October 17, 2022
Our File: 222360

Via Email – fireside@bmts.com

Estate of Muriel McCrabb
c/o Allan Speer
P.O. Box 1817
Port Elgin, ON N0H 2C0

Re: Karst Topography Assessment
Concession 14/15, Lot 24 and Part Lot 23
Township of Georgian Bluffs

Dear Allan,

This letter report provides the findings of the Karst Topography Assessment that was conducted on the subject Site, which consists of three lots that were recently separate properties. It is our understanding that these lots were recently merged by the Township of Georgian Bluffs as a result of administrative estate matters. It is our understanding that the individual(s) managing the estate are attempting to re-sever the overall Site (i.e. recently merged parcel) into the lots that were legally separate in 2017. The legal descriptions of the proposed lots are as follows, as reported in the Grey County GIS online mapping service:

Lot 1: Concession 15, Part Lot 24, Survey PCL 3 ROW, RP16R297 Part 1, RP16R328 Part 1, Municipality of Georgian Bluffs (0.36 ha)

Lot 2: Keppel Concession 14, Part Lot 23, Municipality of Georgian Bluffs (6.8 ha)

Lot 3: Concession 14, Lot 24, Municipality of Georgian Bluffs (40.9 ha)

The overall subject site is currently vacant and contains no structures. The property consists of primarily forested lands with various ATV and snowmobile trails stretch across some portions of the Site. No municipal sanitary sewer or water services are provided to the property.

The subject Site, including each of the three lots, encompasses approximately 48 hectares (118.7 acres) and is located on the north side of Concession Road 14 (i.e. Lot 3). Lot 1 can be accessed from the south side of Big Rock Road and Lot 2 is accessible from a relatively narrow extent of property on the east side of Francis Drive. The location of the property is presented in the attached Figure 1.

We understand that although the proponent is proposing to sever lots 1 and 2 from the parent lot, with Lot 3 to be retained, no specific development is proposed at this time. However, ultimately the lots are expected to be sold and developed as a single residential lots. Therefore, this Karst Topography Assessment is being completed to facilitate the re-severance and/or potential future development of each of the three proposed lots. The potential building envelopes on the Site are presented in Figure 2 for reference.

The footprint of the potential buildings and onsite sewage systems in the areas identified as building envelopes would be determined at the time of future permit applications and are not expected to affect the conclusions presented herein.

The Study Area is focused on the proposed building envelopes that were determined in consultation with the property owner.

The scope of this review includes:

- Review of geologic and physiographic mapping;
- Review of aerial photography;
- A site visit and reconnaissance of the study area on October 10, 2022; and
- The documentation of the nature of soil and bedrock in six (6) excavated test holes (i.e.TH-1 to TH-3 on Lot 3 and TH-4 to TH-6 on Lot 2).

The scope of work described herein relies on surface and subsurface exploration via excavated testholes. No detailed subsurface exploration (such as drilling) or geophysical work was conducted as part of this Assessment Further investigation would be required to comment on the potential for Karst in the locations beyond the study areas.

Karst – Background

Karst topography is generally found in areas where carbonate rock, such as limestone or dolostone, are exposed at surface or lie beneath shallow surficial sediment or overburden. Karst is generally created through the chemical weathering (i.e., dissolution) of carbonate bedrock, subsequently forming a network of voids. In karstic areas, these voids are sometimes evident as irregular or hummocky rock outcrops, crevasses, or sinkhole patterns.

Geologic Setting

The subject property is located within the physiographic region known as “Bruce Peninsula” (Chapman and Putnam, 1984). The region is characterized by generally flat topography with shallow overburden, primarily as fine-textured till, scattered on grey limestone, dolostone or shale in the vicinity of Georgian Bay. In some areas, bedrock is exposed at ground surface.

From a review of geologic mapping, the surface soil in the study area is generally comprised of the Breypen series, which consists of a thin layer of varying soil types over bedrock.

Based on a review of the geologic setting, the potential for karstic features underlying the Site was considered to exist since the area is comprised of dolostone bedrock of the Amabel Formation (i.e., carbonate rock), with Guelph Formation dolostone in the southeasternmost portion of the Site. Additionally, according to the *Karsts of Southern Ontario and Manitoulin Island* GIS Mapping (Ontario Geologic Survey, 2008; Brunton, Dodge), the proposed building envelopes on Lots 2 and 3 are considered to be in an area of known karst. Karst Mapping is enclosed for reference.

A review of the Ministry of Environment, Conservation and Parks (MECP) water well database was also completed as part of this investigation. The well records for nearby wells report that the bedrock surface was typically encountered between approximately 0 and 4.5 mbgs in the vicinity of the Site.

Site Setting and Reconnaissance

The Site visit was conducted by Mr. Corbin Sweet, P.Geo., of GM BluePlan Engineering (GMBP) on October 10, 2022. During the Site visit, GMBP personnel inspected the proposed building envelopes and the surrounding land on Lots 1 to 3 to identify potential areas of subsidence, or depressions, as well as springs or drainage features that may discharge to the subsurface.

The surface in the study areas was observed to be cleared and generally flat. It is our understanding that the areas of potential future development have been historically vacant/vegetated and used for recreational purposes.

Based on the onsite observations at the time of the investigation, no significant depressions, areas of subsidence, groundwater springs, or seeps were observed in the vicinity of the study area. Also, no bedrock outcrops were observed.

Based on the topography and surficial features observed at the time of the October 10, 2022 field assessment completed by GMBP, the specific areas of proposed development do not show surface evidence of hydraulically active karstic features, such as areas of subsidence or springs, that would limit development.

Testhole Investigation Findings

As part of the field investigations, a series of six (6) testholes were excavated by Chet Ashcroft Excavating (the excavation contractor) for inspection by the undersigned during the site investigation. It is noted that since proposed severance Lot 1, adjacent to the south side of Big Rock Road, is not situated within the Grey County Karst Policy Area and no evidence of hydraulically active karst features were observed across the surface of this Lot, no investigative testholes were excavated on Lot 1.

As discussed, the exact footprints of future buildings and onsite sewage systems are to be determined at the time of the planning application. However, to support this review, the approximate future development areas were provided by the owner. The testhole locations were determined to assess the bedrock structure in the general development envelopes on Lots 2 and 3, as outlined in Figure 2.

The testholes were generally evenly spaced in each study area on Lots 2 and 3 to provide sufficient spatial coverage to allow for a reasonable inference of the overall structure of the bedrock in the area of proposed development. The observations of the bedrock structure on Lots 2 and 3 are discussed separately below:

Lot 2: *Keppel Concession 14, Part Lot 23, Municipality of Georgian Bluffs*

Three testholes (i.e. TH-4 to TH-6) were excavated in locations spaced across the proposed building envelope on Lot 2.

The bedrock was encountered between 0.3 and 0.8 metres below ground surface (mbgs) in the testholes, with the bedrock appearing to be shallower toward the west side of the building envelope (i.e. TH-6). The native soil overlying the bedrock in each of the testholes generally consists of a stony loam (i.e. silt and sand with gravel, cobbles, and boulders with trace clay).

The bedrock in TH-4 and TH-6 was observed to consist of generally flat and competent tan-coloured dolostone bedrock of the Amabel formation. The bedrock in TH-5 appeared to have a more weathered and hummocky surface and a minor fracture with a width of approximately 2 to 4 cm in width was found, which was tightly infilled with silt, clay, and organics.

Although this fracture suggests the potential presence of other similar karstic fractures in the area that may have historically been hydraulically active (i.e. in geologic history), the presence of tight soil within the fracture indicates that it is not active and is considered to be an epi-karst feature.

Lot 3: *Concession 14, Lot 24, Municipality of Georgian Bluffs*

Three testholes (i.e. TH-1 to TH-3) were excavated in locations spaced across the proposed building envelope on Lot 3.

The bedrock was encountered between 1.3 and 1.5 metres below ground surface (mbgs) in the testholes. The native soil overlying the bedrock in each of the testholes generally consists of a similar soil as that encountered on Lot 2, but with a higher boulder content.

The bedrock in was observed to be generally heavily weathered, with the excavator able to "pluck" the less competent upper layers of bedrock. However, no evident fractures or other indication of karst or epi-karst features were specifically observed in each of the three testholes excavated on Lot 3.

Photographs of the Site and the testholes are attached for reference.

Conclusions and Recommendations

Based on the findings of this investigation, there is no evidence of hydraulically active karst features in the areas proposed for development that would cause a direct risk to the proposed development. Further, no evidence of epi-karst (i.e. geologically historically active karst features) were observed in the testholes or across the surface of the Study Area with the exception of the bedrock observed in the location of TH-5 on Lot 2, where a soil-infilled epi-karstic fracture was observed.

If the lots are to be developed in the future, at the time of development, the sewage system is to be constructed to meet the Ontario Building Code with appropriate separation from bedrock. Based on the nature of the soils and varying depth to bedrock across the Site, the leaching bed may need to be constructed as a raised bed.

At the time of development, and as is standard under the OBC process, it is recommended that the nature of the bedrock/soils be inspected at the time of the construction of structures and servicing. Where unforeseen fractures or crevasses are uncovered during site preparation for foundations, additional support or adjustments to the foundation design may be required. As per standard requirements under the OBC, we recommend that such a design review/adjustment be completed by a qualified person.

With the implementation of the above noted recommendations, it is our opinion that it is reasonable to expect that a new residence can be built in the areas outlined in Figure 2 without impacts from bedrock features.

In summary, the following recommendations are made to support the severance with potential future residential developments:

1. That at the time of construction, the bedrock surface be inspected in areas where it is exposed to confirm the nature of the bedrock and the presence or absence of any fractures or dissolution features that would pose structural limitations. Should fractures or crevasses be uncovered during site preparation for foundations, additional support or adjustments to the foundation design may required. We recommend that such a review be completed by a qualified person (as per the OBC).

2. That any onsite sewage systems are not constructed on areas with evident karstic features (if encountered) and within the proposed development area identified on Figure 2.

3. That the standard separation requirements developed under the Ontario Building Code for site servicing are considered sufficient to support the construction and mitigate the potential for undue impacts.

4. Development of the property beyond the limits outlined in Figure 2 would be subject to further study and inspection prior to approval.

Limitations

The information in this report is intended for the sole use of Allan Speer. GM BluePlan Engineering Limited accepts no liability for use of this information by third parties. Any decisions made by third parties on the basis of information provided in this report are made at the sole risk of the third parties.

The conclusions and recommendations in this report are based on information gathered at the testhole locations and on available geological information. Subsurface conditions beyond the testholes may differ from those encountered at the testhole locations and conditions may become apparent during construction, which may not have been detected or anticipated at the time of the investigation.

The conclusions pertaining to the condition of soils and/or bedrock identified at the site are based on the visual observations at the locations of the investigative testhole. GM BluePlan Engineering Limited cannot guarantee the condition of soil and/or bedrock that may be encountered at the site in locations that were not specifically investigated.

Yours truly,

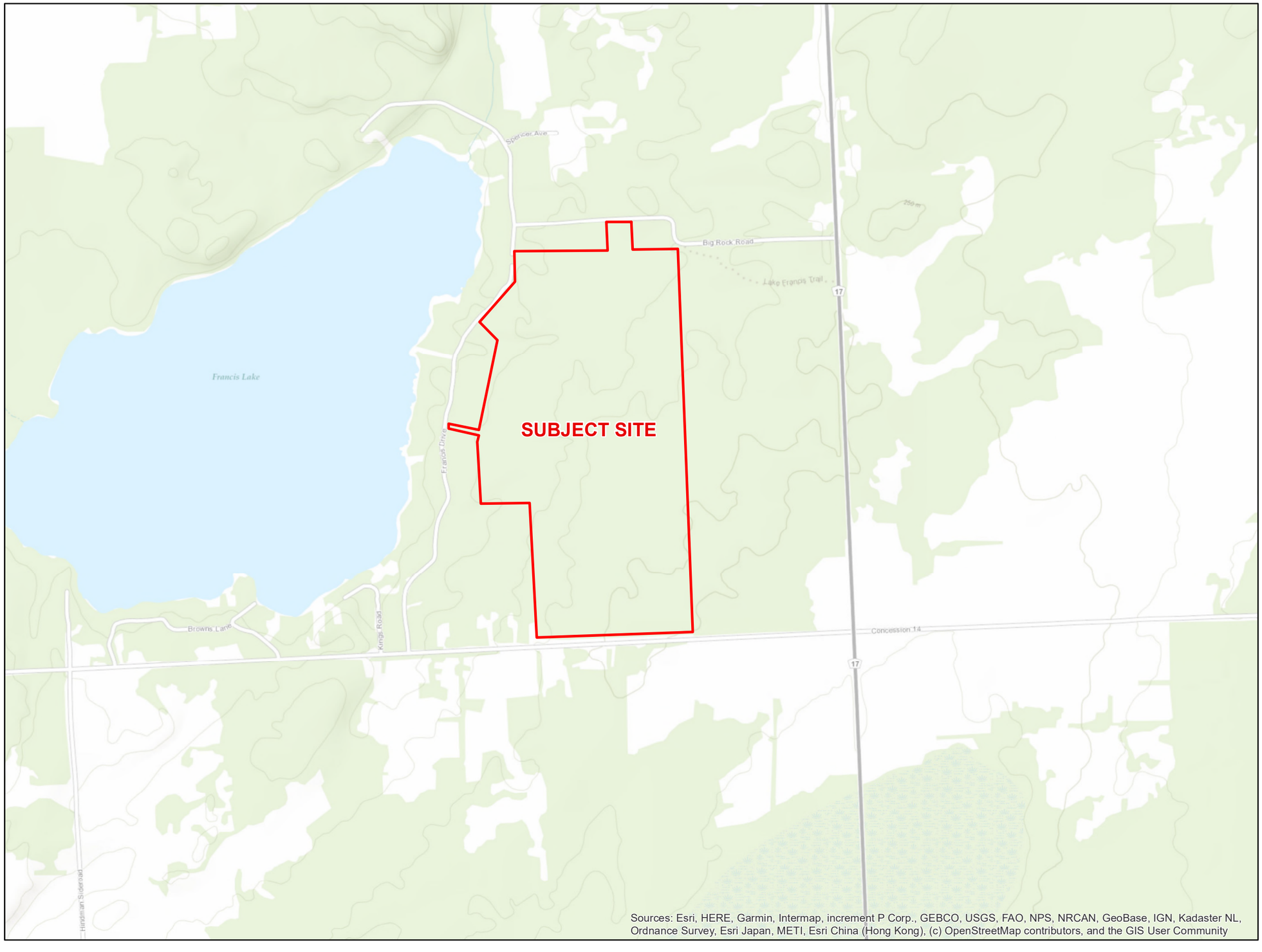
GM BLUEPLAN ENGINERING LIMITED

Per:

Corbin Sweet, P.Geo.
CJS

Enclosures:
Figure 1: Site Location Map
Figure 2: Proposed Severance and Testhole Location Plan
Site Photographs
Karst Mapping
Grey County Official Plan – Appendix A – Karst Areas
cc: File No. 222360

222360
Karst Topography Assessment
Concession Road 14
Township of Georgian Bluffs



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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LEGEND

Approximate Boundary of Subject Property

Scale
1:10,000

October 2022

SITE LOCATION MAP

Estate of Muriel McCrabb

Figure No. 1

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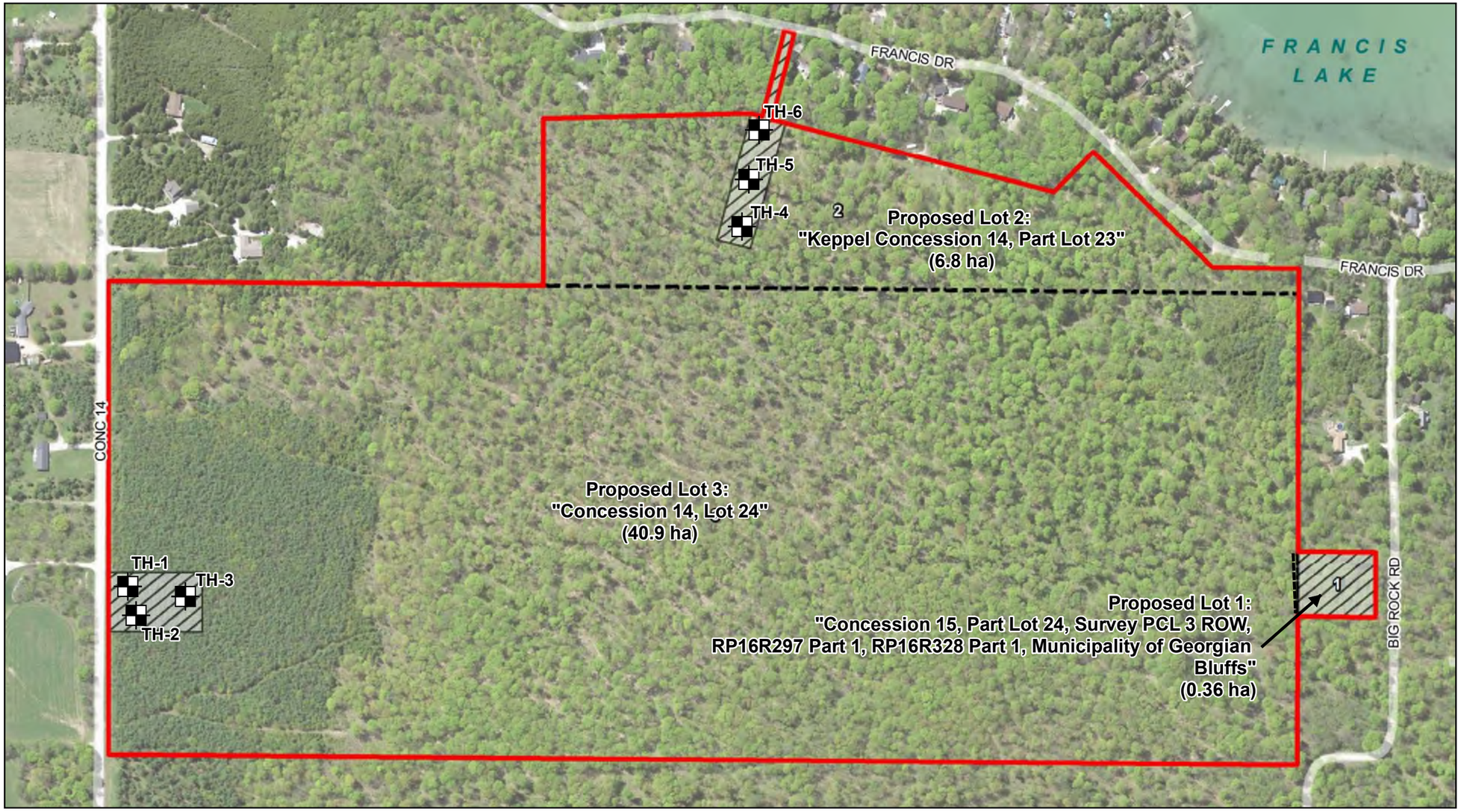
222360
Karst Topography Assessment
Concession Road 14
Township of Georgian Bluffs



Note: Image retrieved from Figure 4 of the EIS Report completed by Palmer and dated September 29, 2022.

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LEGEND

- Approximate Boundary of Subject Property
- Proposed Future Building Envelope
- Proposed Severance Boundaries
- Approximate Testhole Locations (Completed October 10, 2022)

Not To Scale

October 2022

Proposed Severance Lots and Testhole Location Plan

Estate of Muriel McCrabb

Figure No. 2

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Karst Topography Assessment
Concession Road 14 — Municipality of Georgian Bluffs
Estate of Muriel McCrabb

Photo 1: View of area of proposed development on Lot 1.

Photo 2: View of area of proposed development on Lot 2.

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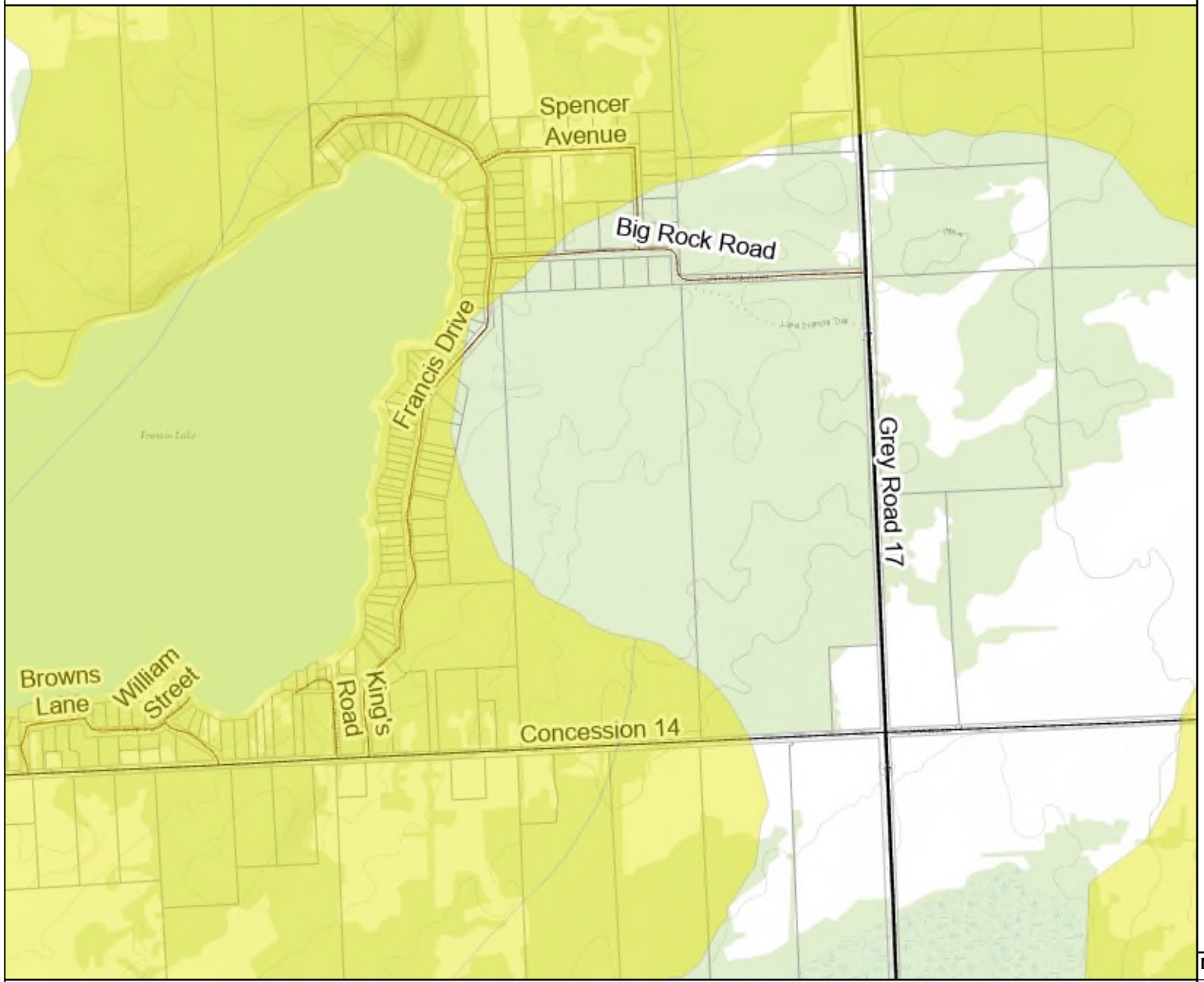
Photo 3: View of area of proposed development on Lot 3.

Photo 4: View of bedrock surface in TH-5. Note soil-infilled epi-karst fracture.

Photo 5: View of bedrock surface in TH-6.

Photo 6: View of bedrock surface in TH-1.

GCOP - Appendix A - Karst Policy Areas



Legend

- Karst Area
- Large Scale Roads
  - Provincial Highway
  - County Road
  - Township Road
  - Seasonal Road
- Parcels - Current
- Grey County Boundary

Notes

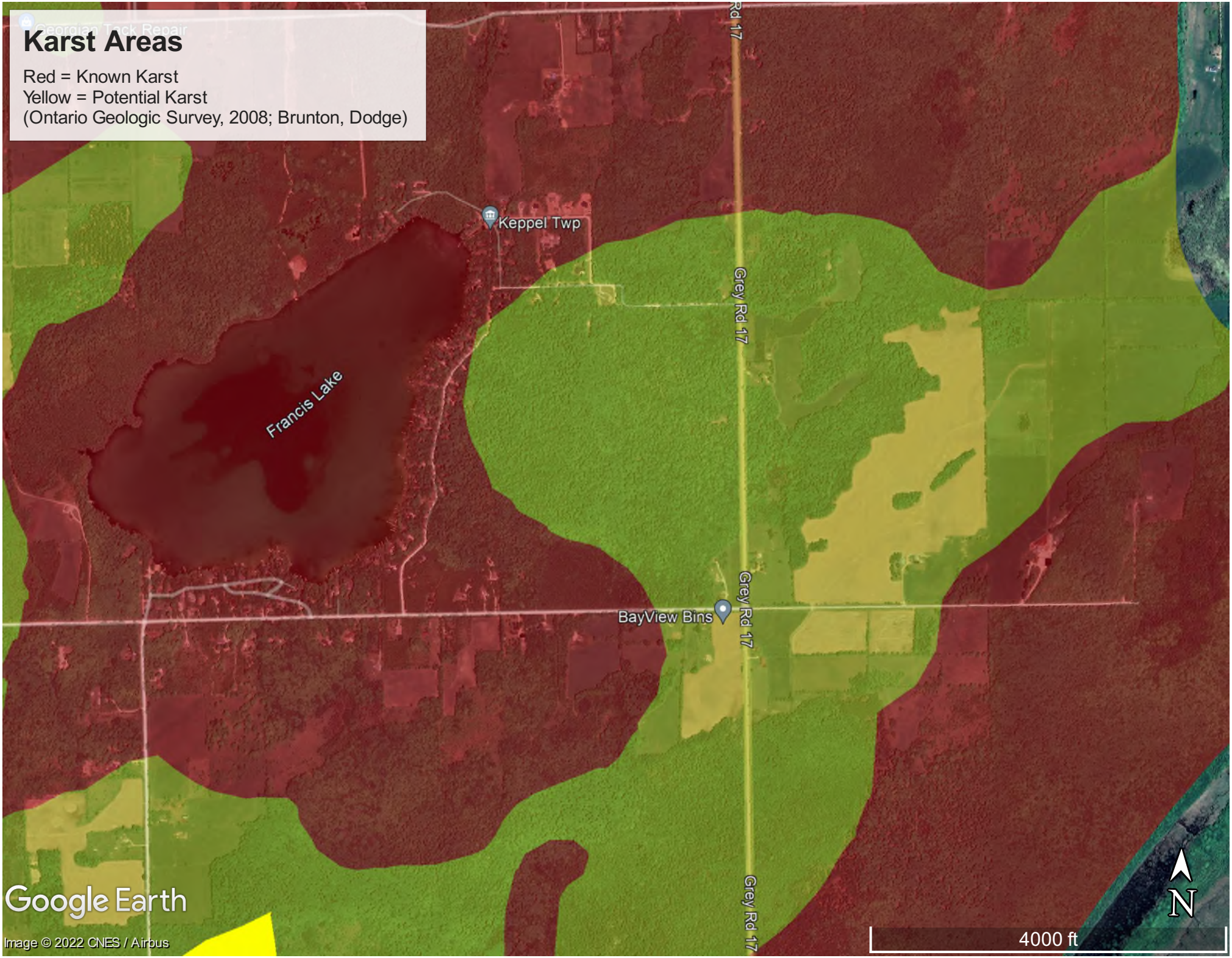
889 0 444 889 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

Printed October 16, 2022

THIS MAP IS NOT TO BE USED FOR NAVIGATION


Karst Areas
Red = Known Karst
Yellow = Potential Karst
(Ontario Geologic Survey, 2008; Brunton, Dodge)
Keppel Twp
Francis Lake
Grey Rd 17
BayView Bins
Google Earth
Image © 2022 CNES / Airbus
N
4000 ft