# rt 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: LA25027

Legal land description: E½ 33-20-23 W4M

☒ Approval ☐ Registration ☐ Authorization ☐ Amendment

## 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.

March 15/2025
Date of signing

[redacted]
Signature

Norander Farms LTD
Corporate name (if applicable)

Matthew Jacobsen
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) |
|---|---|
| Catch basin | 35 m x 22 m x 3 m deep |
| Pen areas including alleys | 151 m x 96 m |
| | |
| | |
| | |

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

| Existing facilities | Dimensions (m) (length, width, and depth) | NRCB USE ONLY |
|---|---|---|
| Area including Allys | 151m x 96m | |
| | | |
| | | |

**NRCB USE ONLY**

AO Comment: Applicant is applying to permit existing pen areas that had been used for seasonal feeding and bedding and construct a catch basin.

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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**

**Construction completion date for proposed facilities** _____

**Additional Information**

AO Comment: Applicant proposes to complete construction of the proposed catch basin by December 31, 2025.

**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** |
|---|---|---|---|
| Beef Feeders / Finishers | | 1500 | 1500 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Noranden farms LTD
E½ 33-20-23 W4

Figure 3


(1) Proposed Catch Basin Location if required

E ½ 23-20-23 W4

Norcanden farms LTD

Figure 2


1 - Barn / Recieving

2 - Water Well - above ground casing, Inactive
Non-Domestic

3 - Fresh Water Storage
↳ 250m from Pens
↳ Above grade of Pens
↳ Burmed

4 Waterwell, inactive non-domestic
50m setback

5 Waterwell - Domestic Water supply
110m setback

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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 ____ 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 AEP under the *Water Act* for the development or activity proposed in this AOPA application.

Signed this 15 day of March, 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 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*

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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:** Hernandez Farms ETD **Proposed 1:** _____

**Proposed 2:** _____ **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 height 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 | |
| Surface water information | How many springs are within 100 m of the manure storage facility or manure collection area? | 0 | | | | ☐ YES ☐ NO ☐ YES with exemption | |
| | How many water wells are within 100 m of the manure storage facility or manure collection area? | 1 | | | | ☐ YES ☐ NO ☐ YES with exemption | |
| | What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal) | 140 m | | | | ☐ YES ☐ NO ☐ YES with exemption | |
| Groundwater information | What is the depth to the water table? | | | | | ☐ YES ☐ NO ☐ YES with exemption | |
| | What is the depth to the groundwater resource/aquifer you draw water from? | N/A Deposit | | | | ☐ YES ☐ NO ☐ YES with exemption | |

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

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

| | | | NRCB USE ONLY | | | | |
|---|---|---|---|---|---|---|---|
| Neighbour name(s) | Legal land description | Distance (m) | Zoning (LUB) category | MDS category (1–4) | Distance (m) | Waiver attached (if required) | Meets regulations |
| Art Bird | SE 4-21-23 w4 | 675m | | | | | |
| Art Bird | SE 4-21-23 w4 | 1030m | | | | | |
| Rob Jones | NE 26-20-23 w4 | 10000m | | | | | |
| Arrowwood Village | | 1500 m | | | | | |
| | | | | | | | |

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

| | | | | NRCB USE ONLY | |
|---|---|---|---|---|---|
| Name of land owner(s)* | Legal land description | Usable area** (ha) | Soil zone *** | Usable area (ha) | Agreement attached (if required) |
| Marsden Farms LTD | W/ 34-20-23 w4 | 259 | Dark Brown | | |
| " | W/ 27-20-23 W4 | 250 | Dark Brown | | |
| " | PT 33-20-23 w4 | 40 | Dark Brown | | |
| | | | | | |
| | | | Total | | |

* 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

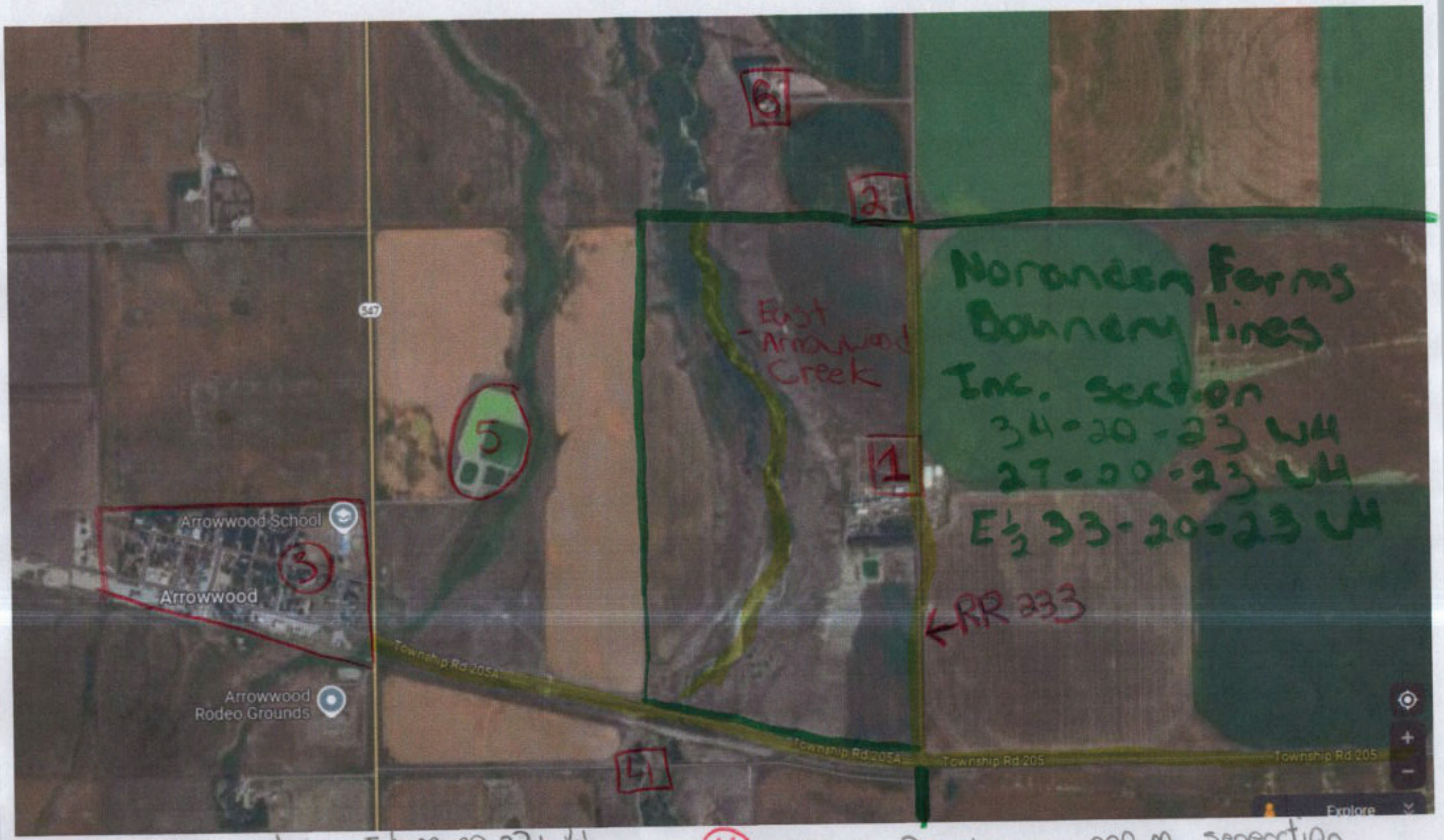
**Additional information (attach any additional information as required)**

Noranden Farms LTD

Runoff runs natural grade NE

N↑

Figure 1




1. Pen Location E½ 23-20-23 W4
2. Neighbor Residence - 675 M seperation
3. Village of Arrowwood - 1500 M seperation
4. Neighbor Residence - 1000 M seperation
5. VOA septic lagoons
6. Neighbor Residence - 1030 M seperation

| | |
|---|---|
| Name | Noranden Farms Ltd |
| Address | |
| Legal Land | |
| Location | E 1/2 33-20-23 W4 |

**MDS Spreadsheet based on 2006 AOPA Regulations**

| Category of Livestock | Type of Livestock | Factor A | Technology Factor | MU | LSU Factor | Number of Animals | LSU |
|---|---|---|---|---|---|---|---|
| Feedlot Animals | Beef Cows/Finishers (900+ lbs) | 0.700 | 0.700 | 0.910 | 0.4459 | 1,500 | 668.9 |
| | Beef Feeders (450 - 900 lbs) | 0.700 | 0.700 | 0.500 | 0.2450 | | - |
| | Beef Feeder Calves (<550 lbs) | 0.700 | 0.700 | 0.275 | 0.1348 | | - |
| | Horses - PMU | 0.650 | 0.700 | 1.000 | 0.4550 | | - |
| | Horses - Feeders > 750 lbs | 0.650 | 0.700 | 1.000 | 0.4550 | | - |
| | Horses - Foals < 750 lbs | 0.650 | 0.700 | 0.300 | 0.1365 | | - |
| | Mules | 0.600 | 0.700 | 1.000 | 0.4200 | | - |
| | Donkeys | 0.600 | 0.700 | 0.670 | 0.2814 | - | - |
| | Bison | 0.600 | 0.700 | 1.000 | 0.4200 | | - |
| | Other | | | | | | - |
| Dairy (*count lactating cows only) | Free Stall – Lactating Cows with all associated dries, heifers, and calves* | 0.800 | 1.100 | 2.000 | 1.7600 | | - |
| | Free Stall – Lactating Cows with Dry Cows only* | 0.800 | 1.100 | 1.640 | 1.4432 | | - |
| | Free Stall – Lactating Cows only | 0.800 | 1.100 | 1.400 | 1.2320 | | - |
| | Tie Stall – Lactating Cows only | 0.800 | 1.000 | 1.400 | 1.1200 | | - |
| | Loose Housing – Lactating Cows only | 0.800 | 1.000 | 1.400 | 1.1200 | | - |
| | Dry Cow | 0.800 | 0.700 | 1.000 | 0.5600 | | - |
| | | | | | | | |
| | Replacements – Bred Heifers (Breeding to Calving) | 0.800 | 0.700 | 0.875 | 0.4900 | | - |
| | Replacements - Growing Heifers (350 lbs to breeding) | 0.800 | 0.700 | 0.525 | 0.2940 | | - |
| | Calves (< 350 lbs) | 0.800 | 0.700 | 0.200 | 0.1120 | | - |
| | Other | | | | | | - |
| Swine Liquid (*count sows only) | Farrow to finish * | 2.000 | 1.100 | 1.780 | 3.9160 | | - |
| | Farrow to wean * | 2.000 | 1.100 | 0.670 | 1.4740 | | - |
| | Farrow only * | 2.000 | 1.100 | 0.530 | 1.1660 | | - |
| | Feeders/Boars | 2.000 | 1.100 | 0.200 | 0.4400 | | - |
| | Growers/Roasters | 2.000 | 1.100 | 0.118 | 0.2600 | | - |
| | Weaners | 2.000 | 1.100 | 0.055 | 0.1210 | | - |
| | Other | | | | | | - |
| Swine Solid (*Count sows only) | Farrow to finish * | 2.000 | 0.800 | 1.780 | 2.8480 | | - |
| | Farrow to wean * | 2.000 | 0.800 | 0.670 | 1.0720 | | - |
| | Farrow only * | 2.000 | 0.800 | 0.530 | 0.8480 | | - |
| | Feeders/Boars | 2.000 | 0.800 | 0.200 | 0.3200 | | - |
| | Growers/Roasters | 2.000 | 0.800 | 0.118 | 0.1888 | | - |
| | Weaners | 2.000 | 0.800 | 0.055 | 0.0880 | | - |
| | Other | | | | | | - |
| Poultry | Chicken - Breeders - Solid | 1.000 | 0.700 | 0.010 | 0.0070 | | - |
| | Chicken - Layers - Liquid (includes associated pullets) | 2.000 | 1.100 | 0.008 | 0.0176 | | - |
| | Chicken - Layers - (Belt Cage) | 2.000 | 0.700 | 0.008 | 0.0112 | | - |
| | Chicken - Layers - (Deep Pit) | 2.000 | 0.700 | 0.008 | 0.0112 | | - |
| | Chicken - Pullets/Broilers | 1.000 | 0.700 | 0.002 | 0.0014 | | - |
| | Turkey - Toms/Breeders | 1.000 | 0.700 | 0.020 | 0.0140 | | - |
| | Turkey - Hens (light) | 1.000 | 0.700 | 0.013 | 0.0091 | | - |
| | Turkey - Broilers | 1.000 | 0.700 | 0.010 | 0.0070 | | - |
| | Ducks | 1.000 | 0.700 | 0.010 | 0.0070 | | - |
| | Geese | 1.000 | 0.700 | 0.020 | 0.0140 | | - |
| | Other | | | | | | - |
| Sheep and Goats | Sheep - Ewes/Rams | 0.600 | 0.700 | 0.200 | 0.0840 | | - |
| | Sheep - Ewes with lambs | 0.600 | 0.700 | 0.250 | 0.1050 | | - |
| | Sheep - Lambs | 0.600 | 0.700 | 0.050 | 0.0210 | | - |
| | Sheep - Feeders | 0.600 | 0.700 | 0.100 | 0.0420 | | - |
| | Goats - Meat/Milk (per Ewe) | 0.700 | 0.700 | 0.170 | 0.0833 | | - |
| | Goats - Nannies/Billies | 0.700 | 0.700 | 0.140 | 0.0686 | | - |
| | Goats - Feeders | 0.700 | 0.700 | 0.077 | 0.0377 | | - |
| | Other | | | | | | - |
| Cervid | Elk | 0.600 | 0.700 | 0.600 | 0.2520 | | - |
| | Deer | 0.600 | 0.700 | 0.200 | 0.0840 | | - |
| | Other | | | | | | - |
| Wild Boar | Feeders | 2.000 | 0.800 | 0.140 | 0.2240 | - | - |
| | Sow (farrowing) | 2.000 | 0.800 | 0.371 | 0.5936 | | - |
| | Other | | | | | | - |
| | | | | | Total | | 668.9 |

**For New Operations**

| | |
|---|---|
| Dispersion Factor | 1 |

| Category | Odour Objective | Distance Feet | Distance Metres |
|---|---|---|---|
| 1 | 41.04 | 1,447 | 441 |
| 2 | 54.72 | 1,929 | 588 |
| 3 | 68.4 | 2,411 | 735 |
| 4 | 109.44 | 3,858 | 1,176 |

**For Expanding Operations**

| | |
|---|---|
| Dispersion Factor | 1 |
| Expansion Factor | 0.77 |

| Category | Odour Objective | Distance Feet | Distance Metres |
|---|---|---|---|
| 1 | 41.04 | 1,114 | 340 |
| 2 | 54.72 | 1,485 | 453 |
| 3 | 68.40 | 1,857 | 566 |
| 4 | 109.44 | 2,971 | 906 |

Name Noranden Farms Ltd
Address 0
Legal Land
Location E 1/2 33-20-23 W4

**Landbase Requirements (hectares) based on 2006 AOPA requirements**

| Category of Livestock | Type of Livestock | Number of Animals | Dark Brown & Brown (ha) | Grey Wooded (ha) | Black (ha) | Irrigated (ha) |
|---|---|---|---|---|---|---|
| Feedlot Animals | Cows/Finishers (900+ lbs) | 1500.0 | 187.5 | 156.0 | 117.0 | 93.0 |
| | Feeders (450 - 900 lbs) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Feeder Calves (<550 lbs) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Horses - PMU | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Horses - Feeders > 750 lbs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Horses - Foals < 750 lbs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Mules | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Donkeys | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Bison | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Other | 0.0 | | | | |
| Dairy (*count lactating cows only) | Free Stall – Lactating Cows with all associated dries, heifers, and calves* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Free Stall – Lactating Cows with Dry Cows only * | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Free Stall – Lactating Cows only* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Tie Stall – Lactating Cows only | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Loose Housing – Lactating Cows only | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Dry Cow (Solid manure) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Dry Cow (Liquid manure) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Replacements – Bred Heifers (Breeding to Calving) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Replacements - Growing Heifers (350 lbs to breeding) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Calves (< 350 lbs) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Other | 0.0 | | | | |
| Swine Liquid (*count sows only) | Farrow to finish * | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Farrow to wean * | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Farrow only * | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Feeders/Boars | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Growers/Roasters | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Weaners | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Other | 0.0 | | | | |
| Swine Solid (*Count sows only) | Farrow to finish * | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Farrow to wean * | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Farrow only * | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Feeders/Boars | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Growers/Roasters | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Weaners | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | 0.0 | | | | |
| Poultry | Chicken - Breeders - Solid | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Chicken - Layers - Liquid (includes associated pullets) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Chicken - Layers - (Belt Cage) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Chicken - Layers - (Deep Pit) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Chicken - Pullets/Broilers | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Turkey - Toms/Breeders | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Turkey - Hens (light) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Turkey - Broilers | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Ducks | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Geese | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Other | 0.0 | | | | |
| Goats and Sheep | Sheep - Ewes/Rams | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Sheep - Ewes with lambs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Sheep - Lambs | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Sheep - Feeders | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Goats - Meat/Milk (per Ewe) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Goats - Nannies/Billies | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Goats - Feeders | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Other | 0.0 | | | | |
| Cervid | Elk | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Deer | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Other | 0.0 | | | | |
| Wild Boar | Feeders | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Sow (farrowing) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Other | 0.0 | | | | |
| | Total Hectares | | 188 | 156.0 | 117.0 | 93.0 |
| | Total Acres | | 463 | 385.5 | 289.1 | 229.8 |

# 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)

## 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. Naranden Farms LTD (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

We used Alberta Agriculture calculator provided at Alberta.ca

**Catch basin capacity**

| | 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 (excl. 0.3 m freeboard) (m³) |
| 1. | 35m | 22m | 3m | 3m | 3:1 | 3:1 | 3:1 | |
| 2. | | | | | | | | |
| 3. | | | | | | | | |
| | | | | | | | TOTAL CAPACITY | |

**Naturally occurring protective layer details**

| | | | |
|---|---|---|---|
| Thickness of naturally occurring protective layer | _____(m) | Provide details (as required) Rosche engineering is currently testing and preparing Report. Samples taken March 7/25 | |
| Soil texture | _____% sand | _____% silt | _____% clay |
| Hydraulic conductivity - naturally occurring protective layer | Depth and type of soil tested | Hydraulic conductivity (cm/s) | Describe test standard used |

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

# 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** Norandon Farms LTD.

**Land Location** SE 33-20-23 W4

**Estimating Runoff Potential**

| Area | Length (m) | Width (m) | Paved? | Area ($m^2$) |
|---|---|---|---|---|
| 1 | 96 | 133 | NO | 12768.00 |
| | **Total Area** | | | 12768.00 |

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

746.93 $m^3$

26378 $ft^3$

164301 Imp. Gal

**Calculating Catch Basin Volume:**

| | Construction Dimensions | Storage Dimensions |
|---|---|---|
| Length (m): | 36 | 32.0 |
| Width (m): | 22 | 19.0 |
| Depth (m): | 3 | 2.5 |

**Evacuation Capacity:**

1095 $m^3$

38670 $ft^3$

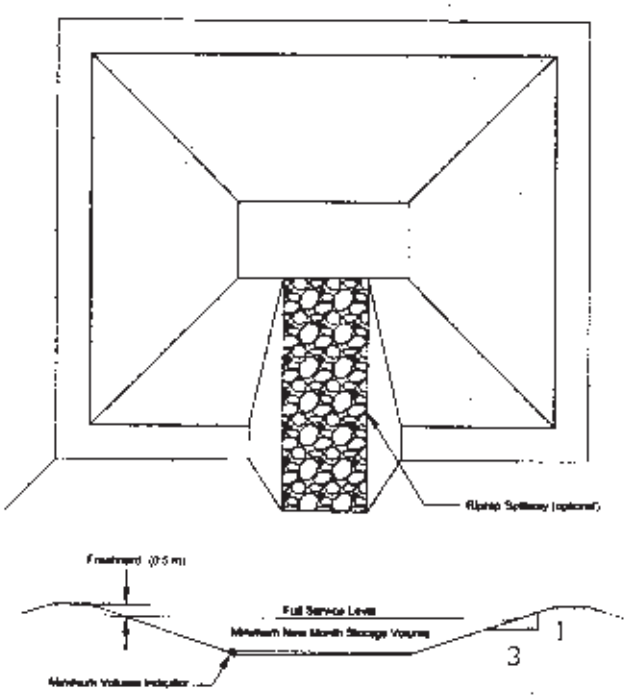
240869 Imp. Gal

**Catch basin volume (minus freeboard):**

751 $m^3$

26521 $ft^3$

165195 Imp. Gal




**Comparing Catch Basin Volume versus Runoff Potential:**

Runoff potential: 746.93 $m^3$

Catch basin volume: 751 $m^3$

The catch basin dimensions meet the design requirements in AOPA

# 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)

## SOLID MANURE, COMPOST, & COMPOSTING MATERIALS: Barns, feedlots, & storage facilities - Naturally occurring protective layer

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

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

1. Nocaden Farms Ltd (Pen areas including alleys)
2. _____

**Manure storage capacity**

| | Length (m) | Width (m) | Depth below ground level (m) | NRCB USE ONLY Estimated storage capacity (m³) |
|---|---|---|---|---|
| 1. | 151 | 96 | | |
| 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

Natural Slope for runoff to North of Area
No natural drainage into Area
Runoff direction was inspected by NRCB and deemed adequate for Runoff

**Naturally occurring protective layer details**

| | | | |
|---|---|---|---|
| Thickness of naturally occurring protective layer | _____(m) | Provide details (as required) see Roseke Engineering Reports | |
| Soil texture | ____ ____% sand | _ _____ % silt | _____% clay |
| Hydraulic conductivity - naturally occurring protective layer | Depth and type of soil tested | Hydraulic conductivity (cm/s) | Describe test standard used |

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

**NRCB USE ONLY**

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

P.O. BOX 180
VULCAN, ALBERTA
T0L 2B0

TELEPHONE: 1-403-485-2241
TOLL FREE: 1-877-485-2299
FAX: 1-403-485-2920
www.vulcancounty.ab.ca

September 27th, 2023

Mr. Matthew Jacobsen
Noranden Farms
P.O. Box 33
Arrowwood, AB
T0L 0B0

Re: Application for CFO license

Dear Mr. Jacobsen,

Vulcan County concluded an Intermunicipal Development Plan with the Village of Arrowwood in December of 2020, and your input during the public consultation phase was greatly appreciated. It was understood by all, at the time of public consultation, that your farming operation had been running an unlicensed confined feeding operation since the 1960s.

With this in mind, your operation is considered an existing confined feeding operation under s. 2.5.2 of the Intermunicipal Development Plan between the Vulcan County and Village of Arrowwood. This section reads:

"New confined feeding operations (CFOs) are not permitted to be established within the Intermunicipal Development Plan Boundary and the Confined Feeding Exclusion Area as illustrated in Map 3. However, any existing CFOs located with the Intermunicipal Development Plan Boundary are allowed to continue with their existing operations and may expand in accordance with the requirements of the Agricultural Operation Practices Act and Regulations. Expansions should not negatively impart rural and urban residents of the area or the environment."

Please consider this letter as support to your current CFO operation and your endeavour to have this operation licensed with the Natural Resource Conservation Board.

Should you have any questions or concerns please do not hesitate to contact my office.

Kind Regards,

[redacted]

Nels Petersen
Chief Administrative Officer
Vulcan County

Village of ARROWWOOD ALBERTA

June 30, 2023

Mr. Matthew Jacobsen,
President,
Noranden Farms
P.O. Box 33
Arrowwood, AB
T0L 0B0

Re: Application for CFO license

Dear Mr. Jacobsen.

The Village of Arrowwood concluded an Intermunicipal Development Plan with Vulcan County in December of 2020, and your input during the public consultation phase was greatly appreciated. It was understood by all, at the time of public consultation, that your farming operation had been running an unlicensed confined feeding operation since the 1960s.

With this in mind, your operation would be considered an existing confined feeding operation under s. 2.5.2 of the Intermunicipal Development Plan between the Village of Arrowwood and Vulcan County. This section reads:

"New confined feeding operations (CFOs) are not permitted to be established within the Intermunicipal Development Plan Boundary and the Confined Feeding Exclusion Area as illustrated in Map 3. However, any existing CFOs located with the Intermunicipal Development Plan Boundary are allowed to continue with their existing operations and may expand in accordance with the requirements of the Agricultural Operation Practices Act and Regulations. Expansions should not negatively impart rural and urban residents of the area or the environment."

Enclosed you will find a copy of the Intermunicipal Development Plan for your review and reference.

Sincerely,

Christopher Northcott
Chief Administrative Officer

Enclosure (1)

**P.O. Box 34, Arrowwood, Alberta, Canada T0L 0B0 www.villageofarrowwood.ca Tel: (403) 534-3821**

ROSEKE ENGINEERING

ROSEKE ENGINEERING LTD.
3614 18TH AVENUE NORTH
LETHBRIDGE, AB T1H 5S7
PHONE: (403) 942-8170

October 1st, 2024

Matthew Jacobsen
Noranden Farms Ltd.
205038 Range Road 233
Vulcan County, AB

**Re: Soil Suitability and Permeability Testing**
**Existing Livestock Pens**
**Vulcan County, AB**

As requested, Roseke Engineering Ltd. (REL) has completed a geotechnical review of the above noted site relative to the required protection of groundwater resources, as required by the Agricultural Operation Practices Act, AB Reg. 267/2001 (AOPA). This letter presents the findings of the geotechnical investigation as it pertains to the suitability of the existing pens noted above.

In order to demonstrate the suitability of the naturally existing soils for consideration as a naturally occurring protective layer for groundwater, four boreholes were advanced at locations spread evenly throughout the existing livestock pen areas. The boreholes were advanced using a truck-mounted solid stem auger drill rig contracted from Chilako Drilling Services Ltd., of Coaldale, AB. The boreholes were drilled to a depth of 4.5 m below the existing ground surface.

The general subsurface conditions at the site consisted predominantly of a surficial layer of topsoil, underlain by clay and clay till in descending order with a seam of sand encountered at 3.8 m in BH001. The clay was described as silty, with a trace of sand and gravel, light brown, and low plastic. Additionally, the clay till was described as silty, some sand, trace gravel, olive brown, and low plastic. Further soil descriptions can be found in the attached borehole logs. Standpipes installed to monitor groundwater depths were found dry when monitored prior to permeability testing. Atterberg limits analysis were conducted on the collected soil samples to confirm soil properties, and the results are included in the table below.

| Sample ID | Depth (m) | Liquid Limit (LL) | Plastic Limit (PL) | Plasticity Index (PI) |
|---|---|---|---|---|
| 1B3 | 2.3 | 23.0 | 16.6 | 6.4 |
| 2B1 | 0.8 | 24.7 | 18.1 | 6.6 |
| 3B4 | 3.0 | 25.6 | 17.2 | 8.4 |

In order to measure the permeability of the subsurface soils, 1.5 m of machine slotted 51 mm diameter PVC monitoring well was installed in all of the boreholes. Final depths of slotted monitoring wells ranged from approximately 3.05 m to 3.81 m in the clay till layer. Well saturation of the monitoring wells was carried out by filling the monitoring wells to the top of the pipe prior to completing the permeability testing. The results of the in-situ permeability testing indicated an average hydraulic conductivity of $k_s = 2.55 \times 10^{-7}$ cm/sec for the clay / clay till strata which ranged in thickness from 3.8 m to at least 4.5 m in thickness across the site.

Using the measured in-situ permeability and the minimum measured thickness of the clay / clay till, the clay / clay till strata has been estimated to represent an equivalent of 3.9 m of naturally occurring materials having a hydraulic conductivity of $1.0 \times 10^{-6}$ cm/sec. This represents a naturally occurring material layer in excess of the minimum groundwater protection requirements for solid manure storage as specified in Section 9.5(c) of the AOPA Standards and Administration Regulations.

## Closure

Based on the results of the in-situ permeability testing, laboratory tests, and the subsurface soil stratigraphy encountered, the clay and clay till strata encountered on site should be considered suitable as a protective layer for the above noted existing livestock pens.

Please feel free to contact me at (403) 942-6170 or by email at bernie.roseke@roseke.com if you have any comments, questions, or concerns.

Respectfully submitted by:

[redacted]

Prepared by:
Mr. Christopher Allard, C.E.T.
Geotechnical Technologist
Roseke Engineering Ltd.
(403) 331-7182
chris.allard@roseke.com

[redacted]

Reviewed by:
Mr. Bernie Roseke, P.Eng., PMP
Principal
Roseke Engineering Ltd.
APEGA Permit to Practice No. P11347
(403) 942-6170
bernie.roseke@roseke.com

PROFESSIONAL ENGINEER ALBERTA
BERNIE C. ROSEKE
#66728
07 October 2024

PERMIT TO PRACTICE
ROSEKE ENGINEERING LTD.
RM SIGNATURE
RM APEGA ID: 66728
DATE: 2024-10-07
PERMIT NUMBER: 11347
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

| | | |
|---|---|---|
| Project: Noranden Farms Permeability Assessment | | BOREHOLE NO: BH002 |
| Client: Matthew Jacobsen | | PROJECT NO: REL243058 |
| | Solid Stem Auger | ELEVATION: |

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

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm | PLASTIC — M.C. — LIQUID (20 40 60 80) | ▲ VANE SHEAR (kPa) ▲ (100 200 300 400) ■ N-VALUE ■ (20 40 60 80) ◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400) ● 0.5 x POCKET PEN. (kPa) ● (100 200 300 400) | OTHER DATA | Elevation (m) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | Topsoil (200 mm) | | | | | | | |
| | | Clay - silty, trace sand, soft to firm, damp, low plastic, light brown | | B1 | | | | | |
| 1 | | | | B2 | | | | | |
| | | Clay Till - silty, some sand, trace gravel, stiff, damp to moist, low plastic, olive brown with coal inclusions and oxide stains | | B3 | | | | | |
| 2 | | | | | | | | | |
| | | | | B4 | | | | | |
| 3 | | | | | | | | | |
| | | - very stiff | | B5 | | | | | |
| 4 | | | | | | | | | |
| | | | | B6 | | | | | |
| | | End of borehole at 4.57 m, no sloughing or seepage. No standpipe installed. | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |

| | |
|---|---|
| LOGGED BY: CA | COMPLETION DEPTH: 4.57 m |
| REVIEWED BY: BR | COMPLETION DATE: 24-9-5 |

| | | |
|---|---|---|
| Project: Noranden Farms Permeability Assessment | | BOREHOLE NO: BH001 |
| Client: Matthew Jacobsen | | PROJECT NO: REL243058 |
| | Solid Stem Auger | ELEVATION: |

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

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

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm | PLASTIC M.C. LIQUID 20 40 60 80 | ▲ VANE SHEAR (kPa) ▲ 100 200 300 400 ■ N-VALUE ■ 20 40 60 80 ◆ UNCONF. SHEAR STR. (kPa) ◆ 100 200 300 400 ● 0.5 x POCKET PEN. (kPa) ● 100 200 300 400 | OTHER DATA | SLOTTED PIEZOMETER | Elevation (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Topsoil & Gravel (150 mm) | | | | | | | | |
| | | Clay - silty, trace sand, soft to firm, damp, low plastic, light brown | | B1 | | | | | | |
| 1 | | | | B2 | | | | | | |
| 2 | | Clay Till - silty, some sand, trace gravel, very stiff, damp to moist, low plastic, olive brown with coal inclusions and oxide stains | | B3 | | | | | | |
| 3 | | | | B4 | | | | | | |
| 4 | | Sand - silty, some clay, trace gravel, damp to moist, fine to medium grained, brown | | B5 | | | | | | |
| | | | | B6 | | | | | | |
| 5 | | End of borehole at 4.57 m, no sloughing or seepage. Standpipe installed to 4.57 m. Standpipe was found dry when monitored on September 11th, 2024. | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

LOGGED BY: CA | COMPLETION DEPTH: 4.57 m

REVIEWED BY: BR | COMPLETION DATE: 24-9-5





AB TRANS BOREHOLE LOG NORANDEN FARMS.GPJ AB_TRANS.GDT 24-9-30

| | | |
|---|---|---|
| Project: Noranden Farms Permeability Assessment | | BOREHOLE NO: BH003 |
| Client: Matthew Jacobsen | | PROJECT NO: REL243058 |
| | Solid Stem Auger | ELEVATION: |

SAMPLE TYPE ■ SHELBY TUBE ◪ CORE SAMPLE ☒ SPT SAMPLE ▭ GRAB SAMPLE ▥ NO RECOVERY

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm | PLASTIC — M.C. — LIQUID (20 40 60 80) | ▲ VANE SHEAR (kPa) ▲ (100 200 300 400) ■ N-VALUE ■ (20 40 60 80) ◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400) ● 0.5 x POCKETPEN (kPa) ● (100 200 300 400) | OTHER DATA | Elevation (m) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | Topsoil (250 mm) | | | | | | | |
| | | Clay - silty, trace sand, soft to firm, damp, low plastic, light brown | | B1 | | | | | |
| 1 | | | | B2 | | | | | |
| 2 | | Clay Till - silty, some sand, trace gravel, very stiff, damp to moist, low plastic, olive brown with coal inclusions and oxide stains | | B3 | | | | | |
| 3 | | | | B4 | | | | | |
| | | - stiff | | B5 | | | | | |
| 4 | | | | B6 | | | | | |
| | | End of borehole at 4.57 m, no sloughing or seepage. No standpipe installed. | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |

| | |
|---|---|
| LOGGED BY: CA | COMPLETION DEPTH: 4.57 m |
| REVIEWED BY: BR | COMPLETION DATE: 24-9-5 |



AB TRANS BOREHOLE LOG NORANDEN FARMS GPJ AB_TRANS.GDT 24-9-30

| | | |
|---|---|---|
| Project: Noranden Farms Permeability Assessment | | BOREHOLE NO: BH004 |
| Client: Matthew Jacobsen | | PROJECT NO: REL243058 |
| | Solid Stem Auger | ELEVATION: |

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

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

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm | PLASTIC — M.C. — LIQUID (20 40 60 80) | ▲ VANE SHEAR (kPa) ▲ (100 200 300 400) ■ N-VALUE ■ (20 40 60 80) ● UNCONF. SHEAR STR. (kPa) ● (100 200 300 400) ⊕ 0.5 x POCKETPEN. (kPa) ⊕ (100 200 300 400) | OTHER DATA | SLOTTED PIEZOMETER | Elevation (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Topsoil (200 mm) | | | | | | | | |
| | | Clay - silty, trace sand, soft to firm, damp, low plastic, light brown | | B1 | | | | | | |
| 1 | | | | | | | | | | |
| | | | | B2 | | | | | | |
| | | Clay Till - silty, some sand, trace gravel, stiff to very stiff, damp to moist, low plastic, olive brown with coal inclusions and oxide stains | | B3 | | | | | | |
| 2 | | | | | | | | | | |
| | | | | B4 | | | | | | |
| 3 | | | | | | | | | | |
| | | | | B5 | | | | | | |
| 4 | | | | | | | | | | |
| | | | | B6 | | | | | | |
| | | End of borehole at 4.57 m, no sloughing or seepage. Standpipe installed to 4.57 m. Standpipe was found dry when monitored on September 11th, 2024. | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

| | |
|---|---|
| LOGGED BY: CA | COMPLETION DEPTH: 4.57 m |
| REVIEWED BY: BR | COMPLETION DATE: 24-9-5 |





AB TRANS BOREHOLE LOG NORANDEN FARMS.GPJ AB_TRANS.GDT 24-9-30

## *ATTERBERG LIMITS TEST*

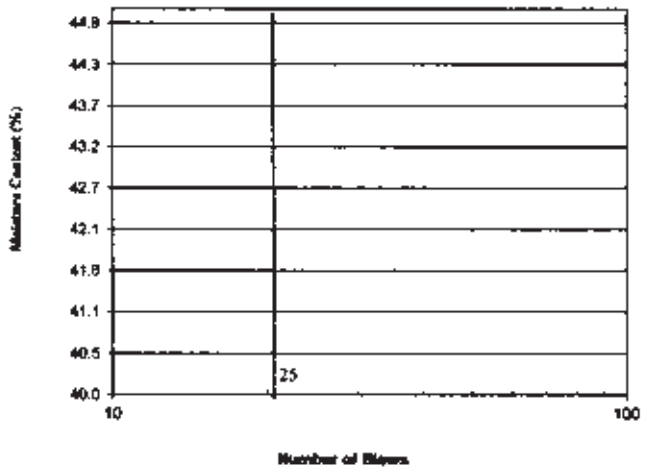
**Attention:** Matthew Jacobsen

**Project No:** REL243058
**Date:** 24-Sep-24

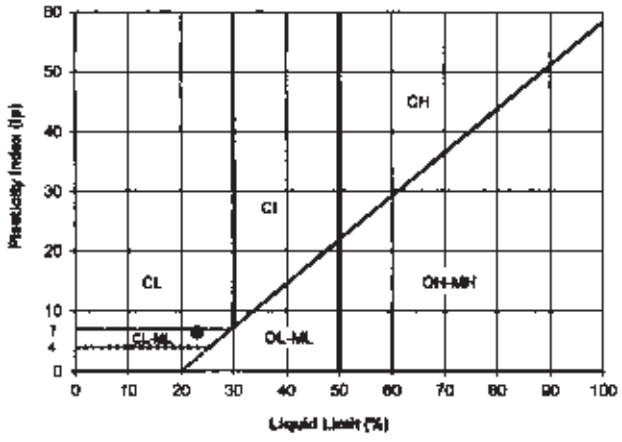
**Project:** Noranden Farms Permeability Testing

| Liquid Limit Test | | | | Plastic Limit Test | | |
|---|---|---|---|---|---|---|
| # of Blows | 26 | | | | | |
| Tare # | 6 | | | Tare # | A3 | |
| Wet Wt + Tare | 42.240 | | | Wet Wt + Tare | 12.094 | |
| Dry Wt + Tare | 36.906 | | | Dry Wt + Tare | 11.400 | |
| Wt of Tare | 13.616 | | | Wt of Tare | 7.220 | |
| % Moisture | 22.9 | | | % Moisture | 16.6 | |

**Liquid Limit Test**




**Plasticity chart for soil passing 425 um sieve**




**Liquid Limit (%):** 23.0 **Plastic Limit (%):** 16.6 **Plasticity Index:** 6.4

**Classification :** CL **Depth:** 2.3 m **Sample ID:** 1B3

**Technician:** CA

= Input Data

**Per:**

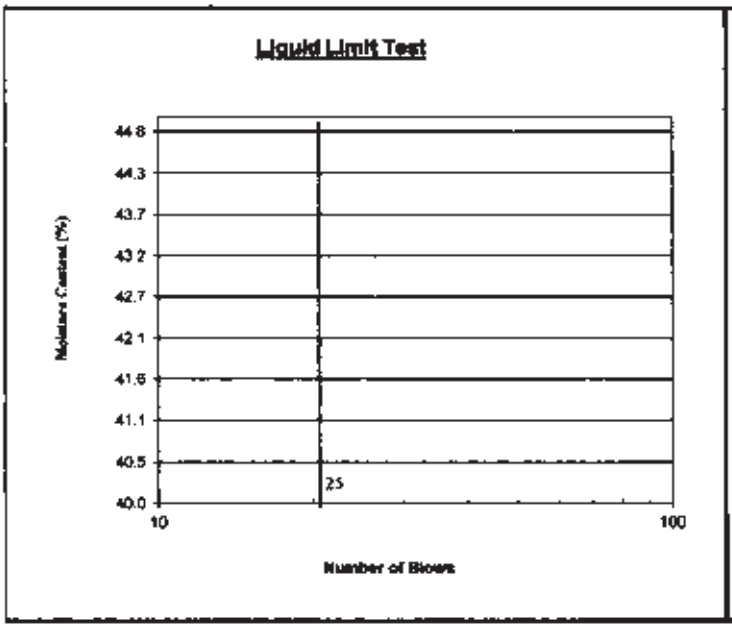
## *ATTERBERG LIMITS TEST*

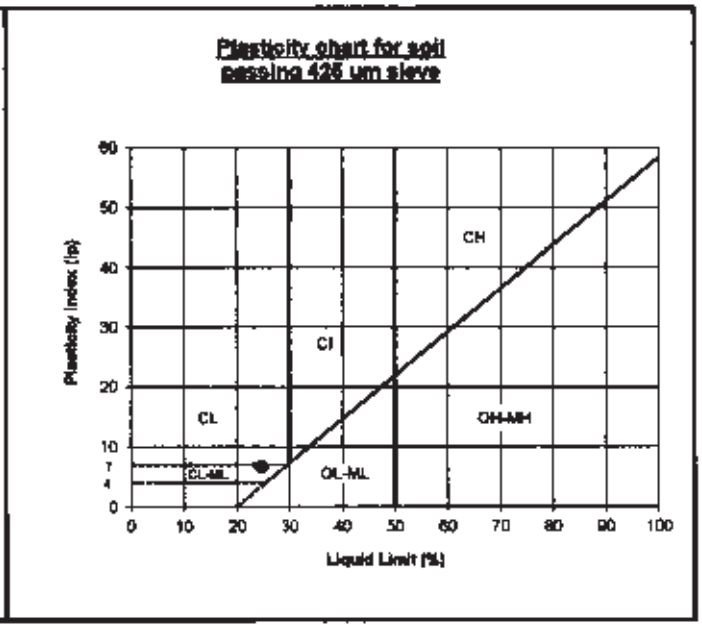
**Attention:** Matthew Jacobsen

**Project No:** REL243058
**Date:** 24-Sep-24

**Project:** Noranden Farms Permeability Testing

| Liquid Limit Test | | | | Plastic Limit Test | | |
|---|---|---|---|---|---|---|
| # of Blows | 30 | | | | | |
| Tare # | 14 | | | Tare # | 10 | |
| Wet Wt + Tare | 40.705 | | | Wet Wt + Tare | 11.370 | |
| Dry Wt + Tare | 35.400 | | | Dry Wt + Tare | 10.736 | |
| Wt of Tare | 13.470 | | | Wt of Tare | 7.234 | |
| % Moisture | 24.2 | | | % Moisture | 18.1 | |




**Liquid Limit (%):** 24.7 **Plastic Limit (%):** 18.1 **Plasticity Index:** 6.6

**Classification :** CL **Depth:** 0.8 m **Sample ID:** 2B1

**Technician:** CA

= Input Data

**Per:**

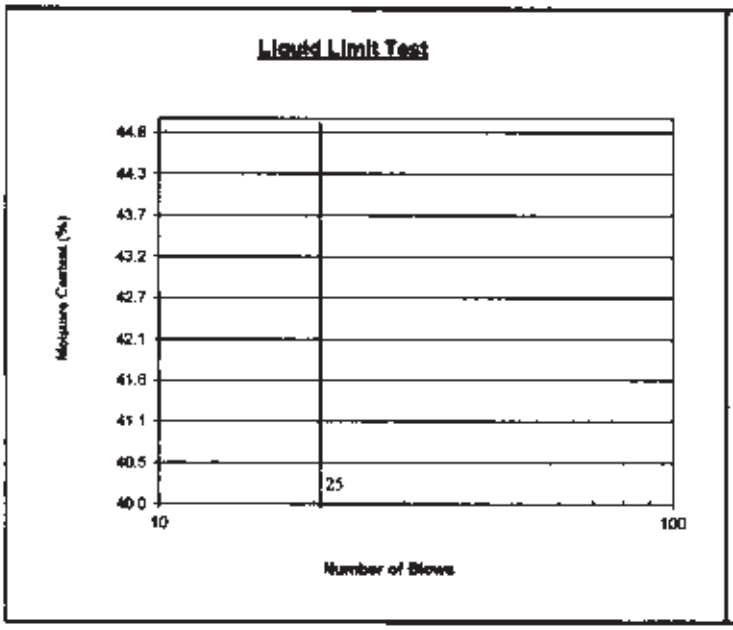
## *ATTERBERG LIMITS TEST*

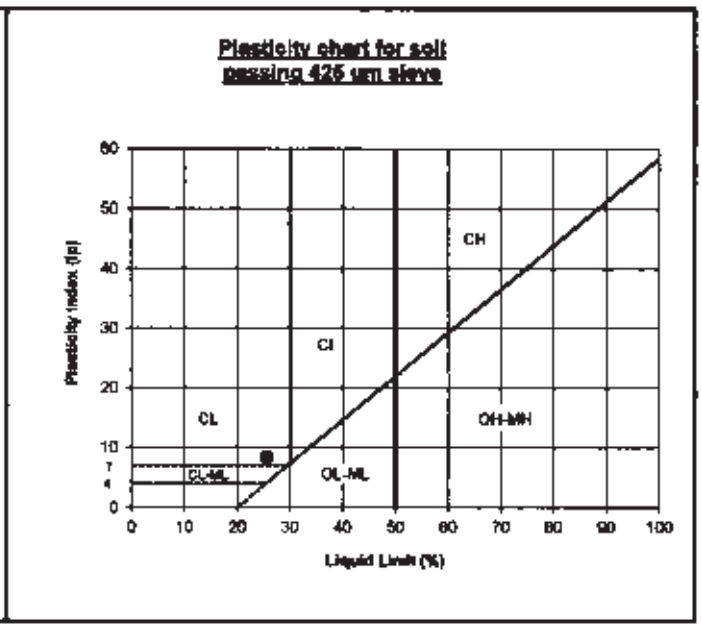
**Attention:** Matthew Jacobsen

**Project No:** REL243058
**Date:** 24-Sep-24

**Project:** Noranden Farms Permeability Testing

| Liquid Limit Test | | | | Plastic Limit Test | | |
|---|---|---|---|---|---|---|
| # of Blows | 30 | | | | | |
| Tare # | 4 | | | Tare # | A6 | |
| Wet Wt + Tare | 38.763 | | | Wet Wt + Tare | 11.548 | |
| Dry Wt + Tare | 33.715 | | | Dry Wt + Tare | 10.916 | |
| Wt of Tare | 13.580 | | | Wt of Tare | 7.257 | |
| % Moisture | 25.1 | | | % Moisture | 17.2 | |




**Liquid Limit (%):** 25.6 **Plastic Limit (%):** 17.2 **Plasticity Index:** 8.4

**Classification :** CL **Depth:** 3.0 m **Sample ID:** 3B4

**Technician:** CA

= Input Data

**Per:** [redacted]

# MOISTURE CONTENT

| JOB # | JOB DESCRIPTION | PROJECT |
|---|---|---|
| REL243058 | Noranden Farms | Evaluation |

| Borehole ID | Sample ID | Depth (m) | Wet + Tare (g) | Dry + Tare (g) | Moisture % |
|---|---|---|---|---|---|
| BH001 | 1B1 | 0.8 | 235.8 | 214.7 | 10.1 |
| | 1B2 | 1.5 | 236.9 | 213.0 | 11.6 |
| | 1B3 | 2.3 | 276.4 | 248.0 | 11.8 |
| | 1B4 | 3.0 | 376.5 | 336.6 | 12.1 |
| | 1B5 | 3.8 | 246.5 | 228.8 | 8.0 |
| | 1B6 | 4.6 | 258.4 | 240.3 | 7.7 |
| BH002 | 2B1 | 0.8 | 190.5 | 183.5 | 4.0 |
| | 2B2 | 1.5 | 257.4 | 236.6 | 9.0 |
| | 2B3 | 2.3 | 265.4 | 232.6 | 14.5 |
| | 2B4 | 3.0 | 297.9 | 256.7 | 16.5 |
| | 2B5 | 3.8 | 245.7 | 219.4 | 12.3 |
| | 2B6 | 4.6 | 303.3 | 276.8 | 9.8 |
| BH003 | 3B1 | 0.8 | 198.1 | 193.4 | 2.5 |
| | 3B2 | 1.5 | 145.6 | 141.3 | 3.2 |
| | 3B3 | 2.3 | 283.1 | 258.0 | 10.0 |
| | 3B4 | 3.0 | 253.5 | 231.0 | 10.0 |
| | 3B5 | 3.8 | 263.5 | 243.0 | 8.7 |
| | 3B6 | 4.6 | 274.1 | 256.4 | 7.1 |
| BH004 | 4B1 | 0.8 | 181.2 | 165.8 | 9.7 |
| | 4B2 | 1.5 | 210.1 | 193.1 | 9.1 |
| | 4B3 | 2.3 | 323.9 | 288.1 | 12.7 |
| | 4B4 | 3.0 | 261.4 | 229.3 | 14.4 |
| | 4B5 | 3.8 | 266.5 | 244.1 | 9.4 |
| | 4B6 | 4.6 | 288.3 | 264.8 | 9.1 |

ROSEKE ENGINEERING LTD.
3614 18TH AVENUE NORTH
LETHBRIDGE, AB T1H 5S7
PHONE: (403) 942-6170

March 18th, 2025 Project No.: REL253013

Matthew Jacobsen
Noranden Farms Ltd.
205038 Range Road 233
Vulcan County, AB

**Re: Soil Suitability and Permeability Testing**
**Additional Geotechnical Investigation**
**Proposed Effluent Pond**
**Vulcan County, AB**

## Introduction

As requested, Roseke Engineering Ltd. (REL) has completed additional geotechnical boreholes in the area of the proposed liquid manure storage pond at the above noted feedlot site to confirm geotechnical subsurface stratigraphy and groundwater conditions. The results of the additional boreholes and this letter report are intended as a supplement to the previous geotechnical report entitled *REL243058 – Permeability Letter* (REL243058) and to confirm that the previously tested in-situ hydraulic conductivity values are applicable to the subsoils beneath the proposed liquid manure storage ponds.

It is understood that the maximum depth of storage for the liquid manure storage pond will be approximately 3 m to 4 m below existing ground, therefore, boreholes were advanced to 9.15 m in order to demonstrate the suitability of the naturally existing soils for consideration as a naturally occurring protective layer for groundwater resources. The boreholes were advanced using a truck-mounted solid stem auger drill rig contracted from Chilako Drilling Services Ltd., of Coaldale, AB. A site plan showing additional borehole locations is attached.

## Subsoil and Groundwater Conditions

The general subsurface conditions encountered in the additional boreholes consisted predominantly of a surficial layer of topsoil, underlain by clay, and clay till in descending order, and were found to be consistent in texture and composition with the naturally occurring protective layer encountered in the 2024 REL243058 boreholes to depths of approximately 7.6 m to 7.9 m where the clay till was observed as becoming gravelly. The clay till was described as silty with some sand, trace gravel, olive brown, and low plastic. Borehole logs showing subsoil and groundwater conditions from 2024 and 2025 drilling operations are attached. The following table summarizes the measured groundwater depths when monitored on March 17th, 2025.

| Borehole ID | Depth of Standpipe (m) | Depth to Groundwater (m) |
|---|---|---|
| BH101 | 7.0 | Dry |
| BH102 | 9.15 | Dry |

In order to comply with the Natural Resources Conservation Board (NRCB)'s requirements, pond construction activities may not take place within 1.0 m of groundwater. Based on the dry monitor well and standpipe observed during groundwater monitoring, it is anticipated that the proposed liquid manure storage pond will not be impacted by groundwater. However, groundwater levels should be monitored prior to construction to confirm these conditions. It should be noted that soil moisture and groundwater levels at the site may fluctuate in response to climatic events.

## Conclusions

Based on the previously determined hydraulic conductivity "K" value of $2.55 \times 10^{-7}$ cm/sec from in-situ testing in REL243058 and the minimum encountered thickness of the clay till strata from the maximum depth of storage to 7.6 m where the soil becomes gravelly, the 3.6 m layer of clay till encountered beneath the proposed liquid manure storage pond can been determined to represent the equivalent of 14.1 m of material having a hydraulic conductivity of $1.0 \times 10^{-6}$ cm/sec. This represents a naturally occurring protective layer exceeding the minimum requirements for liquid manure storage facilities as specified in Section 9.5 of the AOPA Standards and Administration Regulations.

## Closure

Based on the results of the additional field drilling operations, laboratory test results, and in-situ permeability testing, the clay till strata encountered on site should be considered suitable for use as a naturally occurring protective layer for the construction of the proposed effluent pond.

Please feel free to contact the undersigned at (403) 331-7182 or by email at chris.allard@roseke.com if you have any comments, questions, or concerns.

Respectfully submitted by:

[redacted]

Prepared by:
Mr. Christopher Allard, C.E.T.
Geotechnical Technologist
Roseke Engineering Ltd.
(403) 331-7182
chris.allard@roseke.com

[redacted]

Reviewed by:
Mr. Bernie Roseke, P.Eng., PMP
Principal
Roseke Engineering Ltd.
APEGA Permit to Practice No. P11347
(403) 942-6170
bernie.roseke@roseke.com

PROFESSIONAL ENGINEER ALBERTA
BERNIE C. ROSEKE

A66728
19 March 2025

PERMIT TO PRACTICE
ROSEKE ENGINEERING LTD.
RM SIGNATURE:
RM APEGA ID: 66728
DATE: 2025-03-19
PERMIT NUMBER: 11347

# TERMS USED ON BOREHOLE LOGS

## TERMS DESCRIBING CONSISTENCY OR CONDITION

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

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

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

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

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

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

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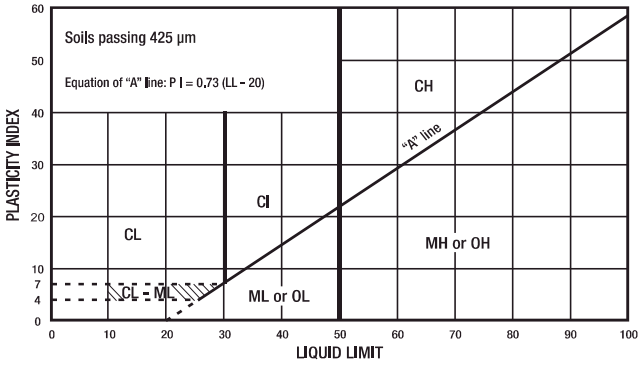
## GENERAL DESCRIPTIVE TERMS

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

# MODIFIED UNIFIED SOIL CLASSIFICATION

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

PLASTICITY CHART




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

## SOIL COMPONENTS

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

## OVERSIZE MATERIAL

| | |
|---|---|
| Rounded or subrounded | |
| COBBLES | 75 mm to 300 mm |
| BOULDERS | > 300 mm |
| Not rounded | |
| ROCK FRAGMENTS | >75 mm |
| ROCKS | > 0.76 cubic metre in volume |

| | | |
|---|---|---|
| Project: Noranden Farms Permeability Assessment | | BOREHOLE NO: **BH101** |
| Client: Matthew Jacobsen | | PROJECT NO: REL253013 |
| | Solid Stem Auger | ELEVATION: |

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

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

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm |
|---|---|---|---|---|---|
| 0 | | Topsoil (100 mm) | | | |
| | | Clay - silty, trace sand, stiff to very stiff, damp to moist, low plastic, light brown | | B1 | |
| 2 | | Clay Till - silty, some sand, trace gravel, very stiff to hard, moist, low plastic, olive brown with coal inclusions and oxide stains | | B2 | |
| 4 | | | | B3 | |
| 6 | | | | B4 | |
| 7 | | | | B5 | |
| 8 | | - gravelly | | | |
| 9 | | | | B6 | |
| | | End of borehole at 9.15 m, no sloughing or seepage. Monitoring well installed to 7.0 m. Monitoring well was found to be dry when monitored on March 17, 2025. | | | |

PLASTIC — M.C. — LIQUID (20 40 60 80)

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

■ N-VALUE ■ (20 40 60 80)

◆ UNCONF. SHEAR STR. (kPa) ◆ (50 100 150 200)

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

OTHER DATA | WELL INSTALLATION | Elevation (m)

| | |
|---|---|
| LOGGED BY: CA | COMPLETION DEPTH: 9.14 m |
| REVIEWED BY: BR | COMPLETION DATE: 25-3-7 |



AB TRANS BOREHOLE LOG NORANDEN FARMS - 2025.GPJ AB_TRANS.GDT 25-3-18

| | | |
|---|---|---|
| Project: Noranden Farms Permeability Assessment | | BOREHOLE NO: **BH102** |
| Client: Matthew Jacobsen | | PROJECT NO: REL253013 |
| | Solid Stem Auger | ELEVATION: |

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

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

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm |
|---|---|---|---|---|---|
| 0 | | Topsoil (100 mm) | | | |
| | | Clay - silty, trace sand, stiff to very stiff, damp to moist, low plastic, light brown | | | |
| 1 | | | | | |
| | | Clay Till - silty, some sand, trace gravel, very stiff to hard, moist, low plastic, olive brown with coal inclusions and oxide stains | | B1 | |
| 2 | | | | | |
| | | | | B2 | |
| 3 | | | | | |
| 4 | | | | | |
| | | | | B3 | |
| 5 | | | | | |
| | | | | B4 | |
| 6 | | | | | |
| 7 | | | | | |
| | | | | B5 | |
| 8 | | - gravelly | | | |
| | | | | B6 | |
| 9 | | End of borehole at 9.15 m, no sloughing or seepage. Standpipe installed to 9.15 m. Standpipe was found to be dry when monitored on March 17, 2025. | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |

PLASTIC — M.C. — LIQUID (20 40 60 80)

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

■ N-VALUE ■ (20 40 60 80)

◆ UNCONF. SHEAR STR. (kPa) ◆ (50 100 150 200)

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

OTHER DATA

SLOTTED PIEZOMETER

Elevation (m)

| | |
|---|---|
| LOGGED BY: CA | COMPLETION DEPTH: 9.14 m |
| REVIEWED BY: BR | COMPLETION DATE: 25-3-7 |



AB TRANS BOREHOLE LOG NORANDEN FARMS - 2025.GPJ AB_TRANS.GDT 25-3-18

| | | |
|---|---|---|
| Project: Noranden Farms Permeability Assessment | | BOREHOLE NO: **BH001** |
| Client: Matthew Jacobsen | | PROJECT NO: REL243058 |
| | Solid Stem Auger | ELEVATION: |

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

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

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm | PLASTIC M.C. LIQUID (20 40 60 80) | ▲ VANE SHEAR (kPa) ▲ (100 200 300 400) / ■ N-VALUE ■ (20 40 60 80) / ◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400) / ● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400) | OTHER DATA | SLOTTED PIEZOMETER | Elevation (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Topsoil & Gravel (150 mm) | | | | | | | | |
| | | Clay - silty, trace sand, soft to firm, damp, low plastic, light brown | | B1 | | | | | | |
| 1 | | | | B2 | | | | | | |
| | | Clay Till - silty, some sand, trace gravel, very stiff, damp to moist, low plastic, olive brown with coal inclusions and oxide stains | | B3 | | | | | | |
| 2 | | | | | | | | | | |
| | | | | B4 | | | | | | |
| 3 | | | | | | | | | | |
| | | | | B5 | | | | | | |
| 4 | | Sand - silty, some clay, trace gravel, damp to moist, fine to medium grained, brown | | | | | | | | |
| | | | | B6 | | | | | | |
| 5 | | End of borehole at 4.57 m, no sloughing or seepage. Standpipe installed to 4.57 m. Standpipe was found dry when monitored on September 11th, 2024. | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

| | |
|---|---|
| LOGGED BY: CA | COMPLETION DEPTH: 4.57 m |
| REVIEWED BY: BR | COMPLETION DATE: 24-9-5 |



AB TRANS BOREHOLE LOG NORANDEN FARMS.GPJ AB_TRANS.GDT 24-9-30

| | | |
|---|---|---|
| Project: Noranden Farms Permeability Assessment | | BOREHOLE NO: **BH002** |
| Client: Matthew Jacobsen | | PROJECT NO: REL243058 |
| | Solid Stem Auger | ELEVATION: |

SAMPLE TYPE ■ SHELBY TUBE ◪ CORE SAMPLE ☒ SPT SAMPLE ▤ GRAB SAMPLE ▥ NO RECOVERY

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm | PLASTIC M.C. LIQUID (20 40 60 80) | ▲ VANE SHEAR (kPa) ▲ (100 200 300 400) ■ N-VALUE ■ (20 40 60 80) ◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400) ● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400) | OTHER DATA | Elevation (m) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | Topsoil (200 mm) | | | | | | | |
| | | Clay - silty, trace sand, soft to firm, damp, low plastic, light brown | | B1 | | | | | |
| 1 | | | | B2 | | | | | |
| | | Clay Till - silty, some sand, trace gravel, stiff, damp to moist, low plastic, olive brown with coal inclusions and oxide stains | | B3 | | | | | |
| 2 | | | | | | | | | |
| | | | | B4 | | | | | |
| 3 | | | | | | | | | |
| | | - very stiff | | B5 | | | | | |
| 4 | | | | | | | | | |
| | | | | B6 | | | | | |
| | | End of borehole at 4.57 m, no sloughing or seepage. No standpipe installed. | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |

| | |
|---|---|
| LOGGED BY: CA | COMPLETION DEPTH: 4.57 m |
| REVIEWED BY: BR | COMPLETION DATE: 24-9-5 |



AB TRANS BOREHOLE LOG NORANDEN FARMS.GPJ AB_TRANS.GDT 24-9-30

| | | |
|---|---|---|
| Project: Noranden Farms Permeability Assessment | | BOREHOLE NO: **BH003** |
| Client: Matthew Jacobsen | | PROJECT NO: REL243058 |
| | Solid Stem Auger | ELEVATION: |

SAMPLE TYPE ■ SHELBY TUBE ◪ CORE SAMPLE ☒ SPT SAMPLE ▤ GRAB SAMPLE ▥ NO RECOVERY

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm | PLASTIC M.C. LIQUID (20 40 60 80) | ▲ VANE SHEAR (kPa) ▲ (100 200 300 400) ■ N-VALUE ■ (20 40 60 80) ◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400) ● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400) | OTHER DATA | Elevation (m) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | Topsoil (250 mm) | | | | | | | |
| | | Clay - silty, trace sand, soft to firm, damp, low plastic, light brown | | B1 | | | | | |
| 1 | | | | B2 | | | | | |
| 2 | | Clay Till - silty, some sand, trace gravel, very stiff, damp to moist, low plastic, olive brown with coal inclusions and oxide stains | | B3 | | | | | |
| 3 | | | | B4 | | | | | |
| | | - stiff | | B5 | | | | | |
| 4 | | | | B6 | | | | | |
| | | End of borehole at 4.57 m, no sloughing or seepage. No standpipe installed. | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |

| | |
|---|---|
| LOGGED BY: CA | COMPLETION DEPTH: 4.57 m |
| REVIEWED BY: BR | COMPLETION DATE: 24-9-5 |



AB TRANS BOREHOLE LOG NORANDEN FARMS.GPJ AB_TRANS.GDT 24-9-30

| | | |
|---|---|---|
| Project: Noranden Farms Permeability Assessment | | BOREHOLE NO: **BH004** |
| Client: Matthew Jacobsen | | PROJECT NO: REL243058 |
| | Solid Stem Auger | ELEVATION: |

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

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

| Depth (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE NO | BLOWS /150 mm | OTHER DATA | SLOTTED PIEZOMETER | Elevation (m) |
|---|---|---|---|---|---|---|---|---|
| 0 | | Topsoil (200 mm) | | | | | | |
| | | Clay - silty, trace sand, soft to firm, damp, low plastic, light brown | | B1 | | | | |
| 1 | | | | B2 | | | | |
| | | Clay Till - silty, some sand, trace gravel, stiff to very stiff, damp to moist, low plastic, olive brown with coal inclusions and oxide stains | | B3 | | | | |
| 2 | | | | | | | | |
| | | | | B4 | | | | |
| 3 | | | | | | | | |
| | | | | B5 | | | | |
| 4 | | | | | | | | |
| | | | | B6 | | | | |
| 5 | | End of borehole at 4.57 m, no sloughing or seepage. Standpipe installed to 4.57 m. Standpipe was found dry when monitored on September 11th, 2024. | | | | | | |
| 6 | | | | | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |

PLASTIC — M.C. — LIQUID (20 40 60 80)

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

■ N-VALUE ■ (20 40 60 80)

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

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

| | |
|---|---|
| LOGGED BY: CA | COMPLETION DEPTH: 4.57 m |
| REVIEWED BY: BR | COMPLETION DATE: 24-9-5 |



AB TRANS BOREHOLE LOG NORANDEN FARMS.GPJ AB_TRANS.GDT 24-9-30

# MOISTURE CONTENT

| JOB # | JOB DESCRIPTION | PROJECT |
|---|---|---|
| REL253013 | Noranden Farms Ltd.<br>Additional Effluent Pond | Evaluation |

| Borehole ID | Sample ID | Depth (m) | Wet + Tare (g) | Dry + Tare (g) | Tare (g) | Moisture % |
|---|---|---|---|---|---|---|
| BH101 | 1B1 | 1.5 | 285.9 | 258.3 | 6.3 | 11.0 |
| | 1B2 | 3.0 | 281.8 | 239.8 | 6.3 | 18.0 |
| | 1B3 | 4.6 | 275.2 | 242.0 | 6.3 | 14.1 |
| | 1B4 | 6.1 | 282.9 | 248.6 | 6.3 | 14.2 |
| | 1B5 | 7.6 | 368.1 | 319.9 | 8.3 | 15.5 |
| | 1B6 | 9.1 | 289.9 | 260.6 | 6.4 | 11.5 |
| BH102 | 2B1 | 1.5 | 270.1 | 229.8 | 6.4 | 18.0 |
| | 2B2 | 3.0 | 274.2 | 228.5 | 6.3 | 20.6 |
| | 2B3 | 4.6 | 304.7 | 271.9 | 6.4 | 12.4 |
| | 2B4 | 6.1 | 267.7 | 234.9 | 6.3 | 14.3 |
| | 2B5 | 7.6 | 263.0 | 229.9 | 6.4 | 14.8 |
| | 2B6 | 9.1 | 271.6 | 245.1 | 6.3 | 11.1 |

**Figure 1 – Site Plan**
**Borehole Locations**