Technical Document LA24009

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	LA24009	NE 20-10-21 W4M

APPLICATION DISCLOSURE

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

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

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

Feb 15/24
Date of signing

[redacted]
Signatu

Anchor X Cattle Ltd
Corporate name (if applicable)

Ron Bezooyen
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)
Sheep Barn - Ewes and Lambs	already constructed	63 m x 27 m
adjacent to each other Sheep Barn Corrals - Ewes and Lambs	already constructed	63 m x 17 m
Sheep Corrals - Feeders	already constructed	145 m x 55 m
Catch Basin		23 m x 23 m x 2 m --> see below
	Catch basin dimensions changed to 25 m x 25 m x 2.5 m deep	

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

Existing facilities	Dimensions (m) (length, width, and depth)	NRCB USE ONLY
N/A		

NRCB USE ONLY

The ewes and lambs and the feeder facilities are already constructed (the sheep barn and corrals form one facility).

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)

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 Dec 31, 2025

Additional information

en
en

AO comment: In addition to the facilities listed, there are also three larger pens located immediately adjacent to the east of the sheep feedlot pens. These pens are used for cow/calf pairs only. The operator is aware that these pens cannot be used for other purposes.

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

Livestock category and type (Available in the Schedule 2 of the Part 2 Matters Regulation)	**Permitted number**	**Proposed increase or decrease in number (if applicable)**	**Total**
AO comment: The application is for 1000 ewes with lambs and 1000 sheep feeders			

Bezooyen
Area and Site Map
NE 20-10-21W4M

Figure 2 – Bezooyen Sheep Facility – Site Map

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)

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 R* [redacted] *cation Order* [Alta. Reg. 171/2007], this basin is currently closed to new surface
7. **Provide:** Water licence application number(s) Documents on file

Signed this 15 day of Feb, 2024.

[redacted]

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 ____ day of _____, 20____.

_____

Signature of Applicant or Agent

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: _____ **Proposed 1:** Lambing Barn

Proposed 2: Lamb - Feeder Corrals **Proposed 3:** Catch Basin

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 located in known 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 observed or listed in EPA water well database
	How many water wells are within 100 m of the manure storage facility or manure collection area?		0	0	0	☒ YES ☐ NO ☐ YES with exemption	none observed or listed in EPA water well database
	What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)		2000m	2000m	2000m	☒ YES ☐ NO ☐ YES with exemption	43 m to the outskirts of the coulee system draining into the Oldman River
Groundwater information	What is the depth to the water table?		>1m	>1m	>1m	☐ YES ☐ NO ☐ YES with exemption	Between 1.1 m and 3.5 m See drilling report attached
	What is the depth to the groundwater resource/aquifer you draw water from?		>10m	>10m	>10m	☒ YES ☐ NO ☐ YES with exemption	No wells within a 1 mile radius (below drilling depth)

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

See attached geotechincal report from WSP

Part 2 — Technical Requirements

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

NRCB USE ONLY

ENVIRONMENTAL RISK SCREENING INFORMATION

ERST for **proposed** facilities see Decision Summary for details

Facility	Groundwater score	Surface water score	File number

ERST for **existing** facilities New CFO

Facility	Groundwater score	Surface water score	File number

ERST 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)

NRCB USE ONLY

WATER WELL AND SURFACE WATER INFORMATION

Well IDs: No wells within 400 m of a CFO facility

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

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

Water wells ☒ N/A

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

Surface water ☒ N/A

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

Water Well Exemption Screening Tool ☒ N/A

Water Well ID	Preliminary Screening Score	Secondary Screening Score	Facility

Groundwater or surface water related comments:

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
Schooten	NW 21-10-21W4M	470m	RA	1	462 m		yes
~~A~~ Koppe	SW 29-10-21W4M	760m	RA	1	761 m		yes

RA = Rural agriculture

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)
Anchor X Cattle Ltd	NE-20-10-21	35ac	Irigated		
Anchor X Cattle Ltd	NE-~~33~~-10-21	90ac	" "		
			Total	125 acres	

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

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

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

Additional information (attach any additional information as required)

Bezooyen
Area and Site Map
NE 20-10-21W4M

Figure 1 – Bezooyen Sheep Facility Near Picture Butte, AB. - Area Map

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): +/- 2 m

Requirements (m): Category 1: 254 m Category 2: 338 m Category 3: 423 m Category 4: 676 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: 70.7 acres irrigated

Land base listed: 125 acres irrigated

Area not suitable: NA

Available area 125 acres irrigated 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 New CFO

If already completed, see _____

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

May 2, 2024	

CORRESPONDENCE WITH MUNICIPALITIES AND REFERRAL AGENCIES

Date deeming letters sent: March 26, 2024

Municipality: Lethbridge County

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

Alberta Health Services: NA

☐ 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: LNID ☐ N/A

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

Other: Tamarck Acquisition Corp, Atco Gas and Pipelines ☐ N/A

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

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. Sheep Barn and Corrals - Ewes
2. Sheep Corrals - Feeders

Manure storage capacity

	Length (m)	Width (m)	Depth below ground level (m)	**NRCB USE ONLY** Estimated storage capacity (m^3)
1.	63 m	44 m	0	
2.	145	55	0	
			TOTAL CAPACITY	Met together with short term

☒ 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

Surface water from the corrals will be directed to the catch basin.

Naturally occurring protective layer details

Thickness of naturally occurring protective layer	3.1 (m)	Provide details (as required) RB2-23 Calculated Equivalent Thickness to AOPA = 36m	
Soil texture	8 % sand	54 % silt	38 % clay
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested 2.9 - 6.0 m Clay	Hydraulic conductivity (cm/s) 8.7 x10-8 cm/s	Describe test standard used Modified Falling Head Test

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

NRCB USE ONLY

Requirements met: ☒ YES ☐ NO

Condition required: ☒ YES ☐ NO

Report attached: ☒ YES ☐ NO

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. Catch Basin
2. _____
3. _____

Determination of runoff area

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

See the attached runoff control plan and calculations

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. 0.5 m freeboard) (m^3)
1.	~~23~~ 25 m	~~23~~ 25	~~2~~ 2.5	~~2~~ 2.5	3:1	3:1	n/a	536 m^3
2.								
3.								
							TOTAL CAPACITY	

Naturally occurring protective layer details

Thickness of naturally occurring protective layer	3.1 (m)	Provide details (as required) RB2-23 Calculated equivalent thickness to AOPA requirements = 36 m	
Soil texture	8 % sand	54 % silt	38 % clay
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested 2.9 - 6.0 m deep Clay	Hydraulic conductivity (cm/s) 8.7 x 10-8 cm/s	Describe test standard used Modified Falling Head Test (see attached geotechnical report from WSP. Nov/2023)

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 Storage Volume Calculator

Construction Dimensions of Catch Basin

*** Only cells in blue can be changed.**

Overall Dimensions of Catch Basin			Catch Basin Dimensions
Total Length*[4]	25.0	m	82 ft
Total Width*[4]	25.0	m	82 ft
Total Depth*[4]	2.5	m	8 ft
Design Capacity Depth	*2.00*	m	7 ft
End Slope*[4]	3	run:rise	3 run:rise
Side Slope*[4]	3	run:rise	3 run:rise
Length of Bottom	10.0	m	33 ft
Width of Bottom	10.0	m	33 ft
Capacity @ top of Bank	*813*	m^3	*Capacity (@tob)* *28,693* ft^3 *178,725 Imp. Gal.*

Design Capacity of Catch Basin (freeboard level)			Design Capacity (freeboard level)
Length (design capacity depth)	22.0	m	72 ft
Width (design capacity depth)	22.0	m	72 ft
Total Depth	*2.5*	m	*8* ft
Design Capacity Depth	2.00	m	7 ft
End Slope	3	run:rise	3 run:rise
Side Slope	3	run:rise	3 run:rise
Design Capacity (freeboard level)	**536**	m^3	18,929 ft^3
			117,903 Imp. Gal.
level)	*484*	m^2	*5,210* ft^2

CFO Name [1]	(Enter CFO Name Here)
Land Location [1]	1-1-4-W5

Paved Runoff Catchment Area(s)

Area [2]	Length (m)	Width (m)	Area (m^2)
1			0.0
2			0.0
3			0.0
4			0.0
5			0.0
		Total Area (m^2)	**0**

Unpaved Runoff Catchment Area(s)

Area [2]	Length (m)	Width (m)	Area (m^2)
6	63	17	1,071.0
7	145	55	7,975.0
8			0.0
9			0.0
10			0.0
		Total Area (m^2)	**9,046**

Rainfall (Select Town [3])

Picture Butte 85

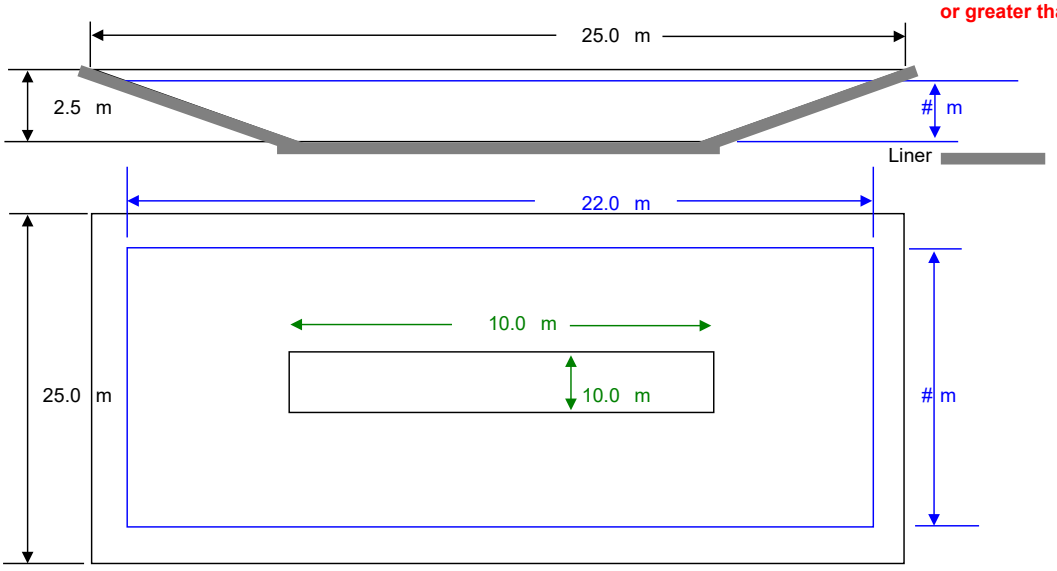
AOPA Design Rainfall **85 mm**

Minimum Catchbasin Storage Volume Required

461 m^3 ** **16292.28 ft^3**

101481.89 Imp. Gal.

**** Design capacity of catch basin should be equal to or greater than, minimum storage volume required.**



Lines in Black - Overall catch basin dimensions

Lines in Blue - Design capacity depth dimensions (excludes freeboard)

NTS - Not To Scale

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

NRCB USE ONLY

Catch basin calculator. Total volume @ freeboard level: 536 m^3 Runoff capacity requirements met: ☒ YES ☐ NO

Calculation of the volume attached: ☒ YES ☐ NO

Depth to water table: below 6 m in catch basin area Requirements met: ☒ YES ☐ NO

Depth to uppermost groundwater resource: no water wells in area below 6 m Requirements met: ☒ YES ☐ NO

ERST completed: ☒ See ERST page for details

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

Uniform layering of very firm, medium plastic clay - clay loam

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

Part 2 — Technical Requirements

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

NRCB USE ONLY **RUNOFF CONTROL CATCH BASIN CAPACITY SUMMARY (if applicable)**	
Facility 1	
Name / description New catch basin	Capacity 536 m^3
Facility 2	
Name / description	Capacity
Facility 3	
Name / description	Capacity
Facility 4	
Name / description	Capacity
TOTAL CAPACITY	536 m^3
RUNOFF VOLUME FROM CONTRIBUTING AREAS	461 m^3
MEETS AOPA RUNOFF CONTROL VOLUME REQUIREMENTS	☒ YES ☐ NO

9 November 2023

WSP File: BX11613

3102 – 12 Avenue North
Lethbridge, Alberta T1H 5V1
T: +1 403 327-7474
www.wsp.com

Ron Bezooyen
c/o Linkage Ag Solutions
Box 1120
Coaldale, Alberta T1M 1M9

Attention: Mr. Cody Metheral:

Re: Geotechnical Review and Evaluation
NRCB Permitting of Existing Pens & Proposed Catch Basin
NE-20-010-21-W4M, near Picture Butte, Alberta

As requested, WSP E&I Canada Limited (WSP) has carried out a geotechnical review and evaluation of the above-captioned site relative to the required protection of the groundwater resource, as required by the Agricultural Operation Practices Act, AB Reg. 267/2001 (hereinafter referred to as "AOPA"). This letter describes site soil conditions to support a permit application related to an area of existing solid manure storage (covered pens and outdoor pens) and a proposed catch basin within NE-20-010-21-W4M (refer to Figure 1, attached).

In order to demonstrate the suitability of the naturally existing soils for consideration as a naturally occurring protective layer to the groundwater, two (2) boreholes were advanced at the site on May 8, 2023, followed by an additional three (3) boreholes in August, 2023. The boreholes were advanced at the approximate locations denoted as RB1-23 to RB5-23 on Figure 1, attached.

The boreholes were advanced by a truck-mounted drill rig owned and operated by Chilako Drilling Services and extended to depths ranging between 4.5 m and 6.0 m below existing grades. The boreholes were logged by Larry Delong of Chilako Drilling Services.

In general, the natural mineral soils encountered within the boreholes comprised of a layer of lacustrine silt and clay loam, which was generally underlain by stiff medium plastic clay till below approximately 1.5 to 3.6 m depth. It is noted that sand soils and saturated conditions were encountered in a borehole advanced NE of the development area in a low-lying area (RB1-23), while predominantly clay conditions were encountered in the other four boreholes. No groundwater resource (as defined by AOPA) was identified within the current (or proposed) development area within the 6.0 m investigation depth.

Samples of soil collected from the screened zone of the boreholes RB2-23, RB4-23, and RB5-23 as well as a fourth sample from RB3-23 were subjected to laboratory grain size (i.e., hydrometer) analyses. The results (attached) indicate a textural breakdown of approximately:

Table 1: Soil Textural Analyses

Borehole/Depth	% Sand	% Silt	% Clay
RB2-23 / 4.0-5.4m	8	54	38
RB3-23 / 4.5-6.0m	7	54	39
RB4-23 / 4.5-6.0m	10	56	34
RB5-23 / 3.0-4.5m	12	55	33

To measure the *in situ* permeability of the subsurface soils, 50 mm diameter PVC monitoring wells were constructed in boreholes RB2-23, RB4-23 and RB5-23. The test wells were screened at various depths from 2.9 m to 6.0 m below existing grades (see Table 2). Well saturation of the 50 mm diameter monitoring wells was carried out by filling the monitoring well to the top for several consecutive days. After several days of saturation, the 24-hour water drop for the wells ranged between 0.23 m and 1.45 m. The 24-hour water drop for each of the monitoring wells are listed in Table 2.

To calculate the permeability of the screened portion of the clay till strata at the test well locations, a modified falling head test (as outlined in the USBR Engineering Geology Field Manual Volume 2 [2001]) was used. The input variables and output data are outlined on the attached In Situ Permeability Test reports. The results of the permeability testing indicate an *in situ* hydraulic conductivity, k_s, values ranging between 1.7×10^{-8} cm/s and 8.8×10^{-7} cm/s (see Table 2).

Using the measured permeability of the clay stratum, the equivalent natural soil thicknesses of naturally occurring material having a hydraulic conductivity of 1×10^{-6} cm/s (the reference standard in AOPA) at the monitoring well locations has been calculated, and those thickness equivalents are presented in Table 2. As indicated, the equivalent thicknesses range between 36 m and 94 m. This represents natural material protection in excess of the minimum requirements outlined by the AOPA for solid manure storage (minimum 2 m, Section 9.5-c) and for catch basins (minimum 5 m, Section 9.5-b).

Table 1: Permeability Test Results

Borehole	24-hr Water Drop in Well (m)	Length of Screened Zone (m)	Depth of Screen (m)	Calculated Permeability	Calculated Equivalent $1x10^{-6}$ cm/s Thickness (m)
RB2-23	1.45	3.10	2.9 – 6.0	8.7×10^{-8} cm/s	36
RB4-23	0.23	1.60	4.4 – 6.0	1.7×10^{-8} cm/s	94
RB5-23	0.43	1.60	2.9 – 4.5	4.4×10^{-8} cm/s	36

Conclusion

Based on the results of the current investigation, permeability testing, and our understanding of the site and proposed development at the site, it is WSP's opinion that the naturally occurring materials at the site satisfy the AOPA requirements for permitting the existing pens and proposed catch basin at this location.

We trust that this report satisfies your present requirements. Should you have any questions, please contact the undersigned at your convenience.

Yours truly,

WSP E&I Canada Limited

PROFESSIONAL ENGINEER JOHN P. LOBBEZOO ID M10450 ALBERTA
26 Nov 2023

John Lobbezoo, P.Eng.
Principal Geotechnical Engineer

Co-authored by:
James Le, EIT
Geotechnical Services

Reviewed by:
Kevin Spencer, P.Eng., M.Eng.
Senior. Associate, Geotechnical Engineer

PERMIT TO PRACTICE
WSP E&I CANADA LIMITED
RM SIGNATURE: _____
RM APEGA ID #: 110450
DATE: 26 Nov 2023
PERMIT NUMBER: P004546
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Attachments
- Figure 1 Borehole Locations
- In Situ Permeability Test Calculations
- Hydrometer Test
- Soil Profile and Parent Material Description, Chilako Drilling Services

Figure 1 - Borehole Locations

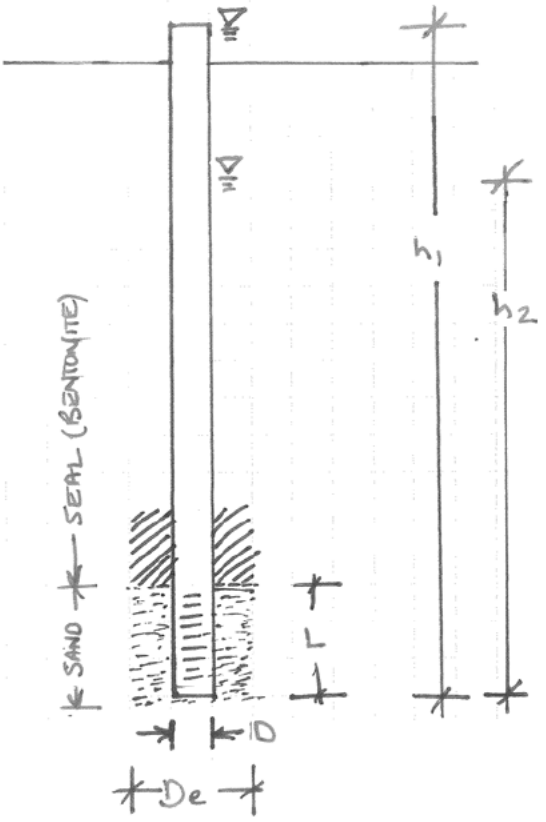
RB2-23

In Situ Permeability Test

Modified Falling Head Permeability Equation

$$K_s = \frac{r^2}{2\ell\Delta t}\left[\frac{\sinh^{-1}\frac{\ell}{r_e}}{2}\ln\left[\frac{2H_1-\ell}{2H_2-\ell}\right]-\ln\left[\frac{2H_1H_2-\ell H_2}{2H_1H_2-\ell H_1}\right]\right]$$

taken from USBR Engineering Geology Field Manual Volume 2 (2001)



RB2-23 - Ron Bezooyen

WSP File: BX11613

INPUT VARIABLES

Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	3.10	length of sand section (m)
h1	6.40	initial height of water above base of hole (m)
h2	4.95	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 8.7E-08 cm/sec

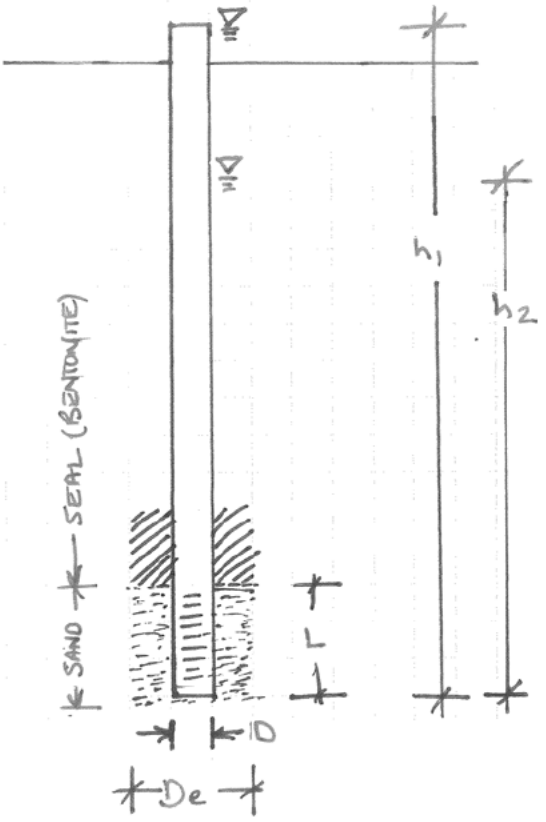
RB4-23

In Situ Permeability Test

Modified Falling Head Permeability Equation

$$K_s = \frac{r^2}{2\ell\Delta t}\left[\frac{\sinh^{-1}\frac{\ell}{r_e}}{2}\ln\left[\frac{2H_1-\ell}{2H_2-\ell}\right]-\ln\left[\frac{2H_1H_2-\ell H_2}{2H_1H_2-\ell H_1}\right]\right]$$

taken from USBR Engineering Geology Field Manual Volume 2 (2001)



RB4-23 - Ron Bezooyen

WSP File: BX11613

INPUT VARIABLES

Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	1.60	length of sand section (m)
h1	6.60	initial height of water above base of hole (m)
h2	6.37	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 1.7E-08 cm/sec

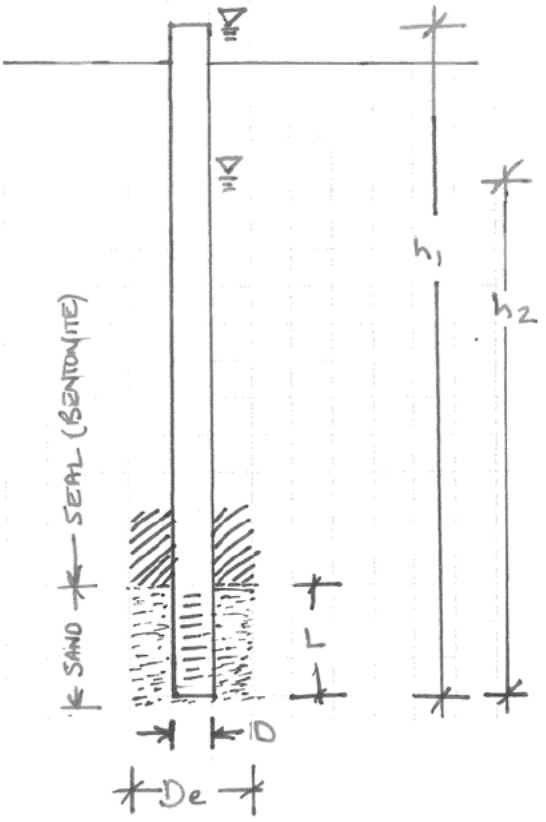
RB5-23

In Situ Permeability Test

Modified Falling Head Permeability Equation

$$K_s = \frac{r^2}{2\ell\Delta t}\left[\frac{\sinh^{-1}\frac{\ell}{r_e}}{2}\ln\left[\frac{2H_1-\ell}{2H_2-\ell}\right]-\ln\left[\frac{2H_1H_2-\ell H_2}{2H_1H_2-\ell H_1}\right]\right]$$

taken from USBR Engineering Geology Field Manual Volume 2 (2001)



RB5-23 - Ron Bezooyen

WSP File: BX11613

INPUT VARIABLES

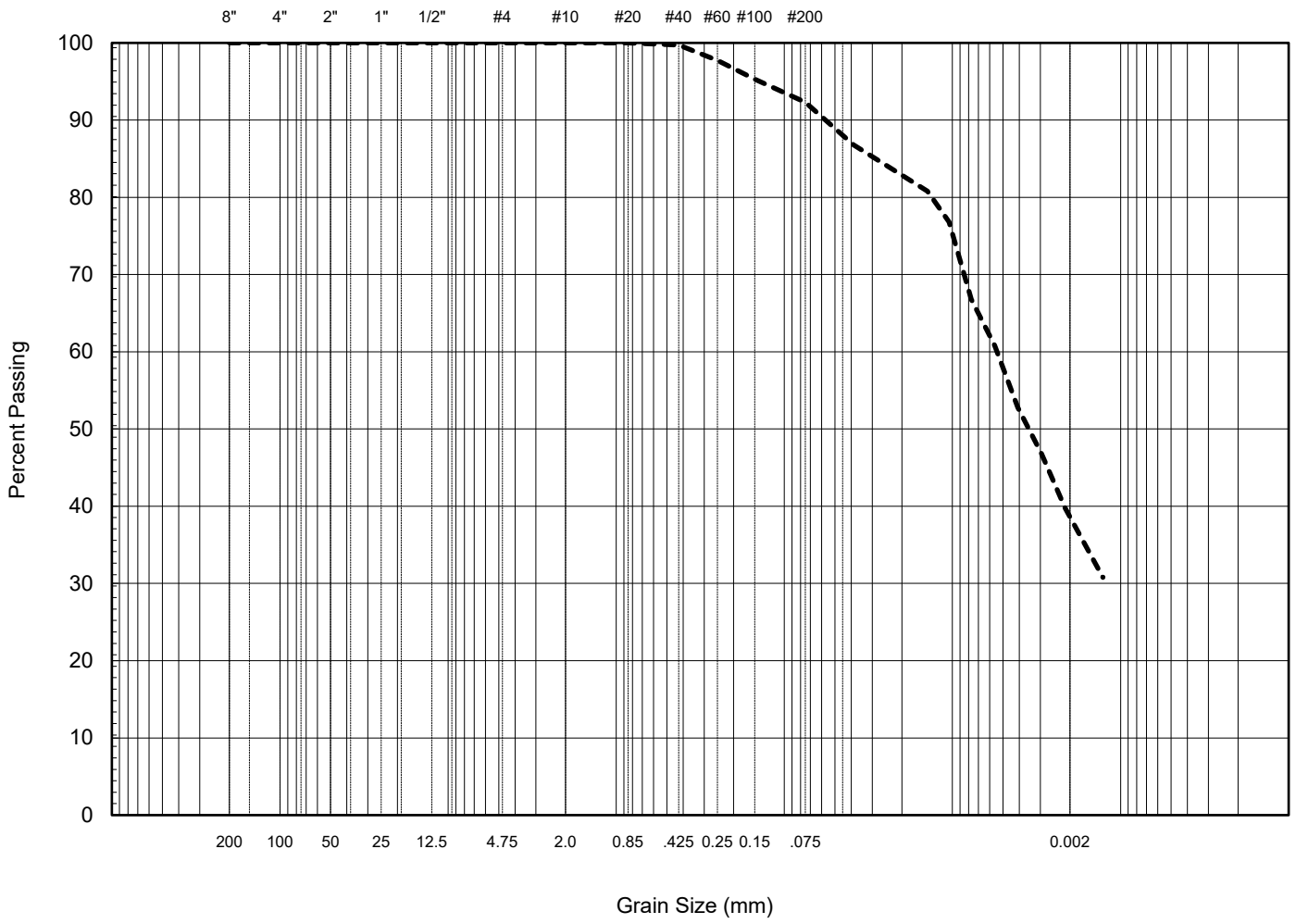
Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	1.60	length of sand section (m)
h1	5.10	initial height of water above base of hole (m)
h2	4.67	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 4.4E-08 cm/sec

HYDROMETER TEST

WSP E&I Canada Limited
3102 12 Avenue North
Lethbridge, AB T1H 5V1

COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary

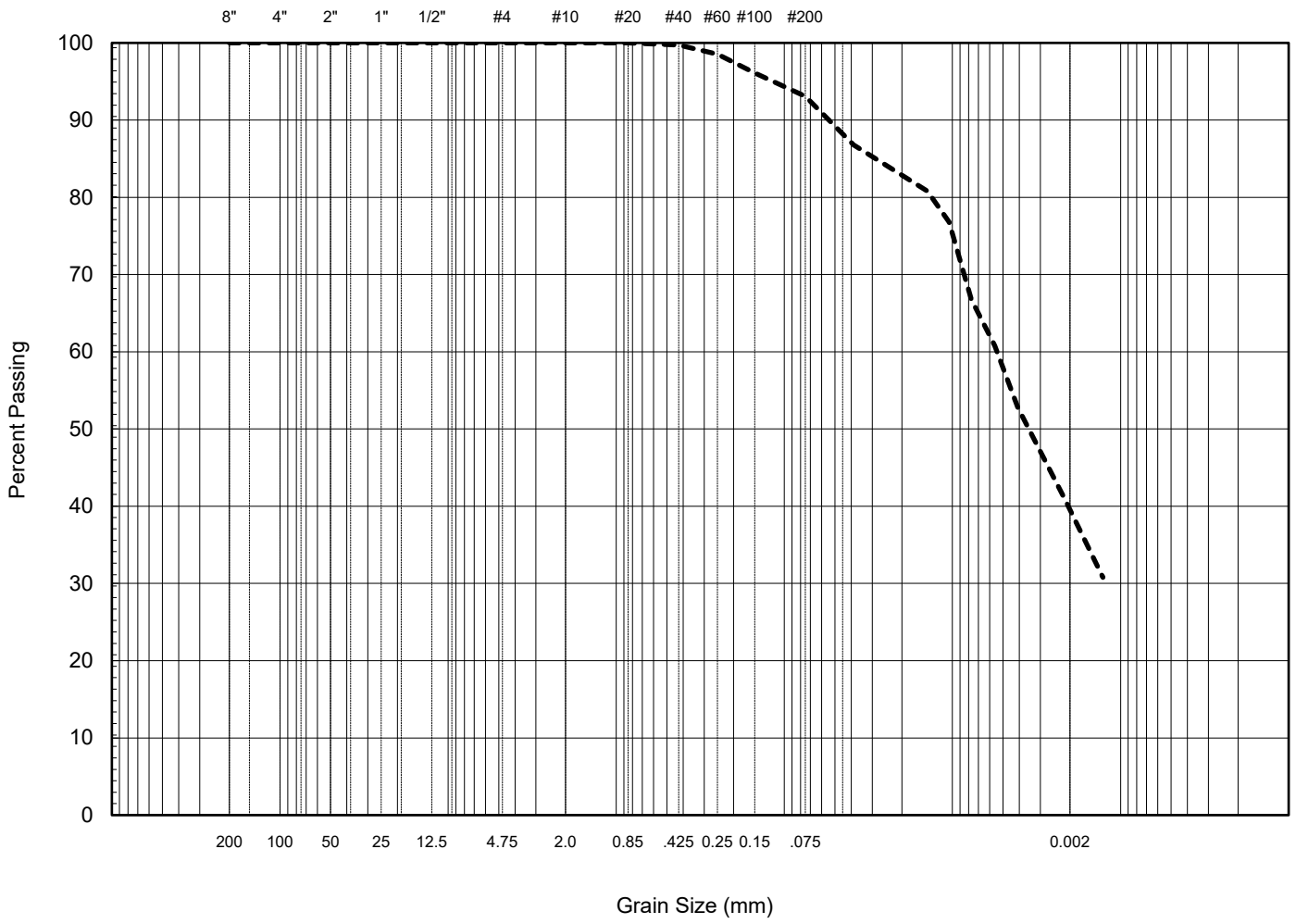
D10 =	#N/A	mm	**Gravel**	0	**%**
D30 =	#N/A	mm	**Sand**	8	**%**
D60 =	0.0055	mm	**Silt**	54	**%**
Cu =	#N/A		**Clay**	38	**%**
Cc =	#N/A				

Project No: BX11613
Hole No: -
Depth (m): 4.0 - 5.4
Sample: RB2-23
Date: June 8, 2023
Tech: TMW

HYDROMETER TEST

WSP E&I Canada Limited
3102 12 Avenue North
Lethbridge, AB T1H 5V1

COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

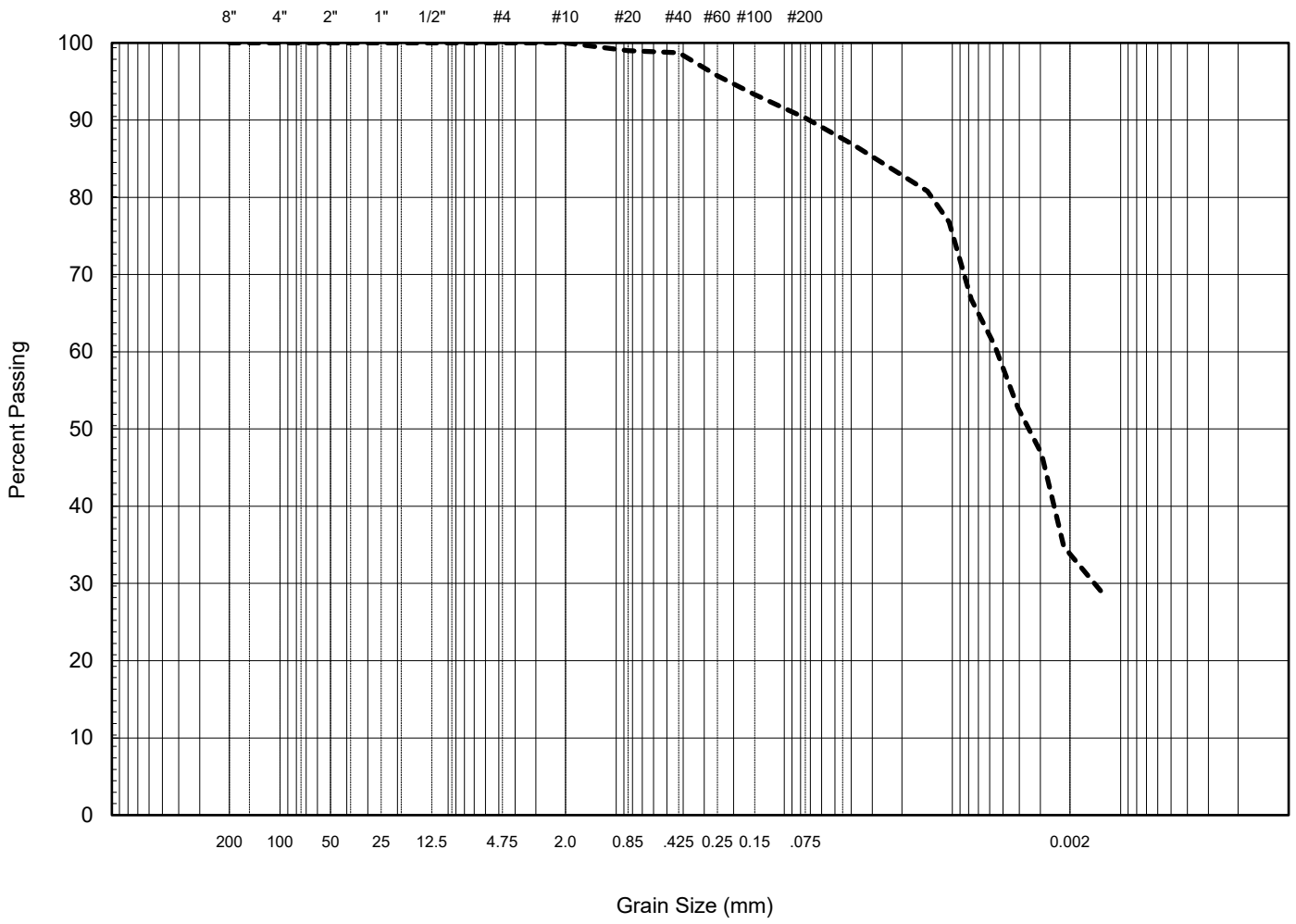
Summary					
D10 =	#N/A	mm	**Gravel**	0	%
D30 =	#N/A	mm	**Sand**	7	%
D60 =	0.0055	mm	**Silt**	54	%
Cu =	#N/A		**Clay**	39	%
Cc =	#N/A				

Project No: BX11613
Hole No: -
Depth (m): 4.5 - 6.0
Sample: RB3-23
Date: September 12, 2023 **Tech:** TMW

HYDROMETER TEST

WSP E&I Canada Limited
3102 12 Avenue North
Lethbridge, AB T1H 5V1

COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary

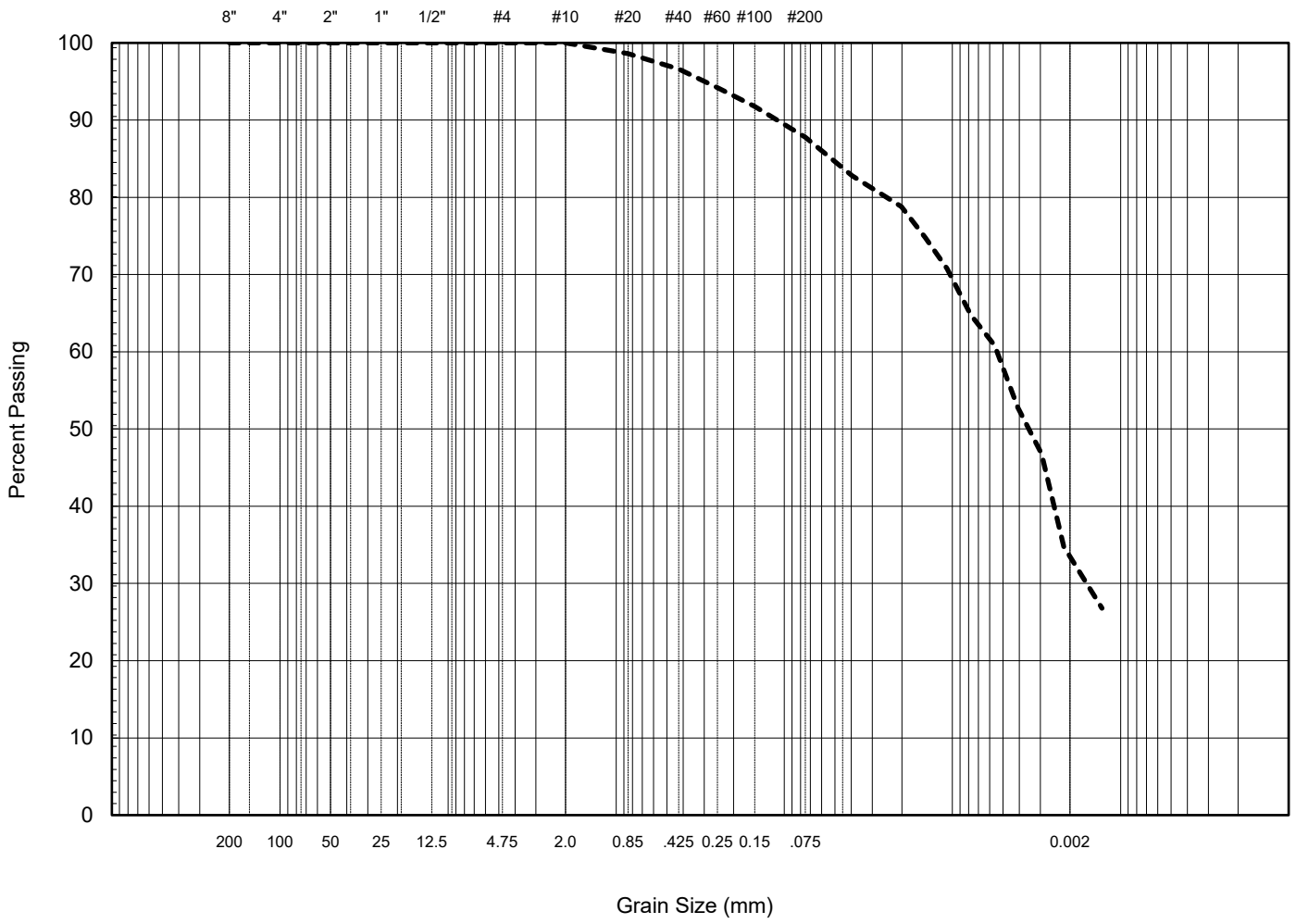
D10 =	#N/A	mm	**Gravel**	0	%
D30 =	0.0015	mm	**Sand**	10	%
D60 =	0.0055	mm	**Silt**	56	%
Cu =	#N/A		**Clay**	34	%
Cc =	#N/A				

Project No: BX11613
Hole No: -
Depth (m): 4.5 - 6.0
Sample: RB4-23
Date: June 8, 2023
Tech: TMW

HYDROMETER TEST

WSP E&I Canada Limited
3102 12 Avenue North
Lethbridge, AB T1H 5V1

COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary

D10 =	#N/A	mm	**Gravel**	0	%
D30 =	0.0016	mm	**Sand**	12	%
D60 =	0.0055	mm	**Silt**	55	%
Cu =	#N/A		**Clay**	33	%
Cc =	#N/A				

Project No: BX11613
Hole No: -
Depth (m): 3.0 - 4.5
Sample: RB5-23
Date: September 12, 2023 **Tech:** TMW

CHILAKO DRILLING SERVICES LTD

Box 942 Coaldale, Alberta, T1M 1M8
(403) 345-3710

SOIL PROFILE AND PARENT MATERIAL DESCRIPTION

Site Location: NE20-10-21W4, Ron Bezooyen Date: 02-May-23

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
RB1-23	0370099	0-0.3	CL	M	Topsoil		Organic
	5522784	0.3-1.0	C	VM	lac		V. Firm, med plastic, brown
	Ponding	1.0-1.5	C	M	Lac		V. Firm, med-high plastic, gray
	area	1.5-3.5	SiCL	VM	Lac		V. Soft, med plastic, yellow brown
		3.5-4.5	M.S.	Sat	lac		Loose
							Free water @ 0.9m
RB2-23	0370091	0-0.15	CL	M	Topsoil		
	5522703	0.15-1.1	CL	M	Lac		V. Firm, med plastic, olive brown
		1.1-2.5	CL-SiCL	VM-Sat	Lac	1.5-2.5	V. Soft, med plastic, brown, some sand
		2.5-5.4	CL	M	Till	4.0-5.4	Stiff, med plastic, brown
		5.4-6.0	CL	M	Till		Stiff, med plastic, brown, oxidized
							50mm H.C. Well installed to 6.0m bgs
							Screen: 6.0-3.0m
							Sand: 6.0-2.9m
							Bentonite: 2.9-0.0m
							Stickup: 0.4m
							Hole Diameter: 0.15m
RB3-23	0369982	0-0.15	CL	M	Topsoil		
	5522698	0.15-1.8	SiCL	M	Lac		V. Firm, med plastic, olive brown
		1.8-4.5	CL	M	Till		V. Firm, med plastic, brown
		4.5-6.0	C	M	Till	4.5-6.0	Stiff, med plastic, brown, iron staining
RB4-23	0370119	0-3.6	CL	M	Fill		Stiff, med plastic, brown
	5522605	3.6-6.0	C	M	Till	4.5-6.0	Stiff, med plastic, brown, organic @ 3.6m
							50mm H.C. Well installed to 6.0m BGS
							Screen: 6.0-4.5m
							Sand: 6.0-4.4m
							Bentonite: 4.4-0.0m
							Stickup: 0.6m
							Hole Diameter: 0.15m
RB5-23	0369888	0-1.5	CL	M	Till		V. Firm, med plastic, brown
	5522602	1.5-4.5	CL	M	Till		V. Firm-stiff, med plastic, dark brown
							50mm H.C. Well installed to 4.5m BGS
							Screen: 4.5-3.0m
							Sand: 4.5-2.9m
							Bentonite: 2.9-0.0m
							Stickup: 0.6m
							Hole Diameter: 0.15m

Legend:

L	Loam
C	Clay
S	Sand
Gr.	Gravel
Si	Silt
F	Fine (sand)
VF	Very Fine (sand)

Eg. VFSCL = Very Fine Sandy Clay Loam