-3 w5	1020	Ag	Cat 1	1020	n/a	yes
4	Grailach	NE 27-60-3 w5	1236	Ag	Cat 1	1236	n/a	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)
NW 27 owned					
SW 27 owned					
SE 27 owned					
			Total	N/A not for an increase in permitted livestock	

* 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)

*Under section 3(5)(c) of Standards and Administration Regulation; as the applicant is applying to build a new lean too and expand the EMS no closer to the residences and the total amount of manure being produced on site is not changing. Therefore, MDS does not apply.


769
Fairwood Sales
Mellowdale Dairy
Mellowdale
769
Mellowdale Hall
Image © 2025 Airbus
Visser's Welding

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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

NRCB USE ONLY

MINIMUM DISTANCE SEPARATION

Methods used to determine distance (if applicable): google earth

Margin of error (if applicable): n/a

Requirements (m): Category 1: 389 m Category 2: 519 m Category 3: 649 m Category 4: 1038 m

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: N/A not for an increase in permitted livestock.

Land base listed:

Area not suitable:

Available area 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 BA25011

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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

NRCB USE ONLY

ALL SIGNATURES IN FILE ☑ YES ☐ NO

DATES OF APPROVAL OFFICER SITE VISITS

July 21, 2025	

CORRESPONDENCE WITH MUNICIPALITIES AND REFERRAL AGENCIES

Date deeming letters sent: July 21, 2025

Municipality: Barrhead County

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

Alberta Health Services: n/a

☐ 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: Axiom oil and gas ☐ N/A

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

Other: _____ ☐ N/A

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

LIQUID MANURE COLLECTION AND/OR STORAGE: In-barn - Concrete liner

*(complete a copy of this section for **EACH** proposed in-barn liquid manure storage facility with a concrete liner)*

Facility description / name *(as indicated on site plan)*

1. Barn two
2. _____
3. _____

Manure storage capacity *(use one row in the table for **EACH** in-barn storage. Attach additional pages if you require more rows)*

	Length (m)	Width (m)	Total depth (m)	Depth below ground level (m)	**NRCB USE ONLY** Calculated storage capacity (m^3)
1.	61	9	1m (pit)	1m	
2.					
3.					
				TOTAL CAPACITY	cross over pit to connect to existing pits.

Concrete liner details

Scrape alleys or unslatted portions of barn floors (if applicable)	Concrete thickness: 6"	Method of sulphate protection: T50	
	Concrete strength: 30 mpa	Concrete reinforcement size and spacing: rebar 10m 18" o/c	
gutter pit In-barn manure pit floors	Concrete thickness: 6"	Method of sulphate protection: T50	
	Concrete strength: 32 mpa	Concrete reinforcement size and spacing: rebar 10m 18" o/c	
In-barn manure pit walls	Concrete thickness: 6"	Method of sulphate protection: T50	
	Concrete strength: 32 mpa	Horizontal reinforcement size and spacing: 14" o/c	Vertical reinforcement size and spacing: 18" o/c

LIQUID MANURE COLLECTION AND/OR STORAGE: In-barn - Concrete liner (cont.)

Describe how the joints at the junction of the pit walls, pit floors and any other joints will be sealed

water stop, sika flex

Describe sealing practices for piping, etc. that penetrates the liner

Connect to existing

Concrete requirements can be found in Technical Guideline Agdex 096-93
Guideline minimums:
Solid manure: 25MPa (D)
Solid manure (wet): 30MPa (C)
Liquid manure: 32MPa (B)
Category A is required to be engineered
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

Additional information

NRCB USE ONLY

Liquid manure storage volume calculator attached: ☐ YES ☑ NO

Depth to water table: >6 m — Requirements met: ☑ YES ☐ NO

Depth to uppermost groundwater resource: 7.62 m — Requirements met: ☑ YES ☐ NO

ERST completed: ☑ see ERST page for details

Concrete liner requirements

Applicant to provide documentation confirming concrete information.

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

Last updated February 26, 2021

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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

LIQUID MANURE STORAGE: Earthen manure storage (EMS): Naturally occurring protective layer

*(complete a copy of this section for **EACH** proposed earthen liquid manure storage facility with a naturally occurring protective layer)*

Facility description / name *(as indicated on site plan)* 1. EMS addition

2.

Manure storage capacity *(complete a separate row of this table for each cell of the EMS)*

	Length (m)	Width (m)	Total depth (m)	Depth below ground level (m)	Slope run:rise			NRCB USE ONLY	
					Inside end walls	Inside side walls	Outside walls	Calculated storage capacity (m^3) (excl. 0.5 m freeboard)	Filled in lower ¼? Y/N
1.	20	42	5	4.5	3	3	3		yes
2.									
							TOTAL CAPACITY	6986 m3	

Total dimensions 75 m x 42 m x 5 m

Surface water control systems

Describe the run-on and runoff control system

berm around facility

New approved lagoon (Approval BA25011) has not been constructed if that facility is not constructed by deadline then applicant's livestock numbers will be reduced to available manure storage capacity on site.

Naturally occurring protective layer details

Thickness of naturally occurring protective layer	9 (m)	Provide details (as required) see attached	
Soil texture	29.6 % sand	31.4 % silt	38.7 % clay
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested	Hydraulic conductivity (cm/s) 1.26×10^{-9}	Describe test standard used in situ

Additional information *(attach copies of soil test reports)*

NRCB USE ONLY

Requirements met: ☑ YES ☐ NO

Condition required: ☑ YES ☐ NO

Report attached: ☑ YES ☐ NO

Applicant is permitted to construct a new earthen liquid manure storage under BA25011, this hasn't started along with the approved expansion. This construction is to update the dairy prior to the expansion occuring.

ENVIROWEST
ENGINEERING

SITE AND SOIL ASSESSMENT

Proposed Earthen Manure Storage Lagoon
NW-27-060-03-W5M

County of Barrhead No.11, Alberta

Site and Soil Assessment
Proposed Liquid Manure Storage Lagoon
NW-27-060-03-W5M
County of Barrhead No.11, Alberta

Prepared For: Jan Otten

Delivered via Email: [redacted]

Prepared By: Envirowest Engineering
Box 4248, Ponoka, AB, T4J 1R6
(403) 783-8229

Report Date: July 9, 2025

Project Number: 2504-43084

Private and Confidential

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Appendices

1.0 Introduction and Scope of Work

Envirowest Engineering (Envirowest) was retained by Jan Otten to conduct a Site and Soil Assessment for the proposed construction of an earthen manure storage (EMS) lagoon for a confined feeding operation for 270 head milking cows plus dries and replacements.

The assessment was completed to determine conditions beneath the proposed construction area and assess soil properties for construction of proposed facilities. The operation, herein referred to as “the Site,” is located on NW-27-060-03-W5M in the County of Barrhead No.11, Alberta.

The assessment has been completed in accordance with the standards and regulations associated with the amended Agricultural Operation Practices Act and associated regulations which govern all new and modified confined feeding operations.

Scope of Work

Three investigative boreholes were drilled using a truck-mounted rotary auger and completed to a maximum depth of 9.0 m below ground surface (mbgs) on April 30, 2025. The boreholes were completed in the area proposed for the EMS lagoon. Representative soil samples were collected from the boreholes and submitted to a third-party laboratory for analysis of soil properties. The borehole locations are shown on Figure 1.0 (attached).

One borehole was completed as a groundwater monitoring well to allow for in-situ hydraulic conductivity testing, which was completed between May 17 and May 29, 2025. In addition, a 2.5 cm diameter piezometer was installed to allow for the determination of the groundwater level at the time of construction. An uppermost groundwater resource (UGR) was conservatively determined to be below 9.0 mbgs (as measured from borehole 24BH01). No further assessment was completed to confirm the UGR.

2.0 Assessment Results

The proposed area of construction is gently rolling and sloped to the northeast.

Potential liner construction material (noted in borehole logs as sandy clay) was typically found beneath topsoil to the depth of investigation. Bedrock was not encountered to the maximum depth of investigation (9.0 mbgs).

Boreholes were backfilled with the material removed by back spinning the solid stem auger and compacting to depth of the borehole.

A saturated water table (as defined in the field by saturated soils) was not found during the assessment. The depth to water table was measured within the piezometer on May 29, 2025 to be 5.65 mbgs.

The results of the soil analysis completed by a third-party laboratory are presented in Table 1 below. The soil sample locations are presented on Figure 1.0, and borehole logs are attached.

Table 1: Soil Properties Results

Sample	Depth (mbgs)	Sand (%)	Silt (%)	Clay (%)	Soil Texture
25BH01-01	0.75	28.9	34.6	36.5	Clay Loam
25BH01-02	5.40	28.0	33.0	38.6	Clay Loam
25BH01-03	9.00	29.2	30.6	40.2	Clay
25BH02-01	5.50	29.6	31.7	38.7	Clay Loam
25BH02-02	6.60	31.5	31.4	37.1	Clay Loam
24BH03-01	6.25	28.6	32.3	38.5	Clay Loam

The soils suspected for a potential natural barrier were identified as clay loam or clay with a clay content ranging from 36.5% - 40.2%. The assessed natural barrier (clay/ clay loam) had an average clay content of 38.2%.

The monitoring well installed at borehole 25BH01 (25MW01), was screened from 7.5 to 9.0 mbgs and was sufficiently hydrated prior to completing the in-situ hydraulic conductivity testing. The in-situ hydraulic conductivity test was completed between May 17 and May 29, 2025.

During the in-situ hydraulic conductivity test, the initial depth to water was measured in the well. A microdiver was then installed to measure and log water level, temperature, and time. A volume of water was then removed from the well and the change in depth measured over time to assess hydraulic conductivity of the clay strata. It is assumed (as per AGDEX 096-01) that all flow occurs under saturated conditions. The depth was measured every 30 seconds. The results of the test were analyzed as a falling head test using AQTESOLV Bouwer-Rice method for unconfined wells. The results of the assessment were an in-situ hydraulic conductivity of 1.26×10^{-9}cm/sec.

As per the request of the owner, a proctor was completed for the clay material for potential use within an alternate project. Natural moisture was found to be 19.1%, optimal moisture was found to be 14.8% with a maximum dry density of 1710 kg/m$^{3.}$

A saturated water table was not encountered during the assessment to a maximum depth of 9.0 mbgs. It was concluded based on the field assessment that a standard water table is present and delineation was not required. A 2.5 cm diameter piezometer was installed at the location of the proposed earthen manure storage lagoon to a depth of 7.5 mbgs to allow for the determination of the groundwater level at the time of construction. The depth to water table was measured within the piezometer on May 29, 2025 to be 5.65 mbgs.

3.0 Liner Assessments

3.1 Natural Barrier Assessment (Liquid Manure Storage)

Based on the information obtained it was determined that the native clay within the proposed area of construction for liquid manure storage was found to the maximum depth of investigation, 9.0 mbgs, generally at surface.

Minimum Required Liner Depth for a natural barrier for a catch basin:

$$\frac{10 \text{ m}}{1 \times 10^{-6} \text{ cm/sec}} = \frac{\mathbf{X} \text{ m}}{1.26 \times 10^{-9} \text{ cm/sec}}$$

$$\mathbf{X} = 0.0126 \text{ m}$$

It is found that there is sufficient protection across the area proposed for a liquid manure storage lagoon.

4.0 Conclusions

The following conclusions are based on the discussed scope of the construction.

The soils beneath the proposed area of construction were determined to be appropriate for a naturally occurring protective layer for a liquid manure storage lagoon.

5.0 Earthen Manure Storage Sizing

The new liquid EMS facility was designed for 270 head plus dries and replacements for approximately 12 months of storage (exceeding the minimum required 9 months of storage). The manure storage lagoon is recommended to have the following specifications:

- To provide the required capacity the new EMS should be 69 m in length x 69 m in width. The overall depth has been designed as 4.5 m. The overall capacity of the new EMS will be 14,134 cubic metres (3.1 million imperial gallons) which accounts for the required 0.5 m of freeboard, a storage capacity of 11,856 cubic metres (2.6 million imperial gallons), approximately 12 months storage. The sizing is based on an inside end and side wall slope of 3:1 (run/rise)
- The overall depth of 4.5 m will be achieved through a below grade depth of 4.0 m. The above-grade dykes of 0.5 m will also prevent runoff from entering the facility. The outside dyke walls should be completed to at slope of 4:1. The crest of the dyke should be sloped slightly outward to direct rainfall away from the storage facility
- The below-grade depth of the EMS must maintain a minimum of a 1.0 m separation above the water table at the time of construction, should one be encountered
- Sand pockets that may be encountered during construction should be removed and replaced with find grained material
- Topsoil, frozen soil or rocks larger than 6 inches should not be included in the liner material
- The freeboard depth of 0.5 m and outside dyke walls should be covered with 0.1-0.2 m of topsoil and seeded to prevent soil erosion.
- The inlet pipe to the EMS should be located in the bottom 1/4 of the lagoon. The annulus around the inlet pipe should be sealed with a bentonite sealer

Earthen Manure Storage Construction

The following general construction procedures are recommended, though some modifications may be required based on actual site conditions encountered during construction:

- The topsoil should be stripped from the area for construction. The topsoil can be reused on the freeboard area after construction completion
- Sand and gravel seams, if encountered, should be excavated during construction and should be removed
- Construction of the lagoon should be supervised by a professional engineer

Following completion of the lagoon the operator should:

- Ensure that shrubs, trees, and deep-rooted plants are not allowed to grow on or near the walls of the facility

6.0 Closure

Envirowest Engineering is pleased to submit the report to Jan Otten. The information and conclusions contained in this report are for their sole use. No other party is to rely upon the information contained within the report without the express written authorization of Envirowest Engineering.

Envirowest Engineering is not responsible for any damages that may be suffered as the result of any unauthorized use of, or reliance on, this report. Envirowest Engineering has performed the work and made the findings and conclusions set out in the report in a manner consistent with the level of care and skill normally exercised by members of the environmental engineer profession practicing under similar conditions at the time the work was performed. Envirowest Engineering accepts no responsibility for any deficiency, misstatement or inaccuracy in this report resulting from misinformation from any individuals or parties that provided information as part of this report.

We trust that this report meets your present needs. Please feel free to contact the undersigned with any questions or should you require additional information.

Respectfully submitted,

July 9, 2025

Reviewed by:
Leah Predy, P.Ag.
Envirowest Engineering

Prepared by:
Emily J. Low, P.Eng.
Envirowest Engineering

PERMIT TO PRACTICE
2206165 ALBERTA LTD.

RM SIGNATURE: _____

RM APEGA ID #: 110373

DATE: July 9, 2025

PERMIT NUMBER: P014810
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

2206165 Alberta Ltd. o/a Envirowest Engineering
Association of Professional Engineers and Geoscientists of Alberta
Permit to Practice No. P14810

7.0 Qualifications of Assessors

Ms. Emily Low, B.Sc., P.Eng, is an Environmental Engineer with Envirowest Engineering and has approximately 15 years of environmental assessment, monitoring, and remediation experience in the agricultural, industrial, real estate and development, and oil and gas sectors. Ms. Low has a Bachelor of Science in Chemical Engineering from the University of Alberta and is a certified Professional Engineer in Alberta (Association of Professional Engineers and Geoscientists of Alberta).

Leah Predy, B.A., B.Sc., P.Ag., is a Professional Agrologist with Envirowest Engineering and has approximately 5 years of experience in the environmental field, both in field data collection and report preparation for environmental assessments, monitoring, and remediation, as well as agricultural projects. Prior to her employment with Envirowest Engineering, Leah had five years of experience managing rangelands and navigating legislation and regulations as a Rangeland Agrologist with the Government of Alberta. She is a Professional Agrologist in Alberta (Alberta Institute of Agrologists).

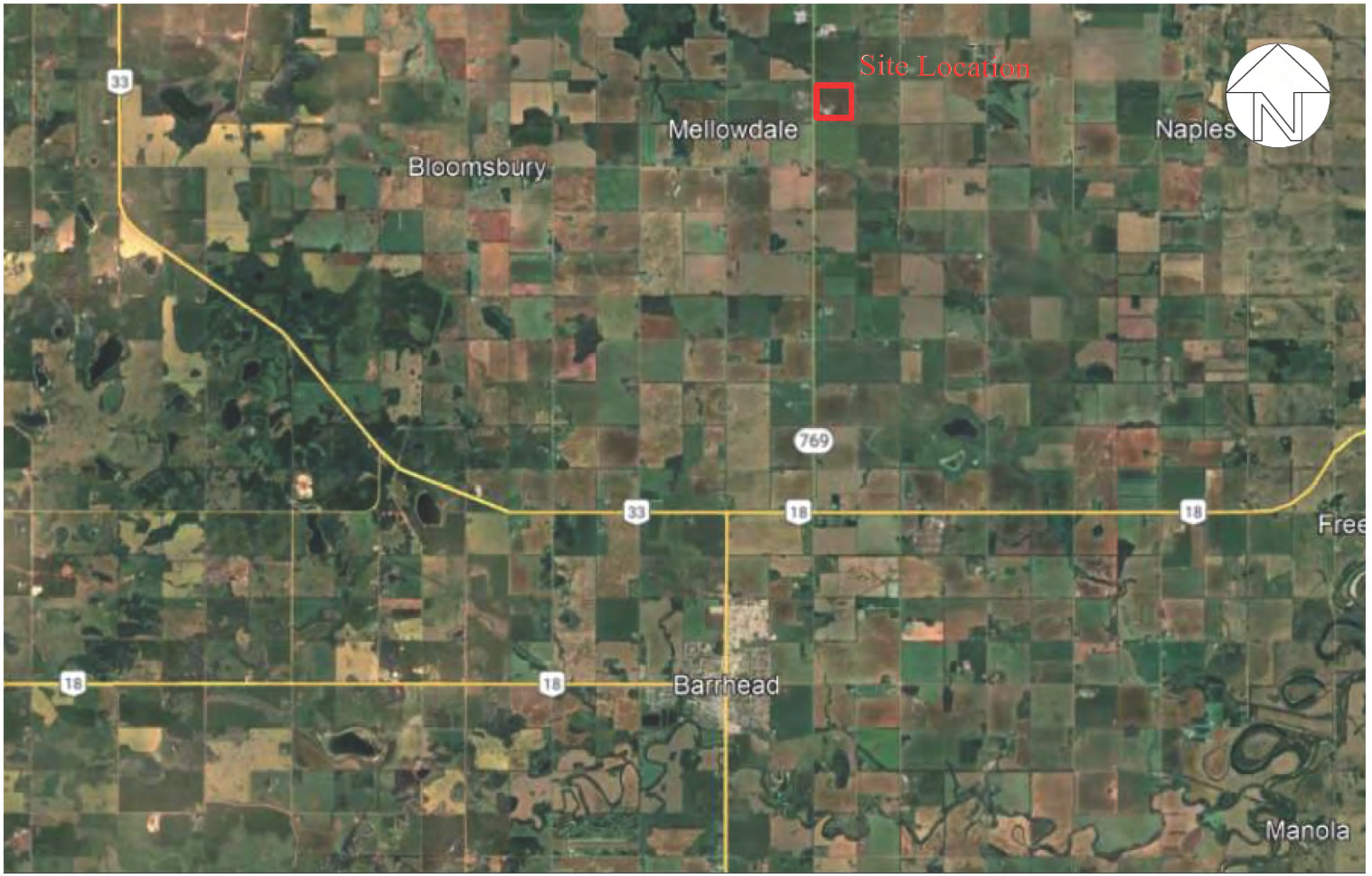
8.0 References

GOA (Government of Alberta). (January 2020). Agricultural Operation Practices Act and Regulations. Edmonton, AB: Author.

GOA (Government of Alberta). (2017). Agricultural Operation Practices Act: Standards and Administration Regulation. Edmonton, AB: Author.

Appendix A

Figures

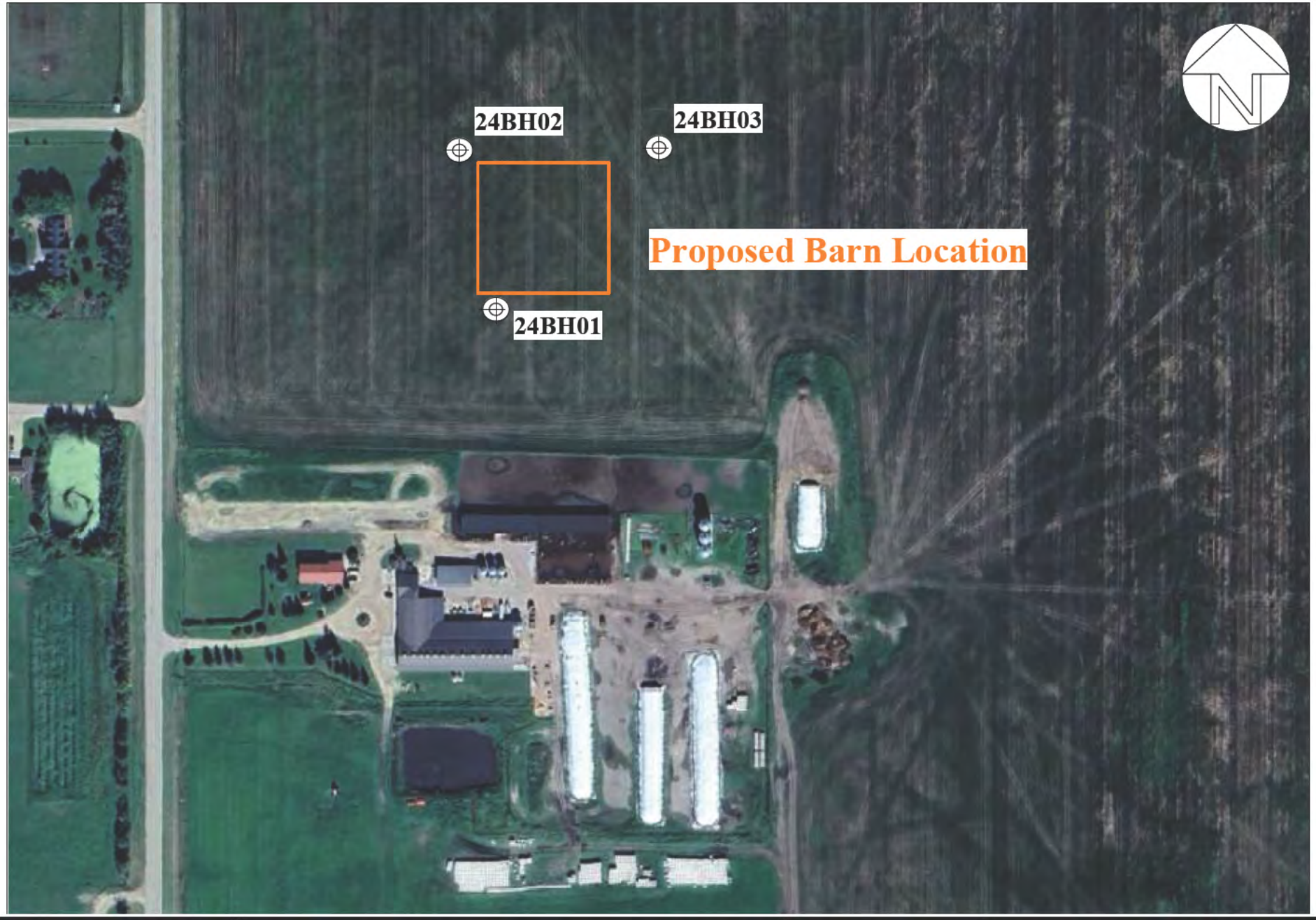


ENVIROWEST ENGINEERING

Title:

Site and Soil Assessment
Proposed Liquid Manure Storage Lagoon
NW-27-060-03-W5M
County of Barrhead No.11, Alberta

Project No: 2504-43084	**Date:** July 9, 2025	**Figure No.:** 1.0
Scale:	**Prepared By:** E.Low	
Image Source: Google Earth Pro (September		



ENVIROWEST ENGINEERING

Title:

Borehole Locations
Site and Soil Assessment
Proposed Liquid Manure Storage Lagoon
NW-27-060-03-W5M
County of Barrhead No.11, Alberta

Project No: 2504-43084	**Date:** July 9, 2025	**Figure No.:** 2.0
Scale:	**Prepared By:** E.Low	
Image Source: Google Earth Pro (September		

Appendix B

Borehole Logs

ENVIROWEST ENGINEERING

LOG OF BORING 25BH01

Site and Soil Assessment
NW-27-060-03-W5M
County of Barrhead No. 11, Alberta

Project Number: 2504-43084

Driller: : Evergreen Drilling
Drilling Method: : Truck Mounted Auger
Drill Date : April 30, 2025
Logged By: : Emily Low P.Eng.

Depth in Meters	Gastech Reading (ppm) 0 100 200 300 400 500	VOC Reading	GRAPHIC	DESCRIPTION	Well: 25MW01 Elev.:	Water Level
0.0				SANDY CLAY, brown, mottling, loose to firm, medium plasticity, moist		
0.3						
0.5						
0.8						
1.0						
1.3						
1.5						
1.8						
2.0						
2.3						
2.5						
2.8						
3.0						
3.3						
3.5					Bentonite	
3.8						
4.0					Solid	
4.3						
4.5						
4.8						
5.0						
5.3						
5.5						
5.8						
6.0						
6.3						
6.5						
6.8				grey		
7.0						
7.3						
7.5						
7.8						
8.0					Sand	
8.3						
8.5					Screen	
8.8						
9.0						

07-08-2025 Y:\Operations\Client Data\43084 Jan Otten\25BH01.bor

ENVIROWEST ENGINEERING

LOG OF BORING 25BH02

Site and Soil Assessment
NW-27-060-03-W5M
County of Barrhead No. 11, Alberta

Project Number: 2504-43084

Driller: : Evergreen Drilling
Drilling Method: : Truck Mounted Auger
Drill Date : April 30, 2025
Logged By: : Emily Low P.Eng.

Depth in Meters	Gastech Reading (ppm) 0 100 200 300 400 500	VOC Reading	GRAPHIC	DESCRIPTION	Well: Elev.:	Water Level
0.0				SANDY CLAY, brown, mottling, loose to firm, medium plasticity, moist		
0.3						
0.5						
0.8						
1.0						
1.3						
1.5						
1.8						
2.0						
2.3						
2.5						
2.8						
3.0						
3.3						
3.5						
3.8						
4.0						
4.3						
4.5						
4.8						
5.0						
5.3						
5.5						
5.8						
6.0						
6.3						
6.5						
6.8				grey		
7.0						
7.3						
7.5						
7.8						
8.0						
8.3						
8.5						
8.8						
9.0						

07-08-2025 Y:\Operations\Client Data\43084 Jan Otten\25BH02.bor

ENVIROWEST ENGINEERING

LOG OF BORING 25BH03

Site and Soil Assessment
NW-27-060-03-W5M
County of Barrhead No. 11, Alberta

Project Number: 2504-43084

Driller: : Evergreen Drilling
Drilling Method: : Truck Mounted Auger
Drill Date : April 30, 2025
Logged By: : Emily Low P.Eng.

Depth in Meters	Gastech Reading (ppm) 0 100 200 300 400 500	VOC Reading	GRAPHIC	DESCRIPTION	Well: 25MW02 Elev.:	Water Level
0.0				SANDY CLAY, brown, mottling, loose to firm, medium plasticity, moist		
0.3						
0.5						
0.8						
1.0						
1.3						
1.5						
1.8						
2.0						
2.3						
2.5						
2.8						
3.0						
3.3					Solid	
3.5						
3.8					Cuttings	
4.0						
4.3						
4.5						
4.8						
5.0						
5.3						
5.5						
5.8						
6.0						
6.3						
6.5						
6.8						
7.0					Screen	
7.3						
7.5						

07-08-2025 Y:\Operations\Client Data\43084 Jan Otten\25BH03.bor

Appendix C

Certificate of Analysis

Laboratory Hydrometer — Sample No.: W708

Sample Information

Date: 02-May-25 **By:** Emily **of:** Envirowest **Type:** Bag

Location: 25BH01-01 **Specification:** ASTM D 422

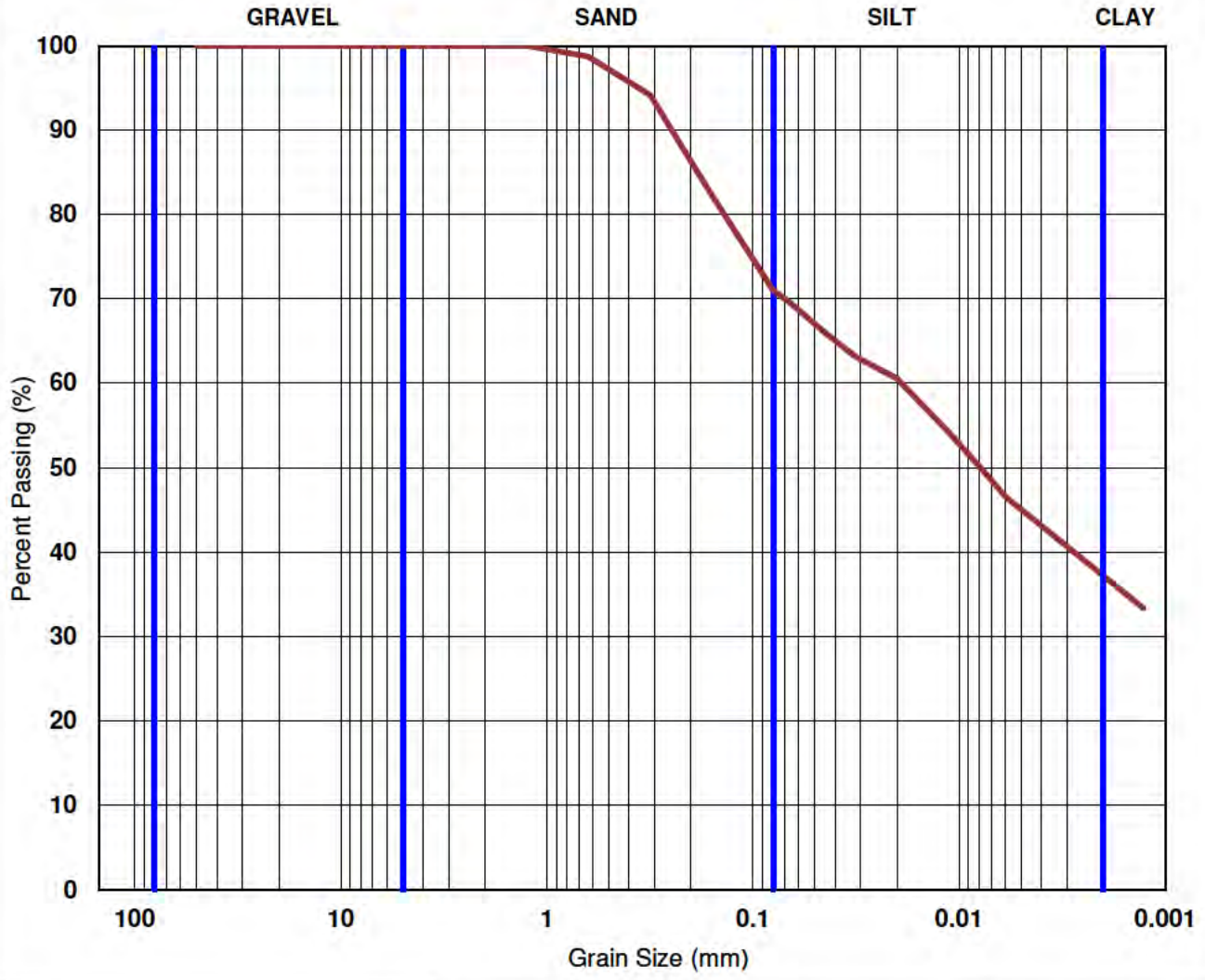
Description: Clay, silty, sandy

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.0** Sand = **28.9** Silt = **34.6** Clay = **36.5**



Union Street Geotechnical

CLIENT:	Envirowest	**FILE No.:**	USG2099
PROJECT:	2025 Materials Testing	**DATE:**	09-May-25
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Hydrometer — Sample No.: W709

Sample Information

Date: 02-May-25 **By:** Emily **of:** Envirowest **Type:** Bag

Location: 25BH01-02 **Specification:** ASTM D 422

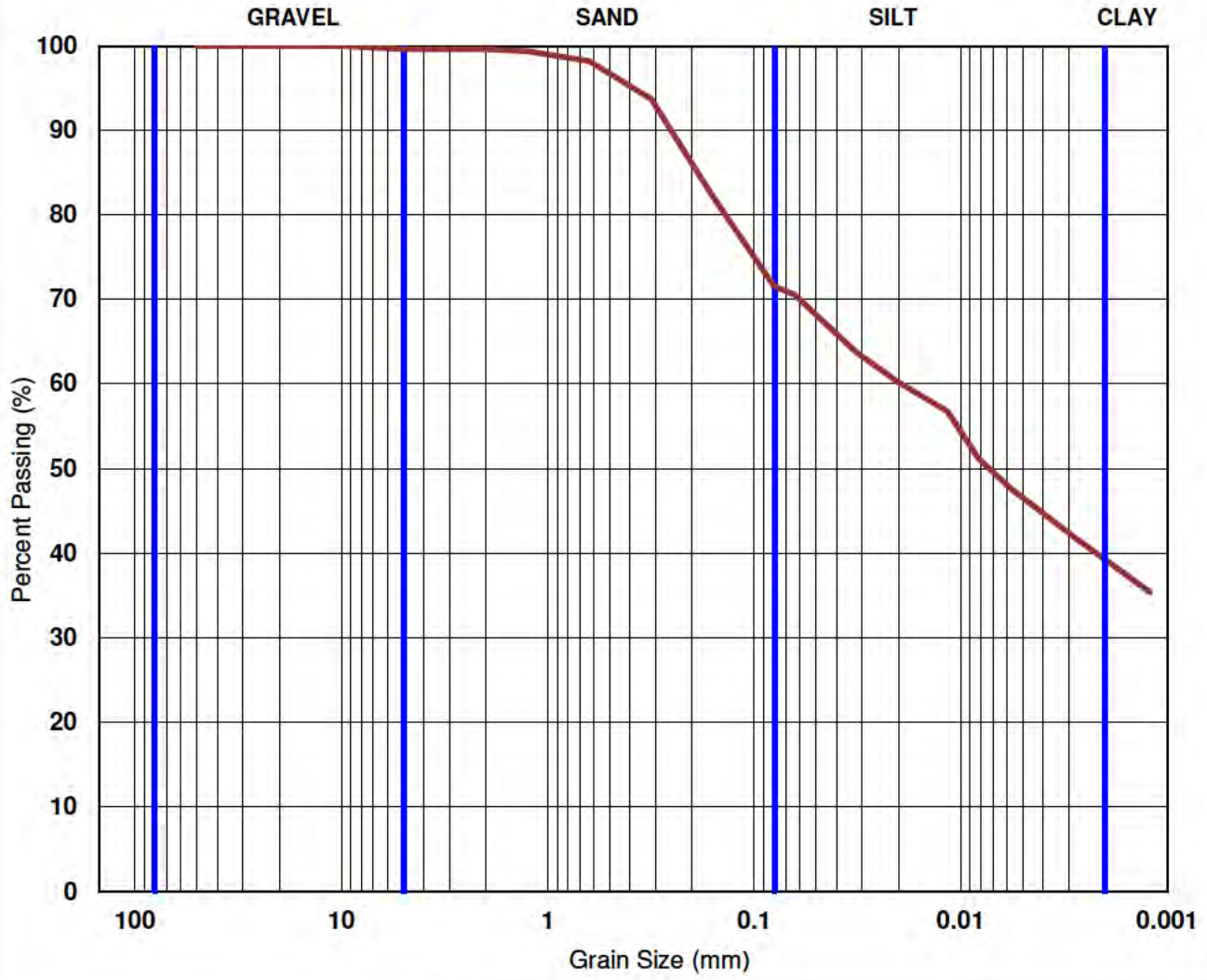
Description: Clay, silty, sandy, gravel inclusions

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.4** Sand = **28.0** Silt = **33.0** Clay = **38.6**



Union Street Geotechnical

CLIENT:	Envirowest	**FILE No.:**	USG2099
PROJECT:	2025 Materials Testing	**DATE:**	09-May-25
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Hydrometer — Sample No.: W710

Sample Information

Date: 02-May-25 **By:** Emily **of:** Envirowest **Type:** Bag

Location: 25BH01-03 **Specification:** ASTM D 422

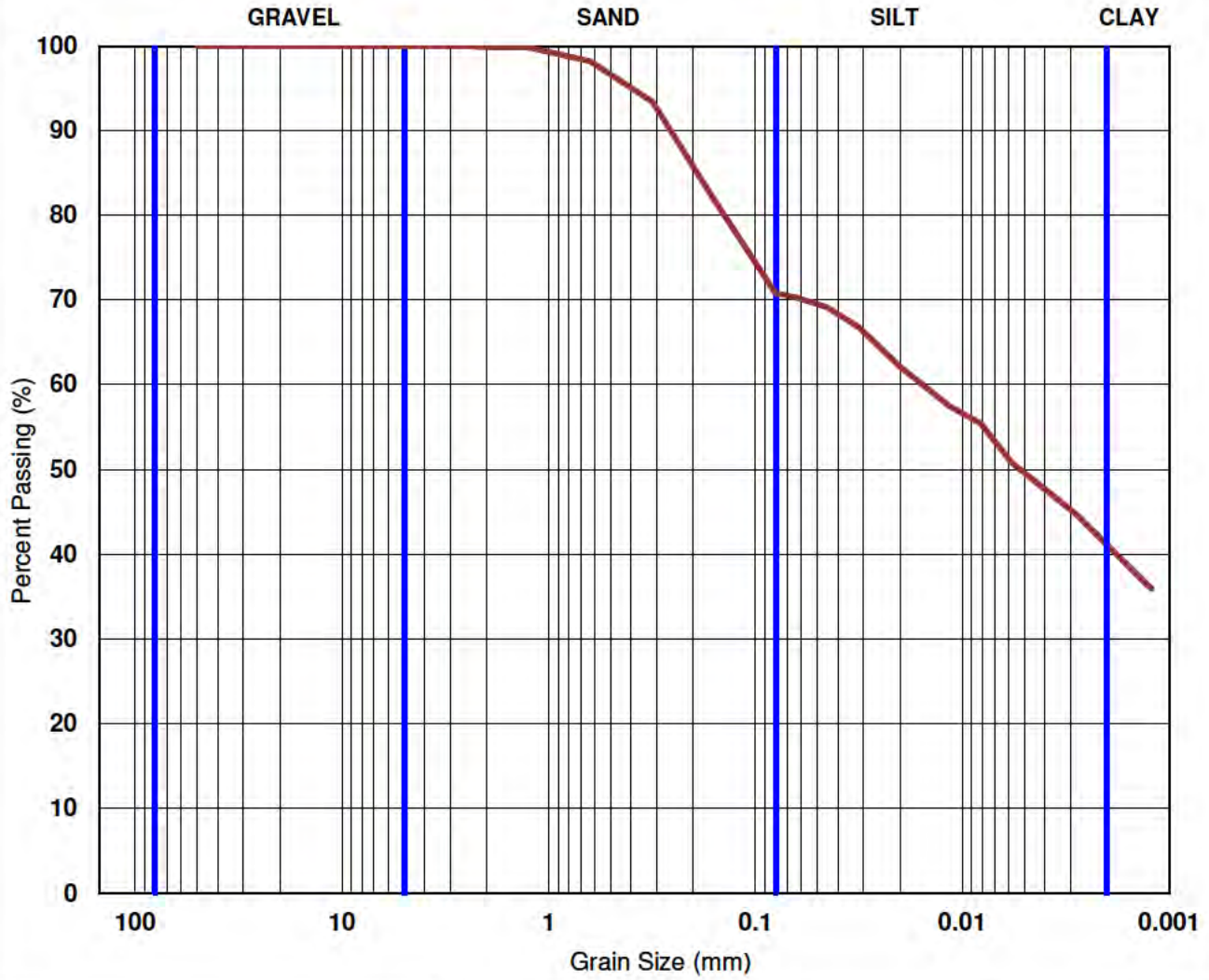
Description: Clay, silty, sandy

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.0** Sand = **29.2** Silt = **30.6** Clay = **40.2**



Union Street Geotechnical

CLIENT:	Envirowest	**FILE No.:**	USG2099
PROJECT:	2025 Materials Testing	**DATE:**	09-May-25
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Hydrometer — Sample No.: W711

Sample Information

Date: 02-May-25 **By:** Emily **of:** Envirowest **Type:** Bag

Location: 25BH02-01 **Specification:** ASTM D 422

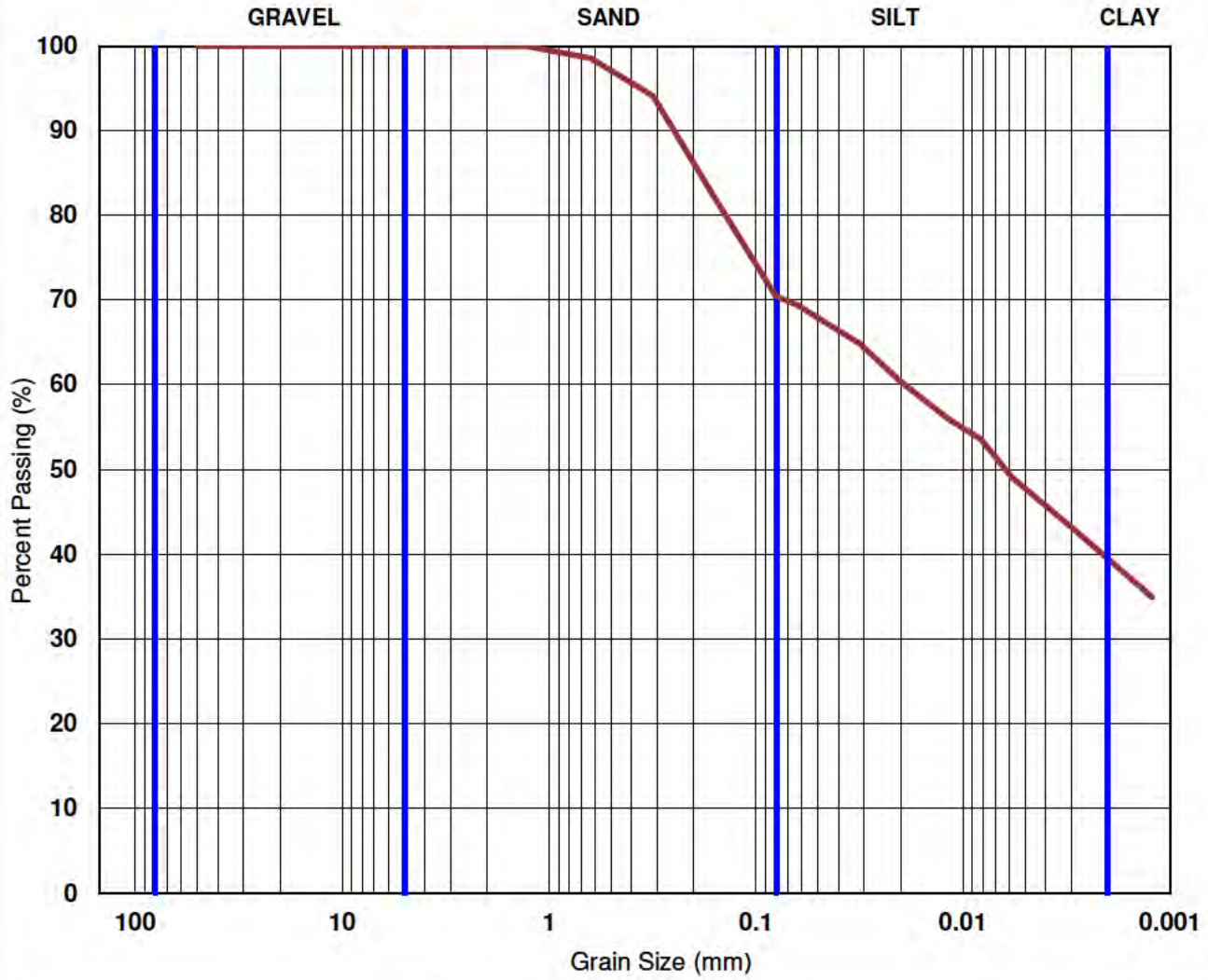
Description: Clay and silt, sandy

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.0** Sand = **29.6** Silt = **31.7** Clay = **38.7**



Union Street Geotechnical

CLIENT:	Envirowest	**FILE No.:**	USG2099
PROJECT:	2025 Materials Testing	**DATE:**	09-May-25
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Hydrometer — Sample No.: W712

Sample Information

Date: 02-May-25 **By:** Emily **of:** Envirowest **Type:** Bag

Location: 25BH02-02 **Specification:** ASTM D 422

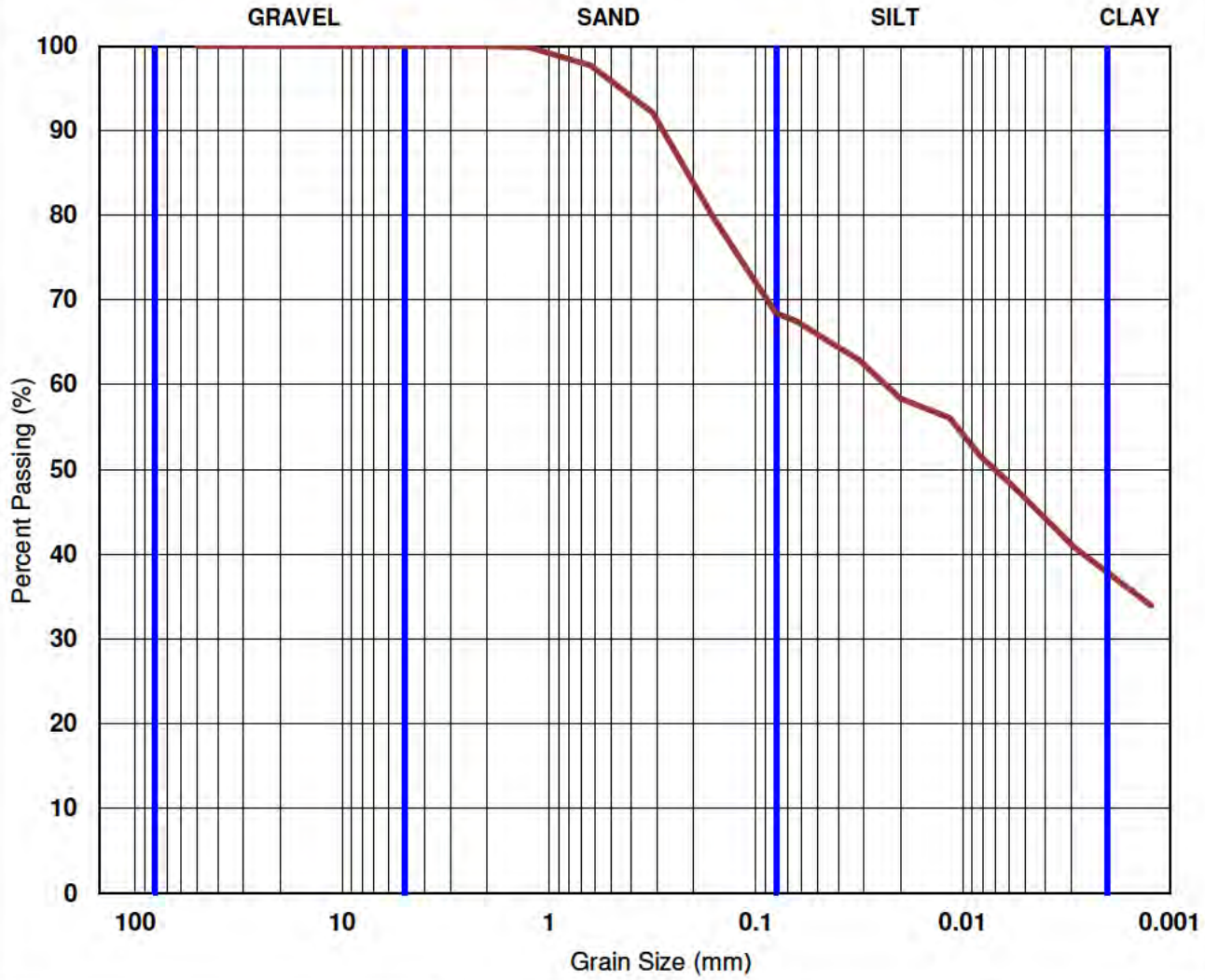
Description: Clay, sandy, silty

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.0** Sand = **31.5** Silt = **31.4** Clay = **37.1**



Union Street Geotechnical

CLIENT:	Envirowest	**FILE No.:**	USG2099
PROJECT:	2025 Materials Testing	**DATE:**	09-May-25
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Hydrometer — Sample No.: W713

Sample Information

Date: 02-Mar-25 **By:** Emily **of:** Envirowest **Type:** Bag

Location: 25BH03-01 **Specification:** ASTM D 422

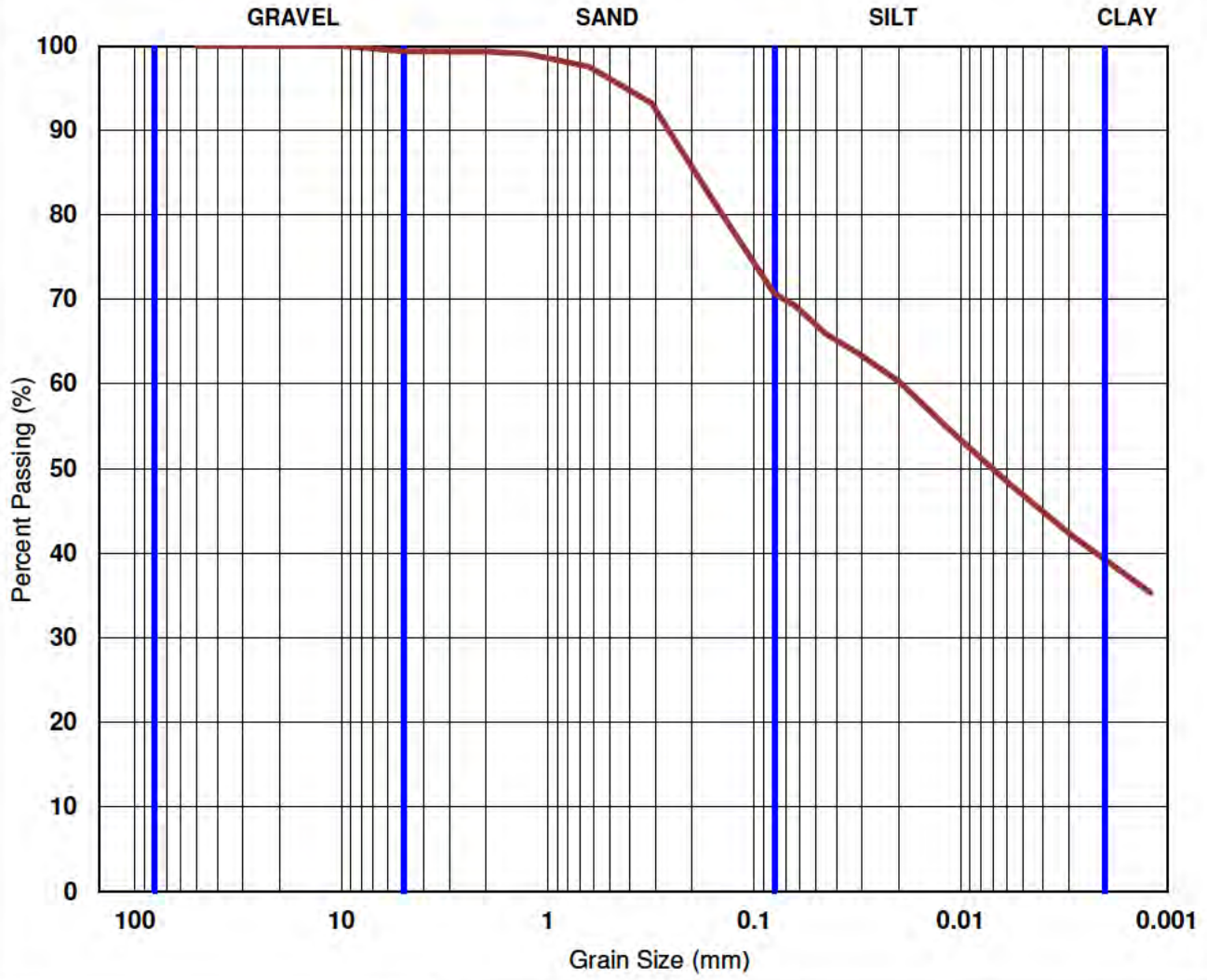
Description: Clay, silty, sandy, gravel inclusions

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.6** Sand = **28.6** Silt = **32.3** Clay = **38.5**



Union Street Geotechnical

CLIENT:	Envirowest	**FILE No.:**	USG2099
PROJECT:	2025 Materials Testing	**DATE:**	09-May-25
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Proctor — Sample No.: W707

Sample Information

Date: 02-May-25 **By:** Emily **of:** Envirowest **Type:** Bag
Location: NW-74-60-03-WSM **Natural Moisture:** 19.1 %
Description: Clay

Specfication: ASTM D 698 - Method A

Comments:

Proctor Results:

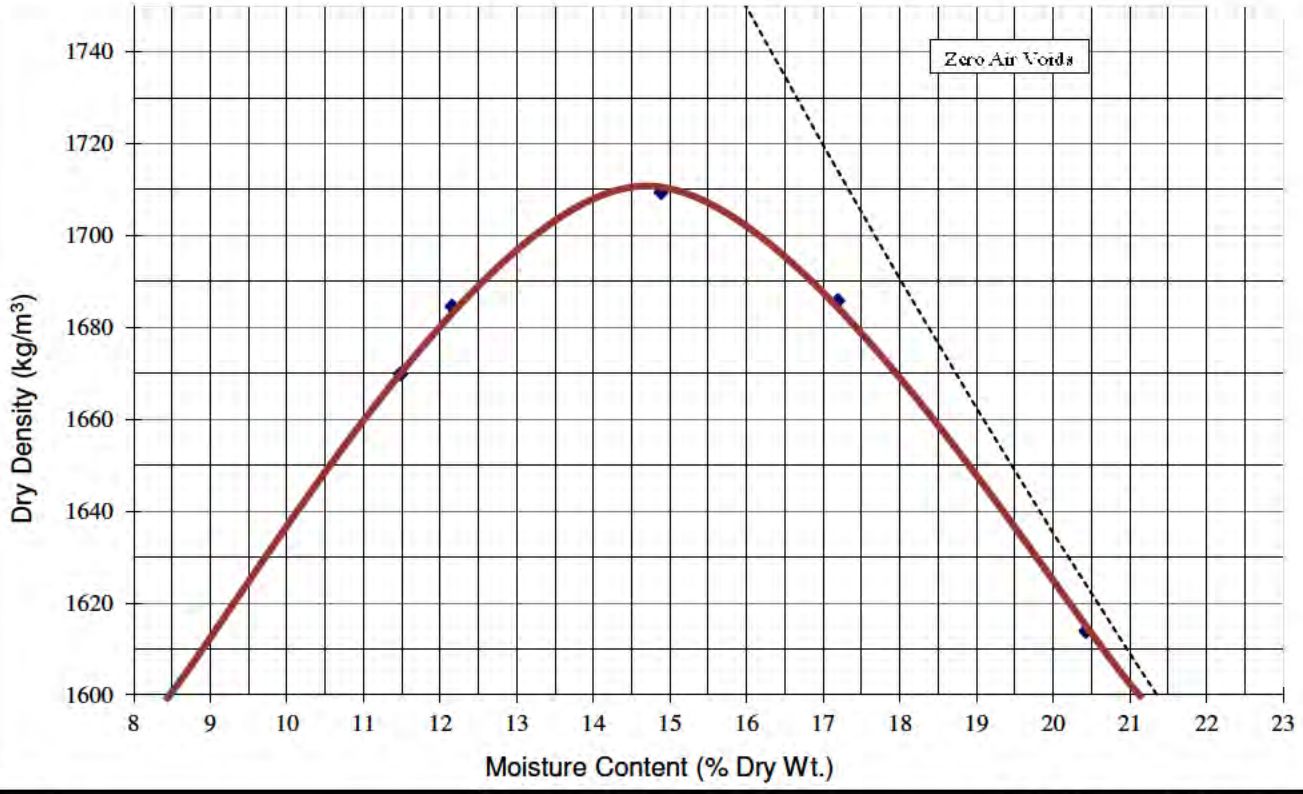
Test Number	1	2	3	4	5
Dry Density (Kg/m^3)	**1670**	**1685**	**1709**	**1686**	**1614**
Moisture Content (%)	**11.5**	**12.2**	**14.9**	**17.2**	**20.4**

Oversize Correction (Calculated using assumed Specific Gravity of 2.40)

Oversize (%)	5	10	15	20	25
Density	**1743**	**1776**	**1809**	**1841**	**1874**

Optimum Results:

Moisture Content = **14.8** %
Dry Density = **1710** Kg/m^3
Corrected Density = **1737** Kg/m^3
Oversize Material = **4.2** %



Union Street Geotechnical

CLIENT: Envirowest **FILE No.:** USG2099
PROJECT: 2025 Materials Testing **DATE:** 09-May-25
LOCATION: Red Deer, Alberta **TECH:** D.J.W.