Michalski Nielsen
ASSOCIATES LIMITED

July 28, 2020

Ms. Kim Roberts
Greg Bishop Surveying and Consulting Ltd.
121 Mallard Road
Box 309
Haliburton, Ontario K0M 1S0

Re: Property Owned by Stephanie Cramm, Baptiste Lake; Our File 3218

Dear Ms. Roberts:

This letter/report constitutes an **Environmental Impact Statement** (**EIS**) of the **Site Development Plan** prepared by Greg Bishop Surveying and Consulting Ltd. for property owned by Stephanie Cramm (**Figure 1**). The subject landholding is an existing lot of record that fronts the shoreline of Baptiste Lake (**Figure 2**). Its legal description is Part of Lots 30 and 31, Concession 8, and Part of the Road Allowance Between Lots 30 and 31, Concession 8, Geographic Township of Herschel, Municipality of Hastings Highlands, County of Hastings. The property has 70 ± metres (m) of frontage on the Lake, and is 1.445 hectares (ha) in area.

BACKGROUND

A driveway from Forest View Road has been constructed to access the central part of the lot; it terminates in a loop road about mid-way into the property. Thereafter, the central part of the landholding has been cleared of vegetation (i.e., both upland and wetland species), and subsequently filled. The filling does not extend to the Controlled Water's Edge of Baptiste Lake (i.e., Contour Elevation of 351.7 m); rather, it extends about 10 m into the Province's Crown Reserve (**Figure 1**). It is impossible to be precise as to how much of the filled area represented wetland and how much was upland. However, I would speculate that based on the limits of the existing wetland north and south of the filled area, the majority of the altered landscape was wetland. A creek cuts diagonally through the property from its northwestern corner, discharging into a swamp forest wetland at the site's southeastern lot line.

The **Municipality of Hastings Highlands Comprehensive Municipal Zoning By-law** (**Municipal Zoning By-law**) shows an Environmental Protection (EP) area covering the northern two thirds of the

SITE DEVELOPMENT PLAN

PART OF LOTS 30 AND 31, CONCESSION 8 AND PART OF THE ROAD ALLOWANCE BETWEEN LOTS 30 AND 31, CONCESSION 8

(CLOSED BY BY-LAW No. 672-2000, REGISTERED AS QR616023)

GEOGRAPHIC TOWNSHIP OF HERSCHEL

MUNICIPALITY OF HASTINGS HIGHLANDS

COUNTY OF HASTINGS

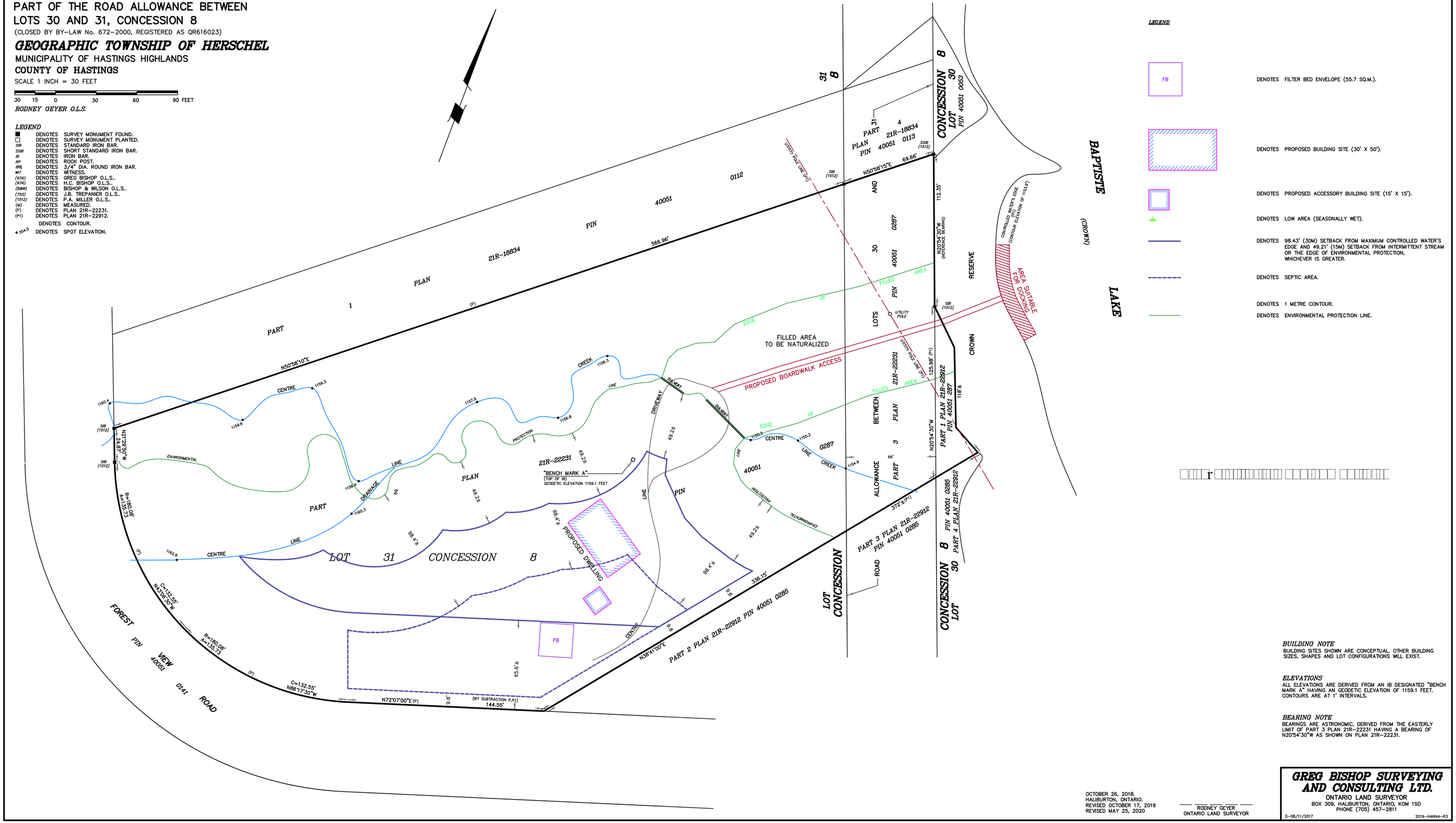
SCALE 1 INCH = 30 FEET

30 15 0 30 60 90 FEET

RODNEY GEYER O.L.S.

LEGEND

■	DENOTES SURVEY MONUMENT FOUND.
□	DENOTES SURVEY MONUMENT PLANTED.
SIB	DENOTES STANDARD IRON BAR.
SSIB	DENOTES SHORT STANDARD IRON BAR.
IB	DENOTES IRON BAR.
RP	DENOTES ROCK POST.
IBR	DENOTES 3/4" DIA. ROUND IRON BAR.
WT	DENOTES WITNESS.
(934)	DENOTES GREG BISHOP O.L.S..
(934)	DENOTES H.C. BISHOP O.L.S..
(BAW)	DENOTES BISHOP & WILSON O.L.S..
(755)	DENOTES J.B. TREPANIER O.L.S..
(1512)	DENOTES P.A. MILLER O.L.S..
(M)	DENOTES MEASURED.
(P)	DENOTES PLAN 21R-22231.
(P1)	DENOTES PLAN 21R-22912.
	DENOTES CONTOUR.
• 354.0	DENOTES SPOT ELEVATION.



IMPERIAL: DISTANCES AND COORDINATES ARE IN FEET AND CAN BE CONVERTED TO METRES BY MULTIPLYING BY 0.3048.

LEGEND

FB	DENOTES FILTER BED ENVELOPE (55.7 SQ.M.).
	DENOTES PROPOSED BUILDING SITE (30' X 50').
	DENOTES PROPOSED ACCESSORY BUILDING SITE (15' X 15').
	DENOTES LOW AREA (SEASONALLY WET).
	DENOTES 98.43' (30M) SETBACK FROM MAXIMUM CONTROLLED WATER'S EDGE AND 49.21' (15M) SETBACK FROM INTERMITTENT STREAM OR THE EDGE OF ENVIRONMENTAL PROTECTION, WHICHEVER IS GREATER.
	DENOTES SEPTIC AREA.
	DENOTES 1 METRE CONTOUR.
	DENOTES ENVIRONMENTAL PROTECTION LINE.

BUILDING NOTE

BUILDING SITES SHOWN ARE CONCEPTUAL. OTHER BUILDING SIZES, SHAPES AND LOT CONFIGURATIONS WILL EXIST.

ELEVATIONS

ALL ELEVATIONS ARE DERIVED FROM AN IB DESIGNATED "BENCH MARK A" HAVING AN GEODETIC ELEVATION OF 1159.1 FEET. CONTOURS ARE AT 1' INTERVALS.

BEARING NOTE

BEARINGS ARE ASTRONOMIC, DERIVED FROM THE EASTERLY LIMIT OF PART 3 PLAN 21R-22231 HAVING A BEARING OF N20°54'30"W AS SHOWN ON PLAN 21R-22231.

OCTOBER 26, 2018.
HALIBURTON, ONTARIO.
REVISED OCTOBER 17, 2019
REVISED MAY 25, 2020

RODNEY GEYER
ONTARIO LAND SURVEYOR

GREG BISHOP SURVEYING AND CONSULTING LTD.
ONTARIO LAND SURVEYOR
BOX 309, HALIBURTON, ONTARIO, K0M 1S0
PHONE (705) 457-2811

D-08/11/2017 2019-HANNA-R3

General Public Interactive Map

10/03/2020, 14:56:15

1:72,224

0 0.42 0.85 1.7 mi

0 0.5 1 2 km

Emergency Services

Fire Station

Property Information

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

Hastings County GIS

property, primarily owing to the presence of unevaluated wetlands (**Figure 3**). According to the **Municipal Zoning By-law**, EP lands are those supporting waterbodies and permanent watercourses, as well as those that may pose a threat to life and property because of inherent physiographic characteristics such as floodplains, erosion hazards, poor drainage, organic soils, steep slopes or other similar physical limitations (see subsections 5.7.1 i) and 5.7.1. ii) of the **Municipal Zoning By-law**). The balance of the property is zoned Waterfront Residential (WR) (**Figure 3**). Given that building structures (i.e., residence and accessory out-buildings) and related **Municipal Zoning By-law** setbacks from the EP lands cannot be accommodated within he filled lands, and that sufficient developable area is not available within the existing WR zone, it became critical to confirm whether the WR lands could be increased in area by confirming the precise location of the on-site creek and its biophysical features.

Environmental provisions associated with relevant subsections of the **Municipal Zoning By-law** that relate to developing the existing lot of record are as follows.

5.7 ENVIRONMENTAL PROTECTION (EP) ZONE

5.7.1 Lands Zoned Environmental Protection

5.7.1 iv) Prior to issuing a building permit for any building or structure within the Environmental Protection Zone, the Municipality should be satisfied that no physical hazard exists which would cause harm to life or property. The municipality may require technical reports to be submitted in support of any development (i.e., drainage reports, slope stability reports, environmental reports) and may require the written approval of the Conservation Authority.

5.8 ENVIRONMENTALLY SENSITIVE LANDS

Environmentally Sensitive Lands are those lands identified as natural heritage areas and systems having significant biological, geological, zoological or other unique natural features such as wildlife habitat, areas of natural and scientific interest, habitat of threatened or endangered species, woodlands and valleylands.

Environmentally Sensitive Lands are shown by an overlay on the attached schedules.

Development of these lands shall be in accordance with the underlying land use designation.

5.9.2 Notwithstanding anything in this By-law, no building, structure, or septic tank installation including the weeping tile field ('no development') shall be located:

i. within 30 metres (98.4 ft) of the highwater mark of a waterbody or permanent watercourse, notwithstanding that such a body of water or watercourse is not shown on any schedule forming part of this By-law; or
ii. notwithstanding i) above, where it is proposed that a septic sewage disposal system is to be installed on private property between 15 m (49.2 ft) and 30 metre (98.4 ft), a requirement for a minor variance to this By-law shall be waived; or
iii. within 15 m (49.2 ft) of the top of bank; or
iv. within 30 metres (98.4 ft) of an Environmental Protection Wetland Zone.

5.9.4 Development that is proposed on lands adjacent to Environmentally Sensitive Lands shall be permitted provided that a satisfactorily completed Environmental Impact Statement, prepared in accordance with Section 3.2.8 of the Official Plan is submitted and

Municipal Zoning

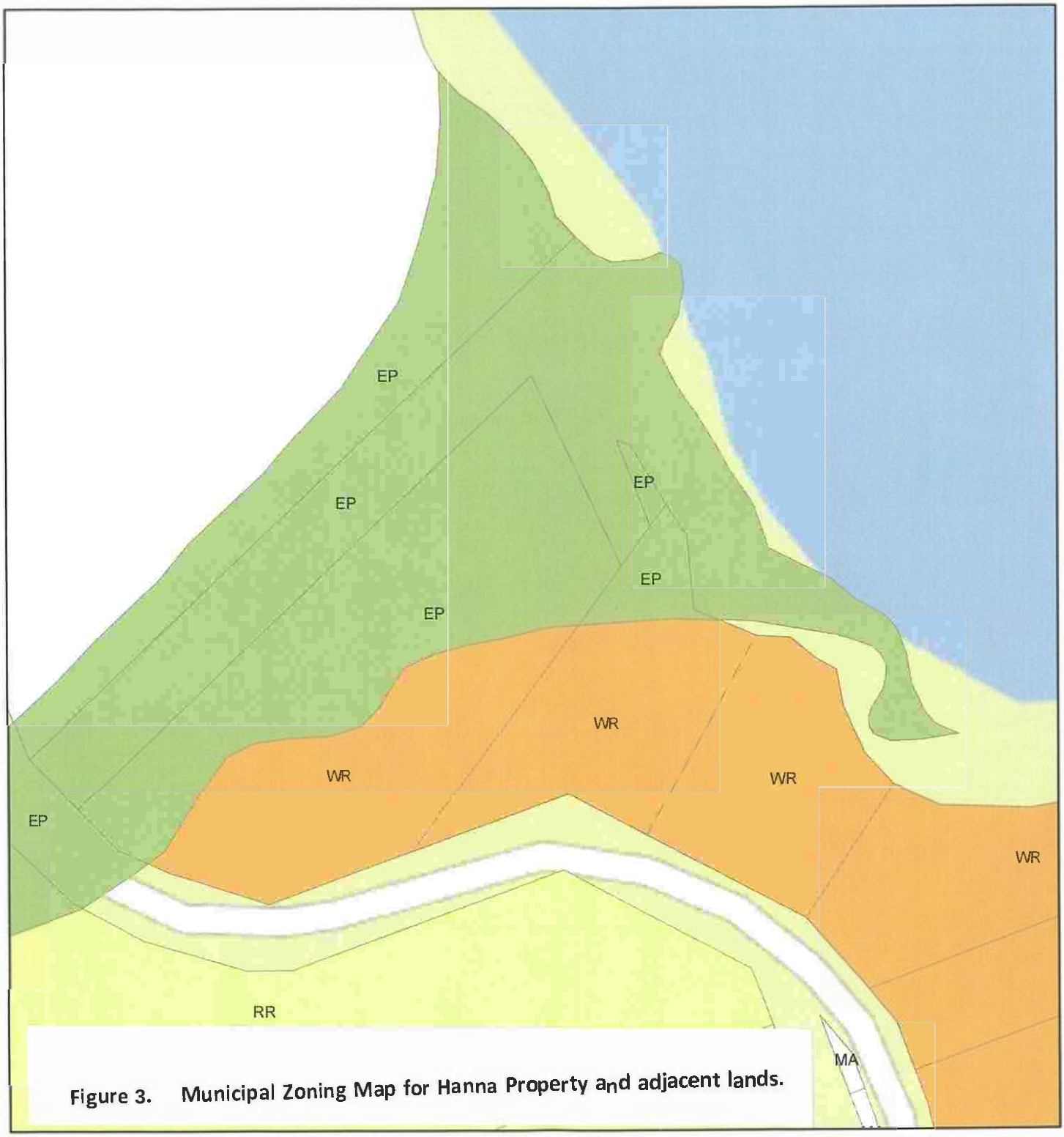


Figure 3. Municipal Zoning Map for Hanna Property and adjacent lands.

11/01/2019, 09:53:23

1:2,257

0 0.01 0.03 0.05 mi

0 0.02 0.04 0.08 km

Zoning: Hastings Highlands

- Marginal Agriculture (MA)
- Rural Residential (RR)
- Waterfront Residential (WR)
- Recreational/Resort Commercial (RRC)
- Environmental Protection (EP)
- Property Information

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

approved by the municipality in consultation with the Ministry of Natural Resources, the Conservation Authority and the Health Unit. The following measures of adjacency shall be used:

Fish Habitat	30 metres (98.4 ft)
Significant Woodlands	50 metres (164.0 ft)
Significant Valleylands	50 metres (164.0 ft)
Significant Wildlife Habitat including habitat of Endangered/Threatened species	50 metres (164.0 ft)
Areas of Natural and Scientific Interest	50 metres (164 ft)

METHODOLOGY

The objective of this **EIS** is to confirm that Ms. Cramm's existing lot of record is capable of being developed for waterfront residential purposes, and is consistent with the environmental values associated with its EP zoning. To achieve this, the centre line of the on-site creek was ground-truthed on August 7, 2018 with both Greg Bishop, O.L.S., P. Eng., then with Greg Bishop Surveying and Consulting Ltd., and I participating. The creek is culverted under the looped part of the access laneway (**Figure 1**). The top of bank south of the creek and west of the loop road was surveyed using GPS technology; it is shown in **Figure 1** as the Environmental Protection Line. This field work resulted in a refinement of the boundary separating the EP and WR zones, which is shown on **Figure 4**. The effect of our on-site investigation indicate a somewhat larger area of developable land (i.e., WR zone) in the lot's southern part than is shown on the existing Municipal Zoning Map.

Information on soil conditions was also collected in the upland mixed deciduous/coniferous forest in the southern part of the property having a WR zone, as I considered this area suitable for a sewage treatment distribution bed. In this regard, the following data were obtained.

- Soil texture, depth to bedrock, internal drainage, and colour characteristics, using a manual soil auger where terrain conditions are typically flat and well-drained.
- Slope (%) estimated visually.
- With respect to on-site soil conditions, methods consistent with the Canadian Soil Information System were used to substantiate existing characteristics at locations having potential for Class IV sewage systems, as defined by the **Ontario Building Code and Guide for Sewage Systems** (**OBC**). As mentioned above, the types of soil layers, their depth and thickness, and colour of the B horizon were recorded. Also, a sample of B horizon soils was collected from the area of the primary drain field, and forwarded to Caduceon Environmental Laboratories in Richmond Hill for estimates of calcium carbonate, phosphorus retention capability, total and extractable iron, total and extractable aluminum, particle size distribution and percolation time.

KEY ENVIRONMENTAL ISSUES

In my opinion, there are three features on the subject property that warrant further description and comment as they are critical to the development capability of the lot: the filled area; the tributary that courses diagonally through the property; and soil conditions in the WR zone in the southern part of the property. These are described in the following paragraphs.

Area of Filling: As mentioned earlier, the filled area extends from the edge of the turning circle into the Crown Reserve that constitutes the shoreline fronting the subject property. The filled lands dominate the eastern part of the landholding being approximately 1,250 square metres (m^2) in area. As mentioned earlier, the majority of the filled area was wetland, presumably a swamp forest, with perhaps some marshland features.

Tributary/Creek: Having walked the length of the creek as it diagonally cuts through the property, it is my opinion that it flows on an intermittent basis and is a warmwater system. Warmwater tributaries are those having water temperatures that typically exceed 21°C; on August 7th, its temperature was 24.5°C. While there was a quite small flow on August 7th, no bottom faunal communities were present on its substrates or on the undersides of rocks and woody debris. If bottom faunal species were present, I would have classified the creek as a permanently flowing system. As well, no minnow species were observed indicating a non-fish bearing feature, particularly above or west of the turning circle. Nonetheless, the tributary provides a fish habitat function in terms of flow conveyance to Baptiste Lake, which is fish bearing. In summary, the creek is a warmwater, intermittently flowing tributary; it does not permanently flow, nor is it fish bearing, but provides a fish habitat flow conveyance function to downstream Baptiste Lake.

Soil Conditions: I examined the soil profile in the WR zone in the southern part of the property using a manual auger, as this area is generally flat and appropriate for supporting a conventional septic tank tile field or filter bed. The soil consists of a thin (i.e., 5 centimeter [cm]) surface layer of black leaf litter and humus. This overlays a B horizon having a dark brown to orange coloured, silty clay intermixed with sand; the soil profile was moist throughout. The B horizon ranges from 0.05 m to approximately 0.5 m in depth; refusal owing to bedrock occurs at 0.60 m. The orange colouration indicates a high amount of iron and excellent ability to retain phosphorus; the colour becomes lighter with depth. Of importance is that the B Horizon is recognized by the Ministry of the Environment, Conservation and Parks (MECP) and Ministry of Natural Resources and Forestry (MNRF) as having significant phosphorus retention capability; more specifically, **Inland Lake Trout Management in Southeastern Ontario** (1993) states that, " . . . Suitable material (for retaining phosphorus) is available at most deposit sites. Generally, it is the top one metre of material overlying the main pit deposits which is characteristically light brown or red in colour. The deeper pit run material has a poor phosphorus retention capability, and is not suitable for the bed construction on lake trout lakes."

As mentioned above, the soil sample was submitted to Caduceon Laboratories for further analyses. The results are presented in **Table 1**. Soil particle size analyses were performed according to ASTM D-422 (American Society for Testing and Material Standards Test D-422). This test method covers the quantitative determination of the distribution of particle sizes in the soils. The distribution of particle sizes larger than 0.075 millimetres (mm) (retained on this No. 200 sieve) is determined by sieving, while the distribution of particle sizes smaller than 0.075 mm is determined by a sedimentation process, using a hydrometer to obtain the necessary data. The T-time estimate was made by a professional engineer, based on effective grain size (D10) diameter of the sample, and charts in the **OBC**. As indicated in **Table 1** and **Appendix A**, the percolation rate was estimated to be 25 minutes/centimetre (min/cm), which is a relatively low but acceptable percolation time. On the other hand, the slow percolation rate translates into excellent capability for retaining phosphorus through adsorption.

The phosphorus uptake capacity estimate is very high (3,330 micrograms per gram of soil [µg/g]) (**Table 1**). As well, very high levels of extractable iron and extractable aluminum were measured; these metals are important in mineralization or complexing processes with sewage-related phosphorus. In my opinion, the values are sufficiently high to conclude that there is an almost unlimited potential in the on-site B horizon soils for sequestering any sewage generated phosphorus.

The acid nature of the soils is confirmed by the very low calcium carbonate value; non-calcareous soils are those with less than 1% $CaC0_3$ equivalent by weight; the permanently-binding chemical reaction between sewage-related phosphorus and reactive aluminum and reactive iron is favoured when the calcium carbonate content of soils is low (i.e., less than 1%). As indicated in **Table 1**, the $CaC0_3$ value of 0.015% by weight fulfills this criterion.

SITE DEVELOPMENT PLAN

<u>The Plan</u>: Figure 1 shows both a 15 m and 30 m setback from the top-of-bank, or the Environmental Protection Line separating the EP and WR zones. The proposed dwelling is upgradient of the 15 m setback, while the accessory building and the sewage treatment drain field are above the 30 m setback. To implement the **Site Development Plan** it will be necessary to amend the Municipal Zoning Map for the subject property to that shown in **Figure 4**. In this regard, it is recommended that:

- **the Municipal Zoning Plate for the subject property be revised with respect to the line separating Waterfront Residential and Environmental Protection zones, as shown in Figure 4, prepared by Greg Bishop Surveying and Consulting Ltd.**

There remains outstanding however, the ultimate disposition of the filled open space in the central part of the property. While acknowledging that the area of filling is small, I am of the opinion that it should be restored to a woodland landscape by planting with tree and shrub species that are native to the area. Tree species would include but would not be limited to: red maple; silver maple; tamarack; white cedar; white spruce; trembling aspen; and balsam fir. Preferred shrub species are: pussey willow; various dogwoods; high bush cranberry; winterberry and various willow species. All of the recommended species are native

Table 1. Texture and chemical properties of B horizon soils relating to phosphorus uptake capabilities, at proposed location of drain field; Hanna property, Baptiste Lake. Sample was collected by Michalski Nielsen Associates Limited on August 7, 2018.

Particle Size Analysis	Extractable Aluminium (µg/g)	Total Aluminium (µg/g)	Extractable Iron (µg/g)	Total Iron (µg/g)	24 Hour Phosphorus Adsorption Ratio (µg/g)	Calcium Carbonate Content (% by Weight)
Silt/clay 73%, and sand 27%	10,400	15,200	15,800	29,000	3,330	0.015

to the south central part of Ontario's Precambrian Shield, and on-site soil conditions should be adequate for all species. The provision of wildlife habitat would be an obvious added-value benefit, particularly for birds such as red-winged blackbirds, common yellow throat, and various species of wren, herons and waterfowl.

Given the size of the area to plant (i.e., approximately 1200 m^2), it is suggested that a planting coverage of 30% is adequate, as the objective here is not to reproduce forest cover, but to replace wetland. The 30% coverage would be comprised of the woody vegetation listed in **Table 2**. For trees, the planting prescription is 3.0 m to 5.0 m on centre for tree whips (i.e., potted or bare root), or farther apart if the tree caliper diameter is larger than a whip. Whips are defined as living woody plant cuttings capable of rooting in moist soils and usually assembled into bundles called wattles or fascines; they are generally 0.5 centimetres (cm) to 2.5 cm in diameter and 1.0 m to 1.5 m in length. They are typically used for bioengineering but may be used in other moist soil conditions. Staking is optional but rabbit and/or deer guards should be used, if browsing is noted. As the trees grow older, pruning and/or selective removal may be needed to maintain overall health of the plantings.

For potted or bare root shrubs, as listed in **Table 2**, the recommended planting spacing is 1.0 m on centre, either in singles or clumped. As with all woody tree and shrub plantings, the key to success is soil preparation, watering and fertilization. In this regard, consultation with nursery staff in advised.

In addition to the woody vegetation listed in **Table 2**, there are a variety of commercial groundcover seed mixes that could be applied. Given the on-site conditions of wet-mucky soils and fill, the following wetland and marsh meadow seed mixes are appropriate and can easily be applied, given the total area to seed. Application rates vary by product.

Ontario Seed Company Limited (OSC Seeds)

https://www.oscseeds.com/product-category/native-seed/riparian-and-wet-meadow-seed-mixes/

- Early Succession Wet Meadow Native Seed Mixture 8170 (Sow at 500 g/180 m^2 or 25 kgs/ha)
- FACW Wetland Native Seed Mixture 8175 (Sow at 500 g/180 m^2 or 25 kgs/ha)
- Seasonally Flooded Native Seed Mixture 8240 (Sow at 500 g/180 m^2 or 25 kgs/ha)

DLF Pickseed

https://www.dlfpickseed.ca/eastern-canada

- Wet Native (Seeding Rate 20-25 kg/hectare, 18-22 lbs/acre, Spot Application 0.50 kg/100 m^2, 1.10 lbs/1000 ft^2)
- Marsh Wetland (Seeding Rate 17-25 kg/hectare, 15-22 lbs/acre, Spot Application 0.50 kg/100 m^2, 1.10 lbs/1000 ft^2)

Table 2. Recommended list of native trees and shrubs for restoration of filled area, Hanna Property, Baptiste Lake. All species thrive in local soils and require less water and fertilizer than ornamental plants.

Common Name	Botanical Name	Soils	Comments
Red Maple	*Acer rubrum*	Wide range	**A**, **R**, prefers moist lowlands.
Silver Maple	*Acer saccharinum*	Wide Range	**A**, **R**, prefers moist lowlands.
Tamarack	*Larix larcina*	Wide range	**R**, occurs in wet areas.
Eastern White Cedar	*Thuja occidentalis*	Wide range	**E, A, R**, prefers moist soils and lowlands, but drought tolerant and established.
White Spruce	*Picea glauca*	Wide range	**E, T, R**
Balsam Fir	*Abies balsamea*	Wide range	**E, R**, prefers acidic soils.
Trembling Aspen	*Populus tremuloides*	Wide range	**I**, tolerant of infertile soils.
Red-osier Dogwood	*Cornus stolonifera*	Wide range	**A, I**, **R**, moist old wetland edge species. High wildlife value. Showy flowers.
Grey Dogwood	*Cornus racemose*	Wide range	**A, I**, **R**, moist old wetland edge species. Showy flowers.
Silky Dogwood	*Cornus obliqua*	Wide range	**I**, **R**, prefers wetland edges; showy flowers.
Alternate-leaved Dogwood	*Cornus alternifolia*	Wide range	**A, T**, showy flowers.
Speckled Alder	*Alnus rugosa*	Poorly drained	**I, R**, wetland edges.
Missouri Willow	*Salix eriocephala*	Poorly drained	**I, R**, wetland edges.
Pussy Willow	*Salix discolor*	Poorly drained	**I, R**, wetland edges.
Slender Willow	*Salix petiolaris*	Poorly drained	**I, R**, wetland edges.
Highbush Cranberry	*Viburnum trilobum*	Poorly drained	**I, R**, wetland edges.
Winterberry	*Ilex verticillata*	Poorly drained	**I, R**, wetland edges.
Nannyberry	*Viburnum lentago*	Wide range	**A,** showy flowers.

Notes: The woody plants listed above are widely available; local native plant nurseries may be able to suggest additional suitable species. Nursery grown stock is recommended, although propagation is often possible using a variety of techniques (i.e., willow whips). Conifers are best obtained as small trees (plugs) from local forestry nurseries or within the subject property.

Legend:

E – Evergreen

T – Shade tolerant

R – Riparian species, flood tolerant

A – Commonly available at nurseries

I – Shade Intolerant

- Wetland Meadow (Seeding Rate 17-25 kg/hectare, 15-22 lbs/acre, Spot Application 0.50 kg/100 m^2, 1.10 lbs/1000 ft^2)

The restoration program will require the issuance of a Work Permit by the MNRF.

A 3.0 wide pathway would be the only use permitted in the restored woodland, to extend from the edge of the vehicular turning circle to the shoreline of Baptiste Lake where a dock would be permitted for boat mooring and other water-oriented recreational activities (**Figure 1**).

Given the above, I recommend that:

- **the filled area in the central part of the property be restored to a shrub/woodland landscape;**
- **the restoration be subject to the issuance of a Ministry of Natural Resources and Forestry Work Permit as the eastern part of the filled area is on the Province's Crown Reserve; and**
- **the only use within the rehabilitated shrub/woodland setting would be a 3.0 metre wide pathway to the shoreline of Baptiste Lake for docking and water-related recreational activities.**

Location of Sewage Disposal Bed: The specific rationale used to identify the types of constraints for locating a conventional tile field is as follows. First, the desirable site conditions according to the **Ontario Building Code OBC** are identified (**Tables 3** and **4**). Subsequently, individual site parameters (specific soil, slope, and site drainage characteristics) are evaluated in order to identify those which represent constraints to locating conventional tile field systems. The specific constraints occurring are then highlighted, and the development capabilities assessed based on the degree and extent of these constraints.

According to the **OBC**, sewage treatment systems require a minimum depth of 0.9 m between the bottom of the absorption trenches and the maximum elevation of impervious surfaces (bedrock) or groundwater. For the area selected for the disposal bed (**Figure 1**), manual auger holes indicate that the depth of soil to bedrock is less than the required amount for a conventional distribution bed. This means that a raised bed will need to be constructed, which will require the importation of fill. The fill can typically be scavenged from within the property; alternatively, off-site fill, for example from a nearby aggregate facility would be acceptable. Final design and comments from the approval authority will confirm specific fill requirements. The drain field located in the area shown in **Figure 1** may require the construction of a downgradient mantle; again, final design will confirm whether or not imported fill will be needed.

The **OBC** indicates that slopes exceeding 25% are unacceptable for a drain field; such slopes do not occur in the area proposed for the distribution bed, as the location proposed for the disposal bed is in a relatively flat area. Also, the regulations require a minimum setback of 15 m from the edge of a disposal bed to surface waters including tributaries. However, the **Municipal Zoning By-law** requires a setback of 30 m.

Table 3. Physical site suitabilities for the installation of conventional septic tank-tile field systems.

Site parameter	Site suitabilities
Soil conditions	Deep native soils having good internal drainage characteristics are most desirable as filter mediums, as they combine the qualities of relatively unimpeded flow while at the same time allowing adsorption of nutrients contained within the effluent. Very course textured soils are too permeable, and do not retain water sufficiently long to allow for adsorption, while dense, fine textured soils are too impermeable and impede flows within tile fields. Both soil types are unacceptable as filter mediums, and require importation of suitable fill to construct raised tile beds. Similarly, shallow but permeable soils over dense subsoils and/or bedrock require fill importation to provide a minimum elevation of 0.9 metres (m) between the bottoms of adsorption trenches and the impermeable surface, as required by Ontario regulations. Organic soils require excavation and replacement with suitable mineral soils.
Slope conditions	Flat, level sites are most desirable, requiring no special techniques for installation. Progressively steeper slopes pose increasingly greater problems necessitating the use of special installation techniques, or regrading where feasible. Tile fields cannot be installed on slopes greater than 25% according to Ontario regulations governing domestic waste systems.
Site drainage	Ontario regulations for domestic sewage systems indicate that the bottom of the distribution pipes of the tile field must be elevated a minimum of 0.90 m above the maximum ground water table. Consequently, well drained sites are desirable. Imperfectly to poorly drained sites necessitate fill importation to develop raised tile beds which provide the minimum elevation of 0.90 m, while sites subject to flooding hazard are unacceptable.
Setbacks from surface water and wells	The 1997 Ontario Building Code requires a minimum setback of 15 m from surface streams and wells

Note: Information in the above table was summarized from Section 8 and the Supplemental Guidelines of the 2006 **Ontario Building Code**.

Table 4. Site development capability/constraint attributes of individual physical characteristics.

Site characteristic	Capability/constraint attributes
Soil Conditions	
Gravel Very coarse sand	generally unsuitable as filter mediums for tile fields due to excessively rapid permeability; necessitates fill importation for raised tile beds
Sandy loams Loamy sands	well suited as filter mediums
Fine sandy loams Loams Silty loams	moderately well suited as filter mediums
Clay loams Moderately dense clays	poorly suited as filter mediums due to slow internal drainage characteristics; necessitate fill importation for partially to fully raised tile beds
Dense clays Bedrock	unsuitable as filter mediums; necessitate fill importation to develop fully raised beds and mantles
Slope class	
Level (0%-3%)	most desirable condition; high capability requiring no site modification
Low to moderate (4%-10%)	minor constraint, may require slight modification of tile field installation or grading
Moderately steep (9%-15%) to steep (11%-25%)	poorly suited for tile fields, necessitating special tile field installation methods and/or extensive regrading
Very steep (>25%)	unacceptable for installing tile fields without regrading or filling
Site drainage class	
Well drained	most desirable condition for tile beds, high capacity requiring no site modification
Moderately drained	moderately suited for tile beds; but may necessitate slight site modification through minimal fill importation
Poorly drained	poorly suited for tile beds, necessitating importation of moderate to high volumes of suitable fill material to develop required distance between adsorption trenches and maximum water table elevation
Very poorly drained	unsuitable without very high volumes of fill; unacceptable where sites are subject to flooding

Note: Information in the above table was summarized from Section 8 and the Supplemental Guidelines of the 2006 **Ontario Building Code**.

The latter is more than achievable for the drain field shown in **Figure 1**, it being approximately 40 m from the EP zone.

Based on the above, the types and degree of physical limitations do not preclude the installation of a sewage tile or filter bed on the existing lot of record. In this regard, it is recommended that:

- **the sewage disposal bed be located on relatively flat terrain, well back from the on-site tributary and shoreline of Baptiste Lake, as approximately shown in Figure 1, which is a Site Development Plan prepared by Greg Bishop Surveying and Consulting Ltd.;**
- **imported fill, or fill scavenged from within the subject lot of record be used to construct the raised drain field and mantle (if warranted), owing to relatively shallow, native soil depths;** and
- **the quantity of fill needed to construct the drain field and downgradient mantle (if warranted) be determined during final design, and in consultation with the Municipality of Hastings Highlands.**

Guidelines for Constructing a Boat Dock: Construction of a dock is feasible in the location shown in **Figure 1;** in this regard, it is recommended that:

- **the optimal location for constructing a dock is approximately shown in Figure 1, which is a Site Development Plan prepared by Greg Bishop Surveying and Consulting Ltd.**

Policies for the protection of fish habitat in Ontario are multi-jurisdictional, and sometimes conflicting between agencies. However, the ultimate goal is to ensure that nearshore important fish habitat is not diminished or destroyed by activities resulting from land use planning decisions. In Ontario, two agencies have primary responsibility for managing and protecting fish and fish habitat. One is the MNRF, through Section 2.1.5 of the 2014 Provincial Policy Statement (**PPS**) which states that, "development and site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements".

However, the ultimate authority for protecting fish habitat in Canada is the federal Department of Fisheries and Oceans (DFO) through administration of the *Fisheries Act*. As a result of amendments to the *Act* made in 2012, a number of important changes have been made on how the Department protects fish and fish habitat. Historically, habitat and deleterious substance provisions were used as primary protection for the environment. The old Section 35 habitat provisions prohibited the harmful alteration, disruption or destruction (HADD) of fish habitat, unless an authorization was issued. A HADD without an authorization was a punishable offence. The new Section 35 states, "No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery." The key changes are: the harm to fish now has to be a serious harm, not just any harm; and the fish that are harmed have to be part of a commercial, recreational or Aboriginal fishery, or that support such a fishery. Serious harm is defined as, " . . . the death of fish or any permanent

alteration to, or destruction of, fish habitat." This definition does not include a prohibition against the "disruption" of fish habitat (i.e., temporary alteration), as did the old version of subsection 35(1).

The DFO subsequently identified those types of projects where its review is **not** required for dock construction. In this regard, a review is **not** needed for new construction, repair or rebuild of a floating, cantilevered or post or pile supported dock where the total combined footprint on the lakebed is less than 20 square metres. Ms. Cramm will still be obligated to avoid causing serious harm to fish by implementing the appropriate best management measures that are set out in the DFO's two releases: **Projects Near Water;** and **Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk** (**Appendix B**). To reiterate, DFO's approach is essentially a self-assessment protocol. The construction window for docks is July 15th through March 31st; limiting in-water construction activities to this period protects spawning for warmwater fish species.

In addition, Ms. Cramm will need to register the project with the Bancroft office of the MNRF, regardless of type of dock or design. As well, if a crib-based dock is proposed that has a footprint on the bed of Baptiste Lake that is greater than 15 square metres, a work permit under the *Public Lands Act* will be required. There is no fee for a Land Use Permit; it is issued for a period of five years.

Given that construction and use of a boat dock is feasible, it is recommended that:

- **the types of docking structures that are most suitable from an environmental perspective are floating or cantilevered or post or pile supported or are constructed of cribs that have a footprint on the bed of Baptiste Lake that is less than 20 square metres;** and
- **the dock be constructed between July 15th and March 31st;** and
- **Ms. Cramm be made aware of:**
  - **his fish and fish habitat protection obligations under the *Fisheries Act;*** and
  - **the Department of Fisheries and Oceans self-assessment process and Projects Near Water and Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk (Appendix B), and the need to contact the Department should Ms. Cramm not wish to adhere to, or is uncertain whether his design is consistent with the Department's mitigation measures;** and
  - **docks having greater than 15 square metres in plan/shadow view must require occupational authority from the Ministry of Natural Resources and Forestry; the permission will be in the form of a Land Use Permit that will be in effect for a period of five years.**

IMPACT EVALUATION

Vegetation Removal and Wildlife Habitat

To implement the **Site Development Plan**, it will be necessary to cut and remove trees and understorey growth to facilitate the residence, accessory building and filter bed. Considering the small amount of

clearing needed in relation to the lot's area and virtually 100% forest cover external to and upgradient of the subject property (i.e., except for Forest View Road), the small loss in vegetation is not mitigable, nor warranted. The diminution in habitat is not considered an adverse impact on the attributes and functions of the forest cover, both within and external to the lot.

With the small diminishment in forest cover, there will likely be some reduction in nesting opportunities, breeding habitats, foraging areas, roosting sites and territories for birds and small mammals. It is also recognized that the tree clearing will result in an increase in edge habitat for those species that are already attracted to the area. Construction activities within the development footprints will result in temporary and long-term impacts including noise, and the introduction of new residential influences (e.g., lighting and typical outdoor activities). Clearly, it is not possible to develop and utilize the existing lot of record while at the same time have no impacts on the property's natural features and functions. In short, impacts on wildlife in an absolute sense (i.e., to the smallest degree possible) will be unavoidable. Those wildlife species that presently occur or have the potential to occur on site will in my opinion continue following construction and during occupation. In this regard, it is recommended that:

- **any tree removal in the area of residential development be undertaken outside the breeding period for birds, which extends from mid-April through to the end of September.**

Of importance is that the above tree cutting timing window not only accommodates the tree removal period for breeding birds under provisions of the federal *Migratory Birds Convention Act*; but, it also covers the hibernacula life cycle of species of bats that are listed as Endangered in the Province's SARO listing, and potentially could be using parts of the subject property. So by adhering to the above recommendation, any endangered species of bats that utilize the subject property will be protected, as they will be off-site.

Impacts From Treated Sewage – Nitrate Nitrogen Contamination

Contamination of groundwater by nitrate nitrogen (as $N0_3 - N$) is often a concern with respect to septic tank-tile field leachate. This parameter is normally two to seven times the Province's Drinking Water Objective of 10 mg/L in tile field effluent, and because it is not retained by absorption on soil particles, it can travel significant distances with the effluent plume. Contamination of shallow groundwater aquifers by nitrate nitrogen from septic leachate can be a concern; for example, drain fields can pollute groundwater when constructed too close to wells, or are not properly installed or maintained. The required separation distance between a tile field and well-head is 15 m.

A numerical limit has not been established by Ontario for nitrate nitrogen in surface waters, although it is recognized that elevated levels may contribute to nuisance vascular and aquatic plant growth; however, this parameter is rarely limiting to aquatic enrichment. As well, it is not toxic to fish at levels found in lakes and streams. Regardless of concentrations of nitrate nitrogen which would leave the proposed lots via drain field effluent plumes, the soils will effectively denitrify any nitrate nitrogen to nitrogen gas. This reaction occurs in natural settings which have a supply of biodegradable non-waste water organic carbon (i.e., the

muck soils and sediments), very low or oxygen-poor conditions in the soils and wetland sediments, and saturated or near-saturated conditions. These findings were verified in field studies by Robertson *et al* (1991), and Michael Michalski Associates and Site Investigation Services Limited (1992). Accordingly, there will be no contamination of the downgradient surface waters of the Hollow River from sewage-related nitrate nitrogen. If groundwater is the preferred source of domestic supply for the new landowners, the wells would in all probability be drilled many hundreds of feet into the bedrock before an acceptable supply is reached. This source, therefore, is well-separated from drain field plumes, which are typically above the bedrock and in shallow soil conditions. Accordingly, there is very little if any risk of true groundwater being contaminated by sewage-related nitrate nitrogen, and virtually zero risk if the wells are located upgradient of the drain fields.

Despite these comments, a quantitative impact analysis of nitrate nitrogen associated with the filter bed effluent on surface waters of Baptiste Lake is presented below for the existing lot of record, which as noted earlier has an area of 1.445 ha.

To meet the Province's Drinking Water Objective for nitrate nitrogen, the assumed tile bed effluent of 4.0 mg/L will need to be reduced to 10 mg/L. The following calculations show this to be feasible.

The Province's Drinking Water Objective at the shoreline of Baptiste Lake, the nitrate nitrogen concentration of leaching bed effluent will need to be diluted to 10 mg/L or less (as NO_3–N) by infiltrating water. In the calculations that follow for the existing lot of record, it is demonstrated that the concentration of groundwater nitrate nitrogen will be diluted on a sustained basis to meet this public health criterion, as follows.

- **Number of proposed residential lots:** 1

- **Total area of proposed development:** 1.4451 ha

- **Site characteristics:** topography – hilly
  : soil – silty clay with sand
  : forest

- **Projected nitrate loading**: Based on current MECP direction, it is assumed that the proposed household will generate on average about 1,000 litres/day (L/day) of domestic sewage having a concentration of nitrate nitrogen of 40 mg/L. The total projected nitrate nitrogen load is as follows.

  1 household x 1,000 L/day/household x 40 mg/L x 252 days (from Paterson et al 2006)

  = 10,080,000 mg/year

- **Available dilution water:** It is assumed that the only source of dilution water is infiltrating precipitation, which is calculated from:

  D(w) = A x W(s) x I(f), where

  D(w) = available dilution water (litres)

A = gross area of the proposed development (m^2)

W(s) = average annual water surplus, as determined from meteorological data from three weather stations (Haliburton A, Minden and West Guilford)(**Appendix C)**

If = infiltration factor being the sum of three factors for topography, soil type and vegetation cover, as determined from data (**Appendix C**).

D(w) = (1.445 ha x 10,000 m^2) x (549 mm/year x 1m/1,000 mm) x (0.10 + 0.4 + 0.20) x 1,000 L/m^3

= 5,553.135 L/year

- **Projected groundwater concentration of nitrate nitrogen**

$$NO_3 = \frac{\text{Projected nitrate loading (mg/year)}}{\text{Available dilution water (L/year)}}$$

$$= \frac{10{,}080{,}000 \text{ mg/year}}{5{,}553.135 \text{ L/year}}$$

= 1.81 mg/L

Based on available on-site dilution, the concentration of nitrate nitrogen in the shallow groundwater (i.e., sometimes referred to as interflow) is estimated to be 1.81 mg/L, which is less than the Province's Drinking Water Objective of 10 mg/L. The above calculation does not take into account the potential reduction of nitrate nitrogen by plant uptake, possible dilution from off-site interflow, and other biogeochemical processes. Accordingly, it is concluded that the existing lot of record when constructed and operational will have no sewage-related nitrate nitrogen negative impacts on either groundwater or surface water resources.

Impacts of Treated Sewage – Microbiological Contamination

Bacteria in water can be divided into two groups: indigenous microbial flora, and disease-carrying (pathogenic) microbes. The latter group has the capacity to infect the human body, and is most important in the context of water quality in recreational lakes.

Microbiological contamination of water has long been a concern to the public. Bacteria, specifically the coliform group, are used as an indicator for the potential presence or absence of pathogenic or disease-producing bacteria and other organisms. Some types of coliform bacteria (total coliforms) are naturally found in soil and in surface water. Total coliform exists in animal waste, soil and vegetation. In this connection, *Escherichia coli* (*E. coli*) or fecal coliforms are found exclusively in the intestinal tracts of warm-blooded animals. An abundance of fecal coliforms present in water typically indicates contamination

of excreta from warm-blooded animals, including humans, failing septic tank-tile field systems, runoff from livestock areas, or wildlife. Ingestion of fecal coliform may result in intestinal and upper respiratory illness.

According to the MECP's Provincial Water Quality Objectives (1994), levels of *E. coli* were established for application by local Medical Officers of Health to swimming and bathing beaches and were based on a recreational water quality guideline established by the Ontario Ministry of Health. The guideline is, ". . . based on a geometric mean of levels of *E. coli* determined from a minimum of five samples per site taken within a given swimming area and collected within a one month period. If the geometric mean *E. coli* level for the sample series at a given site exceeds 100 per 100 mL, the site should be considered unsuitable for swimming and bathing. *E. coli* was selected for the guideline because studies determined that, among bacteria of the coliform group, *E. coli* is the most suitable and specific indicator of fecal contamination."

Of interest here are the preliminary results of detailed work carried out under the auspices of the Lakeshore Capacity Study. This was a six year interministerial project to development predictive methods to permit scientific assessments of the capabilities of aquatic and terrestrial systems to sustain shoreline development. In reporting on findings of lakes in the Muskoka-Haliburton area, microbiologists confirmed that fecal coliform and streptococci bacteria, " . . .can be expected to occur more frequently and in higher numbers in samples collected from single tiered cottage shorelines than in samples secured from undeveloped waters. However, bacterial densities found on developed shorelines would not be expected to produce a significant public health hazard." (Ontario Ministries of the Environment, Housing and Natural Resources 1978).

If surface water is used as a source of supply, there are a variety of commercial treatments on the market to effectively diminish or remove bacteria, protozoa, and other organic and inorganic particulates and odours. On the other hand, should a drilled well be installed and used, subject lot is sufficiently large to ensure a minimum 15 m separation distance between its well head and filter bed, thereby minimizing any potential for cross-contamination, as required by the **OBC**.

Based on the above, and the proposed location for the sewage disposal bed, the risk of microbiological contamination on the on-site tributary, surface waters of Baptiste Lake, and/or groundwater is extremely low to zero.

Impacts of Treated Sewage – Phosphorus Contamination

Even though the location where the tile field/filter bed is proposed is well-removed from the on-site tributary and Baptiste Lake, it is informative to evaluate potential impacts of sewage-related phosphorus on Baptiste Lake, which is a MNRF and MECP designated lake trout lake. My analyses includes: a brief literature review on the ability of soils to retain phosphorus; a presentation of monitoring data from a tile field specifically constructed using B horizon Precambrian Shield soils to demonstrate their ability to retain phosphorus; and an estimate of the life span of soils found on the existing lot of record.

***Research of Scientific Literature*:** Research on existing and innovative small scale sewage treatment systems over the past 25+ years has greatly improved the knowledge base regarding the movement of

phosphorus from septic tank tile field systems, and particularly the ability of B horizon Precambrian Shield soils to negate this movement. For such soils, there is both a non-permanent adsorption process driven by soil hydraulics, as well as a permanent reaction resulting from precipitation by aluminum and iron. Regarding the latter, in acidic soils such as are common throughout Precambrian Shield cottage country (i.e., and which occur on the subject property), aluminum is the dominant ion that reacts with the phosphorus. The first products formed are amorphous (shapeless) aluminum and iron phosphates, which gradually change into compounds that resemble crystalline variscite (an aluminum phosphate compound) and stregnite (an iron phosphate compound). Each of these reactions will result in insoluble compounds of phosphate that are not available for plant growth; this means that the geochemical reactions are permanent and the phosphorus will not move in the soil.

Because of the importance of this matter, **Appendix D** was prepared. It summarizes the research on the movement of phosphorus from small scale sewage treatment systems (producing less than 10,000 L/day of sewage), and the ability of Precambrian Shield B horizon soils to negate the movement. Thirty publications are cited; most of those that relate to Ontario's Precambrian Shield country are from referenced journals, and all indicate that phosphorus is retained by soils. In virtually every case, the retention is substantial and permanent. The publication titled, "Limnology, plumbing and planning: Evaluation of nutrient-based limits to shoreline development in Precambrian Shield watersheds" constitutes a chapter in the **Handbook of Water Sensitive Planning and Design** (Lewis Publisher, CRC Press 2002); it is included in **Appendix E**. Its primary conclusion (which relies on long term data from lakes in the Muskoka River watershed) is that phosphorus in septic systems within 300 m of a lakeshore is mobile, cannot be substantiated scientifically, either on an empirical or mechanistic basis.

Of particular importance is the final two entries in **Appendix D**; the first summarizes phosphorus retention in a 20 year old septic system filter bed located in Precambrian Shield cottage country; its author is Dr. Will Robertson of the University of Waterloo; Dr. Robertson is the MECP's Scientific Advisor on matters relating to the mobility of sewage-related phosphorus and other contaminants in soils. The complete paper is included in **Appendix F**. The abstract in part reads as follows.

> "Septic systems in lakeshore environments often occur where thin soils overlie bedrock and, consequently, filter beds may be constructed of imported filter sand. The objective of this study was to assess the mobility of wastewater phosphorus in such a potentially vulnerable setting by examining a 20 year old domestic septic system located near Parry Sound . . . where the filter bed is constructed of imported non-calcareous sand. The groundwater plume is acidic (pH 6.0) and has a zone of elevated $P0_4$-P (up to 3.1± - 1.7 mg/L) below the tile lines, but no elevated $P0_4$-P is present beyond 5.0 m from the tile lines . . . the total mass of acid-extractable P (39 kg) is similar to the estimated total lifetime P loading to the system (33 kg). Microprobe images reveal abundant Fe and Al-rich mineral coatings on the sand grains that are increasingly P rich near the tile lines. Additionally, 6 years of monitoring data show that groundwater $P0_4$ concentrations are not increasing. This indicates that mineral precipitation, not adsorption, dominates P immobilization at this site. The example of robust long-term P retention opens up the possibility of improving P removal in on-site treatment systems by prescribing specific sand types for filter bed construction."

More recently, Dr. Robertson and his colleagues published "Review of Phosphorus Attenuation in Groundwater Plumes" (**Science of the Total Environment** 692 [2019] 640-652); the two key highlights are as follows.

- Phosphorus retention averaged 97% at sites located on non-calcareous sediments and 69% at sites where sediments were calcareous.

- Secondary mineral coatings containing phosphorus were present in most of the drainfield sediments, indicating that mineral precipitation was the likely cause of the phosphorus attenuation.

The publication's concluding implications are first, that there is a robust capacity for phosphorus removal in non-calcareous soils, and second, that the selective choice of sufficient imported materials offers the potential to provide excellent on-site wastewater treatment, including effective phosphorus removal, even under difficult site conditions. The final sentence of the paper's abstract has important management implications; in this regard, it states, "This challenges the necessity of avoiding septic system use in favour of commercial sewer systems, when limiting phosphorus loading to nearby watercourses is a principal of major concern." (**Appendix G**).

The research has also demonstrated that there are differences between phosphorus attenuation by soils in Precambrian settings (which typically are acidic and have low concentrations of calcium carbonate) and off-shield soils (which are basic and rich in calcium carbonate). To demonstrate, information is presented in **Table 5** from three scientific publications and two reports prepared by Dr. Robertson. Data from the three publications are summarized in **Appendix D**, while the two reports prepared for the MECP are included in **Appendix H**. There can be no ambiguity; the data in **Table 5**, clearly show that Precambrian Shield non-calcareous soils are more effective than calcareous soils in retaining sewage-related phosphorus.

***Monitoring of Branson Tile Field*:** As alluded to above, one of the most promising technologies that is emerging consists of the use of B horizon Precambrian Shield soils in constructing tile or filter beds. In this regard, the Branson matter is informative and important. As background, Mr. William Branson (now deceased) applied to the Land Division Committee, County of Haliburton, to sever a 3.5 ha parcel from about 24.3 ha which front on South Kushog Lake, a MNRF designated at-capacity lake trout lake, meaning no further lot creation. The proposed lot exceeded the then Township of Stanhope's minimum area and frontage requirements of 2,800 m^2 and 45 m respectively; in this regard, the lot has an area of 34,800 m^2 and a frontage of 110 m. The property is now owned by Mr. and Mrs. Michael Sanderson, who occupy it on an extended seasonal basis.

The single-lot application was appealed to the Ontario Municipal Board by the MNRF; the appeal was denied after an extended hearing. In permitting the application, the Board required ongoing monitoring of the tile field, which was to be constructed with B horizon Precambrian Shield soil because of its high capability to retain phosphorus through mineralization or precipitation with aluminum and iron. The monitoring commenced in 2003, after five years of extended seasonal use by the landowners. Five

Table 5. Phosphorus reduction capabilities in calcareous and non-calcareous soils reported by Dr. W.D. Robertson, Department of Earth Sciences, University of Waterloo, and author of this letter/report.

Publication	Calcareous	Non-calcareous	Phosphate phosphorus (mg/L)		% Reduction
			Effluent (N)	Plume (N)	
1998[1]	Cambridge		6.4 (21)	4.9 (26)	23.4
	Camp Henry		11.8 (1)	1.1 (9)	90.7
	Long Point[1]		6.2 (12)	2.8 (13)	54.8
	Long Point [2]		7.1 (1)	4.8 (1.6)	32.4
	Langton		8.2 (6)	1.3 (10)	84.1
		Delawana	1.2 (3)	0.3 (15)	75.0
		Harp Lake	8.9 (2)	0.03 (3)	99.7
		Lake Muskoka	12.1 (10)	0.05 (27)	99.6
2003[2]	Cambridge		6.3 (4)	4.8 (7)	23.8
		Lake Joseph	6.3 (1)	0.06 (13)	99.0
		Lake Muskoka	13.0 (5)	0.016 (8)	99.9
2005[3]		Lake Joseph	1.2 (1)	<0.02 (6)	98.3
		Lake Muskoka	13.5 (10)	<0.02 (7)	99.8[5]
		Killarney	6.5 (1)	<0.02 (10)	99.7
			9.8 (1)	<0.02 (9)	99.8
		Sturgeon Bay	5.3 (1)	<0.02 (3)	99.6
			6.7 (1)	0.78 (3)	88.4
2006[4]		Sturgeon Bay	8.9 (1)	0.06 (10)	99.3
This Letter/Report		South Kushog Lake	10.5 (26)	0.07 (126)	99.3

1 Robertson, W.D., S.L. Schiff, and C.J. Ptacek. 1998. Review of Phosphate Mobility and Persistence in 10 Septic System Plumes. **Ground Water**, 36: 1000-010.

2 Robertson, W.D. 2003. Enhanced Attenuation of Septic System Phosphate in Noncalcareous Sediments. **Ground Water**, 41: 48-56.

3 Robertson, W.D. 2005. 2004 Survey of Phosphorus Concentrations in Five Central Ontario Septic System Plumes. Report prepared for Ministry of the Environment. 7 pages plus table and figures.

4 Robertson, W.D. 2006. Phosphorus Distribution in a Septic System Plume on Thin Soil Terrain in Ontario Cottage Country. Report prepared for the Ministry of the Environment. 7 pages plus tables and figures.

5 Robertson, W.D. Percent reduction determined using effluent data (13.5 mg/L) from Muskoka site presented in Enhanced Attenuation of Septic System Phosphate in Noncalcareous Sediments. **Ground Water**, 41: 48-56.

permanent sampling wells were installed in the leaching bed when it was constructed, four in each of the corner areas, and one in the centre (**Figure 5**). The depth of the wells to bedrock ranged between 1.75 m and 2.0 m. As an objective, staff of the MECP determined prior to the monitoring commencing that phosphorus concentrations following treatment by the soils would need to be reduced by 90% relative to concentrations at the outlet of the septic tank (in the distribution box).

There are 26 sets of monitoring data collected between August 12, 2003 and September 23, 2016; the information is presented in **Table 6**. There are four critical results, as follows.

1. There is a very significant reduction in phosphorus, typically greater than 97%, and in 20 cases out of 26, greater than 99%.

2. The MECP's objective of 90% reduction was achieved for all samples.

3. There was no evidence after 14 years of use that the soils are running out of their capability to retain phosphorus.

4. The findings are consistent with the scientific results achieved by Dr. Will Robertson of the University of Waterloo in his evaluations of the mobility of sewage-related phosphorus in Precambrian Shield soils.

I have had discussions with Mr. Victor Castro, then Surface Water Group Leader, Technical Support Section, MECP relating to the clearance of conditions of approval at the South Kushog Lake property, insofar as the above monitoring results are concerned. On October 29, 2013, this gentleman forwarded a letter to Dawn Newhook, Municipal Clerk, Township of Algonquin Highlands, stating in part that, " . . . These results are very encouraging and are consistent with research findings from other similar studies on septic systems constructed with imported and native acidic soils on the Precambrian Shield. These studies have shown that while adsorption processes slow down the movement of phosphorus, mineralization processes can result in the immobilization and long term retention of phosphorus in the soils." (**Appendix I**). From the perspective of the current owners of the property, an important sentence is, " . . . the MOE would not object to the Township returning the financial security to the owner. We will recommend to Mr. Michalski that he continue to monitor the sewage system to provide a long term record of phosphorus retention at this site; however, this will be done in the context of research and does not need to be tied to the financial security."

There are a number of advantages with the B horizon soil technology. First, it relies on the natural attenuation of phosphorus using soils that are ubiquitous throughout Ontario's Precambrian Shield. Second, it is simple and passive; once in place, homeowners have only normal maintenance to worry about. Third, costs are only slightly higher than what is required for a typical or conventional tile field. Experience in the Muskoka/Haliburton area is that contractors tend to prefer scavenging soils from within a property, on the basis that soil specifications are satisfactory, and that an adequate supply is available. If not, imported soils from outside the lot are needed; these would need to be tested to confirm their capability to remove

Table 6. Sewage related phosphorus reduction at Branson/Sanderson site, South Kushog Lake. Values for raw sewage and the samples from each piezometer are shown as milligrams of phosphorus per litre.

Date	Raw	Piezometer Numbers					Average % Reduction
		1 (NE)	2 (NW)	3 (Centre)	4 (SW)	5 (SE)	
August 12, 2003	9.1	0.04	1.30	0.02	0.01	0.02	97.0
December 2, 2003	9.2	0.36	0.05	0.07	0.03	0.05	98.8
June 10, 2004	10.9	0.2	–	0.01	0.03	0.07	99.4
May 16, 2005	9.5	0.04	0.02	0.01	0.01	0.01	99.8
May 31, 2005	8.7	0.02	0.13	0.005	0.01	0.01	99.6
August 26, 2005	10.4	0.85	0.06	0.06	0.06	0.04	97.9
November 11, 2005	9.6	0.01	0.17	0.02	0.02	0.01	99.6
November 14, 2005	9.6	0.01	0.01	0.01	0.01	0.01	99.9
April 18, 2006	11.4	0.007	0.011	0.012	0.008	0.007	99.9
October 11, 2006	8.5	0.005	0.052	0.005	0.056	0.017	99.7
May 17, 2007	13.9	0.011	0.042	0.006	<0.005	<0.005	99.9
May 22, 2007	10.1	0.012	0.051	0.011	<0.005	0.008	99.8
September 6, 2007	22.8	0.043	0.114	0.450	0.263	0.026	99.4
October 4, 2007	7.9	0.059	–	–	0.107	0.023	99.3
October 10, 2007	8.03	0.020	0.023	–	0.005	0.005	99.9
April 28, 2008	9.14	0.013	0.030	–	0.011	0.006	99.9
May 22, 2008	9.53	0.012	0.051	0.011	<0.008	0.008	99.9
June 6, 2008	8.60	0.020	0.012	0.019	0.006	<0.005	99.9
July 10, 2008	7.90	<0.005	0.008	<0.005	<0.005	0.005	99.9
November 3, 2008	9.60	0.008	0.018	0.010	<0.005	0.009	99.8
August 15, 2009	10.2	0.009	0.006	0.011	0.013	<0.005	99.9
November 12, 2009	13.7	0.156	0.660	0.070	0.064	0.175	98.4
June 26, 2010	14.6	0.235	0.144	0.295	0.082	0.328	98.4
October 17, 2011	9.9	0.222	0.041	0.102	0.008	0.028	99.5
November 2, 2011	11.6	0.022	0.022	0.122	0.023	0.026	99.6

phosphorus from sewage. Fourth, no long term maintenance agreement with a provider is needed, as is the case with most **OBC**-approved tertiary treatment systems, nor are there ambiguities with respect to second and third landowners regarding the continuation of maintenance agreements; this is a long-standing concern with some approval agencies. Fifth, and most importantly, the phosphorus reduction capability is an added benefit with respect to what is typically provided by **OBC** approved treatment systems.

***Impacts of Treated Sewage – Mitigation of Sewage Related Phosphorus Loadings*:** A conventional Class 4 sewage treatment facility is required for the proposed lots to be approved. In this regard, the **OBC** requires the construction of a raised leaching bed or fill-based absorption trench leaching bed when the soil is insufficient for the construction of an in-ground bed. This occurs:

- when soils have a percolation time of more than 50 minutes/centimetre (min/cm) or less than 1 min/cm;
- in areas of a high groundwater table; or
- in areas where bedrock is close to the surface.

The following calculations regarding the life span of a tile field insofar as its ability to retain sewage-related phosphorus is concerned were undertaken using the phosphorus adsorption capacity measurement conducted on the soil sample collected from the WR zone in the existing lot of record. As described earlier, the native B horizon on-site soils which are orangy-brown in colour, have a high capability to retain phosphorus **through adsorption, which is not a permanent reaction, and mineralization with reactive iron and aluminum, which is a permanent reaction**; the results of the laboratory analyses are presented in **Table 1**. The life span of a disposal bed or filter bed was determined on the basis of extended seasonal occupancy for a typical four bedroom home discharging 1,000 litres per day (L/day) of sewage.

Volume of Disposal Bed: Typical surface dimensions for the filter bed contact zone are assumed to be 12 m by 10 m. Manual augering indicated the depth of the B horizon soil is 0.4 m; consequently, imported fill will be needed for constructing the drain field.

The following life span calculation of a disposal bed is to demonstrate the effectiveness and longevity of on-site 0.4 m of B horizon Precambrian Shield soils. In this regard, the total volume of native on-site soil available for phosphorus uptake is:

= 120 m^2 x 0.4 m

= 48 m^3

Assuming a soil bulk density of 1.7 grams/cubic centimetre (g/cm^3), or 1,700 kilograms/cubic metres (kg/m^3), the total mass of this soil is:

= 48 m^3 x 1,700 kg/m^3

= 8.16 x 10^4 kg.

Phosphorus Retention Capacity of Disposal Field: Based on a 24 hour phosphorus retention capacity estimate of 3,330 µg/g soil (or 3,330 mg phosphorus/kg soil) (see **Table 1**) for Proposed Lot 1, the total phosphorus adsorption capacity of the filter bed would be:

= 8.16 x 10^4 kg soil x 3,330 mg phosphorus/kg soil

= 2,717 kg phosphorus

Life Span of Disposal Field: To determine the life span of a leaching bed, two parameters are needed: a typical occupancy rate for extended seasonal residency and the amount of phosphorus contributed by each resident per year of use. Regarding the former, a value of 1.27 capita years/year/unit is used (Paterson et al. 2006). A value of 0.66 kg/capita year/year approximates the amount of phosphorus contributed per capita year/year of use (Paterson et al. 2006).

Accordingly, the life span of 0.50 m of native soils that will be incorporated into the filter bed is:

$$= \frac{2{,}717 \text{ kg phosphorus}}{1.27 \text{ capita years/year/unit} \times 0.66 \text{ kg/capita year/year}}$$

= 3,234 years

In considering this life span estimate, there are a number of points that require clarification.

First, and most importantly, phosphorus retention by any soils, other than those directly associated with the 0.4 m of on-site B horizon soil, was not taken into account, for example, between the tile bed and the on-site creek or Baptiste Lake.

Second, in the calculations, bulk density, depth of infiltration and even distribution of phosphorus within the effluent plume were assumed; some variation can be expected for these parameters.

Third, the phosphorus analysis and related calculations were based on adsorption alone; while the 3,234 year estimate is reasonable given the very high phosphorus adsorption ratio of 3,330 µg/g, it needs to be appreciated that the adsorption process is not a permanent reaction. However, there are very high quantities of reactive iron and aluminum in the on-site soils (**Table 1**); these chemicals, in various geochemical formulations, will be instrumental in irreversibly or permanently complexing phosphorus through geochemical mineralization. **As pointed out by Dr. Robertson in his paper "Phosphorus Reduction in a 20-year Old Septic System Filter Bed" (Appendix F), it is mineral precipitation with iron and aluminum that dominates phosphorus immobilization, not adsorption. Accordingly, any retention beyond adsorption or electrostatic binding will clearly reduce this risk of aquatic enrichment in the downstream tributary and/or Baptiste Lake.**

Fourth, given that the life span of a conventional tile field from hydrological and microbiological perspectives is estimated to be between 30 and 50 years, depending on use, level of maintenance and other biophysical factors, with the importation of appropriate fill having a high capability to retain phosphorus, the drain field will have a longer life expectancy from a phosphorus attenuation perspective, than from hydrological and bacterial considerations. Because the filter bed is going to be upgraded or rejuvenated as a maintenance requirement long before it will run out of ability to retain phosphorus, it will have zero to near-zero impacts on phosphorus loadings to and concentrations in the downgradient surface waters of Baptiste Lake.

To summarize, existing on-site B horizon soils have a very high capability to retain sewage-related phosphorus, both through processes of adsorption and mineralization with reactive iron and aluminum. For the subject property, the soils have an almost unlimited capability insofar as an operational time frame is concerned (i.e., greater than 3,000 years). Accordingly, I am convinced that the sewage treatment system will have zero to near-zero impacts on phosphorus loadings to and concentrations in the on-site tributary and downgradient surface waters of Baptiste Lake.

Impacts of Contaminants from Stormwater Runoff

New development can change the way the earth receives water, by introducing hard surfaces such as driveways, parking areas and roofs. This increase in imperviousness reduces the amount of rain and snow that can infiltrate into the soil. As rainwater or snowmelt runs from a roof or parking area, it picks up natural debris and sediment, as well as various pollutants that may have been introduced by development including pesticides, phosphorus, bacteria and oils, and can transport them as far as the lakes. As well, the flows from hard surfaces are more sudden, increasing erosion and resulting in loose soil and exposed tree roots. In this circumstance, there is one measure that can control contaminants from the development footprint, infiltration trenches (commonly referred to as French drains or soakaway pits). French drains or soakaway pits can also decrease impacts on downgradient surface waters to the Hollow River. French drains are shallow excavations lined with filter fabric and filled with crushed stone to create underground reservoirs for stormwater runoff. The runoff gradually percolates through the drains and into the surrounding soil. Not only do french drains reduce the volume of overland runoff, they are able to remove suspended solids and phosphorus, and can provide groundwater recharge, although in Precambrian Shield cottage country, recharge is not as effective as in off-Shield areas. Accordingly, it is recommended that:

- **french drains or soakaway pits should be used for treating stormwater runoff from roof tops, as a method of decreasing any potential phosphorus and other contaminant loading to the on-site tributary and downgradient Baptiste Lake.**

Erosion Control and Protection of Vegetation

Even though construction will be well-upgradient from the on-site tributary and Baptiste Lake, measures should be employed to ensure that the possibility of sediment-laden runoff is contained. During the period of land clearing, grading and construction, it is recommended that:

- **sediment and erosion control works in the form of siltation fences be installed downgradient from the home construction site (see Appendix J from Living in Cottage Country – What You Need To Know [Muskoka Watershed Council]); and**

- **the sediment and erosion control measures be maintained in good working order throughout the construction period, and until the exposed soils have been fully stabilized or otherwise greened up.**

COMPLIANCE OF REVISED ZONING MAP FOR SUBJECT PROPERTY WITH SECTIONS 5.9.2 AND 5.9.4 OF MUNICIPALITY OF HASTINGS HIGHLANDS COMPREHENSIVE MUNICIPAL ZONING BY-LAW

With respect to compliance with Section 5.9.2 of the **Municipal Zoning By-law** the following is provided.

i) Subsection 5.9.2 i. of the **Municipal Zoning By-law** states that, "no building, structure, or septic tank installation including the weeping tile field (no development) shall be located within 30 metres (98.4 ft) of the high water mark of a waterbody or permanent watercourse, notwithstanding that such a body of water or watercourse is not shown on any schedule forming part of this By-law."

Response: The **Municipal Zoning By-law** states that no buildings, structures or septic tank treatment systems shall be located within 30 m of the high water mark of a waterbody or permanent watercourse. As indicated in **Figure 1**, the residence is between 15 m and 30 m of the on-site stream; the accessory building and filter/tile bed are both greater than 40 m from the feature. The key point here is whether or not the on-site stream is permanently or intermittently flowing. As explained earlier, I am of the opinion based on an on-site investigation on August 7, 2018, that the creek does not flow permanently. It is a warmwater, intermittent, non-fish bearing tributary. Because it is not a permanently flowing tributary, subsection 5.9.2 i) of the **Municipal Zoning By-law** does not apply.

ii) Notwithstanding i) above, where it is proposed that a septic sewage disposal system is to be installed on private property between 15 m (49.2 ft) and 30 m (98.4 ft), a requirement for a minor variance to this By-law shall be waived.

Response: The filter bed is to be located greater than 40 m from the Environmental Protection Zone as well as the centre line of the creek; accordingly, there is no requirement for a minor variance.

iii) Notwithstanding i) above, where it is proposed that a septic sewage disposal system is to be installed on private property within 15 m (49.2 ft) of the top-of-bank, a requirement for a minor variance to this By-law shall be waived.

Response: On the subject property, there is no recognized top-of-bank; however, as mentioned earlier, the top-of-bank on the southern side of the creek was surveyed/ground-truthed using GPS technology on

August 7, 2018. The filter bed will be located upgradient of the 30 m setback from the top-of-bank and even further from the centre line of the intermittently flowing creek, again showing compliance.

iv) Notwithstanding i) above, where it is proposed that a septic sewage disposal system is to be installed on private property within 30 m (98.4 ft) of an Environmental Protection Wetland Zone, a requirement for a minor variance to this By-law shall be waived.

Response: Provincially Significant Wetlands (PSW) within the Municipality of Hasting Highlands are identified as Environmental Protection Wetland Zones. The EP zone shown on the Municipal Zoning Map represents as unevaluated wetland, which is not the same as a PSW (i.e., Schedule A North – Hastings Highlands Official Plan [2017]). It is my opinion that subsection 5.9.2 iv) is not applicable. Nonetheless, the sewage disposal bed is greater than 30 m from the centre line of the subject creek, which constitutes the edge of the EP zone.

Section 5.9.4 of the **Municipal Zoning By-law** states that development that is proposed on lands adjacent to Environmentally Sensitive Lands shall be permitted provided that a satisfactorily completed Environmental Impact Statement, prepared in accordance with Section 3.2.8 of the Official Plan is submitted and approved by the municipality in consultation with the Ministry of Natural Resources and Forestry (MNRF), the Conservation Authority, and the Health Unit. The following measures of adjacency shall be used:

Fish Habitat	30 metres (98.4 ft).
Significant Woodlands	50 metres (164.0 ft)
Significant Valleylands	50 metres (164.0 ft)
Significant Wildlife Habitat	50 metres (164.0 ft)
including habitat of Endangered/Threatened Species	
Areas of Natural and scientific Interest	50 metres (164.0 ft)

Response: The on-site tributary is an intermittently flowing warmwater system. It is not fish bearing; but constitutes fish habitat by way of flow conveyance to Baptiste Lake. With the exception of the primary residence, all aspects of the proposed development are greater than 30 m from the creek.

While most of the upland part of the subject property is woodland, as is the surrounding area, it has not been designated as significant woodland, in the context of the 2014 **Provincial Policy Statement** (**PPS**). Similarly, there are no recognized significant valleylands, or areas of natural and scientific interest on the subject property or on adjacent lands.

With respect to Endangered or Threatened species, I reviewed the Natural Heritage Information Centre's tracking square 17QK3299, within which the subject property is located. Two species are listed for the square: *Potamogeton ogendenii* which is an aquatic plant that is Endangered on the Species at Risk in Ontario (SARO) List; and snapping turtle (*Chelydra serpentia*) which is a species of Special Concern. Both

species would be confined to the adjacent wetland, although snapping turtles are often found in upland areas. Regarding the latter, pregnant females are most often encountered on land, searching for suitable soil in which to dig nests and lay eggs. Accordingly, it would not be surprising to encounter snapping turtles from time to time on upland parts of the subject property, just as this occurs elsewhere in Ontario's Precambrian Shield cottage country.

During the August 7, 2018 site visit, two bird species were encountered that are Special Concern. In this regard, a wood thrush (*Hylocichla mustelina*) was observed foraging on the ground from Forest View Road in the northwestern part of the property. The other bird species is eastern wood pe-wee (*Contopus virens*); it was heard calling in the forest canopy west of Forest View Road. In my opinion, the proposed residential development and related daily on-site activities will not have a negative impact on these species; they have already adapted to typical impacts associated with nearby cottaging (i.e., traffic, noise and lighting), as undoubtedly occurs elsewhere.

Earlier I recommended a timing window for cutting and removing trees from the area of development. Based on the August 7, 2018 field investigation, there is potential habitat on the property for at least two species of bats that are Endangered. They are the little brown bat and the northern long-eared bat. Their Endangered status is in response to declines (i.e., >50% loss) in populations across the Canadian range. Within Ontario, these species have exhibited dramatic declines, with nearly all known winter populations experiencing reductions of up to 94% within one generation (Committee on the Status of Endangered Wildlife in Canada 2013). The declines are primarily a result of a fungal pathogen commonly referred to as White-nose Syndrome. The fungus grows on bats skins, damaging muscle, connective tissue, blood vessels, hair follicles and sweat glands (Meteyer *et al* 2009). It is not conclusive how the Syndrome actually causes mortality. It is thought that dehydration resulting from the fungal growth causes bats to awaken from torpor, leading to increased activities and depletion of fat reserves. In turn, this causes individual bats to attempt to forage for water and insects during the winter months. So, the high rates of mortality are thought to be caused from a combination of dehydration, starvation and exposure. During the summer, the above-mentioned species are often found roosting in trees. When I visited the property on August 7, 2018, I did not survey the forest communities from the perspective of bat habitat (i.e., the quality and quantity of bat snags per hectare). Instead of undertaking such surveys, the MECP which is now responsible for administering the *2007 Endangered Species Act* recognizes the earlier recommended timing window for tree cutting and clearing. If these activities are confined to the period between September 30th and April 15th, there will be no impacts on bat habitat; in effect, this period avoids their active season. As noted earlier, this timing window also accommodates the tree removal period for breeding birds. The latter relates to provisions of the federal *Migratory Birds Convention Act*, and would encompass all species having potential habitat on the property. Accordingly, I am convinced that the **Site Development Plan** complies with all measures of adjacency set out in Section 5.9.4 of the **Municipal Zoning By-law**.

Two types of candidate Significant Wildlife Habitat (SWH) have potential for the subject property, or its adjacent lands: habits of Special Concern and rare wildlife species; and amphibian breeding habitat (i.e., the unevaluated wetlands both within and external to the landholding). The wetlands constitute habitat for

snapping turtles; given implementation of the recommendations set out in this **SEIS**, it is highly unlikely they will be disturbed or otherwise altered during construction and subsequent use. The presence of Special Concern breeding birds (i.e., wood thrush and eastern wood pe-wee) occurs in the extensive woodland tract including the existing lot of record. By limiting tree removal to footprints of development (i.e., the residence, and tile field area), and to the September 30th to April 15th window, any impacts on such species will be negligible. In my opinion, any impacts on candidate SWHs and species in this circumstance need to be considered in a landscape context. Yes, there will be a diminishment in a very small area of forest habitat, and yes, indirect impacts (i.e., increased lighting and noise) are certain to occur. However, when considered not only in the context of the subject property, but the extensive adjacent lands which are wilderness in character, impacts on candidate SWH will be virtually non-detectable.

CONCLUSIONS AND RECOMMENDATIONS

1. This **EIS** relates to the **Site Development Plan** (**Figure 1**) of an existing lot of record owned by Stephanie Cramm; the subject property has 70± m of frontage on Baptiste Lake and is 1.445 ha in area.

2. The legal description is Part of Lots 30 and 31, Concession 8, and Part of the Road Allowance between Lots 30 and 31, Concession 8, Geographic Township of Herschel, Municipality of Hasting Highlands, County of Hastings.

3. A driveway from Forest View Road has been constructed to access the central part of the lot; it terminates in a loop road about mid-way into the property. Thereafter, a substantial part of the landholding has been cleared of vegetation (i.e., both upland ;and wetland species), and subsequently filled. The filling extends about 10 m into the Province's Crown Reserve (**Figure 1**). A creek cuts diagonally through the property from its northwestern corner, discharging into a swamp forest wetland at the site's southeastern lot line. The watercourse is culverted under the looped part of the access laneway (**Figure 1**).

4. The Municipality's **Municipal Zoning By-law** shows an EP area covering the northern two-thirds of the property, reflecting the presence of the creek and unevaluated wetlands; the balance of the property is zoned WR (**Figure 3**). Given that building structures and related **Municipal Zoning By-law** setbacks from the EP lands cannot be accommodated within the filled lands, and that sufficient developable area is not available within the existing WR zone, it became critical to confirm whether the WR lands could be increased in area by confirming the precise location of the on-site creek, and its biophysical features.

5. On August 7, 2018, the subject property was visited by Greg Bishop, O.L.S., P. Eng., then with Greg Bishop Surveying and Consulting Ltd. and me, to:

    - confirm/ground-truth the centre line of the creek;

- evaluate terrain conditions in the southern part of the property (i.e., WR zone) to support a sewage treatment system, with emphasis on soil conditions;
- provide recommendations on the eventual disposition of the filled lands; and
- obtain incidental information on wildlife attributes of the property.

6. Based on field observations, the creek is a warmwater, intermittently flowing tributary; it does not flow permanently, nor is it fish bearing. However, it provides a fish habitat flow conveyance function to downstream Baptiste Lake, which is fish bearing. The field work resulted in a refinement of the boundary separating the EP and WR zones (**Figure 4**), with the effect being a somewhat larger area of developable land than is shown on the existing **Municipal Zoning By-law** Plate. The implications are that a residence, ancillary building and sewage treatment system can be physically accommodated in a modestly expanded WR zone, while at the same time complying with relevant **Municipal Zoning By-law** setbacks.

7. Terrain conditions being relatively flat in the WR zone are generally suitable for supporting a conventional septic tank tile field or filter bed. However, soils are relatively thin, and will require the importation of fill. Of substantial benefit is that B horizon layer has very high capabilities to remove sewage-related phosphorus for virtually an unlimited time period (i.e., in the thousands of years), owing both to adsorption and mineralization processes, the latter of which occurs in non-calcareous soils that are present in the WR zone.

8. While acknowledging that the area of filling is small (i.e., approximately 1,250 m^2), it nonetheless can be restored to a woodland landscape, by planting with tree and shrub species that are native to the area. The provision of wildlife habitat would be an obvious resulting value added benefit, particularly for birds such as red-winged blackbirds, common yellow throat warbler, and various species of sparrows, wrens, herons and waterfowl. A 3.0 m wide pathway would be the only use permitted in the restored woodland, to extend from the edge of the vehicular turning circle to the shoreline of Baptiste Lake, where a dock would be permitted for boat mooring and other water oriented recreational activities.

9. Subsection 5.9.2 i) of the **Municipal Zoning By-law** states that, " . . . no building, structure, or septic tank installation including the weeping tile field (no development) shall be located within 30 metres (98.4 ft) of the high water mark of a waterbody or permanent watercourse, notwithstanding that such a body of water or watercourse is not shown on any schedule forming part of this By-law". The **Site Development Plan** shows that the proposed dwelling is upgradient of the 15 m setback, while the accessory building and the sewage treatment drain field are well above the 30 m setback. As indicated earlier, the on-site creek does not flow permanently. It is an intermittent non-fish bearing watercourse. Because it is not permanently flowing, subsection 5.9.2 i) of the **Municipal Zoning By-law** does not apply insofar as locating the residential building a minimum of 30 m from the EP zone.

10. The **Site Development Plan** was evaluated from the perspective of measures of adjacency to a number of natural heritage features including: Fish Habitat; Significant Woodlands; Significant Valleylands; Significant Wildlife Habitat; Habitat of Endangered and Threatened Species; and Areas of Natural and Scientific Interest. In my opinion, the **Site Development Plan** complies with all measures of adjacency set out in Section 5.9.4 of the **Municipal Zoning By-law**.

11. A suite of measures to mitigate potential negative impacts is recommended, with particular emphasis on protecting attributes and functions of the EP Zone and Baptiste Lake. These are as follows.

- **The Municipal Zoning Map for the subject property be revised with respect to the line separating Waterfront Residential and Environmental Protection Zones, as shown in Figure 4, prepared by Greg Bishop Surveying and Consulting Ltd.**
- **The filled area in the central part of the property be restored to a shrub/woodland landscape.**
- **The restoration be subject to the issuance of a Ministry of Natural Resources and Forestry Work Permit as the eastern part of the filled area is on the Province's Crown Reserve.**
- **The only use within the rehabilitated shrub/woodland setting would be a 3.0 metre wide pathway to the shoreline of Baptiste Lake for docking and water-related recreational activities.**
- **The sewage disposal bed be located on relatively flat terrain, well back from the on-site tributary and shoreline of Baptiste Lake, as approximately shown in Figure 1, which is a Site Development Plan prepared by Greg Bishop Surveying and Consulting Ltd.**
- **Imported fill, or fill scavenged from within the subject lot of record be used to construct the raised drain field and mantle (if warranted), owing to relatively shallow, native soil depths.**
- **The quantity of fill needed to construct the drain field and downgradient mantle (if warranted) be determined during final design, and in consultation with the Municipality of Hastings Highlands.**
- **The optimal location for constructing a dock is approximately shown in Figure 1, which is a Site Development Plan prepared by Greg Bishop Surveying and Consulting Ltd.**
- **The types of docking structures that are most suitable from an environmental perspective are floating or cantilevered or post or pile supported or are constructed of cribs that have a footprint on the bed of Baptiste Lake that is less than 15 square metres.**
- **The dock be constructed between July 15th and March 31st.**
- **Ms. Cramm be made aware of:**
  - **his fish and fish habitat protection obligations under the *Fisheries Act;*** and
  - **the Department of Fisheries and Oceans self-assessment process and Projects Near Water and Measures to Avoid Causing Harm to Fish and Fish Habitat**

Including Aquatic Species at Risk (Appendix B), and the need to contact the Department should Ms. Cramm not wish to adhere to, or is uncertain whether his design is consistent with the Department's mitigation measures; and

- **docks having greater than 15 square metres in plan/shadow view must require occupational authority from the Ministry of Natural Resources and Forestry; the permission will be in the form of a Land Use Permit that will be in effect for a period of five years.**

- **Any tree removal in the area of residential development be undertaken outside the breeding period for birds, which extends from mid-April through to the end of September.**
- **French drains or soakaway pits should be used for treating stormwater runoff from roof tops, as a method of decreasing any potential phosphorus and other contaminant loading to the on-site tributary and downgradient Baptiste Lake.**
- **Sediment and erosion control works in the form of siltation fences be installed downgradient from the home construction site (see Appendix J from Living in Cottage Country – What You Need To Know [Muskoka Watershed Council]).**
- **The sediment and erosion control measures be maintained in good working order throughout the construction period, and until the exposed soils have been fully stabilized or otherwise greened up.**

Given the above, I recommend that the revised re-zoning shown in **Figure 4** be approved, subject to implementing the above recommendations through a Site Plan Control Agreement between the Municipality of Hastings Highlands and Stephanie Cramm.

* * * * *

Should you have any questions, or if further clarification is needed with respect to the above-enclosed, do not hesitate to call or email.

Yours truly,

MICHALSKI NIELSEN ASSOCIATES LIMITED
Per:

Michael Michalski

MM/be

c.c.: Stephanie Cramm

APPENDIX A – SOIL CHEMISTRY AND PERCOLATION RESULTS – HANNA PROPERTY

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: C13037 **REPORT No. B18-28787**

Report To:

Michalski Nielsen Associates
16 Robert Boyer Lane,
Bracebridge Ontario P1L 1R9 Canada
Attention: Michael Michalski

Caduceon Environmental Laboratories
110 West Beaver Creek Rd Unit 14
Richmond Hill ON L4B 1J9
Tel: 289-475-5442
Fax: 289-562-1963

DATE RECEIVED: 20-Sep-18
DATE REPORTED: 02-Oct-18
SAMPLE MATRIX: Soil

JOB/PROJECT NO.: Baptiste Lake
P.O. NUMBER: 3218
WATERWORKS NO.

			Client I.D.		# 1			
			Sample I.D.		B18-28787-1			
			Date Collected		18-Sep-18			
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
TIC	%	0.005	Subcontract	27-Sep-18	0.015 [1]			
P-retention 24hrs	µg/g	10	IN HOUSE	02-Oct-18/R	3330			
Aluminum (Extractable)	µg/g	20	84-011	28-Sep-18/R	10400			
Iron (Extractable)	µg/g	20	84-011	28-Sep-18/R	15800			
Aluminum	µg/g	5	EPA 6010	28-Sep-18/O	15200			
Iron	µg/g	5	EPA 6010	28-Sep-18/O	29300			

1 . Subcontracted to SGS Lakefield

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Grain Size Distribution Chart

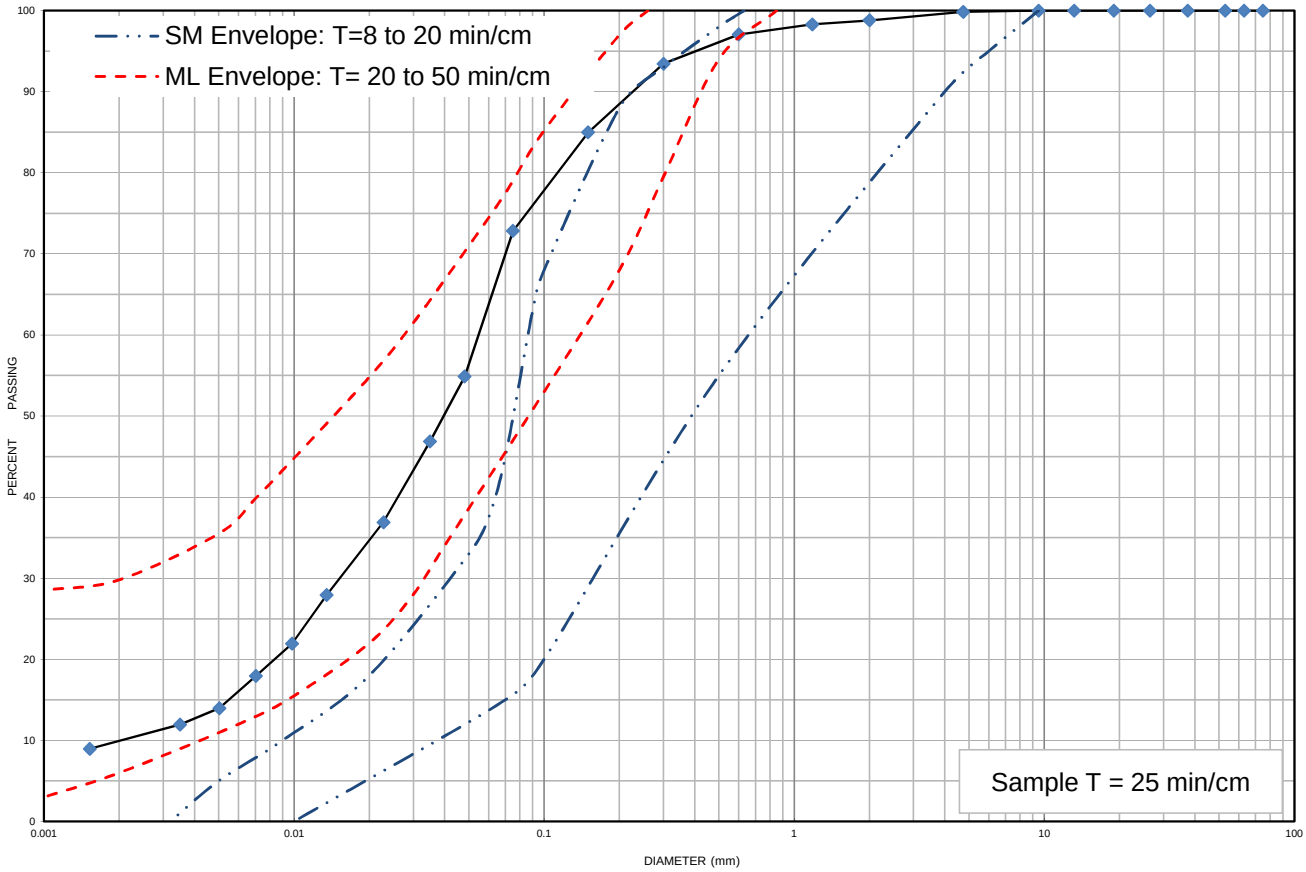
Project Number: *5305-001* **Client:** *Caduceon Environmental Laboratories*

Project Name: *Caduceon Environmental Laboratories*

Sample Date: *N/A* **Sampled By:** *Client* **Client Project No.:** *B18-28787*

Caduceon Sample No.: *#1 - 28787 - 1* **Depth:** **Lab Sample No:** *S-18-0951*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Caduceon Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
B18-28782		0	27	73		42.5

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt trace Clay	ML	0.055	0.016	0.0022	25.00	2.12

Issued By: _____ *Date Issued:* *October 1, 2018*

(Senior Project Manager)

Cambium Inc. (Laboratory)

866.217.7900 | cambium-inc.com

701 The Queensway | Units 5-6 | Peterborough | ON | K9J 7J6

APPENDIX B – DEPARTMENT OF FISHERIES AND OCEANS INFORMATION SHEETS: PROJECTS NEAR WATER, AND MEASURES TO AVOID CAUSING HARM TO FISH AND FISH HABITAT INCLUDING AUATIC SPECIES AT RISK

APPENDIX C – INPUT DATA FOR NITRATE NITROGEN IMPACT ON GROUNDWATER – INFORMATION PRVIDED BY PAUL WILSON, O.L.S., P.ENG., PAUL WILSON CONSULTING LTD.

APPENDIX III – REVIEW OF TECHNICAL MATERIAL RELATING TO PHOSPHORUS UPTAKE CAPABILITIES OF B HORIZON PRECAMBRIAN SHIELD SOILS

APPENDIX E– LIMNOLOGY, PLUMBING AND PLANNING: EVALUATION OF NUTRIENT-BASED LIMITS TO SHORELINE DEVELOPMENT IN PRECAMBRIAN SHIELD WATERSHEDS. DR. NEIL HUTCHINSON. IN: HANDBOOK OF WATER SENSITIVE PLANNING AND DESIGN (LEWIS PUBLISHERS, CRC PRESS 2002)

APPENDIX F – PHOSPHORUS RETENTION IN A 20-YEAR-OLD SEPTIC SYSTEM FILTER BED

APPENDIX G – REVIEW OF PHOSPHORUS ATTENUATION IN GROUNDWATER PLUMES FROM 24 SEPTIC SYSTEMS

APPENDIX H – **2004 SURVEY OF PHOSPHORUS CONCENTRATIONS IN FIVE CENTRAL ONTARIO SEPTIC SYSTEM PLUMES (2005), AND, PHOSPHORUS DISTRIBUTION IN A SEPTIC SYSTEM PLUME ON THIN SOIL TERRAIN IN ONTARIO COTTAGE COUNTRY (2006), PREPARED BY DR. ROBERTSON, DEPARTMENT OF EARTH SCIENCES, UNIVERSITY OF WATERLOO**

APPENDIX I – LETTER, CASTRO TO NEWHOOK OCTOBER 29, 2013

APPENDIX J – EXCERPT FROM MUSKOKA COUNCIL'S LIVING IN COTTAGE COUNTRY – WHAT YOU NEED TO KNOW (PAGES 40 – 41). PROPER INSTALLATION AND MAINTENANCE OF SILT FENCING