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March 31, 2022
Project No. RD6950-03

dblakely@drumheller.ca
Original will remain on file

**Drumheller Resiliency and Flood Mitigation Office
702 Premier Way
Drumheller, Alberta
T0J 0Y4**

ATTN: Ms. Deighen Blakely, P.Eng.

Re: Berm Material Borrow Summary
Drumheller, AB

Dear Ms. Blakely:

1.0 INTRODUCTION

The Drumheller Resiliency and Flood Mitigation (DRFM) Office is proposing to upgrade or construct numerous flood berms along the river between Nacmine and East Coulee. This construction will require significant volume of engineered fill. The DRFM Office posted a tender request for Expressions of Interest (EOI) for potential private borrow sources to the Drumheller and Alberta Purchasing Connection website on January 31, 2022. ParklandGEO was requested to review submissions, visit the sites from the and take samples for laboratory soil testing to review the expected suitability of these private sources around the greater Drumheller area. This letter summarizes the current information of these potential private borrow sources.

2.0 GENERAL FILL MATERIAL SPECIFICATION

The berms are being designed by multiple engineering consultants, each with their own specific criteria for fill material. In general the required fill will be select clay. The general material specifications are summarized in the following table:

TABLE 1: FILL MATERIAL SPECIFICATION

Specification	Test Type	Use/ Significance
Clay content $\geq 20\%$	Hydrometer Grain Size Analysis	Indicator of permeability and workability
Low to medium plastic	Atterberg Limits	Indicator of permeability and workability
Non to low dispersive	Pin Hole Test - Remoulded at $\geq 98\%$ SMPDD	To reduce the risk of erosion of the berm material due to dispersion of the clay fill
Permeability $\leq 1 \times 10^{-6}$ m/s	Hydraulic Conductivity - Remoulded at $\geq 98\%$ SMPDD	Direct measure of permeability for potential flood water passing through the constructed berm
Internal friction Angle $\geq 25^\circ$	Direct Shear - Remoulded at $\geq 98\%$ SMPDD	Used to describe the friction shear resistance for design of berm side slope stability

Any submission of for use of borrow material will require laboratory test results to confirm the material meets or exceeds the parameters outlined in Table 1. All file laboratory test results completed during this program has been provided to potential borrow owner.

3.0 EOI SUBMISSION SUMMARY

To ten submissions were received through the EOI, including four proponents with multiple proposed borrow locations. ParklandGEO reviewed all submission documents and attempted to contact owners to collect samples from the potential borrow locations. Four of the submitted borrow sites are expected to be suitable for use in constructed flood berms. Two additional sites are likely to have suitable material, however samples were not recovered from these sites for direct review. A further two sites have no comment on the suitability as no soils information submitted or collected due to access or contact issues.

A short summary of the submitted borrow locations that are expected to have suitable material or has material that was not directly reviewed have provided in the attached summary table. Pit Locations, where disclosed are shown on the attached figures. Locations that are not considered to have suitable material have not been included in the summary table.

4.0 CLOSURE

Geological conditions are variable. The suitability comments presented in this letter, and any subsequent correspondence, are based on an evaluation of information derived from boreholes, laboratory testing, landowner information and additional sources of information referenced in this letter. This letter has been prepared for the exclusive use of **Town of Drumheller, Drumheller Resiliency and Flood Mitigation Office** and their approved agents for the specified application to the Flood Mitigation Project in Drumheller, Alberta. This letter report has been prepared in accordance with generally accepted soil and geotechnical engineering practices. No other warranty, expressed or implied, is made. The limitations of this report are specified in the General Terms and Conditions section and should be considered part of this report. We trust this meets with your present needs. If you have any questions or comments regarding this information, please do not hesitate to contact this office.

Respectfully submitted,
PARKLAND GEOTECHNICAL CONSULTING LTD.

Bryden Lutz, P.Eng.
Geotechnical Engineer

Reviewed by: Mark Brotherton, P.Eng.

APPENDIX

Table – Clay Borrow Expression of Interest Summary

Figure 1 – Key Plan

Figure 2 – Aerial Plan Drumheller

Figure 3 – Aerial Plan Morrin

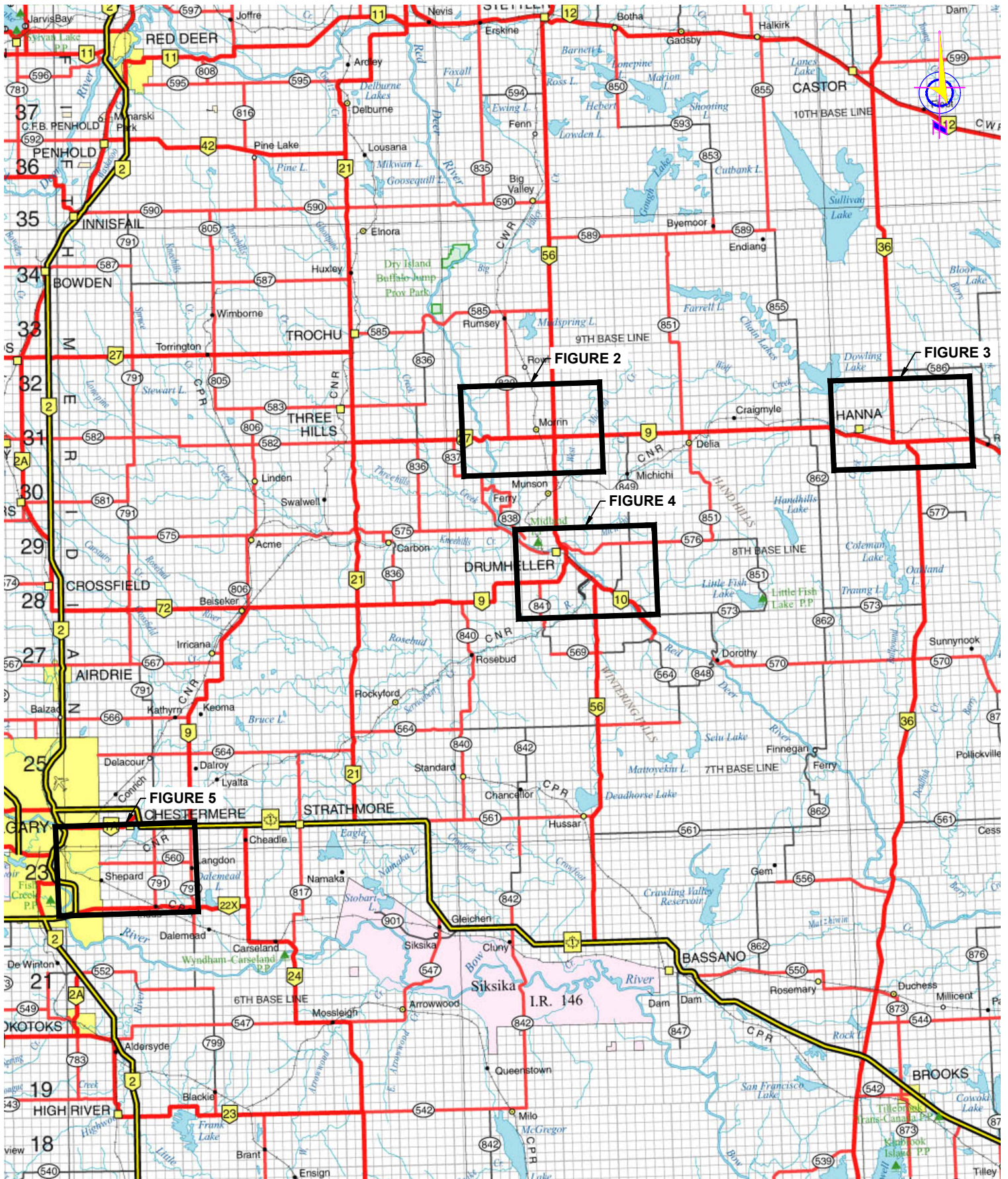
Figure 4 – Aerial Plan Hanna

Figure 5 – Aerial Plan East Calgary

CLAY BOPROW EXPRESSION OF INTEREST SUMMARY
DRUMHELLER RESILIENCY AND FLOOD MITIGATION PROGRAM
 March 31, 2022

Source Owner	Contact Individual	Phone Number	Email	Expected Suitability	Comments/ Expected Soil	Provided Borrow Location	Figure #
Knibb Developments Ltd	Jason Knibb	403-312-1951	jason@knibbdevelopments.com	Yes	Clay Till expected to be suitable	SW-28-28-20-W4M	4
Wiarth Dirtwork Ltd	Darcy Wiarth	403-334-7364	d_nwiart@mac.com	Yes	Till expected to be suitable	16-29-31-20-W4M	2
Reg Gallagher	Reg Gallagher	403-820-2670	reg@gallaghertrucking.ca	Yes	Till expected to be suitable	SW-4-31-20-W4M	2
KLS Earthworks Inc.	Mark Walton	403-370-3749	mwalton@kls earthworks.com	Yes	Till expected to be suitable	232098 Range Rd 283, Alberta T1X 0K7	5
Northstar Trucking	Brendan Jensen	780-215-0950	brendan@Northstartrucking.ca	Yes	Till expected to be suitable	41 km North of Drumheller	N/A
Smith Trucking Service (1976) Ltd.	Doug Wutzke	403-633-7880	Doug@Smithtrucking.com	TBD*	No direct testing or observation. North site expected to be till based on client submitted grain size analysis – possibly suitable	South of Drumheller Valley - North location	N/A
McNair Sand and Gravel Inc.	Miles McNair	403-850-5956	Miles@mcnairmsg.ca	TBD*	No information on soil	4-31-13-W4M & 3-31-13-W4M & 2-31-13-W4M	4
D+K Christensen Farms Ltd.	Duane Christensen	403-334-3644	dewakat@aisnet.co	TBD*	No information on soil	S 36-27-19-W4M	4

*TBD - To be decided/ additional information required



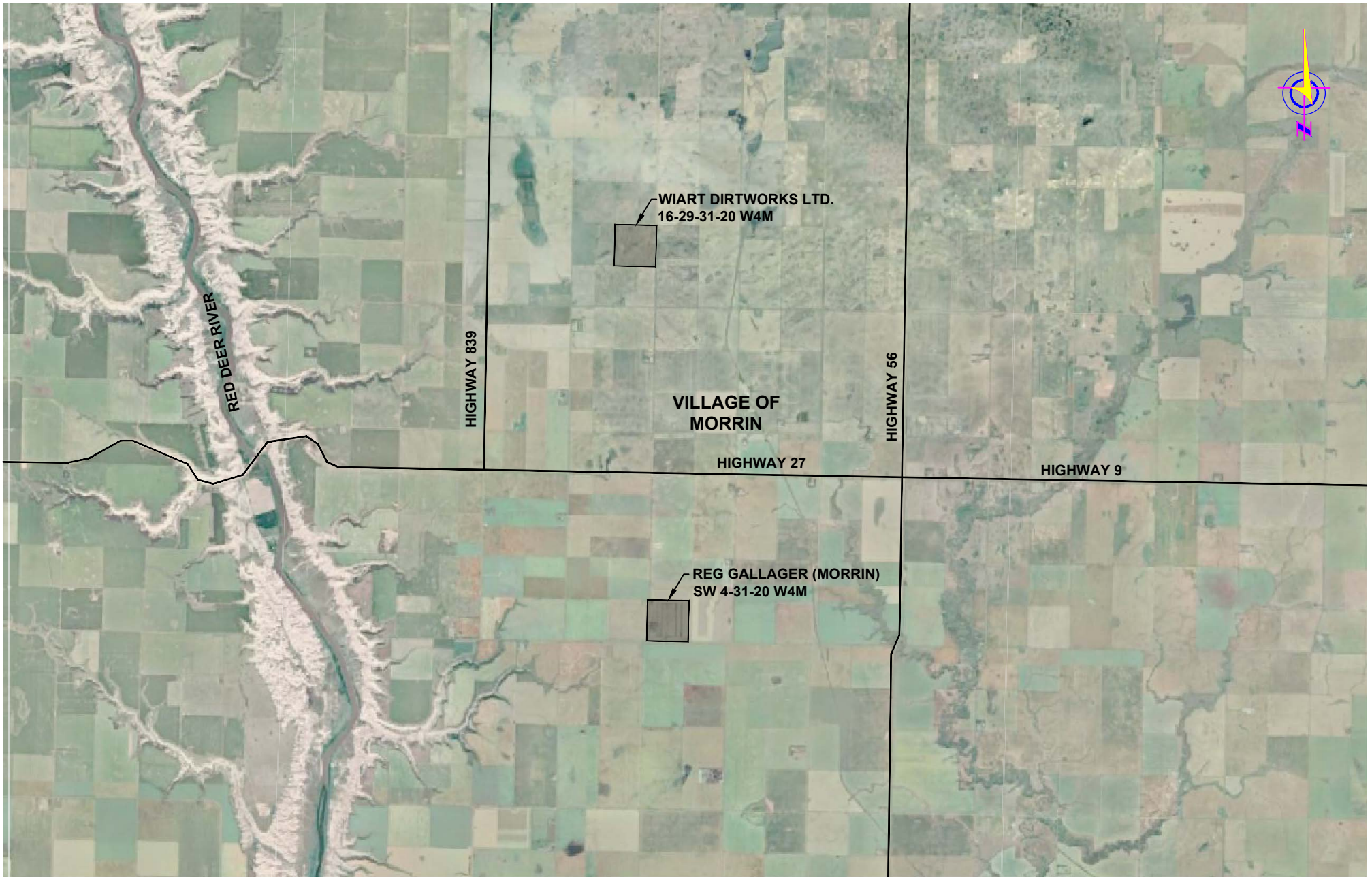
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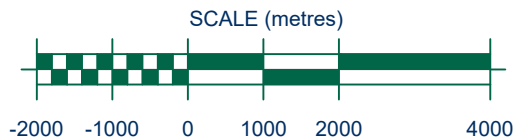
KEY PLAN

BORROW SOURCE SITES MULTIPLE SITES, ALBERTA

DRAWN: NC	CHK'D.: BL	REV #: 0	DATE: MARCH 2022
SCALE: NTS	JOB NO. RD6950-03	DRAWING NO. FIGURE 1	



NOTE: AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED JULY 28, 2021.



CLIENT:



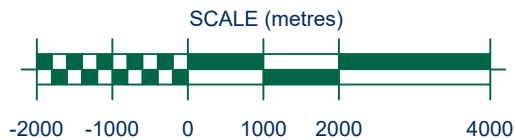
AERIAL PLAN - MORRIN

BORROW SOURCE SITES
16-29-31-20 W4M & SW 4-31-20 W4M, ALBERTA

DRAWN: NC	CHKD.: BK	REV #: 0	DATE: MARCH 2022
SCALE: 1:100,000		JOB NO. RD6950-03	DRAWING NO. FIGURE 2



NOTE: AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED JUNE 20, 2021.



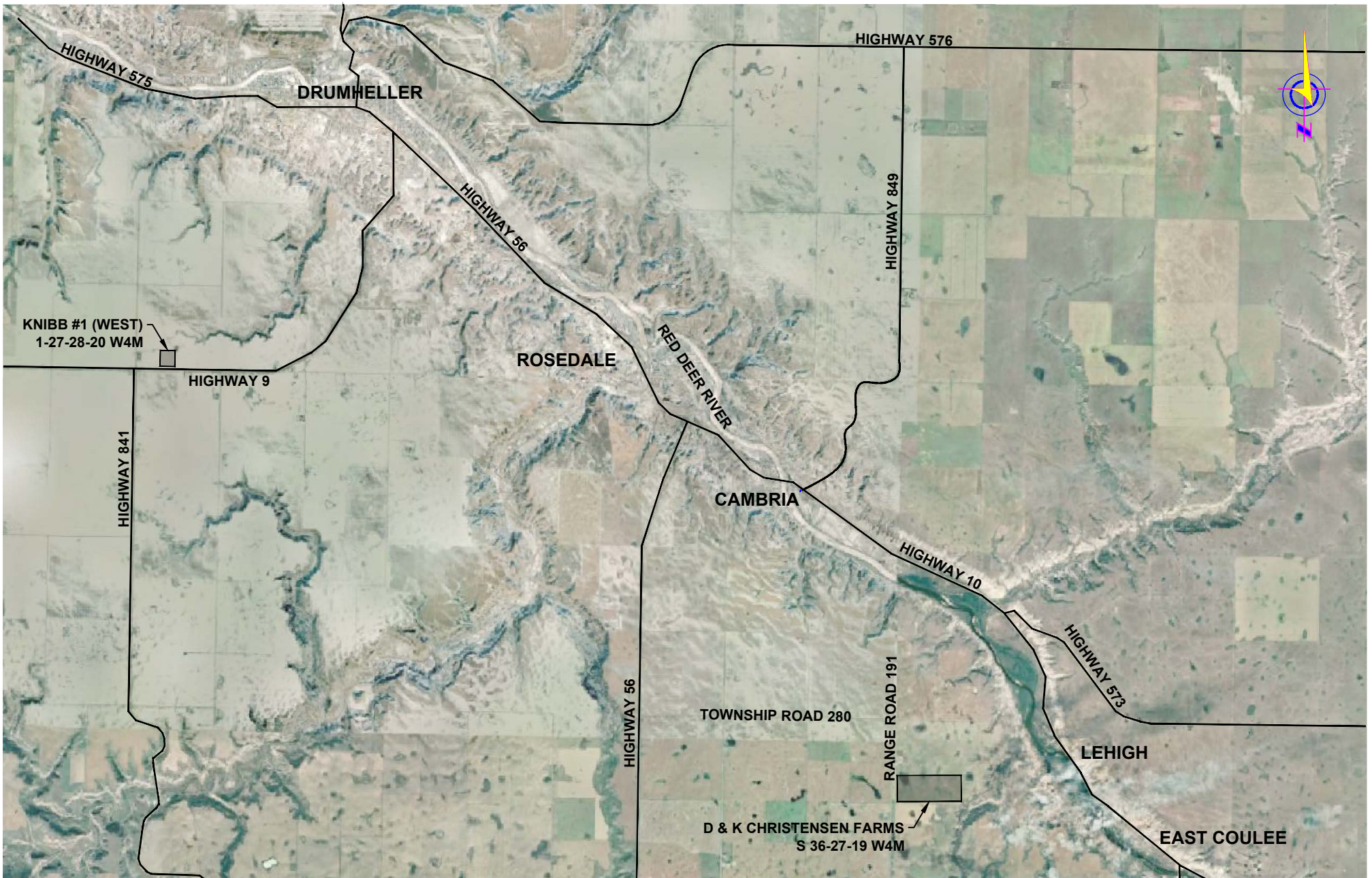
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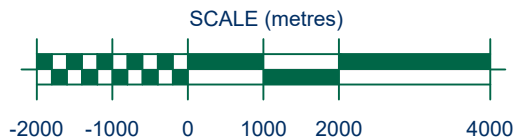
AERIAL PLAN - HANNA

BORROW SOURCE SITES
2-31-13 W4M, 3-31-13 W4M & 4-31-13 W4M, ALBERTA

DRAWN: NC	CHK'D.: BK	REV #: 0	DATE: MARCH 2022
SCALE: 1:100,000	JOB NO. RD6950-03	DRAWING NO. FIGURE 3	



NOTE: AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED JULY 28, 2021.



CLIENT:



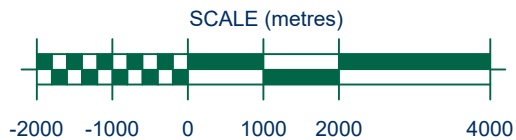
AERIAL PLAN - DRUMHELLER

BORROW SOURCE SITES
8-27-28-20 W4M & S 36-27-19 W4M, ALBERTA

DRAWN: NC	CHK'D.: BK	REV #: 0	DATE: MARCH 2022
SCALE: 1:100,000		JOB NO. RD6950-03	DRAWING NO. FIGURE 4



NOTE: AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED JULY 21, 2021.



CLIENT:

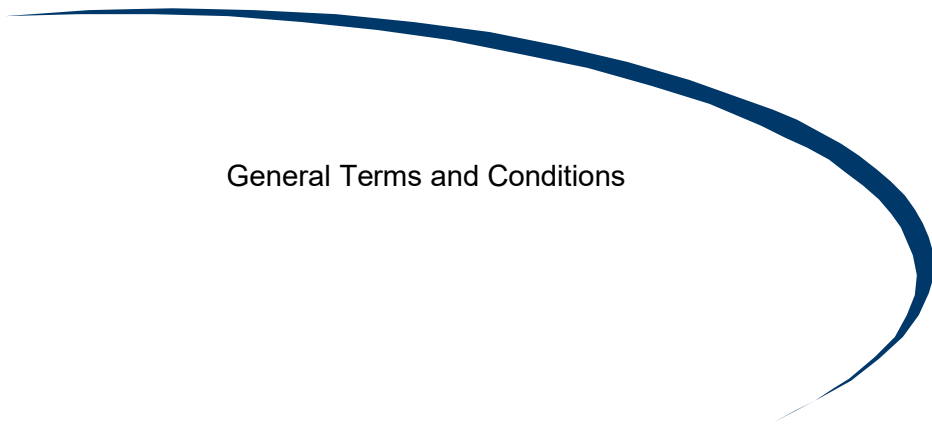


AERIAL PLAN - CALGARY

BORROW SOURCE SITES
232098 RANGE ROAD 283, ALBERTA

DRAWN: NC	CHK'D.: BK	REV #: 0	DATE: MARCH 2022
SCALE: 1:100,000		JOB NO. RD6950-03	DRAWING NO. FIGURE 5

LIMITATIONS



General Terms and Conditions

The use of this attached report is subject to the following general terms and conditions.

1. **STANDARD OF CARE** - In the performance of professional services, ParklandGEO used the degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession practicing in the same or similar localities. No other warranty expressed or implied is made in any manner.
2. **INTERPRETATION OF THE REPORT** - The CLIENT recognizes that subsurface conditions will vary from those encountered at the location where borings, surveys, or explorations are made and that the data, interpretations and recommendation of ParklandGEO are based solely on the information available to him. Classification and identification of soils, rocks, geological units, contaminated materials and contaminant quantities will be based on commonly accepted practices in geotechnical or environmental consulting practice in this area. ParklandGEO will not be responsible for the interpretation by others of the information developed.
3. **SITE INFORMATION** - The CLIENT has agreed to provide all information with respect to the past, present and proposed conditions and use of the Site, whether specifically requested or not. The CLIENT acknowledged that in order for ParklandGEO to properly advise and assist the CLIENT, ParklandGEO has relied on full disclosure by the CLIENT of all matters pertinent to the Site investigation.
4. **COMPLETE REPORT** - The Report is of a summary nature and is not intended to stand alone without reference to the instructions given to ParklandGEO by the CLIENT, communications between ParklandGEO and the CLIENT, and to any other reports, writings or documents prepared by ParklandGEO for the CLIENT relative to the specific Site, all of which constitute the Report. The word "Report" shall refer to any and all of the documents referred to herein. In order to properly understand the suggestions, recommendations and opinions expressed by ParklandGEO, reference must be made to the whole of the Report. ParklandGEO cannot be responsible for use of any part or portions of the report without reference to the whole report. The CLIENT has agreed that "This report has been prepared for the exclusive use of the named CLIENT. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. ParklandGEO accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report."

The CLIENT has agreed that in the event that any such report is released to a third party, the above disclaimer shall not be obliterated or altered in any manner. The CLIENT further agrees that all such reports shall be used solely for the purposes of the CLIENT and shall not be released or used by others without the prior written permission of ParklandGEO.

5. **LIMITATIONS ON SCOPE OF INVESTIGATION AND WARRANTY DISCLAIMER**
There is no warranty, expressed or implied, by ParklandGEO that:
 - a) the investigation uncovered all potential geo-hazards, contaminants or environmental liabilities on the Site; or
 - b) the Site is entirely free of all geo-hazards or contaminants as a result of any investigation or cleanup work undertaken on the Site, since it is not possible, even with exhaustive sampling, testing and analysis, to document all potential geo-hazards or contaminants on the Site.

The CLIENT acknowledged that:

- a) the investigation findings are based solely on the information generated as a result of the specific scope of the investigation authorized by the CLIENT;
 - b) unless specifically stated in the agreed Scope of Work, the investigation will not, nor is it intended to assess or detect potential contaminants or environmental liabilities on the Site;
 - c) any assessment regarding geological conditions on the Site is based on the interpretation of conditions determined at specific sampling locations and depths and that conditions may vary between sampling locations, hence there can be no assurance that undetected geological conditions, including soils or groundwater are not located on the Site;
 - d) any assessment is also dependent on and limited by the accuracy of the analytical data generated by the sample analyses;
 - e) any assessment is also limited by the scientific possibility of determining the presence of unsuitable geological conditions for which scientific analyses have been conducted; and
 - f) the laboratory testing program and analytical parameters selected are limited to those outlined in the CLIENT's authorized scope of investigation; and
 - g) there are risks associated with the discovery of hazardous materials in and upon the lands and premises which may inadvertently discovered as part of the investigation. The CLIENT acknowledges that it may have a responsibility in law to inform the owner of any affected property of the existence or suspected existence of hazardous materials and in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed. The CLIENT further acknowledges that any such discovery may result in the fair market value of the lands and premises and of any other lands and premises adjacent thereto to be adversely affected in a material respect.
6. **COST ESTIMATES** - Estimates of remediation or construction costs can only be based on the specific information generated and the technical limitations of the investigation authorized by the CLIENT. Accordingly, estimated costs for construction or remediation are based on the known site conditions, which can vary as new information is discovered during construction. As some construction activities are an iterative exercise, ParklandGEO shall therefore not be liable for the accuracy of any estimates of remediation or construction costs provided.
 7. **LIMITATION OF LIABILITY** - The CLIENT has agreed that to the fullest extent permitted by the law ParklandGEO's total liability to CLIENT for any and all injuries, claims, losses, expenses or damages whatsoever arising out of or in anyway relating to the Project is contractually limited, as outlined in ParklandGEO's standard Consulting Services Agreement. Further, the CLIENT has agreed that to the fullest extent permitted by law ParklandGEO is not liable to the CLIENT for any special, indirect or consequential damages whatsoever, regardless of cause.
 8. **INDEMNIFICATION** - To the fullest extent permitted by law, the CLIENT has agreed to defend, indemnify and hold ParklandGEO, its directors, officers, employees, agents and subcontractors, harmless from and against any and all claims, defence costs, including legal fees on a full indemnity basis, damages, and other liabilities arising out of or in any way related to ParklandGEO's work, reports or recommendations.