CHILKOOT GEOLOGICAL ENGINEERS LTD.
Box 31146, Whitehorse, Yukon Y1A 5P7
chilkoot.eng@gmail.com (867) 335-5804 c

Geotechnical Feasibility Assessment
Proposed Infill #1 Lot Development
Guggieville Industrial Subdivision Area
Dawson City, Yukon – 2019

Prepared For: **Yukon Government**

Date : **November 29th, 2019**

TABLE OF CONTENTS

Geotechnical Feasibility Assessment
Proposed Infill #1 Lot Development
Guggieville Industrial Subdivision Area
Dawson City, Yukon – 2019

TABLE OF CONTENTS

Geotechnical Feasibility Assessment
Proposed Infill #1 Lot Development
Guggieville Industrial Subdivision Area
Dawson City, Yukon – 2019

FIGURES

1.0 INTRODUCTION

Our firm was retained by *Yukon Government - Department of Community Services, Rural Land Development - Land Development Branch* (*YG*) under a Standing Offer Agreement (No.2017/2018-2753) to conduct a geotechnical feasibility assessment at a proposed infill region (referred to as Infill #1) located in the Guggieville Industrial Subdivision Area in Dawson City, Yukon.

The town of Dawson City is located ~533 km north of Whitehorse along the North Klondike Highway #2. The study area, which measures ~1.6 ha in size, is located ~2.7 km east of the downtown proper as noted in Figure 1.

Authorization to proceed with the assessment was granted by *YG – Community Services* - Senior Program Manager, Mr.K.Fisher on September 12th, 2019. Our field work was subsequently conducted on September 20th, 2019 in accordance with our September 8th, 2019 proposal.

The findings of our assessment have been presented herein along with a description of our methodology.

2.0 SCOPE-OF-WORK

The purpose of our assessment was to delineate regions within the study area which may be geotechnically suitable for potential subdivision/lot development and provide general recommendations regarding infrastructure development. It's understood that the envisioned infrastructure would involve road construction, building construction and septic field installations utilizing conventional construction methodologies following site pre-grading operations.

As our assessment is preliminary in nature, further evaluation will be required through subsurface investigation to verify site-specific geotechnical parameters if development is to be considered in greater detail.

3.0 METHODOLOGY

Our methodology was comprised of a literature review and site reconnaissance.

3.1 Literature Review

A literature review was conducted to evaluate technical reports, surficial geology maps, topographical data, satellite imagery, a selection of aerial photos and other similar types of resources pertaining to the study area. This information was utilized to evaluate the regional conditions and detail the field work program.

The following sources of information were reviewed;

Surficial Geology Map

A 1:25,000 surficial geology map (Open File 2014-12) entitled Surficial Geology, Dawson Region, Yukon – Parts of NTS 115O/14 & 15 and 116B/1, 2, 3 & 4 compiled by K.McKenna and P.Lipovsky - *Yukon Geological Survey* was reviewed to provide insight into the regional geomorphology.

A portion of this map and the corresponding limits of the study area has been provided in Section 4.4, below.

Bedrock Geology Map

A bedrock geology map, available through the *Yukon Geological Survey*, identified the regional bedrock types and characteristics within the study area. The map was entitled *Yukon Bedrock Geology Map* – *Yukon Geological Survey* – Open File 2016-1 - 1:1,000,000 scale compiled by M.Colpron, S.Israel, D.Murphy, L.Pigage, and D.Moynihan. A more detailed delineation of these contacts was subsequently found on the *Yukon Geological Survey* website as noted in Section 4.6, below.

Topographical Information

The regional topography was assessed by viewing a 1:50,000 scale topographical map (116 B03 Dawson) and the *YG- Water Placer Atlas* website.

These maps showed the study area is located near the base of the Klondike River valley.

Aerial Photographs

A selection of aerial photographs was obtained from *YG – Energy, Mines and Resources* to allow for a more detailed assessment through air photo terrain analysis.

The following air photos were reviewed;

Flight Line	Photo No.	Date	Comments
A13139	1-22	1951	35,000' altitude
A17155	96-117	August 1960	15,000' altitude
A24708	22-45	1977	7,700' altitude
A24704	43-56	1977	7,500' altitude
NW9584	79-92	May 1984	11,200' altitude
WP8611	70-93	August 1986	1:20,000 scale
A27483	99-117	July 1989	24,500' altitude
A27664	123-156	July 1990	12,000' altitude
A27669	66-87	August 1990	1:10,000 scale
A28237	187-223	August 1995	1:20,000 scale
G03070868	17-32	July 2003	1:40,000 scale

Satellite Imagery

Satellite imagery, which was available from *Google Earth*, was reviewed to assess the site conditions relative to more recent imagery dated between September 2006 and June 2019.

Technical Reports

A report entitled Dawson Natural Landscape Hazards – Geoscience Mapping for Climate Change Adaptation Planning Report compiled by the *Northern Climate ExChange – Yukon Research Center – Yukon College* (B.Benkert, K.Kennedy, D.Fortier, A.Lewkowicz, L.Roy, K.Grandmont, I.de Grandpre, S.Laxton, L.McKenna and K.Moote), 2015 was reviewed to provide additional background regarding the natural hazard potential in the region of the study areas.

This report was compiled to serve as a baseline to allow for climate change adaptation planning as adverse effects of a warming environment have become a reality in northern Yukon. The intent was to generate a hazards map to help identify the potential for permafrost thaw, landslides and flooding. Their study

area paralleled the limits of a 1:25,000 surficial geology map (Open File 2014-12) which has been described below (in Section 4.7).

The hazards report indicated that an approach was generated to consider local community concerns and infrastructure, disturbance history, permafrost distribution and characteristics, surficial geology conditions, hydrology and projections of future climate. Following the retention of scientific information and case studies, data related to slope angle, slope aspect, surficial materials and permafrost probability were input into a raster comprised of pixels which each represented 30 m^2. The hazard potential relative to each of these criteria was assigned and a map based upon a cumulative weighted risk was generated.

The report was clear to indicate that while the hazard map can serve as an initial guide to local conditions, there are limitations due to site specific conditions and so detailed site studies (e.g., geotechnical or engineering studies) would still be required.

Other Resources

The *Yukon Government – Placer Watershed Atlas* website was reviewed as it provided the boundaries of various land dispositions, mining claims, drainage regimes and other similar types of information. The corresponding boundaries of the study area have been illustrated on the *Placer Watershed Atlas* map as noted in Section 4.8, below.

3.2 Field Work Program

Following collation of the above noted information our firm conducted a field work program which was comprised of a site reconnaissance. This work was conducted by the undersigned on September 20th, 2019 to note geological features and other points of interest.

During this time, the region was traversed on foot such that the local field conditions and geological features could be observed. As our field work coincided with what was considered to be extremely low levels of the Klondike River, the field conditions during our traverse were considered to be favorable.

Our observations were documented through a combination of field notes, GPS waypoints and photographs. These observations have been summarized in Section 4.0 – Site Conditions, below.

4.0 SITE CONDITIONS

4.1 Location of Study Area

The study area is located in the Klondike River valley approximately 2.7 km east of the downtown proper of Dawson City, Yukon as noted in Figure 1.

The northern edge of the study area lies along Rabbit Creek Road. Bonanza Creek Road parallels the western edge of the site.

View of study area from the Dome Road facing south.

This region of the valley is predominately comprised of remnant mine tailings piles which were formed as a result of historical mining activities. These mining activities generally utilized dredges in order to process the fluvial valley deposits once they were thawed through steaming operations. The fluvial deposits are generally characterized by organics/peat which overlie fine-grained fluvial materials which are comprised of frozen ice-rich silts which contain varying amounts of sand and gravel. These materials overlay frozen coarse-grained granular materials which contained high percentages of cobble to boulder sized materials and gold.

4.2 Physiographic Region

The study area is part of the Boreal Cordillera Ecozone and lies within the Klondike Plateau immediately south-west of the Tintina Trench. The mountains in the region are of the Dawson Range, a sub-range of the Yukon (Mountain) Range which dominate much of central Yukon and eastern Alaska. These mountains rise to elevations in the order of 1500 meters. The terrain can be described as smooth, rolling, unglaciated terrain, which is incised by narrow, deep, V-shaped valleys.

Located in the Klondike Valley, the prevailing elevation in the region of the study area is in the order of 330 meters. Higher mountainous terrain, with elevations up to 1000 meters, are located both north and south of the study area on the ridges which define the valley. Regionally, the vegetation is predominately comprised of sparse boreal forest. Black spruce and birch dominate regions which are underlain with permafrost. The understory in these regions consists of a variety of lichen, mosses, willow, alders and shrubs.

Permafrost is extensive, discontinuous and overlain with turbic cryosols in regions where undisturbed native soil deposits are present.

4.3 Site Description

The study area, which measures ~1.6 ha in size, is comprised of mine tailings piles, disturbed areas and tailings ponds as noted in Figure 2. Some of the tailings piles have been partially levelled.

The topography is best described as being flat, with only minor changes in elevation where former mine tailings piles are present.

As the majority of the site has been disturbed through historical mining activities, vegetation is sparse. However, some stands of deciduous trees comprised of poplar, white birch and aspen are present. Where present, the understory consists of a variety of mosses, willows and shrubs.

Panoramic view of study area from northwest corner facing south.

Panoramic view of study area from western tailings pile facing east.

A number of vehicles (potentially associated with the nearby residences) were parked/stored in the eastern and southeastern portions of the study area. The eastern parking area also serves as a driveway to the residence located immediately east of the study area.

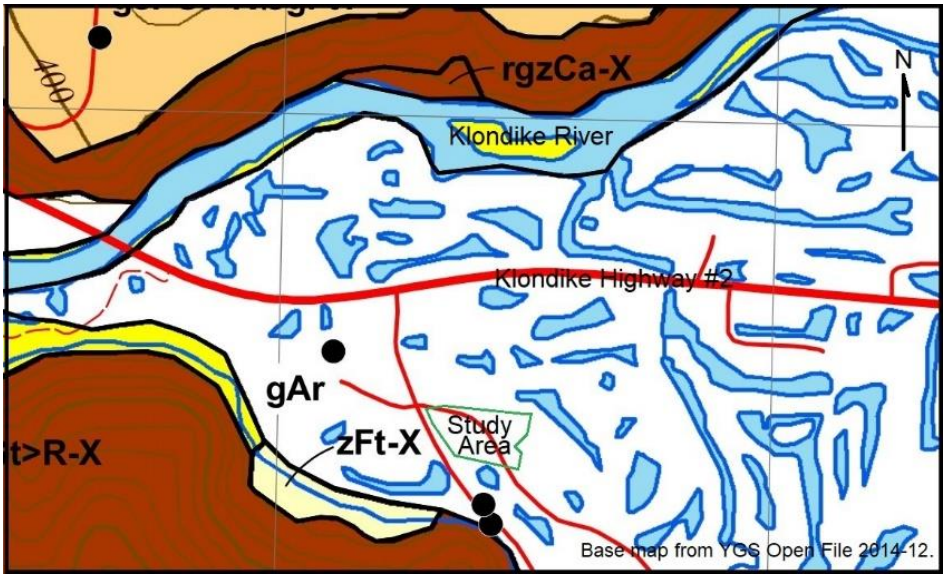
An unnamed secondary road, which carries school bus traffic, bisects the study area. An abandoned former road parallels the northwestern realms of the study area.

Unnamed road facing north.

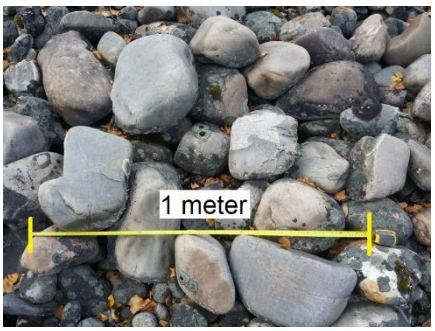
View of former road facing south from Rabbit Creek Road.

4.4 Surficial Geology

The surficial deposits were described in the surficial geology map of Dawson (YGS Open File 2014-12) as being comprised of anthropogenic materials. The approximate limits of the study area have been illustrated in a segment of the surficial geology map as noted below;



In brief, these anthropogenic deposits were described as being comprised of soils which have been significantly disturbed due to human activities. In the case of the study area, these materials are predominately comprised of mine tailings. The geomorphic origin of these materials would have been the fluvial deposits which are prevalent throughout the Klondike River valley. While these fluvial materials were generally comprised of gravels which contain cobble to boulder sized materials, deleterious fine-grained silt and organic soils may also be present within the tailings materials.



4.5 Geomorphology

Deposition

The soils located within the study area are comprised of fluvial deposits which are associated with the Klondike River. Some of these soils have been disturbed through historical mining and more recent human activities.

Glaciation

Evidence shows that the Dawson area and Klondike Plateau have probably not been glaciated since Pre-Reid advances (2.65 Ma to > 200 Ka).

Permafrost

Dawson lies within the zone of extensive discontinuous permafrost (50-90%). The permafrost in this zone can vary from poorly bonded soils with non-visible ice to massive ice lenses ranging in size to tens of meters. Regionally the permafrost is probably more than 100 m thick with taliks (thawed subsurface) present beneath large rivers, lakes and south-facing slopes.

Although the soils which are located within the study area have been disturbed through historical mining operations, it's possible permafrost has formed within the tailings materials since the time these waste materials were generated.

Watercourses

The study area is located approximately 100 meters north of Bonanza Creek and 700 meters southeast of the Klondike River.

Although three (3) tailings ponds are located on the eastern side of the site, there was no indication of surface waters which flow through the site.

View of northeastern tailings pond from Rabbit Creek road.

View of northeastern tailings pile from Rabbit Creek road.

View of northwestern tailings pond from Rabbit Creek road.

A seasonal pond is located immediately south of the study area.

Groundwater

Shallow groundwater would be expected in the form of seepage zones and sheet-wash flows given the nature of the terrain and anticipated soil types. The groundwater elevation would closely parallel the local pond elevations but may be encountered at shallower elevations where perched conditions (or permafrost) are present.

The direction of groundwater flow would likely be to the north-west, towards the Klondike River.

Surface Drainage

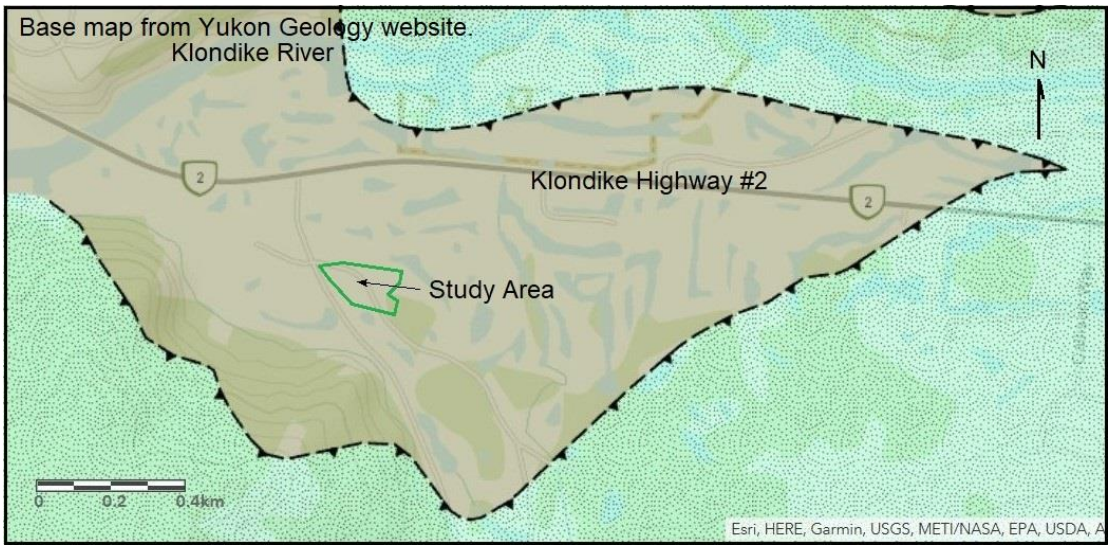
The mine tailings which were encountered within the study area are generally free draining. There were no signs of defined surface drainage in these areas.

4.6 Bedrock Geology

There was no indication of near surface bedrock within the study area.

The geology maps indicate the study area is located in Yukon-Tanana Terrane which is predominately comprised of green schist to lower amphibolite facis metamorphic rocks. These rocks are comprised of locally pillowed dark green to black basalt and greenstone of the Slide Mountain Suite.

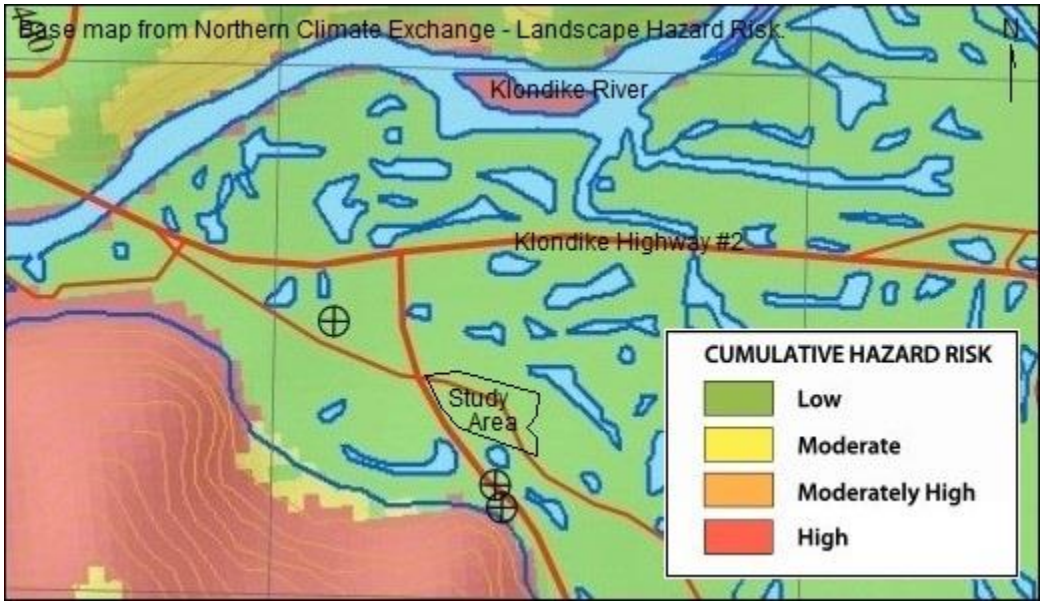
The region is surrounded by dark grey to black carbonaceous metasedimentary rocks of the Finlayson Suite which are separated from the Slide Mountain Suite by a series of thrust faults as noted in the *Yukon Geology* website illustration attached below.



While the depth to bedrock will vary, it's understood that it generally lies at depths of 20 to 30 meters in this region of the Klondike Valley.

4.7 Natural Hazards Risks

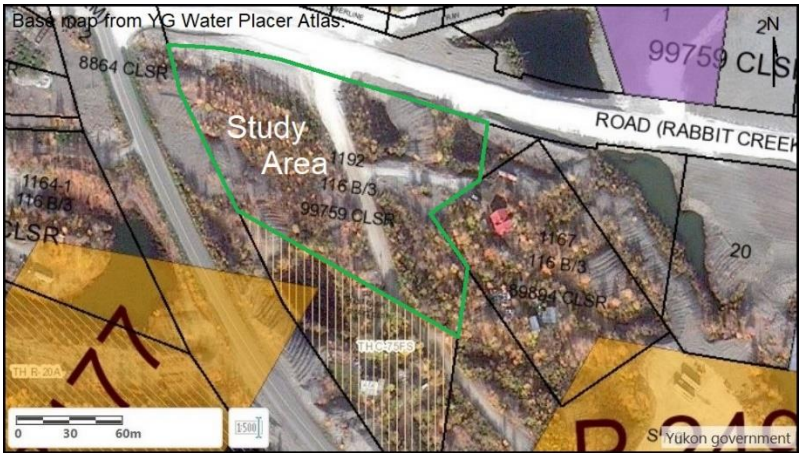
The natural hazard potential in the Klondike Valley was assessed in the Dawson Natural Landscape Hazards – Geoscience Mapping for Climate Change Adaptation Planning Report compiled by the *Northern Climate ExChange*. The study classified the hazard potential in the region of the study area as follows;



In brief, the report classified the terrain within the study area as having a low hazard potential.

4.8 Placer/Quartz Claims and Land Dispositions

The *YG - Placer Watershed Atlas* website was reviewed to identify the presence of (placer and quartz) mining claims and land dispositions which may be located within the study area. The locations of these claims and dispositions relative to the limits of the study area were illustrated as noted in the image, right.



In brief, while none were identified within the limits of the study area, a placer mining claim

(P08177) was noted immediately southwest of the study area. The tenure status of the claim was listed as being ‘Active’.

There was no indication of quartz claims in the region of the study area.

5.0 DISCUSSIONS

5.1 Regional Development

Regionally, developed regions within the Guggieville Industrial Subdivision coincide with the locations of pre-existing mine tailings and/or regions where tailings ponds have been infilled with these materials through pre-grading operations.

In general, the undisturbed areas in the region have not undergone any significant development as these regions are generally more costly to develop due to the potential presence of permafrost and/or organics and fine-grained materials.

5.2 Development Potential Classification

As the overall development potential of the study area is generally dependent upon the availability of suitable mine tailings materials, we have classified the development potential of the various areas within the study area as being either 'Suitable' or 'Unsuitable' as described below;

Suitable

These regions, which are predominately comprised of mine tailings, tailings ponds (and disturbed areas), will generally allow for unfettered lot development utilizing conventional construction methodologies once the areas have been properly pre-graded.

Unsuitable

There were not any regions within the study area which were deemed to be unsuitable relative to lot development. Regionally however, unsuitable regions would typically be comprised of naturally occurring ponds, undisturbed native deposits and/or regions which harbor permafrost.

5.3 Development Potential

The development potential within the study area is primarily dependent upon the presence and availability of mine tailings and site-specific geotechnical conditions. As such, the development potential within the study area will vary as illustrated in Figure 3.

In general, the entire study area will be suitable for development utilizing conventional cut/fill construction methodologies.

Although a cut/fill balance has not been conducted, visually it appears that granular fills will need to be imported to facilitate lot development particularly in the eastern realms of the study area where tailings ponds are present.

> The extent to which the ponds can be infilled may be limited in some areas unless backfill can extend beyond the limits of the study area due to the nature of the terrain in these areas.

Ideally, building construction should coincide with regions of cut within the existing mine tailings as these materials have generally undergone an adequate amount of consolidation since the time they were originally generated. Unless structural fills are established, buildings should not be constructed in regions of fill as the amount of differential and/or total settlement in these regions may otherwise exceed tolerable limits. Buildings should not be constructed in regions where ponds may have been infilled during pre-grading operations.

As the extent of the mine tailings is limited, where possible, roadways, parking and yard areas should be situated in regions where ponds may have been infilled during lot development.

While septic fields would need to be constructed in regions of pre-existing mine tailings additional consideration would be required given the proximity to the groundwater table and the generally porous/coarse-grained nature of the mine tailings. If the site conditions are not favorable for septic field installations, then the use of insulated holding tanks would be required.

6.0 RECOMMENDATIONS

The following recommendations have been provided assuming the site conditions are deemed to be suitable following completion of a subsurface geotechnical evaluation. Development should be restricted to regions of the study area where the development potential has been identified as being 'Suitable' as noted in Figure 3.

6.1 Site Development

In general, regions which have been deemed to be 'Suitable' for development should be pre-graded through conventional cut/fill construction methodologies in order to establish the required design elevations. These design elevations should parallel those which have been established in other nearby developed areas located in the Guggieville Industrial Subdivision Area.

Initially, clearing, grubbing and stripping operations should be conducted to prepare the region for site grading as determined through future geotechnical evaluation. Caution should be exercised during site preparation if permafrost is encountered as their disturbance may result in thaw-degradation of the underlying soils. Once the site has been adequately prepared, low-lying regions should be backfilled through systematic placement and compaction of approved tailings materials.

If the quantities of onsite mine tailings are insufficient to establish the required design elevations, then approved granular fills would need to be imported.

All backfilled materials should be placed and compacted in uniform, level lifts. If the mine tailings are to be utilized as structural fill, then materials larger than 150 mm in diameter would need to be removed from the tailings prior to use. Caution will need to be exercised during backfill operations as the mine tailings may also harbor deleterious materials such as organics, fine-grained materials, frozen soils and/or ice. These deleterious materials will not be suitable for backfill use and would need to be wasted in designated areas or else hauled offsite.

As water within the ponded regions will be displaced during backfill, excess water (above the groundwater elevation) should be removed during backfill operations such that subsequent backfill is placed in a drained state. Additional consideration may be required relative to infilling ponds due to the turbidity that would be created during the backfill operations.

6.2 Surface Utilities

The mine tailings will generally be suitable for use as road and yard area subgrade materials. These regions should be properly shaped in order to establish positive drainage which incorporates the use of ditches and culverts.

Granular subbase and base course materials will need to be imported to establish the roadways. These materials should be placed in uniform, level lifts upon approved subgrade materials while being compacted to the required specified densities. While the thickness of the road structure would depend upon the envisioned traffic frequencies and loads, at this stage, we anticipate the road thickness should measure in the order of 0.5 meters.

As the tailings materials contain large cobbles and boulders, granular fills may need to be imported to properly prepare driveways, parking and yard areas.

Roadways which are constructed over potentially disturbed disturbed/undisturbed areas and/or ponds will generally require additional time to stabilize relative to potential long-term settlement and so an increased level of maintenance may initially be required in these regions.

6.3 Subsurface Utilities

Septic fields should be situated in regions of pre-existing mine tailings. They should not be established in regions of fill or former pond areas. The presence of permafrost will preclude the installation of septic fields where encountered within the study area.

Additional consideration will be required relative to the installation of septic fields given the proximity to the groundwater table and generally porous/coarse-grained nature of the mine tailings. If required, filter sand may need to be imported during septic field construction in order to reduce the rate of percolation and allow for their installation.

If septic field installation is not feasible, then insulated holding tanks would need to be utilized to handle sewage effluent.

The tailings materials will generally allow for installation of subsurface utility lines. However, as tailings materials contain large cobbles and boulders, excavation difficulties may be encountered. Caution will need to be exercised to ensure these

materials are not placed within 300 mm of utility pipes. The utility pipes should be encased in bedding sand as per standard installation practices.

If the installation of water wells is not feasible, water tanks would need to be incorporated into heated buildings.

6.4 Building Foundations

Following pre-grading operations, buildings can be founded upon conventional footing or monolithic-slab concrete foundation systems which are constructed upon engineered granular fills. These buildings should be situated in cut areas (in regions of pre-existing mine tailings) provided the tailings exposed at the subgrade elevation(s) are undisturbed and considered suitable for development.

Unless structural fills are established, buildings should not be constructed in regions of fill as the amount of differential and/or total settlement in these regions may otherwise exceed tolerable limits. Buildings should not be constructed in regions where ponds may have been infilled during pre-grading operations.

Buildings should be closed to the weather and heated prior to the onset of winter conditions and throughout their lifespan whenever freezing temperatures prevail.

6.5 Geotechnical/Development Setbacks

Development setbacks should be considered relative to the active mining claims which were identified in Section 4.8, above.

Geotechnical/building setbacks (in the order of 15 meters in width) should be observed relative to the crests of adjacent slopes in order to allow for a factor of safety relative to potential slope movements. These slopes would generally be comprised of either pre-existing mine tailings materials or else mine tailings which have been placed during more recent pre-grading operations.

While buildings and septic fields should not be constructed in these setback regions, some of these areas could be incorporated into the individual lots for use as laydown areas as assessed on a case-by-case basis.

6.6 Additional Assessments and Evaluations

As our findings are preliminary in nature, additional assessments and evaluation(s) will be required to verify site-specific design parameters, as described below.

Site Survey

Detailed site surveys (which compile bathymetric charts and extend beyond the limits of the study area) should be conducted to better assess development options where cut/fill operations are to be considered. Specifically, the intent would be to determine the volume of mine tailings which may be available to fill the tailings ponds and potentially other areas which are to be developed.

These survey results should be assessed during the geotechnical evaluation phase to assist in soil and terrain classification within the study area.

Geotechnical Evaluation

A geotechnical evaluation should be conducted by qualified personnel prior to lot development to assess the sub-surface conditions and identify site-specific geotechnical parameters.

Environmental Site Assessment

A Phase I Environmental Site Assessment (ESA) should be conducted to identify potential environmental liabilities which may be associated with the study area and nearby properties if lot development is to be considered.

Hydrogeological Assessment

A hydrogeological study would be required to assess the feasibility of installing water wells within the study area. During this time, the aquifer capacity should be assessed relative to supporting the envisioned water wells.

Habitat Assessment

As the ponds may harbor potential riparian areas, habitat assessments should be conducted by qualified personnel to identify potential setbacks and/or measures which may need to be employed to mitigate the impacts of potential lot development.

Heritage Assessment

A heritage assessment should be conducted to determine whether or not the study area harbors any heritage items of value.

Other Plans, Studies and Assessments

Additional plans should be compiled to identify site grading, surface drainage, erosion control, potential insect control requirements.

Other similar types of studies/assessments may be required as deemed necessary during the development of conceptual plans and the design processes.

Construction Monitoring, Testing and Inspection Services

As the suitability of the mine tailings and site conditions would need to be assessed on a case-by-case, qualified geotechnical personnel should provide construction monitoring, testing and inspection services at the time of lot development.

7.0 CONCLUSIONS

7.1 Development Potential

The development potential within the study area is primarily dependent upon the presence and availability of mine tailings materials and site-specific geotechnical conditions. As such, based upon our observations, in general, it appears the entire study area will be suitable for lot development utilizing conventional cut/fill construction methodologies. Additional consideration will be required relative to backfilling some of the peripheral areas of the site to anticipated finished grades given the nature of the surrounding terrain.

Although the mine tailings may contain deleterious materials, they should otherwise be suitable for use as fill to allow for development of other regions within the study area. Their suitability would ultimately need to be assessed in the field by qualified geotechnical personnel at the time of lot development.

Visually it appears granular fills may need to be imported if the entire site is to be developed.

7.2 Road Construction

The mine tailings materials will generally be suitable for use as road, parking and yard area subgrade materials once the site has been pre-graded. Granular fills would need to be imported to establish finished design elevations. Where possible, this infrastructure should be situated in regions where ponds may have been infilled during lot development such that the tailings areas are available to allow for building construction.

7.3 Building Construction

Following pre-grading operations, buildings can be founded upon conventional footing or monolithic-slab concrete foundation systems which are constructed upon engineered granular fills. These buildings should be situated in cut areas (in regions of pre-existing mine tailings) provided the tailings exposed at the subgrade elevation(s) are considered suitable for use.

Unless structural fills are established, buildings should not be constructed in regions of fill (or disturbed regions) as the amount of differential and/or total settlement in these areas may otherwise exceed tolerable limits. Buildings should not be constructed in

regions where ponds or undisturbed regions may have been infilled during pre-grading operations.

Buildings should be closed to the weather and heated prior to the onset of winter conditions and throughout their lifespan whenever freezing temperatures prevail.

7.4 Septic Field Suitability

Additional consideration would be required to assess the feasibility of installing septic fields in regions of pre-existing mine tailings given the proximity to the groundwater table and the generally porous/coarse-grained nature of the mine tailings. If deemed feasible, filter sands may need to be imported during septic field construction to slow the rate of percolation. Otherwise the use of insulated holding tanks would be required if site-specific conditions are not suitable for septic field installation.

Septic fields should not be developed in regions of permafrost, fill or former pond areas.

7.5 Additional Assessments and Evaluations

As our findings are preliminary in nature, additional assessments and evaluation(s) should be conducted to verify site-specific design parameters, as described in Section 6.6, above.

8.0 LIMITATIONS

This report is intended for the sole use of *Yukon Government*.

No portion of this report may be used as a separate entity; it is intended to be read in its entirety.

Any use of this report by a third party is the responsibility of such third party.

The comments contained herein reflect our best judgment in light of the information available to our firm at the time of our assessment. They are based upon our collation of available literature, observations made during our site reconnaissance, recognition of geomorphic features and generally accepted engineering practices.

Given the nature of our assessment and scale of mapping, the information contained herein will not be sufficient to assess all factors that may have an effect upon design and construction and so this should be considered from a project management perspective. As such our findings should be supplemented through subsequent geotechnical evaluations and other technical studies as may be required.

Due to the geomorphological nature of the deposits encountered, interpolations of subsurface conditions have not been made or implied other than for discussion purposes. The anticipated construction conditions have also been discussed, but only to the extent that they may influence design decisions. Suggestions of construction methods contained herein express our opinion and are not intended to direct contractors on how to carry out construction. Any reference to structures, roads or overall use of the study area have been for discussion purposes only. The actual use of the study area will need to be determined during future geotechnical evaluations and the design process.

Should unexpected subsurface conditions be encountered during future evaluations, our firm should be notified in order to confirm the suitability of our recommendations and conclusions. If required, our firm may alter or modify our recommendations and conclusions at such time.

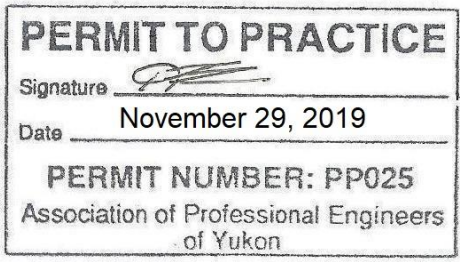
9.0 CLOSURE

Thank you for providing our firm with the opportunity to conduct the above noted feasibility assessment.

We trust that the information we have provided will be suitable for your purposes, however, if you should have any questions or concerns, please feel free to contact the undersigned at your convenience.

Respectfully Submitted,

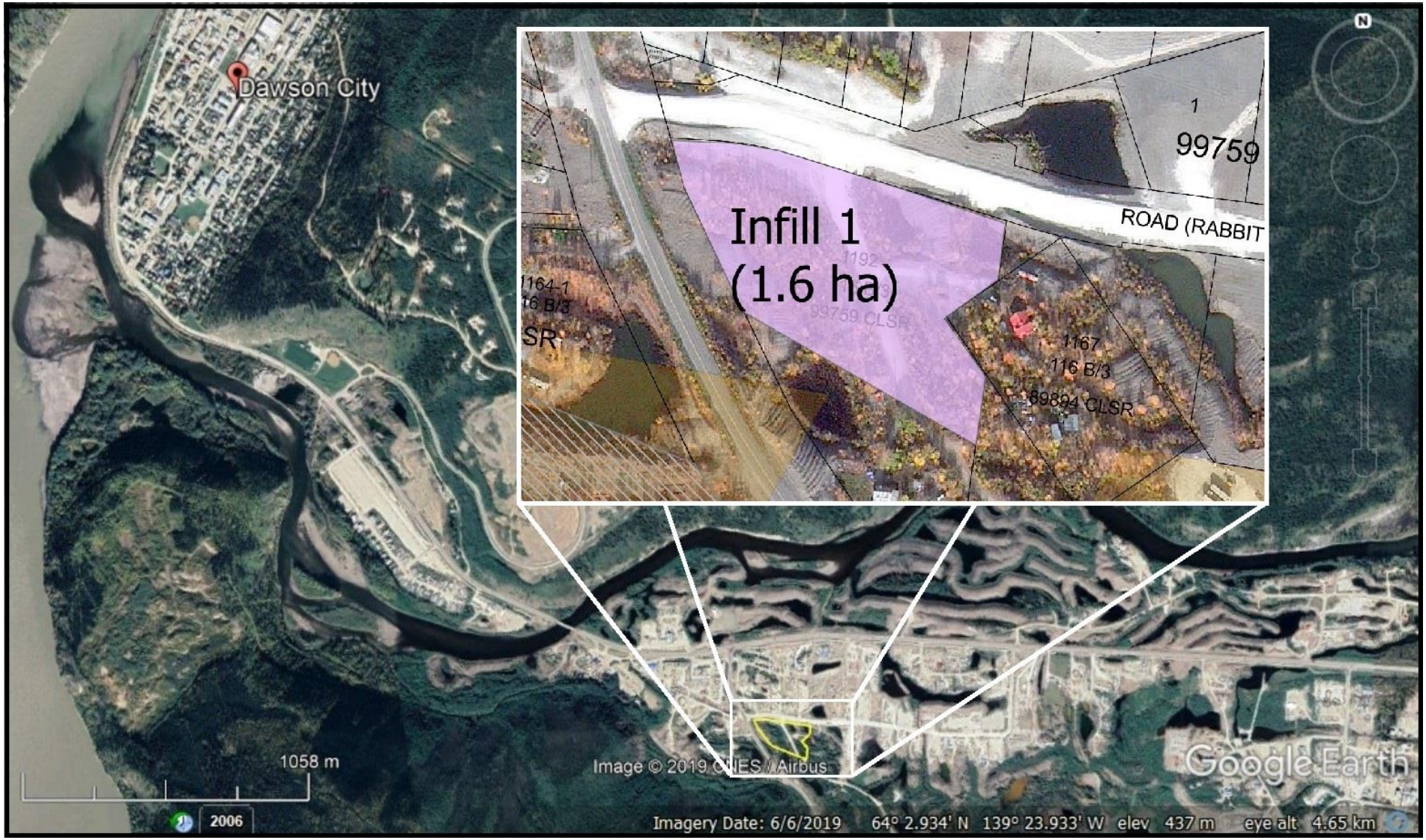
CHILKOOT GEOLOGICAL ENGINEERS LTD.



Tares Dhara, P.Eng.
Senior Geotechnical Engineer

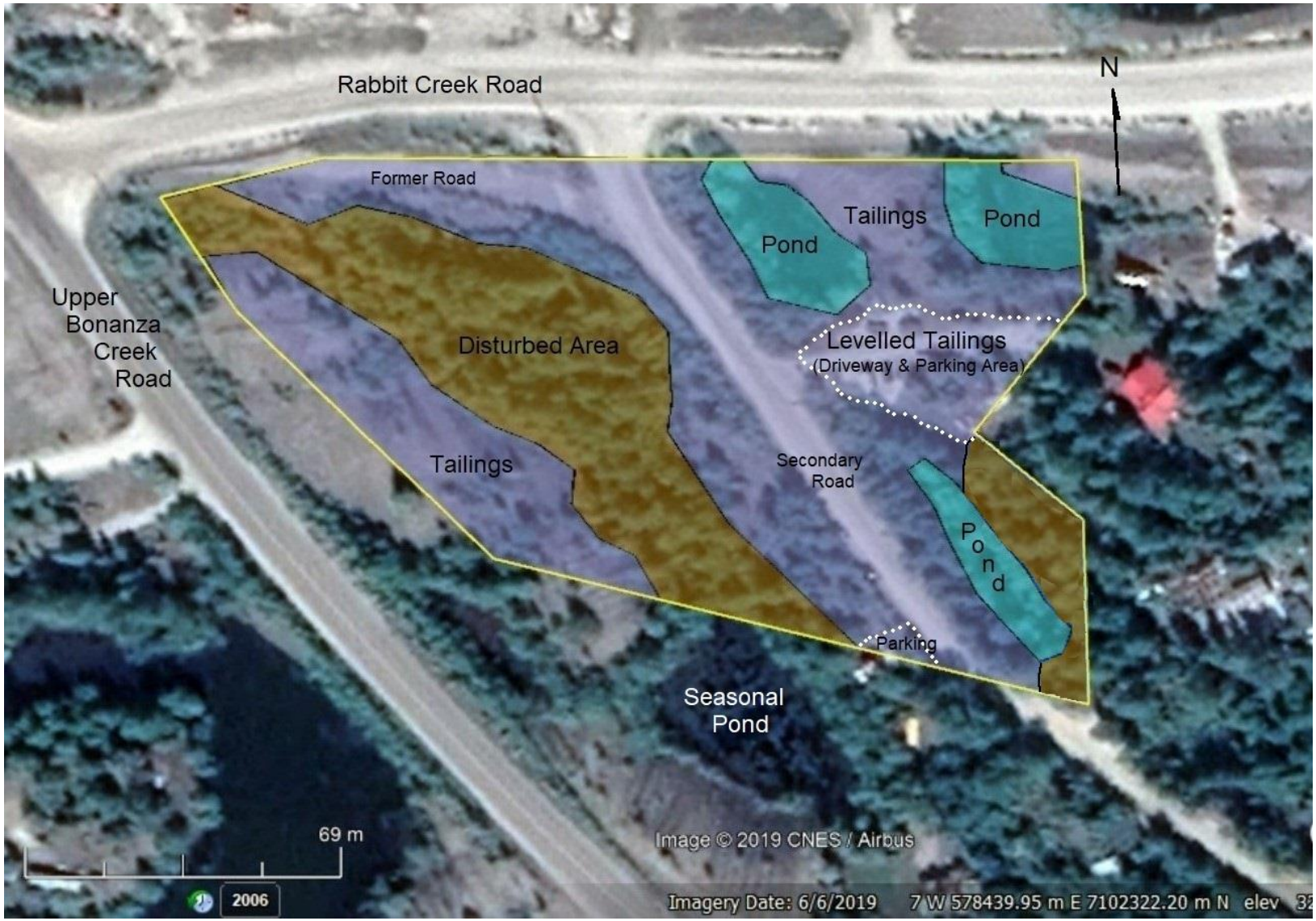
TD/td

Geotechnical Feasibility Assessment
Proposed Lot Infill Development
Guggieville Industrial Subdivision Area - Dawson City, Yukon - 2019
Figure 1 – Site Location – Infill #1



Based map from Google Earth and YG supplied Site Plan – Not to Scale – Locations are approximate. Compiled November 2nd, 2019 by T.Dhara

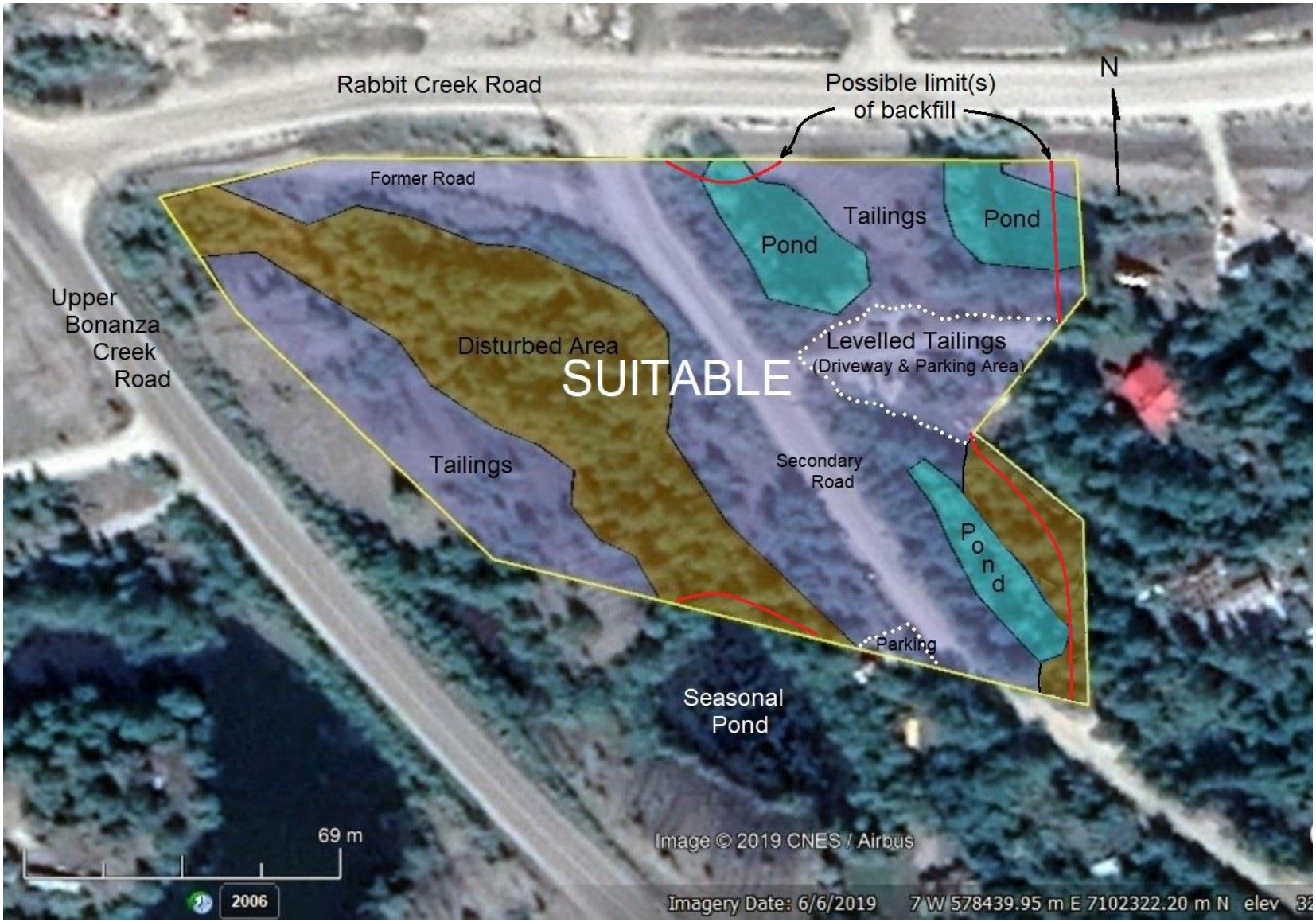
Geotechnical Feasibility Assessment
Proposed Lot Development - Guggieville Industrial Subdivision Area
Dawson City, Yukon - 2019
Figure 2 – Site Conditions - Infill #1



Based map modified from *Google Earth* – Not to Scale – Locations are approximate.

Compiled November 4th, 2019 by T.Dhara, P.Eng.

Geotechnical Feasibility Assessment
Proposed Lot Development - Guggieville Industrial Subdivision Area
Dawson City, Yukon - 2019
Figure 3 – Development Potential - Infill #1



Based map modified from *Google Earth* – Not to Scale – Locations are approximate.

Compiled November 19th, 2019 by T.Dhara, P.Eng.