Desktop Planning and Geotechnical Assessment, Vacant Lot, Golden Horn, Whitehorse, YT

Photo credit: Aidan Allen

Prepared for:

Government of Yukon, Community Services, Land Development Branch
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Project No. 106523-01

Prepared by:

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April 13, 2022

EXECUTIVE SUMMARY

Hemmera Envirochem Inc. (Hemmera) was retained by the Government of Yukon, Community Services, Land Development Branch to conduct a desktop geotechnical investigation for development of a vacant parcel located on the corner of Venus Place and the Alaska Highway at 60°35'53.5"N 134°50'47.4"W, in Golden Horn subdivision, Yukon, herein referred to as the Site.

The vacant parcel considered for the development of multiple rural residential lots, is located just outside the Whitehorse City limits approximately 21.6km south of the city center. The Site is 6.18ha in size, unoccupied, generally flat and covered with spruce and pine trees. It does not seem to have been previously disturbed except for a narrow (3.8m) cutline that runs from the North side of the site down the center before exiting to the West of the site.

Findings

The findings of the assessment are summarized as follows:

- The surficial geological conditions at the site consist of morainal till with mixed fragmented sand and mud. The morainal or glacial till deposits generally consist of an unsorted mixture of clay, sand and gravel derived from the erosion, transport, and deposition of material by moving historical ice.
- The geomorphology or regional physiography at the site is the Yukon plateau and the bedrock geology of the site consists of shale, siltstone, calcareous greywacke, and argillaceous limestone
- Based on the site visit and available data there are no severe natural Hazards Risk to the site
- The zoning around the site is predominantly rural residential 2 (RR-2) with some Commercial
- No features were identified that would warrant any geotechnical setbacks. As per area development regulations, all buildings must have a setback of at least 10m from each lot line for rural residential 2 (RR-2) and 3m of setback for rural residential 1 (RR-1).
- Base on the size of the lot and location the site could be classified as rural residential 2 (RR-2) or rural residential 1 (RR-1)
- As per area development regulations the site could be divided into two separate lots
- Power service to the area is by overhead power utility lines along Venus Place and along the Alaska Highway. There is no municipal sewer or water service connections in the area
- The available data does not suggest that any geotechnical conditions would negatively effect building foundations
- There is no indication that septic fields will not be feasible on this site
- There are no visible geotechnical constraints to driveway or building construction.

Recommendations

The recommendations of the assessment are summarized as follows:

- At least one borehole at each building location to least 5m below existing ground surface should be undertaken to determine the subsurface stratigraphy and to provide information to determine design parameters for foundations. This is typically undertaken by the new lot owner before development.
- Septic field soil investigation and percolation testing should be completed before any septic system install as per Government of Yukon's Public Health and Safety Act, Sewage Disposal System Regulations. This is typically undertaken by the new lot owner before design and installation of a septic field.

This work was performed in accordance with a Consultant Services Agreement between Hemmera Envirochem Inc. (Hemmera), a wholly owned subsidiary of Ausenco Engineering Canada Inc. (Ausenco), and Government of Yukon, Community Services, Land Development Branch (Client), dated February 3, 2022 (Contract). This report has been prepared by Hemmera, based on research conducted by Hemmera, for sole benefit and use by Government of Yukon, Community Services, Land Development Branch. In performing this work, Hemmera has relied in good faith on information provided by others and has assumed that the information provided by those individuals is both complete and accurate. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the report was produced. The conclusions and recommendations contained in this report are based upon the applicable guidelines, regulations, and legislation existing at the time the report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

This Executive Summary is not intended to be a stand-alone document, but a summary of findings as described in the following Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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APPENDICES

1.0 INTRODUCTION

Hemmera Envirochem Inc. (Hemmera) was retained by Government of Yukon, Community Services, Land Development Branch to conduct a desktop geotechnical investigation for development of a vacant parcel located on the corner of Venus Place and the Alaska Highway at 60°35'53.5"N 134°50'47.4"W, in Golden Horn Subdivision, Yukon, herein referred to as the Site. A site location figure is attached (**Figure 1**). Photos are included in **Appendix A**.

This work was performed in accordance with a Consultant Services Agreement between Hemmera Envirochem Inc. (Hemmera), a wholly owned subsidiary of Ausenco Engineering Canada Inc. (Ausenco), and Government of Yukon, Community Services, Land Development Branch (Client), dated February 3, 2022 (Contract). This report has been prepared by Hemmera, based on fieldwork conducted by Hemmera, for sole benefit and use by Government of Yukon, Community Services, Land Development Branch. In performing this work, Hemmera has relied in good faith on information provided by others and has assumed that the information provided by those individuals is both complete and accurate. This work was performed to current industry standard practice for similar geotechnical work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the report was produced. The conclusions and recommendations contained in this report are based upon the applicable guidelines, regulations, and legislation existing at the time the report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

1.1 Site Description

The vacant parcel considered for the development of multiple rural residential lots, is located just outside the Whitehorse City limits approximately 21.6km south of the city center. The vacant lot is located on a plateau south of the Yukon River and is at approximately 750m in elevation. The Yukon River is approximately 2.7km to the North-East in the valley bottom at approximately 660m in elevation. A map showing the site location is attached (**Figure 1**).

The Site is 6.18ha in size, unoccupied, generally flat and covered with spruce and pine trees (Photos 7 and 8 in **Appendix A**). It does not seem to have been previously disturbed except for a narrow cutline that runs from the North side of the site down the center before exiting to the West of the site. The cutline's purpose is unknown, but it is approximately 3.8m wide which is not wide enough to be a powerline easement. The site is surrounded by rural residential properties to the north, one commercial property to the West, and a powerline easement land disposition immediately to the South. Further south bordering the site is the Alaska Highway right-of-way. A map showing the details of the surrounding properties is attached (**Figure 5**).

1.2 Scope of Work

Based on discussions with Government of Yukon, and our review of the available information, the objectives and scope of the Work were as follows:

- Conduct desktop research to investigate site geotechnical characteristics
- Conduct desktop research for site planning, access, and development purposes
- Perform a site visit to confirm topography and general site layout
- Document the investigation activities and findings in a report
- Provide recommendations for additional geotechnical investigation.

2.0 FIELD ACTIVITIES

2.1 Site Visit

The field site visit was carried out on March 23, 2022, by Aidan Allen of Hemmera. The visit consisted of a site walkthrough and general assessment. Hemmera also used a remotely controlled aircraft system (RPAS or drone) to efficiently survey the site and take photos of the layout. The site is generally flat and does not have any apparent limiting geological features. The vacant parcel is accessible from Venus Place on the East side as well as directly from the Alaska Highway from the South. There was approximately 0.75m of snow during the site visit.

Select photographs from the site visit are included in **Appendix A**.

3.0 SITE CHARACTERISTICS

3.1 Surficial Geological Conditions

According to the Yukon geological surveys data, the surficial geological conditions at the site consist of Morainal Till with mixed fragmented sand and mud. The morainal till is from the McConnell Glacial meltwater channel. Approximately 200m North-West of the site is primarily Glaciofluvial surface geological conditions with Gravel, mud, sand, glaciofluvial and glaciolacustrine plain also from the McConnell Glacial meltwater channel. Approximately 1km South of the site are Fluvial geological conditions with gravel, sand, and mud plain conditions.

The Atlas of Canada further expands stating that morainal or glacial till deposits generally consist of an unsorted mixture of clay, sand and gravel derived from the erosion, transport, and deposition of material by moving ice. These deposits are typically rolling and hummocky due the presence of ice with the materials during deposition. The moraine deposits are generally 4 to 10m thick.

A map showing the surface geological condition is attached (**Figure 2**).

3.2 Geomorphology and Bedrock Geology

As per the geomatics Yukon's open data, the geomorphology or regional physiography at the site is the Yukon plateau. The larger region is the Western Canada Cordillera region within the Northern plateau and mountain area. A map showing the geomorphology is attached (**Figure 3**).

According to the Yukon geological surveys data, the bedrock geology of the site consists of shale, siltstone, calcareous greywacke, and argillaceous limestone. To the West of the site approximately 2km the bedrock geology changes to quartz monzonite, granite, and conglomerate. To the East approximately 2.5km the bedrock geology changes from massive to thick-bedded limestone. A map showing the bedrock geology is attached (**Figure 4**).

3.3 Natural Hazards Risk

Based on the site visit and available data there are no severe natural Hazards Risk to the site. Flooding is a low risk because the site appears to have good drainage, is on a plateau, and is 100m above the water level of the Yukon River. For fire the site is heavily vegetated with Spruce and Pine trees (Photos 7 and 8 in **Appendix A**) so adequate fire-smart and clearing should be performed before development. According to the available data the soils on-site should not pose a natural hazard risk.

The Government of Yukon department of Highways and Public Works has subsurface exploration drilling reports from 2011 that were advanced at the Carcross cut-off approximately 1.8km away from site. Assuming the soils encountered are similar to soils at depth in other parts of Golden Horn, the soils would likely be classified as Class D for seismic response based on the National Building Code (2015).

3.4 Zoning, Claims and Land Dispositions

The zoning to the North and North-West of the site is approximately 60ha of rural residential with 7.8ha public use park land and 6.1ha of public use school land. Directly to the West of the site is a 5.78ha parcel of Commercial land that has been divided into 3 parcels of approximately 1.1 to 2.5ha in size.

There are 3 Quartz Claim groupings in the area. To the South-East 1.7km away there is a group of claims approximately 934.57ha in size. To the South 2.4km away there is a group of claims approximately 217.66ha in size. To the North-West 2.4km away there is a group of claims approximately 163.05ha in size.

The only land disposition near the site is the overhead utility powerline easement to the South that borders the edge of the site and runs along the Alaska Highway. There are also various reservation land dispositions for environmental and gravel quarry purpose in the area.

A map showing the zoning, claims, and land dispositions is attached (**Figure 5**).

3.5 Geotechnical and Development Setbacks

During the site visit the vacant parcel was examined for potential geotechnical features that would require setbacks. The site was generally flat, and no features were identified that would warrant any geotechnical setbacks. The slope in the North-East corner of the site is approximately 10% of the site so it should not be a limiting factor to development.

The local area plan from 2004 by UMA Engineering suggested that the site had no constraints to conventional development. The report stated that the area should have relatively low development cost for most types of structures.

According to the Golden Horn Development Area Regulations for rural residential 2 (RR-2) all buildings must have a setback of at least 10m from all lot lines (2011). For rural residential 1 (RR-1) all buildings must have a 3m setback.

3.6 Current Regional Development

There is development on all properties directly adjacent to the site. To the North bordering the site there is a rural residential property (RR-2) with residential buildings. On the West bordering the site is a commercial property currently developed as an RV park, restaurant, and liquor off-sales under the name Caribou RV Park. The South side of the site is bordered by an overhead powerline easement and the Alaska Highway. On the Eastern border of the site is Venus Place.

The region to the North and North-East is predominantly developed as rural residential (RR-2), with some Public use currently occupied by Golden Horn Elementary School. The region to the West of the site is developed as rural residential (RR-2) with some commercial and light industrial near the Carcross corner. The region to the south across the Alaska Highway is First Nations land use. The region to the East is largely developed as rural agriculture (AG-1 and AG-2) with some environmental resource lands.

3.7 Development Potential and Classification

According to the Golden Horn Development Area Regulations, the classification of the surrounding sites is Rural Residential (RR-2). Base on the size of the lot and location the site could be classified as rural residential 2 (RR-2) or rural residential 1 (RR-1).

Rural residential 2 (RR-2) and rural residential 1 (RR-1) zoning requires minimum lot sizes of 3ha (2011). The site is 6.18ha in size, as a result, it could be divided into two lots. If the site was divided into two lots, they would be 3.09ha each in size.

Based on discussions with the Government of Yukon and a preliminary review the site has three options for development. The first option would be if the site was divided with one lot in the rear in a “pan-handle” shape with the driveway running along the side of the first lot as shown on **Figure 6**. The second option would be to divide the lots in two halves lengthways and having two narrow and long lots that each have their own frontage on Venus Place as shown on **Figure 7**.

There is also a third option to divide the lots in half North to South but that would force one of the two lots to have a driveway exiting onto the Alaska Highway. This was not considered feasible as it is assumed that the Government of Yukon would allow another exit onto the highway.

It should be noted that the development potentials above are preliminary options that have not been investigated in detail and are intended for driveway/building planning. For more details on driveway and building layout see **Section 3.11**.

3.8 Surface and Subsurface Utilities

Power service to the area is provided by overhead power utility lines on poles. There are existing overhead power lines running along Venus Place and the Alaska Highway. If the site is developed, it could possibly be serviced by overhead or underground power depending on the developer and/or owner’s preference. The existing overhead utility lines on Venus Place stop at lot 165 and do not pass in front of the site as shown on **Figure 6 and 7**. As a result, power service for the two proposed lots will need to be provided from the overhead power lines on the Alaska Highway or the lines on Venus Place would have to be extended to reach the front of the new proposed lots.

There are no sewer or water connections in this area. The Golden Horn area is typically serviced by water delivery to cisterns or tanks or by private water wells. Septic fields are typically used in the area for treatment and disposal of sewage. See **Section 3.10** for more details on septic fields.

3.9 Building Foundations

It appears that the surficial geotechnical conditions on site are typical for development in the Whitehorse area. The available data does not indicate any geotechnical conditions would negatively effect building foundations. Typical building foundations could be strip or spread footings, pile foundations or raft slabs depending on geotechnical investigation and the type and size of buildings. Geotechnical investigations and foundation design should be undertaken by the property owner before construction of any buildings. Building foundations should be designed in accordance with the National Building Code of Canada (2015).

3.10 Septic Field Sustainability

From the available data including the surficial geology, boreholes advanced by the Government of Yukon at the Carcross corner 1.8km away, historical permits pulled for septic fields on the surrounding properties, and our experience in the area there is no indication that septic fields will not be feasible on this site. According to the Government of Yukon Environmental Health departments there are numerous active septic fields within 2km radius that have been successfully permitted, installed and are currently in use by the owners.

Prior to construction of any buildings requiring a septic field, the required testing for septic fields should be conducted and permits from the Government of Yukon Health and Social services should be obtained. This is typically the responsibility of the new property owner before design and installation of a new septic system.

3.11 Preliminary Driveway and Building Construction

From the site visit, area development plan, and the anticipated surficial geology there are no geotechnical hinderances to driveway or building construction. There are no physical limitations to where a building or driveway can be constructed on-site. The approximately 10% slope on the North-East corner of the site should not negatively effect driveway or building design.

For the first development options shown in **Figure 6** the driveway serving the first lot will have to start from Venus Place and run along the North border of the site before hooking downwards on the West side of the site. The second lot's driveway would start from Venus Place and run directly into the lot.

For the second development option shown on **Figure 7** both driveways would start from Venus Place and run directly into each respective lot.

Before construction of any driveway or building it is recommended that the owner remove all vegetation, topsoil and roots from the footprint. Buildings should be designed in accordance with the National Building Code of Canada (2015).

4.0 RECOMMENDATIONS

4.1 Additional Geotechnical Evaluation

4.1.1 Geotechnical Drilling

It is recommended that at least one borehole at each building location to least 5m below existing ground surface should be undertaken to determine the subsurface stratigraphy and to provide information to determine design parameters for foundations. This investigation typically falls under the responsibility of the property owner who buys the lot before construction of a building. Building foundation should be designed in accordance with the National Building Code of Canada (2015).

4.1.2 Septic Field Test

Septic field soil investigation and percolation testing should be completed before any septic system is installed. Depending on the number of bedrooms (occupants), one or two test pits may be required. Test pits are typically dug to approx. 3.5m and soil types are noted as the test pit is completed. After the test pit is completed to depth a percolation test is completed to ensure that the soil is suitable for the long-term operation of a septic field system. This investigation typically falls under the responsibility of the property owner who buys the lot and should be conducted prior to any septic field design or construction.

The Government of Yukon Health and Social Services application for a permit to install a sewage disposal system outlines the full testing and submission requirements (2016). All septic field installations should be completed as per the Government of Yukon's Public Health and Safety Act, Sewage Disposal System Regulations (1999).

5.0 CLOSURE

We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned.

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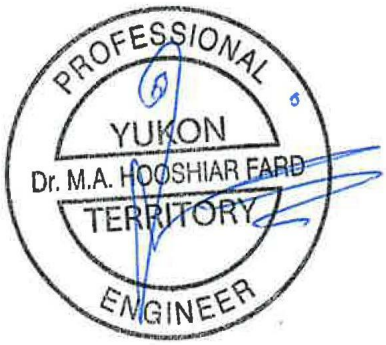

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6.0 STATEMENT OF LIMITATIONS

This work was performed in accordance with a Consultant Services Agreement between Hemmera Envirochem Inc. (Hemmera), a wholly owned subsidiary of Ausenco Engineering Canada Inc. (Ausenco), and Government of Yukon, Community Services, Land Development Branch (Client), dated February 3, 2022 (Contract). This report has been prepared by Hemmera, based on research conducted by Hemmera, for sole benefit and use by Government of Yukon, Community Services, Land Development Branch.

The conclusions and recommendations given in this report are based on information determined from desktop research. Subsurface conditions at this site have not been investigated and may vary from those anticipated in the desktop site investigation. It is recommended practice that a geotechnical investigation be conducted and a Geotechnical Engineer be retained during construction to determine the subsurface conditions specific to each construction location.

The comments made in this report are intended only for the guidance. The parties undertaking the construction should make their own interpretation of the information presented and draw their own conclusions as to how the conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

7.0 REFERENCES

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FIGURES

Desktop Geotechnical Assessment
Vacant Lot, Golden Horn, Whitehorse, YT

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Legend

- Site Boundary
- Property Line

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licensed under the Open Government Licence - Yukon Territory
- Aerial Image: ESRI World Imagery
- Inset Basemap: ESRI World Topographic Map

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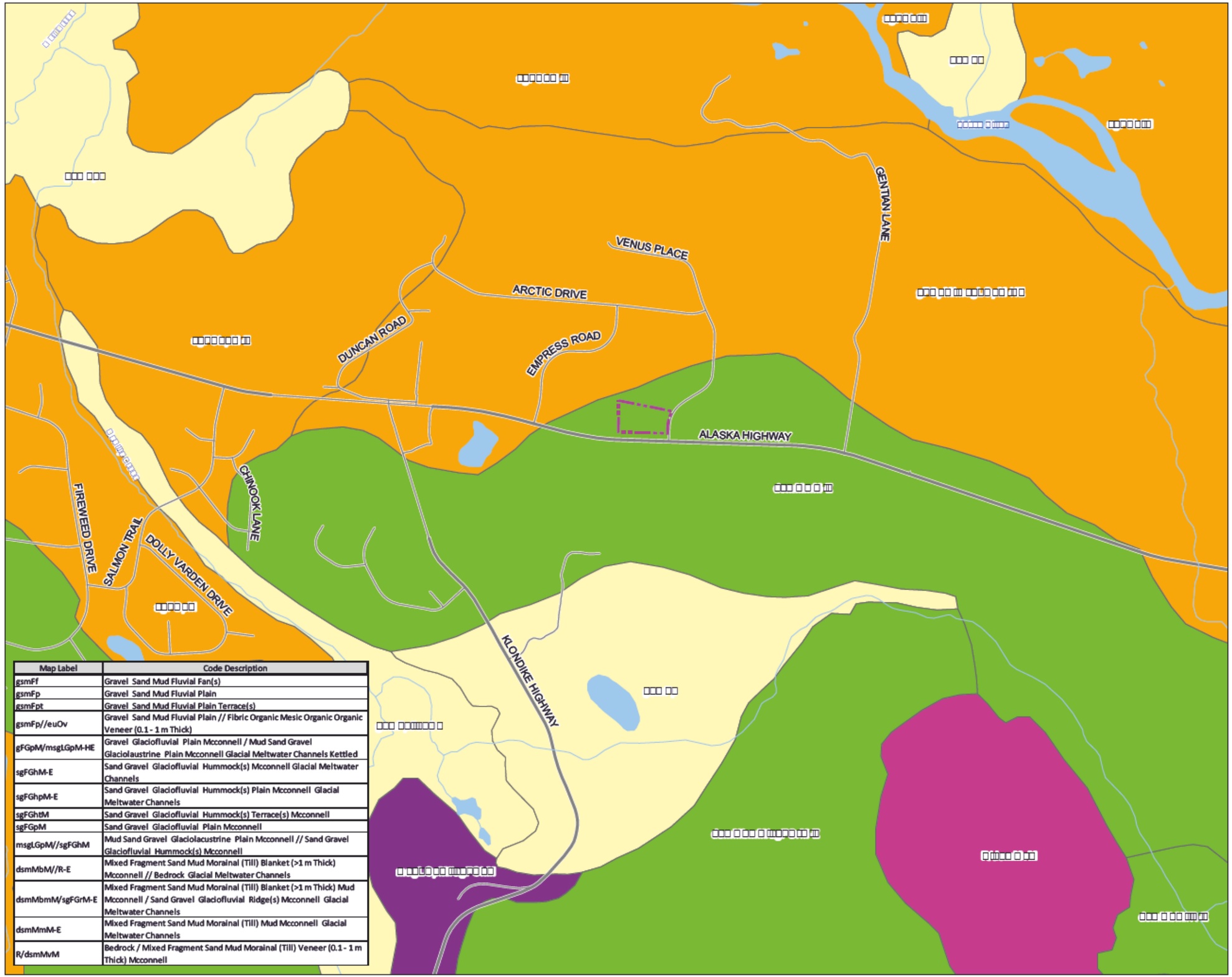
NAD 1983 UTM Zone 8N

Page Size: 11" x 17"

106523-01	Production Date: Apr 12, 2022	Figure 1

Hemmera
An AuecomCompany

Yukon



Map Label	Code Description
gsmFf	Gravel Sand Mud Fluvial Fan(s)
gsmFp	Gravel Sand Mud Fluvial Plain
gsmFpt	Gravel Sand Mud Fluvial Plain Terrace(s)
gsmFp//euOv	Gravel Sand Mud Fluvial Plain // Fibric Organic Mesic Organic Organic Veneer (0.1 - 1 m Thick)
gFGpM/msgLGpM-HE	Gravel Glaciofluvial Plain Mcconnell / Mud Sand Gravel Glaciolaustrine Plain Mcconnell Glacial Meltwater Channels Kettled
sgFGhM-E	Sand Gravel Glaciofluvial Hummock(s) Mcconnell Glacial Meltwater Channels
sgFGhpM-E	Sand Gravel Glaciofluvial Hummock(s) Plain Mcconnell Glacial Meltwater Channels
sgFGhtM	Sand Gravel Glaciofluvial Hummock(s) Terrace(s) Mcconnell
sgFGpM	Sand Gravel Glaciofluvial Plain Mcconnell
msgLGpM//sgFGhM	Mud Sand Gravel Glaciolacustrine Plain Mcconnell // Sand Gravel Glaciofluvial Hummock(s) Mcconnell
dsmMbM//R-E	Mixed Fragment Sand Mud Morainal (Till) Blanket (>1 m Thick) Mcconnell // Bedrock Glacial Meltwater Channels
dsmMbmM/sgFGrM-E	Mixed Fragment Sand Mud Morainal (Till) Blanket (>1 m Thick) Mud Mcconnell / Sand Gravel Glaciofluvial Ridge(s) Mcconnell Glacial Meltwater Channels
dsmMmM-E	Mixed Fragment Sand Mud Morainal (Till) Mud Mcconnell Glacial Meltwater Channels
R/dsmMvM	Bedrock / Mixed Fragment Sand Mud Morainal (Till) Veneer (0.1 - 1 m Thick) Mcconnell

Desktop Geotechnical Assessment
Vacant Lot, Golden Horn, Whitehorse, YT

Legend

- Site Boundary
- Highway
- Road
- Watercourse
- Waterbody

Fluvial
Glaciofluvial
Glaciolacustrine
Morainal (till)
Bedrock

Notes

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106523-01	Production Date: Apr 12, 2022	Figure 2

Hemmera
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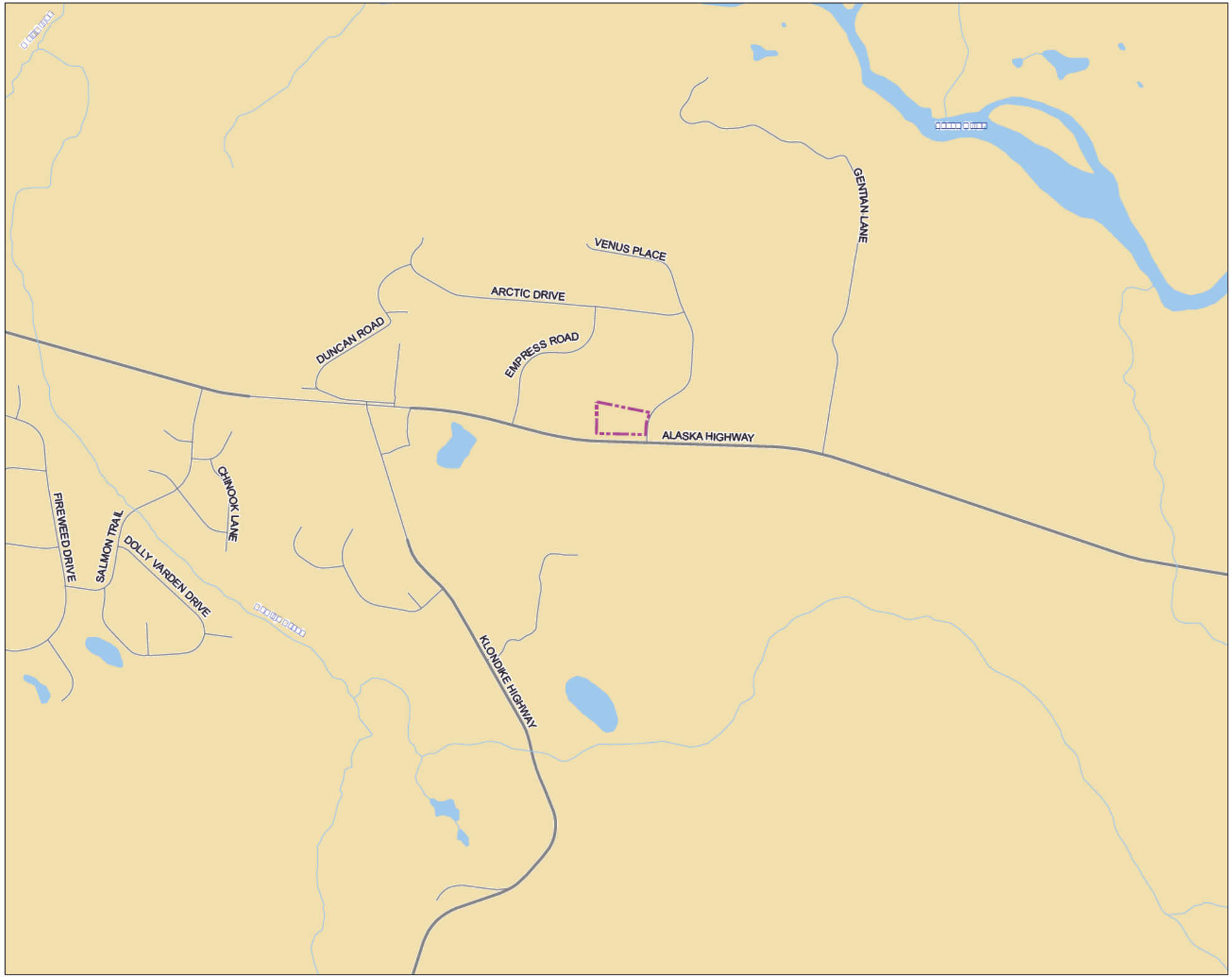
Yukon



Desktop Geotechnical Assessment
Vacant Lot, Golden Horn, Whitehorse, YT

Legend

- Site Boundary
- Highway
- Road
- Watercourse
- Waterbody
- Plateau

Notes

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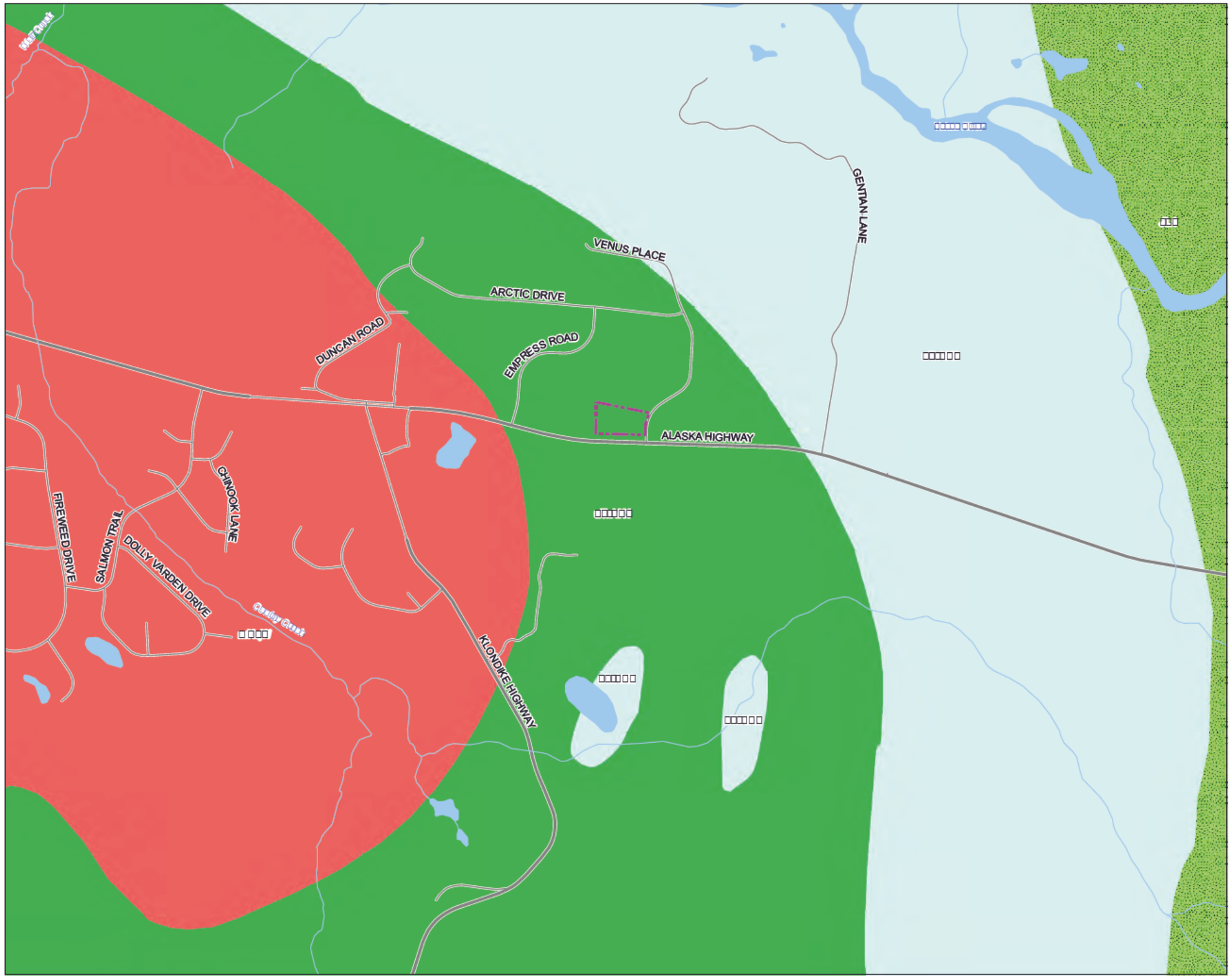
106523-01	Production Date: Apr 12, 2022	Figure 3

Hemmera An Ausenco Company

Yukon



Desktop Geotechnical Assessment
Vacant Lot, Golden Horn, Whitehorse, YT

Legend

- Site Boundary
- Highway
- Road
- Watercourse
- Waterbody
- mKqW: WHITEHORSE SUITE: Bt quartz monzonite, Bt granite and leucogranite
- JL1: RICHTHOFEN: turbiditic sandstone-siltstone-mudstone, conglomerate
- uTrAK2: HANCOCK: massive to thick-bedded limestone
- uTrAK1: CASCA: shale, siltstone, calcareous greywacke, argillaceous limestone

Notes

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106523-01	Production Date: Apr 12, 2022	Figure 4

Hemmera
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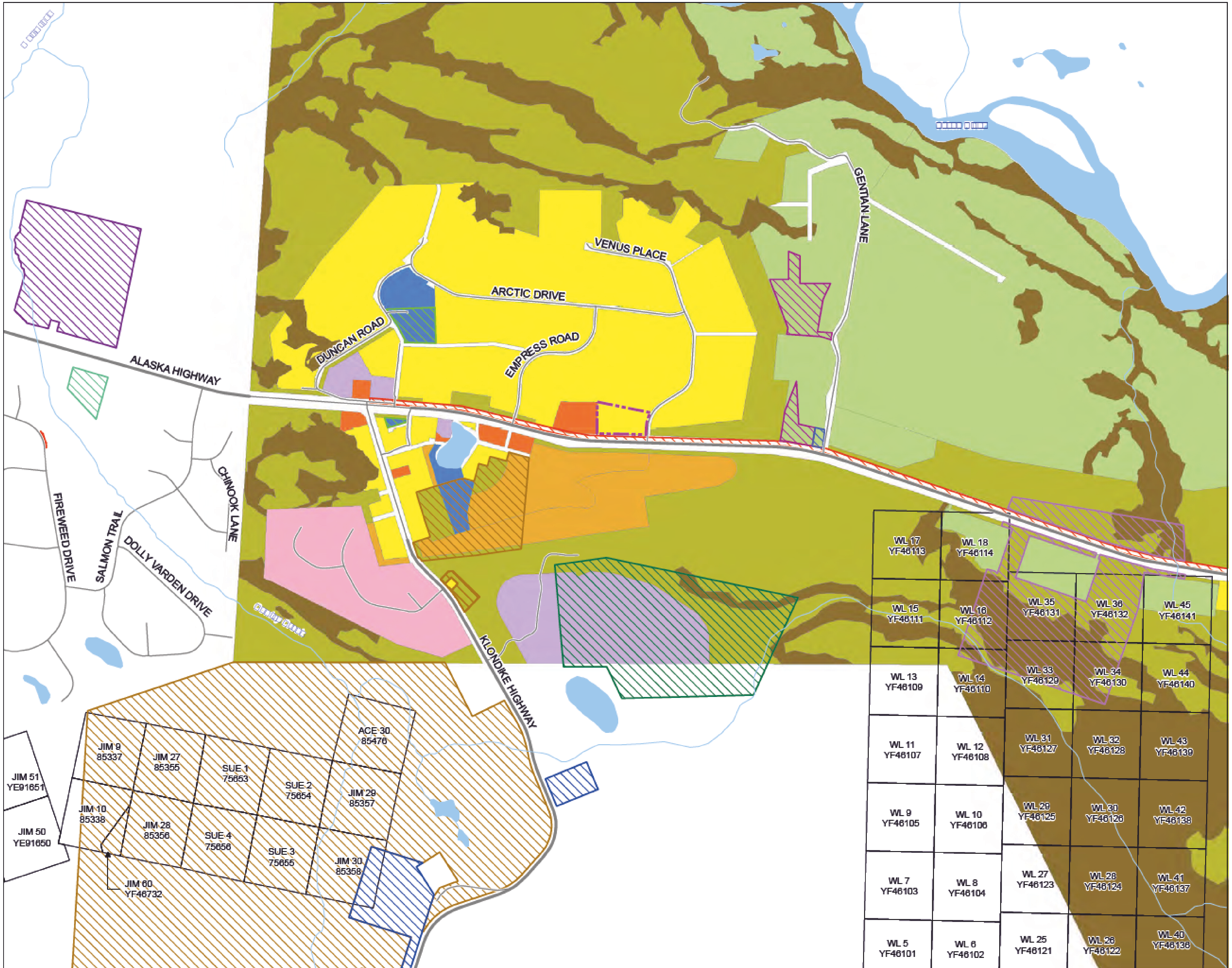
Yukon



Desktop Geotechnical Assessment
Vacant Lot, Golden Horn, Whitehorse, YT

Legend

- Site Boundary
- Highway
- Road
- Watercourse
- Waterbody
- Aggregates & Light Industrial
- Commercial
- Environmental Resource
- Existing Rural Residential
- Proposed Rural Residential
- Public Use
- Rural Agricultural
- Rural Residential Carcross Tagish First Nation
- Steep Slopes (30%+)
- Agricultural
- Country Residential
- Environment
- Garbage Dump
- Gravel Pit
- Institutional
- Recreational
- Roadway
- Rural Residential
- Utility
- Active Quartz Claim

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

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N
1:25,000
0 200 400 600 800 1,000
Metres
NAD 1983 UTM Zone 8N
Page Size: 11" x 17"

106523-01	Production Date: Apr 12, 2022	Figure 5

Hemmera
An Ausenco Company
Yukon

Desktop Geotechnical Assessment
Vacant Lot, Golden Horn, Whitehorse, YT

[redacted]

Legend

- Building
- Driveway /Cutline
- EP Overhead Powerline Utility
- Site Boundary
- Proposed Lot Line
- Property Line

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- Aerial Image: ESRI World Imagery

N

1:7,500

0 50 100 150 200 250

Metres

NAD 1983 UTM Zone 8N

Page Size: 11" x 17"

106523-01	Production Date: Apr 12, 2022	Figure 6

Hemmera An Ausenco Company

Yukon

Desktop Geotechnical Assessment
Vacant Lot, Golden Horn, Whitehorse, YT

[redacted]

Legend

- Building
- Driveway /Cutline
- EP Overhead Powerline Utility
- Site Boundary
- Proposed Lot Line
- Property Line

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- Aerial Image: ESRI World Imagery

N

1:7,500

0 50 100 150 200 250

Metres

NAD 1983 UTM Zone 8N

Page Size: 11" x 17"

106523-01	Production Date: Apr 12, 2022	Figure 7

Hemmera An Ausenco Company

Yukon

APPENDIX A
Site Photos

Photo 1 View of vacant parcel site facing North during site visit (March 23, 2022).

Photo 2 View of vacant parcel site facing North-West during site visit (March 23, 2022).

Photo 3 View of vacant parcel site facing North-East during site visit (March 23, 2022).

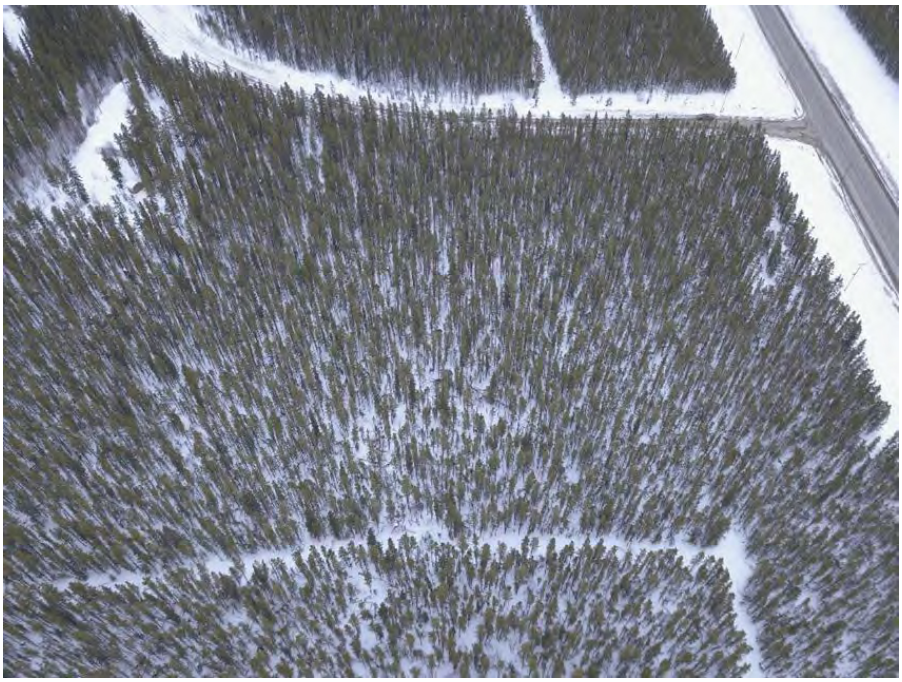

Photo 4 View of West portion of vacant parcel site facing West during site visit (March 23, 2022).

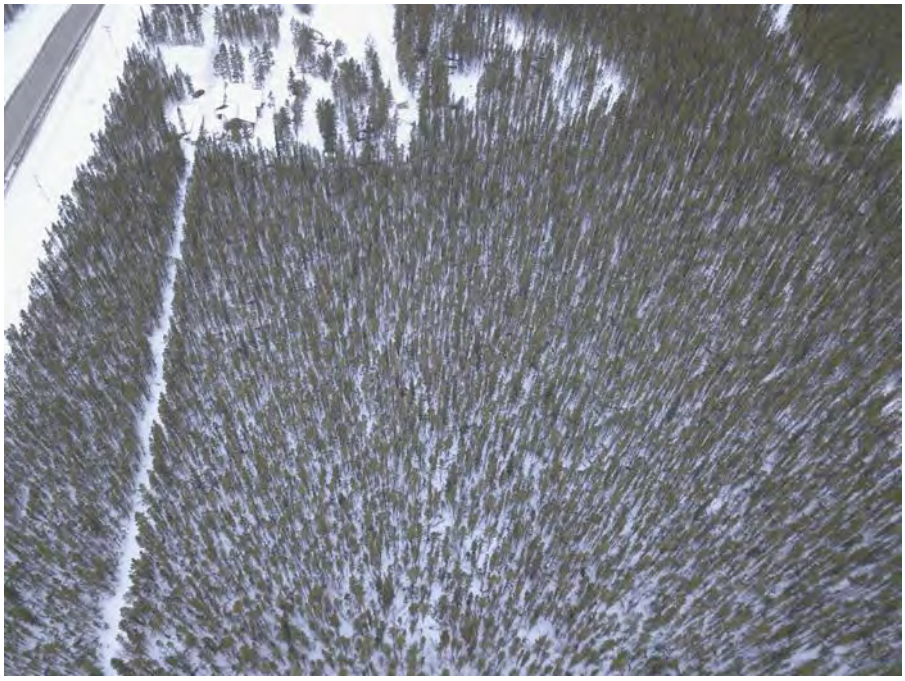

Photo 5 View of East portion of vacant parcel site facing East during site visit (March 23, 2022).

Photo 6 View of cutline on vacant parcel site facing North during site visit (March 23, 2022).

Photo 7 View of vegetation on vacant parcel site facing North during site visit (March 23, 2022).

Photo 8 Close up View of vegetation on vacant parcel site facing West from Venus Road during site visit (March 23, 2022).

Photo 9 View of overhead powerline easement along the Alaska Hwy facing West during site visit (March 23, 2022).