TOWN OF CALEDON
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BEACON ENVIRONMENTAL

GUIDING SOLUTIONS IN THE NATURAL ENVIRONMENT

12434 Dixie Road Geomorphic Assessment

Humber River Watershed

Town of Caledon, Regional Municipality of Peel

Prepared For:

Nishan Transport Inc.

Prepared By:

Beacon Environmental Limited

Date:	*Project:*
April 2021	**220196**

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1. Introduction

Beacon Environmental Limited (Beacon) has been retained by Nishan Transport Inc. to undertake a geomorphic assessment for the lands located at 12434 Dixie Road in the Town of Caledon, Regional Municipality of Peel (hereto referred as the "subject property"; **Figure 1**). The subject property, which is located within the jurisdiction of the Toronto and Region Conservation Authority (TRCA), is a rectangular parcel of land with an approximate area of 10.7 ha located on the west side of Dixie Road, north of Regional Road 14 (Mayfield Road).

Presently, land use within the subject property consists of agricultural fields with a residence, barn, and associated outbuildings. The remainder of the subject property is being used for agricultural purposes. A tributary associated with the West Humber River, known as Kilmanagh Creek, traverses the north-east corner of the subject property. It is understood that development opportunities are being considered for the subject property.

It is our understanding that the reach of Kilmanagh Creek within the subject property is classified as Redside Dace (*Clinostomus elongatus*) occupied habitat by the Ministry of Conservation, Environment and Parks (MECP). Under Ontario Regulation 242/08 of the *Endangered Species Act* (ESA 2007), the definition of regulated habitat includes the meander belt width, plus vegetated areas or agricultural lands within 30 metres of the meander belt.

The purpose of this geomorphic assessment was to inform the determination of environmental constraint limits in relation to the subject property through delineation of the meander belt and Redside Dace regulated habitat limits (referencing 30 m from the meander belt). Specifically, the following tasks were undertaken in support of the study:

- Background review of available materials (topographic mapping, recent and historic aerial photography, watershed reports);
- Desktop assessment to delineate reaches based on underlying geomorphic controls;
- Historic assessment to determine trends in channel planform and land use;
- A field assessment to characterize existing geomorphic conditions and document evidence of active channel processes;
- Following applicable policies and guidelines, delineate the meander belt width on a reach basis, referencing recent aerial imagery and historic trends in channel planform (where feasible); and
- In accordance with Ontario Regulation 242/08, delineate the limit of Redside Dace regulated habitat referencing 30 m from the meander belt.

2. Policy Context

2.1 *Endangered Species Act* (2007)

The ESA (2007) came into effect on June 30, 2008, with over 200 species in Ontario identified as extirpated, endangered, threatened, or of special concern. The MECP provides oversight of the ESA for the regulation of Species at Risk (SAR) in Ontario. Under the ESA, native species that are in danger

of becoming extinct or extirpated from the province are identified as being extirpated, endangered, threatened and special concern. These designations are defined as follows:

- Extirpated - a species that no longer exists in the wild in Ontario but still occurs elsewhere;
- Endangered – a species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's *Endangered Species Act;*
- Threatened - a species that is at risk of becoming endangered in Ontario if limiting factors are not reversed; and
- Special Concern (formerly Vulnerable) - a species with characteristics that make it sensitive to human activities or natural events.

Under the ESA, protection is provided to threatened or endangered species and their habitat, as well as providing stewardship and recovery strategies for species. Permitting is required to conduct works within habitat regulated for threatened or endangered species.

2.2 Provincial Policy Statement (2020)

The Provincial Policy Statement (Ministry of Municipal Affairs and Housing 2020) issued under the *Planning Act* (1990) outlines areas of provincial interest with respect to natural hazards. In support of the Policy Statement, a Technical Guide - Rivers and Streams: Erosion Hazard Limit document was prepared by MNR (2002) to outline standardized procedures for the delineation and management of riverine erosion hazards in the Province of Ontario. The guide presents erosion hazard protocols based on two generalized landform systems through which watercourses flow: confined and unconfined valley systems. Through this approach, the meander belt width plus an erosion access allowance is defined to determine the erosion hazard limit of an unconfined valley system. For confined valley systems, the erosion hazard limit is governed by geotechnical considerations, including the stable slope allowance and an applicable toe erosion allowance (i.e., channel migration component).

2.3 The Greenbelt Plan (2017)

The *Greenbelt Plan* (OMMAH 2017) identifies Protected Countryside lands within the Greenbelt Plan Area, which is made up of Agricultural System and a Natural System, with a series of settlement areas. The Agricultural System has two components, the agricultural land base and rural lands. The Natural System identifies lands that support both natural heritage and hydrologic features and functions. The *Greenbelt Plan* identifies Protected Countryside and Natural Heritage System within the western portion of the subject property.

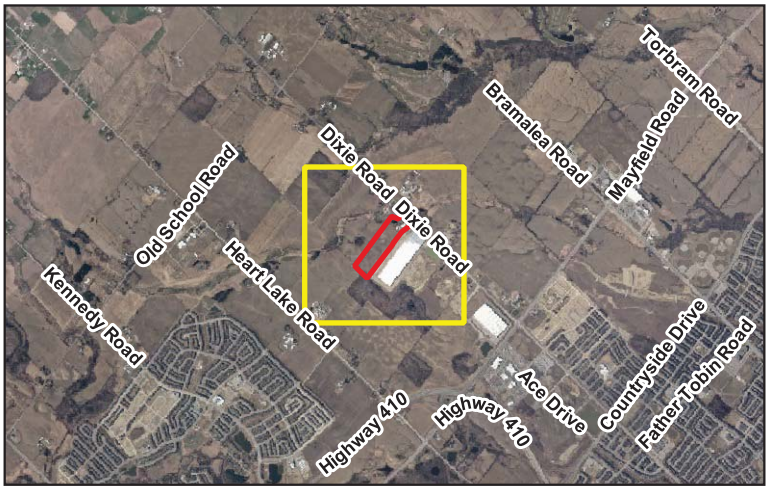
Key hydrologic areas include:

- Significant groundwater recharge areas;
- Highly vulnerable aquifers; and
- Significant surface water contribution areas.

KNHFs include:

- Habitat of endangered species and threatened species;
- Fish habitat;





Site Location	Figure 1
12434 Dixie Road, Caledon	
BEACON ENVIRONMENTAL	Project: 220196 Last Revised: April 2021
Client:	Prepared by: BD Checked by:
N 1:8,000	Inset Map:1:70,000
Contains information licensed under the Open Government License–Ontario Orthoimagery Baselayer: 2019 (FBS)	

C:\Dropbox\Dropbox (Beacon)\All GIS Projects\2020\220196 12434 Dixie Road & 12451 & 12577 Airport Road EIS\Q Project Files\2020-06-05 - 12434 Dixie Road EIS - 220196.qgz

- Wetlands;
- Life science areas of natural and scientific interest (ANSIs);
- Significant valleylands;
- Significant woodlands;
- Significant wildlife habitat (including the habitat of special concern species);
- Sand barrens, savannahs and tallgrass prairies; and
- Alvars.

KHFs include:

- Permanent and intermittent streams;
- Lakes (and their littoral zones);
- Seepage areas and springs; and
- Wetlands.

Generally, development or site alteration is not permitted in KNHFs and KHFs within the Natural Heritage System, including any associated vegetation protection zone, unless exemptions within the *Greenbelt Plan* apply.

2.4 Regional Municipality of Peel Official Plan (Office Consolidation – 2018)

The Region of Peel Official Plan (2018) provides direction on land use within the Region. The Region of Peel Official Plan (OP) Office Consolidation December 2018 is the most current version of the Region's OP. It identifies a Greenlands System consisting of Core Areas, Natural Areas and Corridors (NAC's), and Potential Natural Areas and Corridors (PNAC's) and includes policies aimed at protecting, maintaining, and restoring this system.

Key elements of the Region's Greenlands System include the following:

- *Areas of Natural and Scientific Interest;*
- *Environmentally Sensitive or Significant Areas (ESA);*
- *Escarpment Natural Areas;*
- *Escarpment Protection Areas;*
- *Fish and wildlife habitat;*
- *Habitats of threatened and endangered species;*
- *Wetlands;*
- *Woodlands;*
- *Valley and stream corridors;*
- *Shorelines;*
- *Natural lakes;*
- *Natural corridors;*
- *Groundwater recharge and discharge areas;*
- *Open space portions of the Parkway Belt West Plan; and*
- *Other natural features and functional areas.*

The various components of the Regional Greenlands System are to be interpreted, identified and protected in accordance with ROP policies.

The following maps and schedules were reviewed to determine the applicable policy framework for this application:

- *Schedule A - Core Areas of the Greenlands Systems in Peel* – shows Core Areas of the Greenland System on the subject property corresponding to the area associated with Kilmanagh Creek and woodland on the western portion.

Policy 2.3.2.6 prohibits development and site alteration within the Core Areas of the Greenlands System in Peel except for limited uses such as, but not limited to: conservation and erosion control projects, passive recreation, minor development, and existing uses.

Area municipalities are directed to adopt appropriate policies to allow the above exceptions when it can be demonstrated that there is no reasonable alternative location outside of the Core Area and the use, development or site alteration is directed away from the Core Area feature to the greatest extent possible and the impact to the Core Area feature is minimized and any impact to the feature or its functions that cannot be avoided is mitigated through restoration or enhancement to the greatest extent possible.

The area associated with the Kilmanagh Creek is considered part of the NAC of the Greenlands Systems designated under Policy 2.3.2.9 of the ROP. NAC's and PNAC's represent natural features and areas that are considered locally significant. Regional policies pertaining to NAC's and PNAC's defer their interpretation, protection, restoration, enhancement, proper management and stewardship to local municipalities.

2.5 Town of Caledon Official Plan (Office Consolidation – 2018)

The *Town of Caledon Official Plan* (2018) provides direction as to the land use within the Town.

Schedule A1 - Town of Caledon Town Structure shows that the subject property is designated as part of the Agricultural and Rural Area of the Growth Plan. It also shows the Kilmanagh Creek corridor as being within the Greenbelt Plan Area.

2.6 Toronto and Region Conservation Authority Regulations and Guidelines

2.6.1 Conservation Authorities Act (Ontario Regulation 166/06)

The TRCA regulates land use activities in and adjacent to wetlands, watercourses and valleylands under Ontario Regulation 166/06 (*Regulation for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*) made under the *Conservation Authorities Act.*

Subject to conformity with the municipality's Official Plan, the completion of appropriate studies and application for Conservation Authority permits, TRCA may grant permission for development within these areas if it can be proven that control of flooding, erosion, pollution or the conservation of land will not be affected by the development.

2.6.2 The Living City Policies (2014)

The TRCA's Living City Policy (LCP) was approved in November 2014 and replaces the Valley and Stream Corridor Management Program (1994). The LCP document, among other matters, implements current federal, provincial and municipal legislation, policies and agreements affecting conservation authorities; and implements the policies for TRCA's updated section 28 of Ontario Regulation 166/06. For purposes of implementing TRCA's Environmental Management Policies:

- Confined River or Stream Valleys are considered **Valley Corridors**; and
- Unconfined River or Stream Valleys are considered **Stream Corridors**.

According to the LCP, the boundaries of a valley or stream corridor generally require a minimum 10 m setback from the greater of:

- Physical top of the valley feature;
- Long term stable top of slope, where geotechnical concerns exist (which must be confirmed through an appropriate geotechnical analysis);
- Regulatory floodplain;
- Meander belt; and
- Limits of significant vegetation which is contiguous with the valley corridor.

It is the policy of TRCA:

> *That erosion hazard limits will be determined through site specific field investigations and technical reports where required, in accordance with the text of TRCA's Regulation and Provincial and TRCA standards. Where erosion hazard limits are required and not available, or where existing erosion hazard information does not meet current Provincial or TRCA standards, TRCA may require the erosion hazard to be determined by a qualified professional, at the expense of the proponent, to the satisfaction of TRCA.*

The *Belt Width Delineation Procedures* (TRCA 2004) document outlines standards for delineating the meander belt in TRCA jurisdiction.

3. Background Review

3.1 Climate

Climate provides the driving energy for a fluvial system and directly influences basin hydrology and rates of channel erosion, particularly through precipitation. Precipitation records obtained from climate normals (1981-2010) recorded at the Toronto Lester B. Pearson Airport, located south of the subject property, averaged 58 mm per month in winter (November through February), and 70 mm in summer (March to August; Environment Canada 2020). This increase over the summer months is likely a result of convective thunderstorms. While total precipitation amounts are greater during the summer months, snowmelt and rain-on-snow events tend to produce the highest flows within a watershed.

3.2 Watershed Conditions

In 2008, the TRCA prepared a *State of the Watershed Report* for the Humber River Watershed as a key reference document for land use planning decisions within and adjacent to the Humber River watershed. This report provided the basis for the Watershed Management Plan and provided an overview of existing environmental conditions within the watershed. The Humber River watershed drains a total area of 903 km^2 and is made up of 5 subwatersheds: Main Humber, East Humber, West Humber, Lower Humber, and Black Creek. The subject property is situated within the West Humber subwatershed (TRCA 2008).

3.3 Geology

The planimetric form of a watercourse is fundamentally a product of the channel flow regime and the availability of sediments (i.e., surficial geology) within the stream corridor. The 'dynamic equilibrium' of these inputs govern channel planform. These factors are influenced in smaller systems by physiography, riparian vegetation and land use. The subject property falls within the South Slope physiographic region (Chapman and Putnam 1984); this area is defined by the southern slope of the Oak Ridges Moraine that gently slopes south, towards Lake Ontario. The South Slope physiographic region consists of a smooth clay till plain that is faintly drumlinized and contains deeply incised stream valleys. Although the topography is relatively flat, infiltration is limited by the high clay content resulting in high runoff characteristics. Surficial geology within the subject property is dominated by low permeability silt, clay, and silt till of the Halton Till formation. Locally, within the stream corridor, the river reworks a veneer of modern alluvial clay, silt, sand, gravel and organic deposits (TRCA 2008).

3.4 Fluvial Geomorphology

The TRCA (2008) *Humber River State of the Watershed Report* summarized existing fluvial geomorphic conditions throughout the watershed. The report characterized the portion of Kilmanagh Creek relevant to the subject property as a third order stream. In general, the report noted on-going pressures on stream corridors associated with urbanization as a major management challenge throughout the watershed.

3.5 Aquatic Habitat

The subject property is located within Fishery Management Zone (FMZ) 2 of the Humber River watershed (OMNR and TRCA 2005). These zones delineate areas within which fish communities, thermal regimes and underlying environmental controls, remain relatively consistent. FMZ 2 is managed for the key target species, Redside Dace (*Clinostomus elongatus*) and Brook Trout (*Salvelinus fontinalis*). The reach of the Kilmanagh Creek relevant to the subject property was characterized as a small riverine coldwater system due to the relatively small stream size and drainage area, and moderately stable groundwater inputs.

3.6 Historical Assessment

The following section presents an overview of historic conditions with respect to land use, land cover and channel conditions in the vicinity of the subject property. Historic analyses provide insight into the scale of natural and human-induced changes within a watershed, particularly the degree to which channel planform adjustment and land use has changed over time.

In support of the historic assessment, black and white aerial photographs and digital colour imagery were analysed and compared to obtain a simple, qualitative assessment of the degree of land use and channel planform change over time (**Appendix A**). **Table 1** provides a summary of specific observations regarding change in land use based on available historical aerial imagery.

Table 1. Summary of Key Historical Observations

Time Period	Scale, Source	Observations
1972	1:12,000 Northway/Photomap/Remote Sensing Ltd.	Land use is predominantly agricultural (orchard). Dixie Road has been constructed.
		The channel planform was observed to be generally sinuous; immediately west of Dixie Road, it appeared to have been channelized. Adjacent to the channelized section of creek, an offline pond could also be observed. Riparian vegetation along the creek corridor appeared to be dominated by grasses or herbaceous species.
2019	First Base Solutions (Digital Image)	Land use remained agricultural but with a transition in crops. Dixie Road had been widened.
		While the channel planform remained sinuous adjacent to the subject property, further channelization appeared to have occurred within the subject property. Two additional offline ponds could be observed adjacent to the channel relative to 1972. Additional tree cover could be observed within the riparian zone.

4. Existing Conditions

4.1 Reach Delineation

To facilitate a systematic evaluation of the relevant portion of Kilmanagh Creek, the watercourse was delineated into reaches. Reaches are homogenous sections of channel with regard to form and function and can, therefore, be expected to behave consistently along their length to changes in hydrology and sediment inputs, as well as to other modifying factors (Montgomery and Buffington 1997; Richards et al. 1997).

For the purposes of this study, the section of the Kilmanagh Creek relevant to the subject property was captured within a single reach that extends upstream and downstream of Dixie Road (Reach KC-1, see

Figure 1). The determination of reach extents was based on a desktop assessment of transitions in riparian vegetation, degree of valley confinement, meander geometry (channel planform) and road crossings based on available aerial imagery and topographic mapping.

4.2 Rapid Assessments

4.2.1 Methods

In order to characterize existing geomorphic conditions along Reach KC-1 of Kilmanagh Creek, a field assessment was conducted on August 12, 2020 within the subject property limits. The following standardized rapid visual assessment methods were applied:

i. Rapid Geomorphic Assessment (RGA – MOE 2003)

The Rapid Geomorphic Assessment (RGA) documents observed indicators of channel instability by quantifying observations using an index that identifies channel sensitivity. Sensitivity is based on evidence of aggradation, degradation, channel widening and planimetric form adjustment. The index produces values that indicate whether the channel is stable/in regime (score <0.20), stressed/transitional (score 0.21-0.40) or in adjustment (score >0.41).

ii. Rapid Stream Assessment Technique (RSAT – Galli 1996)

The Rapid Stream Assessment Technique (RSAT) uses an index to quantify overall stream health and includes the consideration of biological indicators (Galli 1996). Observations concerning channel stability, channel scouring/sediment deposition, physical in-stream habitat, water quality, and riparian habitat conditions are used to calculate a rating that indicates whether the channel is in poor (<13), fair (13-24), good (25-34), or excellent (35-42) condition.

ii. Downs Classification Method (Downs 1995)

The Downs (1995, outlined in Thorne et al. 1997) classification method infers present and future potential adjustments based on physical observations, which indicate the stage of evolution, and type of adjustments that can be anticipated based on the channel evolution model. The resultant index classifies streams as stable, laterally migrating, enlarging, undercutting, aggrading, or recovering.

4.2.2 Results

Within the extent assessed, Reach KC-1 was characterized as a well-defined channel with a moderate degree of sinuosity situated within an unconfined valley setting. The reach displayed a low gradient and moderate degree of entrenchment. Riparian vegetation was generally characterized as fragmented, extending 1 to 5 channel widths laterally. Riparian vegetation was comprised of grasses and herbaceous plants with trees and shrubs.

Bankfull widths and depths ranged from 3.5 – 4.5 m and 0.55 – 0.9 m, respectively. Riffle substrate consisted of sand, gravel, and cobble sized material. Pool substrate consisted of sand and gravel. The

channel bank angles ranged between 60 – 90 degrees, with 30 – 60% of banks exhibiting evidence of erosion. Where present, bank undercuts measured an average of 0.30 m. Bank materials were dominated by silt, clay, and sand. Channel morphology was influenced locally by the presence of large instream woody debris. Observed channel modifications included the Dixie Road crossing, historical channelization, localized boulder bank protection and several offline ponds.

RGA results characterized Reach KC-1 as stable or '*in regime*', with a score of 0.19. Minor evidence of widening and aggradation was observed in the form of exposed tree roots, basal scour through riffle sections, presence of fracture lines along the tops of bank and medial bar formation. An RSAT score of 31 indicated a 'good' degree of overall ecological health, with riparian habitat conditions noted as the primary limiting factor, The Downs model classified Reach KC-1 as 'stable' with minor evidence of m – 'lateral migration' based on the initiation of alternating bank erosion along a previously straightened channel.

Rapid assessment results are summarized in **Table 2** and **Table 3** below. A photographic record of site conditions at the time of the assessment is provided in **Appendix B**.

Table 2. General Reach Characteristics – Reach KC-1

Reach	Bankfull Width (m)	Bankfull Depth (m)	Channel Substrate	Riparian Vegetation	Notes
KC-1	3.5 – 4.5	0.55 – 0.90	Sand, gravel and cobble (riffles) Sand and gravel (pools)	Grasses, herbaceous plants, trees and shrubs	• Localized boulder bank protection • Historically channelized • Offline ponds adjacent to creek

Table 3. Rapid Assessment Results – Reach KC-1

Reach	Rapid Geomorphic Assessment			Rapid Stream Assessment Technique			Downs Classification Method
	Score	Condition	Dominant Mode of Adjustment	Score	Condition	Limiting Feature	
KC-1	0.19	In Regime	Widening	31	Good	Riparian Habitat Conditions	S – 'stable' with evidence of m – 'lateral migration'

5. Analysis

5.1 Meander Belt

The meander belt width is generally defined as the lateral extent that a meandering channel has historically occupied and will likely occupy in the future. Following TRCA (2004) procedures, the

meander belt for Reach KC-1 was delineated based on the lateral extent of the outermost meander bends for those sections of reach that displayed a natural, meandering planform over the available historical record. The resultant 35 m dimension was then reviewed relative to available topographic mapping and field observations to ensure that it was sufficient to capture the active (bankfull) channel and evidence of lateral occupation of the floodplain at the reach scale. A 20% factor of safety (10% either side) was then applied to the preliminary belt width dimensions in order to account for long-term adjustments in channel form (channel erosion and migration), as well as potential post-development changes in hydrologic regime. The resultant 42 m meander belt is illustrated on **Figure 2**.

5.1.1 Redside Dace Occupied Habitat

For the purposes of determining regulated Redside Dace habitat limits associated with Reach KC-1, the 30 m setback was applied to the preliminary meander belt (35m), as this dimension accounts for existing and historic trends in channel planform. **Figure 2** identifies all lands within 30 m of the meander belt as they pertain to Reach KC-1 within the subject property.

6. Policy Conformance

It is our opinion that the findings of this report are in conformance with the Provincial Policy Statement (2020), Regional Municipality of Peel Official Plan (2018), Town of Caledon Official Plan (2018), Ontario Regulation 166/06, the TRCA (2004) *Belt Width Delineation Procedures* document and Ontario Regulation 242/08.

7. Conclusions

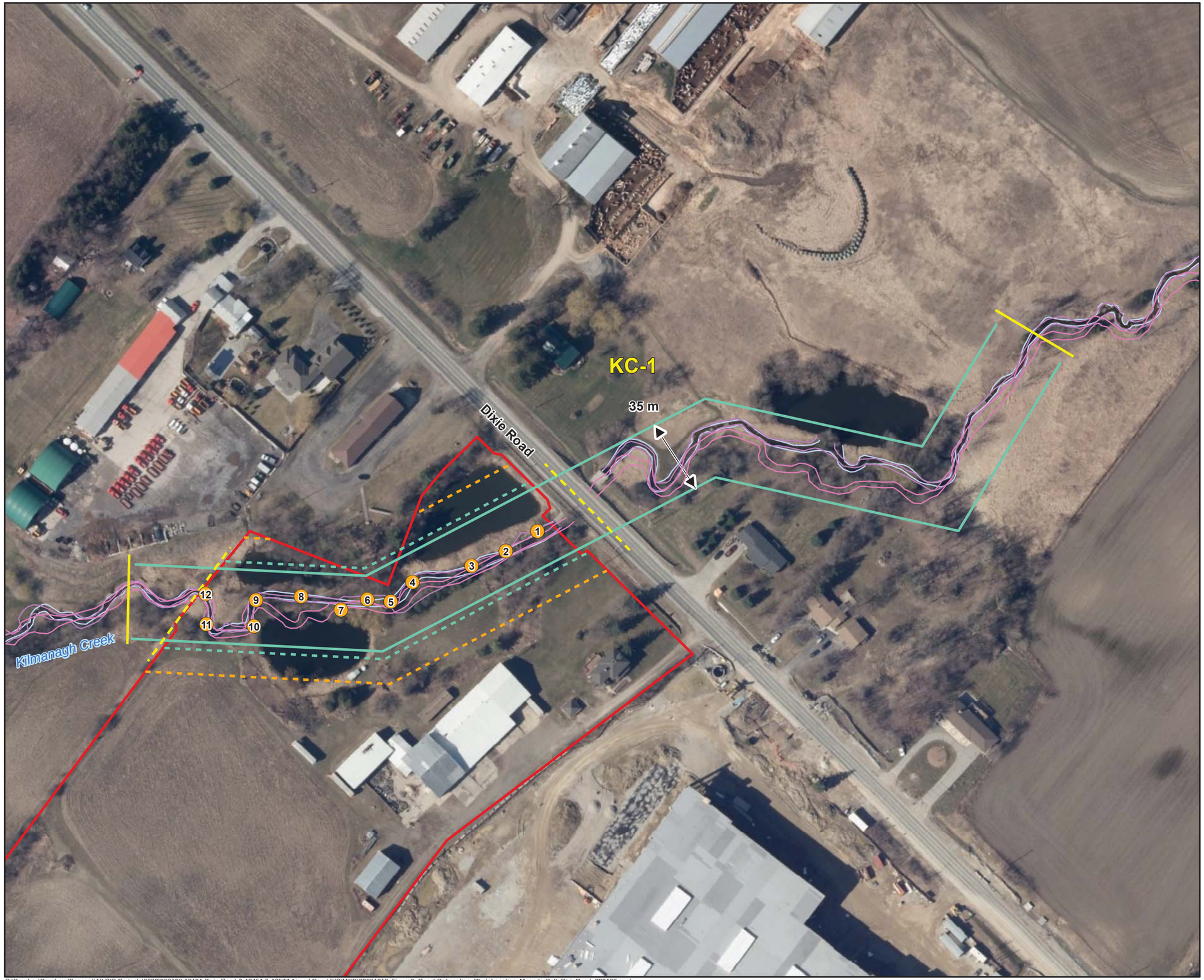
Beacon Environmental Limited (Beacon) was retained by Nishan Transport Inc. to undertake a geomorphic assessment for lands located at 12434 Dixie Road in the Town of Caledon. The following points summarize the findings of this study:

- Reach KC-1 of was characterized as a well-defined channel situated within an unconfined valley system;
- A review of historical and recent aerial imagery identified that Reach KC-1 of Kilmanagh Creek had been channelized west of Dixie Road;
- Rapid geomorphic assessment results for Reach KC-1 identified the reach as being in regime (score of 0.19) with minor evidence of widening and aggradation;
- The RSAT assessment indicated that Reach KC-1 displayed a good degree of overall ecological health with riparian habitat conditions noted as the primary limiting factor;
- The meander belt for Reach KC-1 was determined referencing the outermost extent of meander bends based on the current and historical channel planform. A 20% factor of safety was applied to the initial meander belt width of 35 m, resulting in a recommended dimension of 42 m; and
- In conformity with Ontario Regulation 242/08, lands within 30 m of the meander belt have been identified.

Reach Delineation, Photo Locations and Meander Belt

Figure 2

12434 Dixie Road
Geomorphic Assessment



Legend

- Subject Property
- Extent Assessed
- Reach Break
- Governing Dimension
- Photo Locations
- Meander Belt (35 m)
- Meander Belt + FOS (42 m)
- Meander Belt + 30 m (Redside Dace Habitat)

Watercourse

- Watercourse 1972
- Watercourse 2002
- Watercourse 2019



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Project: 220196
Last Revised: April 2021

Client: Nishan Transport	Prepared by: DU Checked by: SG

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Should you have any questions or require any additional information please contact the undersigned.

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River Scientist

Report reviewed by:
Beacon Environmental



Shelley Gorenc, M.Sc., P.Geo.
Senior Geomorphologist

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Appendix A

Historical Aerial Imagery



Legend

Subject Property

Historical Aerial Imagery	**1972**
12434 Dixie Road Road & 12451 & 12577 Airport Road EIS	
BEACON ENVIRONMENTAL	Project: 220196 Last Revised: September, 2020
Client: Nishan Transport	Prepared by: DU Checked by: SG
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Legend

Subject Property

Historical Aerial Imagery	2019

12434 Dixie Road Road &
12451 & 12577 Airport Road EIS

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Project: 220196
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Client: Nishan Transport	Prepared by: DU Checked by: SG

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0 50 100 m

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Appendix B

Photographic Record



Photograph 1. (Photo Location 1)
Downstream view of medial bar formation upstream of Dixie Road.



Photograph 2. (Photo Location 2)
Upstream view of woody debris jam.



Photograph 3. (Photo Location 3)
Upstream view of riffle substrate. Note: leaning trees and presence of wood debris in channel.



Photograph 4. (Photo Location 4)
Upstream view of basal scour along channel bank.



Photograph 5. (Photo Location 5)
Downstream view of general conditions.



Photograph 6. (Photo Location 6)
Downstream view of minor debris jam debris jam.



Photograph 7. (Photo Location 7)
Offline pond.



Photograph 8. (Photo Location 8)
Upstream view of general conditions.



Photograph 9. (Photo Location 9)
Upstream of woody debris jam.



Photograph 10. (Photo Location 10)
Downstream view of localized stone bank protection.



Photograph 11. (Photo Location 11)
Downstream view of general conditions.



Photograph 12. (Photo Location 12)
Downstream view of general conditions.