

Fluvial Geomorphology Assessment and Conceptual Natural Corridor Designs

Alloa Secondary Plan Area – Phase 1 Lands
Caledon, Ontario



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M O R P H I X™



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This report presents professional opinions and findings of a scientific and technical nature based on the knowledge and information available at the time of preparation. This document is prepared solely for the Client, and the data, interpretations, suggestions, recommendations, and opinions expressed in the report pertain only to the project being completed for the Client.

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1 Introduction

GEO Morphix Ltd. (GEO Morphix) was retained to complete the fluvial geomorphology assessment supporting the Phase 1 lands of the Alloa Secondary Plan Area in the Town of Caledon, Ontario. The Phase 1 lands, hereafter referred to as the subject lands, are generally bounded by the future Highway 413 footprint to the north, Mayfield Road to the south, Creditview Road to the west, and Chinguacousy Road to the east (**Appendix A, Figure 1**). The subject lands are located within two (2) watersheds/subwatersheds: Etobicoke Creek and Fletchers Creek. The Alloa Drain is located within the Etobicoke Creek watershed and flows generally west-to-east in the central portion of the subject lands. Additionally, a municipal drain known as Lyons Drain is located north of and flows into the Alloa Drain just within the western boundary of the subject lands. The headwaters of Fletchers Creek are located in the southern extent of the subject lands, and generally flow from north to south, exiting the subject lands at Mayfield Road.

This report serves as a supporting document to the Environmental Impact Report (EIR) and builds upon the Local Subwatershed Study (LSS) prepared by C.F. Crozier and Associates Inc. (Crozier) et al. (2026). Several planning-level studies have been undertaken on lands east of Chinguacousy Road and south of Mayfield Road. This report provides a summary of the relevant components of these studies. The fluvial geomorphology assessment is a comprehensive study that includes characterization and delineation of municipal drains and watercourses, as well as the delineation of erosion hazards under both existing and proposed conditions. This information is crucial to identifying the opportunities and constraints to development. Additionally, it provides conceptual natural corridor designs for proposed watercourse/municipal drain and drainage feature realignments. The assessment was completed per the EIR Terms of Reference prepared by the Consultant Team and reviewed by the Town of Caledon, Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC).

Specifically, the following activities were completed by GEO Morphix as part of the fluvial geomorphology assessment and are summarized in this report:

- Review of available background reports and mapping (i.e., watershed/subwatershed studies, geology, topography, conceptual development plans)
- Delineate/refine municipal drain and watercourse reaches based on a desktop assessment of available data and confirmed through field reconnaissance
- Review of recent and historical aerial photographs to understand historical changes in channel form and function
- Conduct reach-level rapid geomorphological field assessments following standard protocols (e.g., RGA, RSAT) to evaluate instream and riparian conditions
- Complete detailed geomorphological field surveys to support the conceptual natural corridor designs
- Delineate limits of the meander belt width/erosion hazard on a reach basis using results of the desktop and field assessments
- Provide technical input and recommendations for proposed watercourse/municipal drain crossings with consideration to crossing span
- Prepare preliminary conceptual natural corridor design plans for proposed channel realignments (planform, cross-sections, floodplain features, and bioengineering details)

The conceptual natural corridor design drawings have been prepared to demonstrate how the realigned corridors will function and be integrated with the overall natural heritage system. The conceptual design is subject to revision in subsequent project stages (i.e., detailed design).

GEO Morphix has also completed the following assessments, which are documented under separate cover and form independent appendices to the EIR:

- Baseline surface water quantity and quality monitoring
- Headwater drainage feature assessments
- Erosion mitigation assessment in support of the proposed stormwater management strategy

2 Background Review

3 Subwatershed Characteristics

3.1 Etobicoke Creek

The Etobicoke Creek watershed is highly urbanized (approximately 60% as of 2019) and contains predominantly industrial and commercial land uses with significant amounts of impervious cover. This watershed has one of the lowest amounts of natural cover within the TRCA's jurisdiction (TRCA, 2024). The only remaining rural portions of the watershed are located within the Town of Caledon (TRCA, 2024). The subject lands are in the Headwaters subwatershed, which is the only subwatershed with less than 50% impervious cover. The headwaters of Etobicoke Creek originate south of Inglewood and drain south into Etobicoke Creek, which ultimately discharges into Lake Ontario. Land use within the watershed is dominated by approximately 60% urban land cover, 28% rural land cover, and 12% natural land cover. The predominance of urban land cover leaves the majority of watercourses with a narrow to moderate vegetated riparian corridor. Approximately 50% of watercourses within the watershed have a riparian buffer consisting of either forests, meadows, or wetlands. However, the canopy cover within the Headwaters subwatershed is low due to agricultural practices (TRCA, 2021).

The subject lands are comprised of agricultural lands and rural development and contain multiple tributaries to Etobicoke Creek and numerous HDFs. The Alloa Drain flows west to east through the centre of the subject lands. Lyons Drain flows generally north to south but only flows west to east along its small portion that is located within the subject lands. Most drainage features and watercourses traverse cultivated agricultural fields and have been straightened and channelized to promote drainage and maximize arable lands/pasture.

3.2 Fletchers Creek

Fletchers Creek is located within the lower portion of the Credit River watershed and has a drainage area of approximately 45 km². Only 9% of the subwatershed is situated in the Town of Caledon, with agriculture being the predominant land use. As of 2012, approximately 62% of the overall subwatershed was developed (CVC, 2012), with residential being the predominant land use. Because development commenced in the upper watershed largely after the year 2000, contemporary stormwater management measures and best practices have been used in engineering and natural heritage designs for recently constructed development. Conversely, in the middle portion of the subwatershed, development largely predates the use of contemporary stormwater controls, and as such, there are fewer stormwater management measures in place. Development in the lower subwatershed, south of Highway 401, commenced in the mid-90s. Therefore, this area contains an increased level of stormwater control relative to older developments in the middle portion of the subwatershed (CVC, 2012).

Reach delineation was completed as part of the overall subwatershed characterization work and is documented in CVC (2012); however, due to low-order drainage features within the subject lands, limited geomorphic information is available for these reaches. CVC also established several monitoring locations along Fletchers Creek as part of their Effectiveness Monitoring Program, including site SW4, reviewed in subsequent planning studies and noted in the erosion mitigation assessment prepared by GEO Morphix under separate cover.

The headwaters of Fletchers Creek originate in predominantly agricultural lands north of Mayfield Road and drain south into the Credit River and ultimately into Lake Ontario. Several HDFs were identified in the southeastern extent of the subject lands within the Fletchers Creek subwatershed. These features flow through agricultural fields, which generally lack canopy cover and a natural riparian zone.

3.3 Physiography and Surficial Geology

Surficial geology and physiography act as constraints to channel development and tendency. These factors determine the nature and quantity of the availability and type of sediment. Secondary variables that affect the channel include land use and riparian vegetation. These factors are explored as they not

only offer insight into existing conditions, but also potential changes that could be expected in the future as they relate to a proposed activity.

The subject lands are located within the South Slope physiographic region and drumlinized till plains landform, although no drumlins are mapped in the subject lands (Chapman and Putnam, 2007). The South Slope region is characterized by gently sloping glacial till plain deposits (Chapman and Putnam, 1984). Surficial geology mapping indicates deposits within the subject lands are of glaciolacustrine origin and are comprised primarily of clay to silt-textured till. Along the downstream extent of the main channel and tributaries of the Alloa Drain, modern alluvial deposits comprised of clay, silt, sand, gravel and organic remains are noted in published mapping (OGS, 2010). Along the main channel of the Lyons Drain and mid to upstream of the Alloa Drain, fine-textured glaciolacustrine deposits comprised of clay, silt, with minimal sand and gravel are noted in mapping records. These deposits may also have interbedded layers of pebbly till and rainout deposits (OGS, 2010). Published mapping is generally consistent with field observations, where all channels and drainage features contained predominantly fine-grained substrates and bank materials.

4 Historical Assessment

A series of historical aerial photographs was reviewed to determine changes to the channel and surrounding land use and land cover. This information, in part, provides an understanding of the historical factors that have contributed to current channel morphodynamics and potentially how past changes may affect channel planform in the future. Aerial photographs from 1946 (1:20,000) and 1974 (1:25,000) from the National Air Photo Library and recent satellite imagery for the years 2005, 2015 and 2024 from Google Earth Pro were reviewed to understand site history and inform the erosion hazard assessment. Historical aerial photographs are provided in **Appendix B** for reference.

Since 1946, the subject lands have been actively cultivated. The 1946 aerial imagery shows that the majority of the Alloa Drain and its tributaries had been straightened, and natural riparian vegetation had been removed from the landscape except for somewhat isolated, generally rectangular woodlots. Lands north of Mayfield Road within the Fletchers Creek subwatershed was also actively cultivated, with the drainage network faintly visible in cropped agricultural fields. These extensive modifications likely contributed to limited channel form, increases in instream temperatures, and fine sediment inputs due to a lack woody riparian vegetation having a relatively deep root network. Drainage features were also likely routinely disturbed/disrupted due to cultivation activities.

There was limited change in land use and channel planform between 1946 and 1974. The Alloa Drain, and Lyons Drain appeared to maintain a planform consistent with 1946 imagery. The dug pond west of Chinguacousy Road in the northeastern corner of the subject lands was visible in the 1974 image and appeared to be connected to the adjacent channel via a drainage feature at its eastern extent. A second dug pond is visible south of the Alloa Drain, west of Chinguacousy Road, but a direct connection was not visible in imagery. The subject lands continued to be cultivated, and additional rural residences were present when 1946 and 1974 images were compared.

Between 1974 and 2005, there were limited changes in channel planform and land use. Most of the subject lands remained under active cultivation, coupled with rural residential development. By 2015, urban residential development, multiple stormwater management facilities and formalized natural heritage corridors were apparent south of Mayfield Road. Since approximately 2019, residential development has largely directly abutted Mayfield Road. Construction within the Mayfield West lands east of Chinguacousy Road commenced in 2020.

In summary, there has been limited change to land uses within the subject lands during the period of available record. Channels and drainage features within the subject lands were largely straightened and channelized prior to 1946, with retained natural vegetation limited to isolated woodlots. More recently, residential development has steadily encroached from the south and east.

5 Municipal Drain and Watercourse Characteristics

5.1 Reach Delineation

Reaches are homogeneous segments of channel used in geomorphological investigations. Reaches are studied semi-independently as each is expected to function in a manner that is at least slightly different from adjoining reaches. This method allows for a meaningful characterization of a watercourse as the aggregate of reaches, or an understanding of a reach, for example, as it relates to a proposed activity. Reaches are typically delineated based on changes in the following:

- Channel planform
- Channel gradient
- Physiography
- Land cover (land use or vegetation)
- Flow, due to tributary inputs
- Soil type and surficial geology
- Historical channel modifications

This follows scientifically defensible methodology proposed by Montgomery and Buffington (1997), Richards et al. (1997), and the Toronto and Region Conservation Authority (2004). Reaches are first delineated as a desktop exercise using available data and information such as aerial photography, topographic maps, geology information and physiography maps. The results are then verified in the field.

Reaches within the subject lands were previously delineated at a high-level of assessment as part of the Scoped Subwatershed Study (SSWS) prepared by Wood (2022a, 2022b, 2022c) via a desktop review and windshield survey. The LSS (Crozier et al., 2026) refined these reaches based on site specific field work. Several reaches were delineated along the Alloa Drain, which flows centrally in a west-to-east orientation, as well as the lower portions of Lyons Drain in the western portion of the subject lands. All watercourse reaches are located within the Etobicoke Creek watershed. Drainage features identified in the southern portion of the subject lands near Mayfield Road are located within the Fletchers Creek subwatershed and are characterized as HDFs. The reach delineation is graphically presented in **Appendix A, Figure 1** and is consistent with the LSS (Crozier et al., 2026).

5.2 Reach Observations

Watercourse and municipal drain field investigations were completed on May 2, 2024, and included the following observations on a reach basis:

- Descriptions of riparian conditions
- Estimates of bankfull channel dimensions
- Determination of bed and bank material composition and structure
- Confirmation of valley form (i.e., unconfined, partially confined, confined)
- Observations of erosion, scour, or deposition
- Collection of photographs to document watercourses, riparian areas, adjacent land use, and channel disturbances such as crossing structures

These observations and measurements are summarized in **Table 1**. Field descriptions are supported by representative photographs included in **Appendix C**. Field sheets, including those completed for reach characterization and rapid assessments, are provided in **Appendix D**. Excepting **Reach AD1-2**, all watercourse reaches consist of municipal drains and are considered infrastructure that undergoes periodic maintenance under the direction of the drainage superintendent appointed by the Town of Caledon.

Table 1: General reach characteristics

Reach Name	Avg. Bankfull Width (m)	Avg. Bankfull Depth (m)	Bed Substrate	Bank Materials	Dominant Riparian Conditions	Notes
Alloa Drain						
*AD1-2	2.99	0.21	**Clay, silt and sand		Narrow buffer of established grasses at the downstream extent Wide forested buffer of trees and grasses at the upstream extent	Channel flowed through a wetland and was straightened Wetland vegetation was present in the downstream portion of the reach
*AD2	4.05	0.42	*Clay, silt and sand		Narrow riparian buffer consisting of grasses with isolated trees	Run-dominant straightened channel between agricultural fields
AD3	3.64	0.82	Sand, gravel, and cobbles	Clay, silt, sand	Narrow riparian buffer consisting of shrubs and grasses	Straightened channel with poor longitudinal substrate sorting Run-dominant system with few riffles
Lyons Drain						
LD1	3.93	0.77	**Clay, silt to gravel		Narrow, fragmented buffer consisting of mature trees and shrubs	Straightened channel with sand/silt substrate. One artificial riffle was present following the culvert at the road

* Bankfull dimensions based on detailed geomorphological assessment

** Uniform channel bed, substrate observations reflective of full channel condition

Rapid assessments were completed to identify dominant geomorphic processes, document stream health, and identify any areas of concern regarding erosion or instability. Channel instability was objectively quantified through the application of the Ontario Ministry of the Environment's (2003) Rapid Geomorphic Assessment (RGA). Observations were quantified using an index that identifies channel sensitivity based on evidence of aggradation, degradation, channel widening, and planimetric adjustment. The index produces values that indicate whether a channel is stable/in regime (score <0.20), stressed/transitional (score 0.21-0.40), or adjusting (score >0.41).

The Rapid Stream Assessment Technique (RSAT) was also employed to provide a broader view of the system as it considers the ecological function of the watercourse (Galli, 1996). Observations were made of channel stability, channel scouring or sediment deposition, instream and riparian habitats, and water quality. The RSAT score ranks the channel as maintaining a poor (<13), fair (13-24), good (25-34), or excellent (35-42) degree of stream health.

Although the RGA and RSAT tools are intended to be generally used on natural systems, which are largely not present in the subject lands due to the presence of municipal drains, results are reported below as they still provide an assessment of channel stability and overall stream health. A summary of the reach classifications and rapid assessment scores is provided in **Table 2**.

Table 2: Summary of rapid assessment results

Reach	RGA (MOE, 2003)		RSAT (Galli, 1996)		
	Score	Condition	Score	Condition	Limiting Feature(s)
Alloa Drain					
AD1-2	0.098	In Regime	24	Fair	Physical Instream Habitat
AD-2	0.174	In Regime	23	Fair	Riparian Habitat Conditions
AD3	0.170	In Regime	23	Fair	Riparian Habitat Conditions
Lyons Drain					
LD1	0.067	In Regime	25	Good	Riparian Habitat Conditions

The Alloa Drain is an artificial feature that has been straightened and entrenched along its entire length within the subject lands. The channel has a low gradient and generally flows between agricultural fields. The riparian vegetation buffer is narrow but continuous, consisting of isolated trees and grasses that moderately encroach on the channel. Limited erosion was present along the drain. Bed substrates consisted primarily of clay, silt, and sand, and evidence of channel aggradation was observed due to accumulations of fine-grained sediments along the drain bed. The banks were steep, ranging from 60 to 90 degrees. Watercross was often present in the channel in most reaches. An absence of bar forms was observed in all reaches, indicating they are either poorly formed or otherwise removed from the channel. All reaches were classified as "In Regime" based on the RGA and as "Fair" condition based on the RSAT.

Reach AD1-2 is a tributary of the Alloa Drain that flowed through a wetland and woodlot. The channel is sinuous with a low gradient and low entrenchment. At the upstream extent, the channel flows as a single pathway through a riparian buffer consisting of a forest with established trees. At the forest edge, the single channel transitioned to multiple flow paths and had a riparian buffer consisting of grasses that heavily encroached on the channel. Instream wetland vegetation was present throughout the downstream extent. The reach was run-dominant and lacked riffle pool morphology. The bed and bank substrates consisted of clay, silt and sand. Minimal erosion was observed throughout the reach. Leaning trees were observed in the upstream extent of the reach, and organic debris was observed throughout the reach. The RGA score was 0.098 based on the change in form from a single-thread channel to a multi-thread system, leaning trees and large organic debris.

Reach AD2 is the furthest downstream reach of the Alloa Drain. Multiple tile drains were observed to outlet to the channel. Widening was observed at the outlets of a couple of the tile drains. Woody debris was present, with two woody debris jams identified. Localized undercutting was also observed in one location, while minimal erosion was observed elsewhere in the reach. The reach was run-dominant, with a few riffles consisting of gravel and cobbles. The bed substrate was poorly sorted longitudinally. The RGA score was 0.174 due to a lack of bar forms, exposed tile drain, siltation on the bed, and poor longitudinal sorting of bed materials.

Reach AD3 flowed through a wetland area; however, due to entrenchment, the wetland area was not directly connected to the channel. This reach had poor longitudinal substrate sorting and bed materials ranged from clay/silt to cobbles, although sand, gravel, and cobbles were generally dominant. This reach had some irregular meanders, and one localized area of dredging was observed at the downstream extent. The RGA score was 0.170 based on the lack of bar forms, exposed tile drain, siltation on the bed, and poor longitudinal sorting of bed materials.

Reach LD1 was the furthest downstream reach of the Lyons Drain and connected to the Alloa Drain. The reach was relatively short and had been artificially straightened. The channel was moderately entrenched with a low gradient. The riparian vegetation was a narrow, fragmented buffer of mature trees and shrubs. The bed substrate and bank materials were primarily clay, silt, sand, and gravel, with sand being dominant. Bank angles ranged from 30 to 60 degrees. Minimal erosion was present throughout the reach. Watercress was observed in some areas of the reach. The reach was run-dominant with one artificial riffle at the upstream reach extent at Creditview Road. The reach was evaluated as “Good” based on the RSAT but could be assessed with a higher score if the riparian buffer were more substantial. The RGA score was 0.067 based on the fallen and leaning trees and accretion on point bars; however, a limited number of bars were present.

5.3 Detailed Geomorphological Assessments

Obtaining detailed geomorphological measurements and observations allows for a more complete characterization of channel geometry, flow, and sediment characteristics. The data obtained are used to inform the natural corridor designs. In the interest of maintaining or improving channel conditions with regard to stability and fluvial function, the most natural and sensitive reaches within a study area are typically assessed. Given the extent of historical channel modification within and downstream of the Phase 1 Lands, historically modified reaches were surveyed and then evaluated in the context of hydrology modelling provided by Urbantech (2024), our previous experience designing naturalized corridors in the watershed, our understanding of natural heritage system targets and agency expectations.

Reach AD1, Reach AD2 and Reach LD2 were selected for detailed assessments in support of the proposed realignment and restoration of the Alloa Drain and Lyons Drain. The selected reaches serve as reference locations for Alloa Drain and Lyons Drain in their existing form that may be used to inform design approaches and criteria.

The surveys were completed on May 27, 2024, May 28, 2025, and June 3, 2024, and included the following:

- Longitudinal survey of the channel centre line
- Detailed surveys of up to eight to ten cross-sections
- Instream measurements of bankfull channel geometry, riparian conditions, bank material, bank height/angle, and bank root density at each surveyed cross-section
- Bed material sampling at each cross-section following a modified Wolman (1954) pebble count or substrate sample, as appropriate

The results of the detailed assessments are presented below in **Table 3**. A full summary of each detailed assessment is provided in **Appendix E**.

Table 3: Detailed assessment summary

Channel parameter	Reach AD1	Reach AD2	Reach LD2
Average bankfull width (m)	4.90	4.05	6.47
Average bankfull depth (m)	0.25	0.42	0.38
Channel gradient (%)	0.25	0.01	0.38
D₅₀ (mm)	0.145	0.219	0.084
D₈₄ (mm)	1.334	0.766	0.534
Manning’s n roughness coefficient	0.035	0.035	0.035
Calculated Bankfull discharge (m³/s)*	0.73	1.66	2.66

Channel parameter	Reach AD1	Reach AD2	Reach LD2
Calculated Bankfull velocity (m/s)*	0.60	0.98	1.08

*Based on Manning’s equation

6 Existing Conditions Erosion Hazard Delineation

Most watercourses in southern Ontario have a natural tendency to develop and maintain a meandering planform provided there are no topographical or spatial constraints. When defining the limits of an erosion hazard for a watercourse, unconfined and confined systems are assessed differently (TRCA, 2004 and MNR, 2002). Unconfined systems are those with streams in open areas (i.e., valley not apparent) or with valley walls that are positioned at a sufficient distance where the channel cannot reasonably be expected to contact because of migration under existing or future hydrologic scenarios. In this type of setting, the extent of the erosion hazard is delineated by the meander belt width, which is defined as the lateral extent that a channel has historically occupied and will likely occupy in the future.

Following MNR (2002), the meander belt width can be applied, at minimum, based on 20 times the bankfull channel width. Alternatively, the meander belt width can be determined through a detailed geomorphological study that examines the largest channel meanders observed through historical and recent aerial photograph interpretation. The meander belt width can then be graphically defined using orthorectified aerial imagery by determining the channel centerline and the channel’s central tendency (i.e., meander belt axis). In cases where the channel is not discernible in aerial photographs or the channel has been substantially modified, empirical models can be used to estimate the meander belt width.

Confined systems, in contrast, are those where a watercourse is contained within a defined valley where meander bend migration may be constrained by valley walls. Partially confined systems are those where meander bends are adjacent to only one valley wall and the watercourse is therefore restricted in migration and floodplain occupation on one side of the valley system. In these settings, where the channel is positioned within 15 m of a valley slope, the erosion hazard is generally defined by the toe erosion allowance, stable slope allowance, and erosion access allowance. In some instances, a meander belt width may also apply in partially confined systems (i.e., where the channel is greater than 15 m from the valley slope toe).

All watercourse reaches within the Secondary Plan Area were characterized as unconfined. Because all watercourse reaches have been historically straightened to accommodate agricultural land uses and/or are managed as municipal drains, natural meanders are not present on the landscape. Aerial imagery was reviewed to locate potential reference reaches to use as surrogates. No suitable reference reaches are available for the Alloa Drain, Lyons Drain, or associated tributaries with natural watercourse reaches (i.e., **AD1-2**). Natural meanders are present along Etobicoke Creek approximately 2.7 km downstream of the Secondary Plan Area; however, several tributary inputs are present that would influence meander amplitude. A suite of empirical equations was therefore used to delineate meander belt widths.

The bankfull channel dimensions observed during field reconnaissance were used to inform both the Williams (1986) and Ward (2002) models outlined below.

The empirical relations from Williams (1986) were modified to include channel width and applied using the bankfull channel dimensions such that:

$$B_w = 18A^{0.65} + W_b \quad \text{[Eq. 1]}$$

$$B_w = 4.3W_b^{1.12} + W_b \quad \text{[Eq. 2]}$$

where B_w is meander belt width (m), A is bankfull cross-sectional area (m^2), and W_b is bankfull channel width (m). An additional 20% buffer, or factor of safety, was applied to the computed belt width values. This addresses issues of under prediction.

The Ward et al. (2002) bankfull width model was also used to determine a meander belt width (ft), B_w :

$$B_w = 6W_b^{1.12} \quad [\text{Eq. 3}]$$

The resulting value was then converted to the metric system (m). A 20% factor of safety was not applied to this value due to the approach used in the modelling (i.e., hazard envelope rather than a linear relationship).

Lastly, meander belt widths were also calculated based on TRCA's (2004) empirical model:

$$B_w = -14.827 + 8.319 \ln(\rho g Q S * DA) \quad [\text{Eq. 4}]$$

where ρ is water density (1000 kg/m³), g is acceleration due to gravity (9.8 m/s²), Q is discharge (m³/s), S is channel slope (m/m), and DA is drainage area (km²). Reach gradients were determined using topographic data derived from LiDAR. Drainage areas were obtained from the Ontario Watershed Information Tool (OWIT), while the 2-year discharge for each reach was provided by Urbantech (2024). **Table 4** provides a summary of parameters used in the TRCA (2004) model.

Table 4: Parameters used in TRCA (2004) empirical model

Reach	Discharge (m ³ /s)	Slope (m/m)	Drainage Area (km ²)
Alloa Drain			
AD1-2	0.23	0.0050	3.30
AD2	3.74	0.0015	9.83
AD3	3.42	0.0015	9.48
Lyons Drain			
LD1	0.96	0.0084	2.03

Empirical modelling results are summarized in **Table 5**, below. The extents of all meander belt widths based on existing conditions are illustrated in **Appendix F, Figure 2**. Regarding the Alloa Drain, calculated meander belt widths range from 19 m to 48 m within the Phase 1 Lands. With the exception of **Reach AD1-2** in the eastern extent of the subject lands, values determined using the TRCA (2004) model are recommended as the final meander belt widths. These values include one (1) standard error (8.63) as a factor of safety. A meander belt width of 19 m based on the modified Williams (1986) width equation and a 20% factor of safety is recommended for **Reach AD1-2**. **Reaches AD2** and **AD3** of the Alloa Drain are proposed for realignment and the designed channel and associated meander belt widths are to be accommodated within their constructed corridors. Refer to **Section 7.5** for additional details.

Calculated meander belt widths for **Reach LD1** ranged from 29 to 49 m. Values calculated using the modified Williams (1986) width equation are generally selected as appropriate. Typically, meander belt widths decrease in the upstream direction due to reduced drainage areas, relatively lower discharges and in turn, smaller bankfull channel geometries. The modified Williams (1986) width equation resulted in a narrow meander belt width for **Reach LD2** relative to adjoining reaches. Therefore, the 29 m meander belt width calculated upstream and downstream was adopted for this reach. **Reach LD1** is proposed for realignment as part of future development and therefore the designed channel and associated meander belt widths are to be accommodated within their constructed corridors. Refer to **Section 7.5** for additional information.

Table 5: Summary of modelled meander belt widths for existing conditions

Reach	Modified Williams (1986) Area*	Modified Williams (1986) Width*	Ward Width (2002)	TRCA (2004)**	Recommended Meander Belt Width (m)
Alloa Drain					
AD1-2	27	19	21	24	19
AD2	55	31	34	46	46
AD3	48	26	29	45	45
Lyons Drain					
LD1	49	29	32	36	29

* Includes 20% factor of safety

** Includes one standard error (8.63 m) for factor of safety

7 Conceptual Natural Corridor Design

7.1 Design Objectives

Reaches AD2 and **AD3** of the Alloa Drain are proposed for realignment within the subject lands. The Alloa Drain currently services the surrounding agricultural fields and is proposed to be restored to provide a self-maintaining low-flow channel while enhancing connection to the floodplain. The proposed design will continue supporting low-flow conditions and storm events with channel form and function enhancements. The section of **Reach LD1** within the western portion of the subject lands is also proposed for realignment. HDF **Reach FC-2A** is proposed for realignment and the former wetland located at 1850 Mayfield Road is to be restored, as agreed to in consultation with CVC.

The proposed realignments provide an opportunity to replace the morphologically limited and impacted channels and HDFs with naturalized watercourses and enhanced corridors. The proposed designs have cross-sectional dimensions closer to a naturalized watercourse conveying similar flows and will significantly improve morphologic form and function per unit length. The realignment and naturalization designs provide opportunities for improved riparian conditions and well-developed bankfull channels with morphological variability. Improvement in morphology and function will benefit sediment balance, floodplain storage, vegetation communities, aquatic and terrestrial habitat, water balance, fish passage and water quality.

The primary objectives of the designs are to:

- Reinststate a more natural physical form, including planform and instream characteristics
- Improve the function of the channels by increasing flow interactions with the floodplain
- Provide a mix of coarse- and fine-grained sediment sources throughout the low-flow channels and floodplain
- Enhance aquatic habitat through the provision of morphologically diverse channels with spatially varied flows
- Improve riparian habitat by installing woody plantings and dynamic floodplain features
- Mitigate potential hazards to the development as well as lands surrounding the development
- Preserve flood storage to the greatest extent possible
- Replicate existing Wetland 7 within the realigned corridor

The realigned features will enhance terrestrial habitat by increasing diversity and providing a more natural floodplain form. Further functional benefits, such as water retention, infiltration, evapotranspiration, and sediment banking, will also be provided in the proposed design. Technical details are provided in subsequent sections to outline the approach used for channel sizing and habitat restoration.

Conceptual natural corridor design drawings are contained in **Appendix G**. To provide additional context, the proposed channel planforms and wetland pockets are also overlain on an aerial image in **Appendix G (Figure 3)**. The conceptual natural corridor design drawings have been prepared to demonstrate how the realigned corridors will function and be integrated with the overall natural heritage system. The proposed design will be further refined during the detailed design stage.

7.2 Bankfull Channel

A riffle-pool system is proposed for the realigned channel, which will provide significant improvements to not only the channel, as it essentially replicates a natural system, but also to aquatic and semi-aquatic habitat. When it is assessed to be an appropriate channel type, a riffle-pool system offers numerous benefits, such as:

- Channel bed relief for flow variability
- Improve feature function and interaction with the floodplain
- Relatively quiescent flows in pool sections to provide refuge for fish during high flows
- In-channel energy dissipation
- Improvement of riparian habitat by installing woody plantings and floodplain features

Channel design dimensions are determined by bankfull discharge, as this represents what is generally referred to as the "*channel-forming discharge*" or the "*dominant discharge*". Several methods can be applied to select an appropriate bankfull discharge. Back calculation of discharge from a reference reach and support from hydrological modelling is usually the most appropriate. Given the significant historical channel modifications due to agricultural activities and anticipated hydrology changes likely to occur due to the proposed development, discharges based on hydrologic modelling were determined for all reaches proposed for realignment. These discharges were then used to define channel bankfull geometries. The bankfull discharge used to size the channel was assumed to be equivalent to the modelled 2-year return period post-development flow. The following sections describe the discharge and bankfull geometries for each channel proposed for realignment.

7.2.1 Alloa Drain Reaches (AD Reach 3a to AD Reach 6)

To maintain a defined low-flow channel and efficiently transport sediment, a nested channel is proposed for design reaches **AD Reach 4 to AD Reach 6**. This design will provide a self-maintaining low-flow channel while also providing a connection to the floodplain and reducing aggradation. The larger channel carries the bankfull discharge, equivalent to the modelled 2-year return post-development flow. The smaller channel carries a portion of the bankfull discharge in a concentrated arrangement, which will increase sediment transport at lower flow events. A non-nested bankfull channel is proposed for **AD Reach 3a** to better match conditions within the corridor and create more opportunities for erosion mitigation given the current non-participating properties adjacent to the corridor.

The 2-year discharges used to size the bankfull channel were provided by Urbantech (2024) and are summarized in **Table 6**. Bankfull capacity for channels generally ranged from the 1- to 2-year return events. The channel has been subdivided into six design reaches throughout the Phase 1 lands based on changes in flow magnitude and/or corridor conditions.

Table 6: Alloa Drain 2-year return period discharges used in conceptual design based on hydrologic modelling (Urbantech, 2024)

Reach	2-year return period discharge (m ³ /s)
AD Reach 3a	2.50
AD Reach 4	3.26
AD Reach 5	3.42
AD Reach 6	3.74

A simple Manning's approach was used to iteratively back-calculate bankfull dimensions for the design. Since pool sections are designed to contain ineffective space, this model over-predicts the amount of discharge they convey. The modelled values for the riffle sections better predict the channel's capacity. Channel riffle and pool geometries and bankfull conditions for the proposed channels are provided in **Table 7** to **Table 10**. **Reach 3** is only present in the channel corridor in the crossing under Creditview Road (Crossing ADX5). As such, riffle and pool geometries and bankfull conditions for this reach are provided in **Table 18** in **Section 8**.

Design reach **AD Reach 3a** has an overall bankfull gradient of 0.10% for 288 m. The width and depth of the bankfull channel range from 6.30 m to 7.75 m and 0.85 m to 1.35 m for the riffles and pools, respectively. The average riffle gradient for **AD Reach 3** is 0.45%.

Design reach **AD Reach 4** has an overall bankfull gradient of 0.10% for 294 m. The width and depth of the low-flow channel range from 4.50 m to 5.15 m and 0.60 m to 0.85 m for the riffles and pools, respectively. The width and depth of the larger, bankfull channel range from 7.35 m to 9.10 m and 1.05 m to 1.50 m, respectively, for the riffles and pools. The average riffle gradient for **AD Reach 4** is 0.45%.

Design reach **AD Reach 5** has an overall bankfull gradient of 0.10% for 334 m. The width and depth of the low-flow channel range from 4.35 m to 5.25 m and 0.60 m to 0.80 m for the riffles and pools, respectively. The width and depth of the larger, bankfull channel range from 7.25 m to 9.40 m and 1.10 m to 1.50 m, respectively, for the riffles and pools. The average riffle gradient for **AD Reach 5** is 0.45%.

Design reach **AD Reach 6** has an overall bankfull gradient of 0.10% for 775 m. The width and depth of the low-flow channel range from 4.30 m to 5.65 m and 0.60 m to 0.80 m for the riffles and pools, respectively. The width and depth of the larger, bankfull channel range from 7.65 m to 9.80 m and 1.10 m to 1.50 m, respectively, for the riffles and pools. The average riffle gradient for **AD Reach 6** is 0.45%.

Table 7: Bankfull parameters for AD Reach 3a of the proposed channel

Channel parameter	AD Reach 3a	
	Riffle ^{††}	Pool [†]
Bankfull width (m)	6.30	7.75
Average bankfull depth (m)	0.63	0.80
Maximum bankfull depth (m)	0.85	1.35
Bankfull width-to-depth ratio	9.95	9.64
Channel gradient (%)	0.45	0.10
Bankfull gradient (%)	0.10	
Radius of curvature (m)‡	17	
Riffle-pool spacing (m)‡‡	49	
Manning's roughness coefficient, <i>n</i>	0.07	0.05
Mean bankfull velocity (m/s) *	0.63	0.48
Bankfull discharge (m³/s) *	2.50	3.00
Discharge to accommodate (m³/s)	2.50	
Tractive force at bankfull (N/m²)	38	13
Stream power (W/m)	110	29
Unit stream power (W/m²)	17	4
Froude Number (unitless)	0.25	0.17
Maximum grain size entrained (m) **	0.04	0.01
Mean grain size entrained **	0.03	0.01

† Based on bankfull gradient

†† Based on riffle gradient

‡ Based on Williams (1986)

‡‡ Based on Hey and Thorne (1986)

* Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative

** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)

Table 8: Bankfull parameters for AD Reach 4 of the proposed channel

Channel parameter	Low-flow Channel		Bankfull Channel	
	Riffle ^{††}	Pool [†]	Riffle ^{††}	Pool [†]
Bankfull width (m)	4.50	5.15	7.35	9.10
Average bankfull depth (m)	0.44	0.51	0.68	0.84
Maximum bankfull depth (m)	0.60	0.85	1.05	1.50
Bankfull width-to-depth ratio	10.34	10.01	10.89	10.85
Channel gradient (%)	0.45	0.1	0.45	0.10
Bankfull gradient (%)	0.10		0.10	
Radius of curvature (m)[‡]	20			
Riffle-pool spacing (m)^{‡‡}	57			
Manning's roughness coefficient, <i>n</i>	0.07	0.05	0.07	0.05
Mean bankfull velocity (m/s) *	0.49	0.36	0.66	0.50
Bankfull discharge (m³/s) *	0.95	0.95	3.26	3.83
Discharge to accommodate (m³/s)	--		3.26	
Tractive force at bankfull (N/m²)	26	8	46	15
Stream power (W/m)	42	9	143	38
Unit stream power (W/m²)	9	2	32	7
Froude Number (unitless)	0.24	0.16	0.26	0.18
Maximum grain size entrained (m) **	0.03	0.01	0.05	0.02
Mean grain size entrained **	0.02	0.01	0.03	0.01

† Based on bankfull gradient

†† Based on riffle gradient

‡ Based on Williams (1986)

‡‡ Based on Hey and Thorne (1986)

* Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative

** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)

Table 9: Bankfull parameters for AD Reach 5 of the proposed channel

Channel parameter	Low-flow Channel		Bankfull Channel	
	Riffle ^{††}	Pool [†]	Riffle ^{††}	Pool [†]
Bankfull width (m)	4.35	5.25	7.25	9.40
Average bankfull depth (m)	0.43	0.50	0.70	0.86
Maximum bankfull depth (m)	0.60	0.80	1.10	1.50
Bankfull width-to-depth ratio	10.07	10.45	10.36	10.89
Channel gradient (%)	0.45	0.10	0.45	0.10
Bankfull gradient (%)	0.10		0.10	
Radius of curvature (m) [‡]	20			
Riffle-pool spacing (m) ^{‡‡}	57			
Manning's roughness coefficient, <i>n</i>	0.07	0.05	0.07	0.05
Mean bankfull velocity (m/s) *	0.49	0.36	0.67	0.51
Bankfull discharge (m ³ /s) *	0.91	0.94	3.42	4.15
Discharge to accommodate (m ³ /s)	--		3.42	
Tractive force at bankfull (N/m ²)	26	8	49	15
Stream power (W/m)	40	9	152	41
Unit stream power (W/m ²)	9	2	36	8
Froude Number (unitless)	0.24	0.16	0.26	0.18
Maximum grain size entrained (m) **	0.03	0.01	0.05	0.02
Mean grain size entrained **	0.02	0.01	0.03	0.01

† Based on bankfull gradient

†† Based on riffle gradient

‡ Based on Williams (1986)

‡‡ Based on Hey and Thorne (1986)

* Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative

** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)

Table 10: Bankfull parameters for AD Reach 6 of the proposed channel

Channel parameter	Low-flow Channel		Bankfull Channel	
	Riffle ^{††}	Pool [†]	Riffle ^{††}	Pool [†]
Bankfull width (m)	4.30	5.65	7.65	9.80
Average bankfull depth (m)	0.43	0.52	0.72	0.89
Maximum bankfull depth (m)	0.60	0.80	1.10	1.50
Bankfull width-to-depth ratio	9.99	10.91	10.67	11.06
Channel gradient (%)	0.45	0.10	0.45	0.10
Bankfull gradient (%)	0.10		0.10	
Radius of curvature (m) [‡]	21			
Riffle-pool spacing (m) ^{‡‡}	60			
Manning's roughness coefficient, <i>n</i>	0.07	0.05	0.07	0.05
Mean bankfull velocity (m/s) *	0.48	0.36	0.68	0.52
Bankfull discharge (m ³ /s) *	0.90	1.06	3.74	4.53
Discharge to accommodate (m ³ /s)	--		3.74	
Tractive force at bankfull (N/m ²)	26	8	48	15
Stream power (W/m)	40	10	163	44
Unit stream power (W/m ²)	9	2	35	8
Froude Number (unitless)	0.24	0.16	0.26	0.18
Maximum grain size entrained (m) **	0.03	0.01	0.05	0.02
Mean grain size entrained **	0.02	0.01	0.03	0.01

† Based on bankfull gradient

†† Based on riffle gradient

‡ Based on Williams (1986)

‡‡ Based on Hey and Thorne (1986)

* Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative

** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)

7.2.2 Lyons Drain (LD Reach 2)

The 2-year discharge used to size the bankfull channel was provided by Urbantech (2024) and is 0.96 m³/s. Bankfull capacity for channels generally has a range from the 1- to 2-year return events. A simple Manning's approach was used to iteratively back-calculate bankfull dimensions for the proposed design. Since pool sections are designed to contain ineffective space, this model over-predicts the amount of discharge they convey. The modelled values for the riffle sections better predict the channel's capacity. Channel riffle and pool geometries and anticipated bankfull conditions for the proposed channel are provided in **Table 11**. Designed **LD Reach 2** has an overall bankfull gradient of 0.37% for 218 m. The bankfull width and depth range from 2.70 m to 3.45 m and 0.40 m to 0.65 m, respectively. The average riffle gradient for **LD Reach 2** is 1.55%.

Table 11: Bankfull parameters for LD Reach 2

Channel parameter	LD Reach 2	
	Riffle ^{††}	Pool [†]
Bankfull width (m)	2.70	3.45
Average bankfull depth (m)	0.30	0.37
Maximum bankfull depth (m)	0.40	0.65
Bankfull width-to-depth ratio	9.10	9.26
Channel gradient (%)	1.52	0.37
Bankfull gradient (%)	0.37	
Radius of curvature (m)‡	7	
Riffle-pool spacing (m)‡‡	23	
Manning's roughness coefficient, <i>n</i>	0.04	0.03
Mean bankfull velocity (m/s) *	1.20	0.92
Bankfull discharge (m ³ /s) *	0.96	1.18
Discharge to accommodate (m ³ /s)	0.96	
Tractive force at bankfull (N/m ²)	60	24
Stream power (W/m)	143	42
Unit stream power (W/m ²)	66	20
Froude Number (unitless)	0.70	0.48
Maximum grain size entrained (m) **	0.06	0.02
Mean grain size entrained **	0.05	0.01

† Based on bankfull gradient

†† Based on riffle gradient

‡ Based on Williams (1986)

‡‡ Based on Hey and Thorne (1986)

* Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative

** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)

7.3 Channel Planform

The initial channel planform layout was created using the modelled radius of curvature value (R_c) as a guide. The radius of curvature (R_c) of meanders can be used to evaluate channel stability. For example, stable meanders typically exhibit larger R_c values as opposed to lower values that indicate increased channel bank erosion and avulsion. Bankfull width is often an appropriate indicator of this instability. Hickin and Nanson (1984) note that channel avulsions are common when meander R_c is approximately 1-2 times the channel's bankfull width. For larger R_c (e.g., >5), the upstream limb of the meander will migrate more rapidly than the downstream limb (Hooke, 1975). Based on the bankfull widths described in **Section 7.2**, the radius of curvatures and feature spacing were determined.

Williams (1986) was used to derive values for the channel radius of curvature using the following equation (Eq. 5):

$$R_c = 2.43 \times w \quad [\text{Eq. 5}]$$

where R_c is the radius of curvature and w is the average bankfull width.

Empirical models derived by Hey and Thorne (1986) were followed to determine riffle spacing. Hey and Thorne's (1986) modelled values are often applied in larger watercourses. As such, multiple methods (Eq. 6-8) were considered to provide a range of riffle spacing values. These are:

$$Z = 6.31 \times w \quad [\text{Eq. 6}]$$

$$Z = 9.1186 \times w^{0.8846} \quad [\text{Eq. 7}]$$

$$Z = 7.36 \times w^{0.896} \times S^{-0.03} \quad [\text{Eq. 8}]$$

where Z represents riffle spacing.

Stream power and unit stream power were calculated as a function of bankfull discharge and channel gradient (Eq. 9-10). Stream power values are important to determine the need for mitigating channel bank and bed erosion. Stream power is given by:

$$\Omega = \rho \times g \times d \times S \quad [\text{Eq. 9}]$$

where ρ is the density of water (kg/m^3), g is the acceleration due to gravity (m/s^2), and Q and S are discharged (m^3/s) and channel gradient, respectively.

Stream power per unit width (Eq. 10) is given by:

$$\omega = \frac{\Omega}{w} \quad [\text{Eq. 10}]$$

whereas before Ω and ω are stream power and bankfull width, respectively.

The final channel planform was established through an iterative process. First, a cross-section with defined bankfull geometry was developed to calculate parameters for the planform (i.e., radius of curvature, riffle-pool spacing). The cross-section was then further refined, based on the final channel gradient. Once the cross-section dimensions were refined, hydraulic sizing for the channel substrate was completed, as outlined in **Section 7.4** below.

In developing a natural channel design, the length of the watercourse proposed to be realigned is typically replicated or exceeded to provide an overall gain in habitat. Within the Phase 1 Lands, the existing total length of the Alloa Drain Reaches **AD2** and **AD3** proposed for rehabilitation is approximately 1,705 m. The Phase 1 realigned corridor provides a total linear length of approximately 1,620 m and contains 1,805 m of low-flow channel realignment. These lengths form part of the larger proposed natural heritage system along the Alloa Drain in the Alloa Secondary Plan Area, wherein the

existing channel length is approximately 4,024 m and proposed channel length is approximately 4,589 m.

Within the Phase 1 Lands, the existing length of the Lyons Drain **Reach LD1** proposed for rehabilitation is approximately 160 m. The Phase 1 realigned corridor provides a linear channel length of approximately 130 m and contains 240 m of low-flow channel realignment. The proposed design continues northwards along Lyons Drain, west of the Phase 1 lands, including portions of HDFs. The channel lengths form part of the overall proposed natural heritage system for the Alloa Secondary Plan Area. The total length of existing channel and headwater drainage features associated with Lyons Drain is approximately 896 m, while the proposed design has approximately 1,090 m in length for the entire Secondary Plan Area.

The realigned sinuous channels will produce systems more akin what would occur in natural conditions, resulting in an increased total channel length of 180 m for all reaches within the Phase 1 Lands. When the entire Secondary Plan Area is considered, there is a gain of approximately 990 m in channel length when existing and proposed conditions are compared. Therefore, the proposed channels will significantly increase the restored and enhanced habitat area.

The conceptual corridor design also provides several swales on the floodplain that are connected to wetland pockets. These proposed swales have a total length of approximately 223 m within the Phase 1 lands. The Alloa Drain corridor provides a total swale length of 490 m. The length and configuration of floodplain swale features will be further refined at the Tertiary Plan and detailed design stages.

7.4 Channel Substrate Hydraulic Sizing

The sizing of the proposed substrate materials was guided by a review of hydraulic conditions (i.e., tractive force, flow competence) in the typical channel cross sections. The channel bed substrate is derived by balancing the average shear stress acting on the bed with the critical shear stress for the material. When the critical shear stress slightly exceeds the average shear stress acting on the bed, sediment transport is initiated.

Miller et al. (1977) was used to calculate the maximum and average substrate grain size entrained under the anticipated flow conditions, using the following equation (Eq. 11):

$$\theta = \frac{\tau_{cr}}{(\rho_s - \rho_w)gD} \quad [\text{Eq. 11}]$$

where θ is Shields parameter (dimensionless; assumed to equal 0.06 for gravel), τ_{cr} is the critical shear stress acting on the sediment particles (N/m^2 ; values provided in **Table 7** to **Table 10**), ρ_s is the density of sediment (kg/m^3), ρ_w is the density of water (kg/m^3), g is the acceleration due to gravity (m/s^2), and D is the characteristic particle diameter of the sediment. Reaches **AD Reach 3a** to **AD Reach 6** have a proposed mix of granular 'B', and native material for the riffles to provide for a stable bed and level of sorting. Pools will consist of native material.

For Reach **LD Reach 2**, a mix of 100 mm – 150 mm diameter riverstone with granular 'B' and native material is proposed for the riffles and a mix of 50 mm – 100 mm diameter riverstone with granular 'B' and native material for the pools. These materials will provide for a stable bed and level of sorting.

Granular 'B' consists of a mix of rounded stone where approximately 20% - 50% of the stone is greater than 0.005 m in diameter, with nothing larger than 0.15 m in diameter. It should contain no post-construction materials. The granular 'B' will always have a core of sediment that is not entrained under bankfull flow conditions. This maintains the character of the native material, while providing slightly higher stability and opportunity for sediment sorting. The gravel also provides opportunities for infiltration, filtration, and detention of water within the pore spaces to provide additional benefits by elongating the hydroperiod. The proposed mix will also improve aquatic habitat by increasing diversity between the riffle and pool substrates.

7.5 Channel Corridor Requirements

7.5.1 Corridor Size

In support of the corridor realignment design, the meander belt widths for each reach were calculated based on design bankfull dimensions to ensure that the designed channels have meander belt widths that fall within their corridor requirements. A range of models were used to calculate the meander belt widths of the designed channels, including TRCA (2004), modified Williams (1986; includes a 20% factor of safety). Based on the range results, a meander belt width was selected for each reach. The final value was also informed by the meander belt widths modelled using observations of field conditions, as provided in **Table 5** in **Section 6**.

All meander belt width calculations are based on channels where instream energy is greater than the potential resistance of the bank materials. As such, they over predict the potential extent of meandering of vegetation-controlled channels and therefore the erosion hazard. All the meander belt widths selected for the designed reaches include a factor of safety to ensure the results provide a conservative estimate of the hazard limit. Additionally, the proposed channel designs have been sized using the 2-yr flows to provide a conservative approach for the conceptual design; however, as the planning process progresses, there are opportunities to refine the channel dimensions using a more frequent but lower magnitude storm event (i.e., between the 1-yr and 2-yr).

Using the current dimensions of the channels, designed to a larger return event, the corridor bottom widths for all reaches can accommodate either the TRCA (2004) meander belt widths, and/or the Williams (1986) values. As the channel dimensions will likely be refined to a lower flow event at detailed design, this approach adequately proves that the corridors can address the erosion hazard requirements. In addition, given the low gradient, scale, bioengineering and erosion control elements implemented in the design in appropriate locations, and the vegetation control of the channels, they are anticipated to be stable. As such, the proposed corridor bottom widths are appropriately sized.

7.5.2 Alloa Drain AD Reach 3a to AD Reach 6

The nested channel design implemented in the Alloa Drain reaches (except for **AD Reach 3a** which does not incorporate a nested design), intentionally creates an inefficient system to provide a more defined channel during lower flow events while still conveying the 2-year return event flow. As a result, the Williams (1986) method functions more appropriately for nested channel reaches and typically provides larger, though similar, meander belt width estimates than the TRCA (2004) model. As such, the Williams (1986) model was generally selected to be implemented in the nested reaches of this channel to provide a more conservative estimate of meander belt width at this conceptual design stage. The exception is **AD Reach 3a**, for which the TRCA (2004) approach was selected. The bankfull widths of the designed **AD Reach 3a**, **AD Reach 4**, **AD Reach 5** and **AD Reach 6** used to calculate the meander belt widths were 6.30 m, 7.35 m, 7.25 m, and 7.65 m, respectively. The resulting meander belt width estimates are provided in **Table 12**.

Table 12: Meander belt widths for the proposed Alloa Drain - AD Reach 3a to AD Reach 6

Channel parameter	AD Reach 3a	AD Reach 4	AD Reach 5	AD Reach 6
Channel gradient (%)	0.10	0.10	0.10	0.10
Discharge to accommodate (m ³ /s)	2.50	3.26	3.42	3.74
Bankfull width (m)	6.30	7.35	7.25	7.65
Average bankfull depth (m)	0.85	1.05	1.10	1.10
Meander belt width (m)	36	57	56	60

Once the channel planforms were finalized through the iterative process of determining bankfull widths, radius of curvature and riffle-pool spacing, the meander belt widths were overlain to ensure the channel fits within the corridor. The proposed valley bottom widths generally range between 100 m and 119 m, except for **AD Reach 3a**, which ranges from 36 m to 40 m due to constraints from non-participating

properties. The corridor bottom widths adequately address the erosion hazard. Meander belt widths for designed channels will be refined at subsequent project stages, as required.

7.5.3 Lyons Drain LD Reach 2

The bankfull widths of the designed **LD Reach 2** used to calculate the meander belt widths is 2.70 m. The resulting meander belt width estimate is provided in **Table 13**.

Table 13: Meander belt widths for proposed channel LD Reach 2

Channel parameter	LD Reach 2
Channel gradient (%)	0.37
Discharge to accommodate (m ³ /s)	0.96
Bankfull width (m)	2.70
Bankfull depth (m)	0.40
Meander belt width (m)	19

Once the channel planforms were finalized through the iterative process of determining bankfull widths, radius of curvature and riffle-pool spacing, the meander belt widths were overlain to ensure the channel fits within the corridor. The proposed valley bottom width for **LD Reach 2** is 59 m, adequately addressing the erosion hazard.

7.5.4 Headwater Drainage Feature FC-2A Restoration Design

HDF Reach **FC-2A**, located on the property at 1850 Mayfield Road, is proposed for realignment. The management classification of **Reach FC-2A** is Conservation, as noted in the Headwater Drainage Feature Assessment Report prepared under separate cover (GEO Morphix Ltd., 2026). In addition, a wetland that was formerly present along **Reach FC-2A** on the property located at 1850 Mayfield Road is to be restored, as agreed to in consultation with CVC. The existing HDF and historical wetland have been heavily impacted by agricultural practices and contain a homogenous habitat that provides limited benefit.

A conceptual swale and wetland design is proposed to replicate and enhance **Reach FC-2A** and restore the previously removed wetland. The design proposes a meandering swale with areas of deeper pools within a wetland feature. Approximately 168 m of headwater drainage feature designated for conservation (i.e., **Reach FC-2A**) will be restored and replaced with 194 m of design features that will provide an overall net benefit to the system. The corridor provides 2,083 m² of wetland compensation area, which is slightly larger than the 2,070 m³ agreed to in consultation with CVC. The proposed design will provide feature form, length and function while incorporating wetland features to promote infiltration, evapotranspiration and produce organic carbon for the downstream system. The design increased habitat variability allowing for a range of habitat used for terrestrial and semi-aquatic species. The existing feature was heavily impacted by past agricultural activities, and the proposed design provides significant improvements to the feature and the downstream system. The design maintains channel length by providing a sinuous channel that will have good communication with the floodplain to maintain wetland habitat.

The wetland features will enhance terrestrial habitat by increasing diversity and providing a more natural floodplain form while also providing functional benefits such as short-term water retention and sediment banking. The wetlands will be irregularly shaped to maximize the perimeter for a given area, which increases the potential for edge effects. These wetlands' short-term water retention function helps polish the water and moderate discharge. These features, combined with the integrated swale feature, will increase system diversity and function, provide habitat features, and enhance overall productivity for the downstream natural heritage system.

7.5.5 Corridor Wetlands

In addition to the corridor realignments, one existing wetland (i.e., Wetland 7) is proposed for replication. This wetland was evaluated in 2024 by Azimuth Environmental Consulting Inc. (Azimuth, 2024), following the Ontario Wetland Evaluation System (OWES) methodology outlined in the OWES Southern Manual 4th Edition (MNR, 2022). Based on this assessment, Wetland 7 was determined to be not significant, following provincial criteria. Wetland 7 has a total area of 1.23 ha and will be replicated within the Alloa Drain corridor. A total of 1.3 ha of offline wetlands and stone-cored wetlands are proposed within the Phase 1 Alloa Drain corridor. Wetlands proposed in realigned corridors for the overall Secondary Plan Area result in a total constructed wetland area of 3.5 ha.

The offline wetland features proposed within the corridor in addition to the low-flow channel will enhance terrestrial habitat by increasing diversity and providing a more natural floodplain form. They also provide functional benefits such as short-term water retention, infiltration, evapotranspiration, and sediment banking. They are irregularly shaped to maximize the perimeter for a given area, which increases the potential for edge effects and increases habitat diversity. Submerged and dry mounds are proposed within the offline wetlands to increase habitat heterogeneity by providing a topographically complex bottom. A granular mix is proposed within these features and can provide future sediment sources to the channel if it migrates laterally. The granular mix will have substrate sizes similar to those proposed within the riffle features.

Stone-cored wetlands will also be installed at the proposed stormwater management ponds and on-site control outfalls throughout the corridor. The stone core refers to hydraulically sized rounded stone, the subsurface material used to ensure wetland stability. The stone should be hydraulically sized during detailed design. Like the offline wetlands, the stone core wetlands will have submerged and dry mounds to provide a topographically complex bottom that will increase habitat heterogeneity. The short-term water retention function of these wetland types helps to polish the water, increase potential infiltration, and moderate the discharge of water into the channel (in addition to the functions provided by the SWM pond).

The channel corridor will be restored using native plant species, including appropriate species for the various seed mixes and woody vegetation. The plantings are intended to enhance the terrestrial habitat by providing species and habitat diversity, increasing floodplain soil stability, and increasing floodplain roughness and sedimentation. Landscape restoration planting plans will be prepared by others as part of detailed design.

7.5.6 Habitat Features

Several habitat elements are incorporated into the design within the channel corridors to improve riparian habitat and promote wildlife biodiversity. The habitat elements include potential overwintering pools, brush mattresses, basking logs, brush piles, raptor poles, turtle nesting sites, snake hibernacula, rock piles, root wads and terrestrial mounds. The proposed elements provide a variety of topographies and woody debris that maximize the potential for wildlife passage, forage, and residency. The accompanying conceptual design drawings provide further details and directions for the implementation.

Potential overwintering pools are proposed to provide critical habitat for resident fish. The overwintering pools are located within the tortuous meander pattern, which will increase scour and pool depth. This habitat feature will provide fish with potential refuge from freezing conditions in the winter and an ideal habitat during low flow periods and increase habitat heterogeneity within the channel.

Brush mattress is included in the design to provide erosion mitigation for the corridor in areas where the channel meander belt width is in proximity to the toe of the corridor slope, particularly in the area adjacent to hold-out properties east of Creditview Road. This treatment consists of live brush cuttings installed parallel to the channel banks on the outside bends of the meanders and tied with coir twine and stakes. The brush mattress will provide bank stability and improve aquatic habitat through shading and foraging opportunities. As noted above, given the channel is low-gradient and will have vegetation control, it is unlikely the channel will significantly migrate within the corridor. As such, the brush mattress is a conservative measure to provide additional erosion mitigation.

Basking logs consist of a mixture of hardwood and softwood species, placed in shallow areas of wetlands and anchored with a mix of stone or limestone blocks. These logs are angled in a way that promotes turtle basking.

Brush piles consist of logs, snags and other wood debris placed in a way that forms a stable interconnected mound shaped like a pallet. The brush piles are also planted with native fruit-bearing vines, which provide foraging opportunities for wildlife. Brush piles are placed at various locations along the length of the floodplain.

Root wad bank treatments are also proposed at specific locations within the tortuous meander pattern. The treatment extends the entire length of the outside meander bends between riffles, which consists of partially buried root wads on a bedding of riverstone. The root wad bank treatment enhances bank stability while improving aquatic habitat by providing low flow refugia and foraging opportunities.

Raptor poles are constructed from large conifer tree trunks embedded into the ground, providing perches for larger raptors.

Turtle nesting sites are installed on south or west-facing slopes away from the watercourse. These are constructed by excavating a slight depression in the ground and filling it with granular 'a' or 'm' material.

Snake hibernacula are constructed similarly to turtle nesting sites on south—or west-facing slopes away from the watercourse. The excavated depressions are filled with a mix of angular stones of various sizes and woody debris. A layer of leaf litter is installed on top to provide insulation.

Rock piles consist of stones of varying sizes piled up to create small mounds. These features provide hibernation habitat and cover from predators for various terrestrial species. The base of the piles is partially buried to prevent rock falls. Rock piles are installed at multiple locations along the corridor length within the buffer.

Terrestrial mounds consist of native material piled up to create small mounds with a small dimple on the top. The bottom of the mound is seeded with the specified seed mix, while the top has limited soil and seed on it to provide foraging opportunities.

7.6 Phase 1 Corridor Water Availability Assessment

As detailed in the preceding sections, restoration concepts have been developed for the Alloa Drain (**AD Reaches 3a–6**), which will include wetland compensation areas for the existing **Wetland 7** along the Alloa Drain (**AD**). The restoration concept includes nine (9) wetlands located within the channel corridor of the Alloa Drain and its tributary (**Wetland F to Wetland Mi**), some of which would receive inputs from uncontrolled backyard runoff and onsite storage from the planned development and/or from releases from the proposed stormwater management ponds (SWM Ponds). Proposed dimensions and catchment inputs for each wetland are provided in **Table 14**, and the proposed wetland locations are shown on **Figure 4** in **Appendix H**.

Table 14: Conceptual wetland dimensions and contributing areas

Wetland	Area (m ²)	Average depth (m)	Volumetric Storage (m ³)	Contributing area		
				Uncontrolled backyard and onsite storage runoff (m ²)	Channel corridor (m ²)	SWM Pond (m ²)
Wetland F	1,525	0.3	431	-	4,934	381,000 (Pond 5)
Wetland G	1,285	0.3	356	-	4,934	163,000 (Pond 3)
Wetland H	3,907	0.3	3,547	1,736	11,513	-

Wetland	Area (m ²)	Average depth (m)	Volumetric Storage (m ³)	Contributing area		
				Uncontrolled backyard and onsite storage runoff (m ²)	Channel corridor (m ²)	SWM Pond (m ²)
Wetland I	1,344	0.3	377	3,520	8,224	301,000 (Pond 4)
Wetland J	3,889	0.3	4,185	2,600	13158	-
Wetland K	511	0.3	136	-	4934	504,000 (Pond 6)
Wetland Ii	191	0.3	57	-	329	-
Wetland Ki	265	0.3	80	-	443	-
Wetland Mi	262	0.3	79	-	401	-

The nine wetlands within the **AD** corridor summarized in **Table 14** are designed to compensate for the loss of existing **Wetland 7**, which has a total area of 12,300 m². Combined, designed **Wetlands F-Mi** will have a surface water volumetric storage capacity of approximately 9,248 m³, and will cover an area within the channel corridor of 13,178 m², resulting in a net post-development increase in wetland area of 7%. Additionally, the proposed riparian floodplain corridor within Phase 1, excluding the wetlands and channel areas, covers a total area of 145,950 m².

A selection of the proposed wetlands have been designed with deeper pools, **Wetlands F, G, I, and K** contain deep pools with a maximum depth of 1.5 m, and **Wetlands H and J** contain deep pools with a maximum depth of 2 m. **Wetlands F, G, I and K** will receive direct surface water inputs from stormwater management pond outlets. Uncontrolled backyard runoff and runoff from onsite storage facilities within the proposed development will also be directed to the channel corridor, with **Wetlands H, I and J** intercepting a percentage of this surface runoff. **Wetlands Ii, Ki, and Mi** will generally only receive surface runoff from the adjacent channel corridor areas, although during large storm events, contributions from the adjacent SWM Ponds' emergency overflow spillway are anticipated.

7.6.1 Methods

The primary objectives of the water availability assessment were to determine whether inputs to the created wetlands are sufficient to maintain wetland water levels and to estimate annual infiltration volumes along the proposed corridor. Water availability for the created wetlands was assessed using a monthly soil-moisture water balance approach (Thorntwaite & Mather, 1957). This relatively straightforward approach estimates monthly water availability from commonly available meteorological data (i.e., temperature and precipitation) and information about the site's topography, soils, and land cover. Precipitation (P) data were retrieved from the Georgetown 1981 to 2010 Canadian Climate Normals (Environment Canada, 2022), and evapotranspiration (ET) rates were calculated using a water availability model that accounts for both monthly meteorological conditions and monthly water availability. The majority of runoff to the wetlands in **AD** channel corridor is expected to come from direct precipitation as well as runoff from the channel corridor, uncontrolled backyard runoff, onsite storage runoff and SWM Pond discharge from the proposed development (Urbantech, 2026). Inputs from the backyards, onsite storage and SWM Ponds were calculated using results from a 40-year continuous hydrological simulation for each individual backyard, onsite storage facility and SWM Pond provided by Urbantech (2025;2026). Monthly average discharge was calculated from the continuous hydrological simulation model results and converted to average monthly runoff. Hydrological data were also provided at 15-minute intervals for two separate flow nodes along the Alloa Drain channel to allow for an inundation frequency analysis. To account for uncertainties in modelled runoff contributions from catchments external to the subject lands, Urbantech (2026) provided high, baseline, and low runoff

scenarios. Inundation frequencies were calculated for all three scenarios and incorporated into the wetland water availability assessment.

While limited data is available regarding shallow groundwater conditions along the Alloa Drain, shallow groundwater conditions were measured by Crozier using nested piezometers located at the upstream and downstream extent of **Wetland 7** (PZ24 and PZ25). Measured water table elevations at **Wetland 7 (AD)** ranged from 0 mbgs to 0.74 mbgs at the downstream extent of **Wetland 7**, with an average water depth of 0.67 mbgs (Crozier, 2025). The sediments underlying the proposed channel corridor and wetland features have been characterized as relatively low hydraulic conductivity Halton Till (10^{-7} - 10^{-8} m/s; Crozier, 2024). Given that the sediments underlying the proposed pocket wetlands are likely to have low hydraulic conductivity, a conservative seepage rate of 5 mm/day was adopted for the pocket wetland water balance estimates.

Although the monthly water balance results are useful for estimating the average seasonal patterns in wetland water availability, periodic and intermittent rewetting of wetlands can be expected throughout the year at the time scale of individual storm runoff events. The timescale of individual storm runoff events (i.e., hourly to daily) mean that their influence on wetland water depths is not captured in a monthly water balance model, which instead provides general seasonal trends in wetland water availability. Additionally, water retention in wetland features is highly sensitive to soil infiltration rates. The infiltration process is highly dynamic in unsaturated soils, and infiltration rates can be expected to vary over relatively short time scales (i.e., minutes to hours) and over relatively short distances (i.e., 1m-10m) due to the local variability in the physical properties of the surface and subsurface. A more detailed and ongoing assessment of hydrological conditions at the specific location of the planned wetlands would provide relevant data to ensure that the hydrology of the pockets wetlands will satisfy or can be made to satisfy the required hydroperiods through optimization of the wetland hydrological characteristics (e.g., site grading to reduced depth to water table, installation of low/high permeability layers to reduce/increase infiltration rates).

7.6.2 Results – Wetland Hydroperiods

The results of the monthly water availability model using the baseline scenario indicated that ponded water will be maintained in all four constructed wetlands receiving input from SWM Ponds (**Wetlands F, G, I and K**). These four wetlands will remain full year-round, contributing runoff to the channel throughout the year. **Wetland J**, which will intercept uncontrolled backyard runoff and onsite storage, is also expected to retain ponded water from September to June, with runoff from the wetland anticipated from January to March, and in May. **Wetland H**, also intercepting uncontrolled backyard runoff, will retain ponded water from December to May, with runoff from the wetland anticipated from February to May. **Wetlands Ii, Ki, and Mi**, which will generally not receive direct runoff contributions from the development, will maintain ponded water in the fall, winter, and spring, but, under average meteorological conditions, are anticipated to remain dry from summer to late fall (i.e., June to November). Runoff from **Wetlands Ii, Ki and Mi** is anticipated only following inundation events.

Results from the high runoff scenario are generally consistent with those from the baseline scenario for the four (4) wetlands receiving SWM Pond runoff and for the two (2) wetlands receiving uncontrolled runoff (**H and J**). Under the high runoff scenario, **Wetlands Ki and Mi** will receive overbank flow from an average of seven inundations per year. Both wetlands are expected to remain wet year-round, with runoff from the development anticipated following inundation events. **Wetland Ii**, located further downstream, will receive overbank flow contributions from an average of two inundations per year, and thus only retains ponded water from December to July

The low runoff simulation represents a conservative scenario in which upstream catchment contributions are lower. Results from the low runoff scenario indicate that the four (4) wetlands receiving SWM Pond contributions will maintain ponded water year-round, consistent with the baseline and high runoff scenarios. **Wetlands H and J**, receiving direct inputs via uncontrolled runoff, are expected to remain wet from December to May (**Wetland H**), and from September to June (**Wetland J**), with minimal runoff from the wetlands following spring freshet. **Wetlands Ii, Ki and Mi**, with no direct inputs from the development, are only anticipated to maintain ponded water in the winter and spring (i.e. December to May). Runoff from these three wetlands is not expected under the low runoff scenario. Results from

the wetland water availability analysis for all three scenarios are summarised in **Appendix H** for reference.

The hydroperiod of the proposed constructed wetlands meets the requirements of the existing vegetation and aquatic communities. Vegetation communities in **Wetland 7** along **AD** are highly sensitive to changes in the hydroperiod and consist predominantly of American Elm, Black, Green and Red Ash, Spotted Touch-me-not and Red-osier Dogwood (Azimuth, 2024). These species rely on open water year-round, a condition provided by four (4) of the nine (9) constructed wetlands across all three assessed scenarios. These four wetlands account for 4,655 m², or approximately 38% of the existing **Wetland 7** area in the Phase 1 lands alone.

7.6.3 Results – Corridor Infiltration Volumes

Using the results of the wetland water availability assessment, average annual infiltration rates from each wetland were calculated for the three runoff scenarios (**Table 15**). Results indicate that the constructed wetlands are anticipated to provide a total annual infiltration volume of approximately 12,178 m³ under the baseline scenario, 13,109 m³ under the high runoff scenario, and 11,954 m³. The highest infiltration volumes are anticipated to occur in wetlands receiving SWM Pond inputs, as they remain wet year-round with seepage occurring during spring, summer and fall months when temperatures remain above 0°C. The monthly wetland water balance model assumes that wetland open water is frozen and that wetland seepage ceases when the average monthly air temperature is below zero.

Table 15: Annual infiltration volumes for the constructed wetlands

Wetlands	Baseline Annual infiltration volume (m ³) ¹	High Runoff Annual infiltration volume (m ³) ¹	Low Runoff Annual infiltration volume (m ³) ¹
F	1908	1908	1908
G	1608	1608	1608
H	3296	2657	2012
I	1640	1640	1640
J	4745	3917	3917
K	622	623	623
Ii	142	114	65
Ki	197	323	92
Mi	194	320	90
Total	12,178	13,109	11,954

¹Calculated using inputs from SWM Pond, backyard and onsite storage runoff estimates, assuming a wetland infiltration rate of 5 mm/day

Soil augmentation within restored channel corridors can also increase infiltration by providing a deeper layer of soil with more pore space. This additional layer of deeper, more permeable soil serves as a subsurface storage reservoir, contributing to increased infiltration volumes. To determine the volumetric storage provided by topsoil augmentation within the proposed channel corridor, three different scenarios were assessed with 200 mm, 400 mm and 600 mm of augmented soil. Based on borehole measurements, existing topsoil depths across the subject lands range from 200 mm to 300 mm, with an average of 250 mm (Crozier, 2024). Therefore, the three assessed soil augmentation scenarios would result in a total corridor topsoil depths of 450 mm, 650 mm and 850 mm, respectively. For the purpose of this analysis, it is assumed that volumetric storage benefits are provided by the difference between augmented topsoil and existing topsoil depth. To remain conservative, an effective porosity of 0.25 was assumed based on the local surficial geology. The effective porosity represents the field capacity for the augmented topsoil to retain and store water. This assessment conservatively assumes that even under

the low runoff scenario, there are sufficient water contributions from direct precipitation and local runoff to the corridor soils to fill and infiltrate the augmented topsoil soil reservoir at least once annually. Volumetric storage estimates provided by the augmented topsoil are summarised in **Table 16**.

Table 16: Volumetric storage from topsoil augmentation

Scenario	Channel corridor area ¹ (ha)	Topsoil Depth (mm)	Topsoil water storage (mm)	Volumetric Storage (m ³)
Scenario 1 (200 mm augmented topsoil)	145,950	200	50	7,298
Scenario 2 (400 mm augmented topsoil)		400	100	14,595
Scenario 3 (600 mm augmented topsoil)		600	150	21,893

¹Channel corridor excluding wetlands and channel.

²Based on an effective porosity of 0.25

The volumetric storage capacity of the augmented topsoil provides a reasonable first-order approximation of annual infiltration potential as it can be expected that these soils will fill and drain multiple times over a typical year. To assess the total potential infiltration volumes provided by the channel corridor, infiltration from the augmented topsoil was combined with infiltration volumes from the constructed wetlands. Results are summarised in **Table 17** and demonstrate that the combination of augmented topsoil and pocket wetlands from the Phase 1 lands is estimated to provide a minimum of 33,461 m³ per year of infiltration (low runoff scenario with 200 mm of augmented topsoil) and a maximum of 77,630 m³ per year (high runoff scenario with 600 mm of augmented topsoil).

Table 17: Total annual infiltration provided by the channel corridor

Scenario	Annual infiltration from wetlands (m ³)	Annual infiltration from augmented topsoil (m ³)	Total annual infiltration (m ³)
Baseline Scenario			
Scenario 1 (200 mm augmented topsoil)	12,178	7,298	19,476
Scenario 2 (400 mm augmented topsoil)		14,595	26,773
Scenario 3 (600 mm augmented topsoil)		21,893	34,071
High Runoff Scenario			
Scenario 1 (200 mm augmented topsoil)	13,109	7,298	20,407
Scenario 2 (400 mm augmented topsoil)		14,595	27,704

Scenario	Annual infiltration from wetlands (m ³)	Annual infiltration from augmented topsoil (m ³)	Total annual infiltration (m ³)
Scenario 3 (600 mm augmented topsoil)		21,893	35,002
Low Runoff Scenario			
Scenario 1 (200 mm augmented topsoil)	11,954	7,298	18,892
Scenario 2 (400 mm augmented topsoil)		14,595	26,189
Scenario 3 (600 mm augmented topsoil)		21,893	33,487

8 Corridor Crossing Recommendations

Five road crossings are proposed within the realigned Alloa Drain Corridor within the extent of Phase 1 lands (**Appendix G, A**). One crossing is proposed in **AD Reach 3**, under Creditview Road. Culvert **ADX5** is proposed as an 18 m x 2.5 m open-bottom culvert under the existing Creditview Road. One crossing, culvert **ADX6** is proposed in **AD Reach 4** under a proposed road. Culvert **ADX6** is proposed to be a 20 m x 2.5 m open-bottom structure. Two crossings are proposed in **AD Reach 6**. Crossing **ADX7** is a 20 m x 2.5 m open-bottom culvert under a proposed road. Crossing **ADX8** is currently an existing 6 m x 2.5 m open-bottom culvert under Chinguacousy Road at the downstream extent of the designed corridor. A 22 m x 2.5 m open-bottom culvert is proposed to replace the existing crossing structure. One crossing is proposed within the **Reach LD2** corridor. Culvert **LDX1** is proposed as a 9 m x 1.75 m open-bottom crossing under Creditview Road.

To support an appropriate tie-in with the channel, the dimensions for channels through the crossings are consistent with the channel upstream and downstream of the structure. Given the increased substrate size under culverts, a nested channel approach is not recommended at the crossings due to difficulties to construct. As such, geometries for non-nested bankfull channels were calculated for the crossings through these reaches using the Manning's approach outlined in **Section 7.2** to determine appropriate channel geometries through the structures. Riffle and pool dimensions and anticipated flow conditions in the vicinity of the crossing are provided in **Table 18**.

Table 18: Bankfull parameters for AD Reach 3, AD Reach 4, and AD Reach 6 through the proposed crossings

Channel parameter	AD Reach 3 Crossing		AD Reach 4 Crossing		AD Reach 6 Crossing	
	Riffle ^{††}	Pool [†]	Riffle ^{††}	Pool [†]	Riffle ^{††}	Pool [†]
Bankfull width (m)	5.75	7.20	6.15	7.90	6.45	8.30
Average bankfull depth (m)	0.68	0.77	0.77	0.85	0.81	0.89
Maximum bankfull depth (m)	0.95	1.35	1.10	1.50	1.50	1.55
Bankfull width-to-depth ratio	8.50	9.37	7.99	9.31	7.99	9.36

Channel parameter	AD Reach 3 Crossing		AD Reach 4 Crossing		AD Reach 6 Crossing	
	Riffle ^{††}	Pool [†]	Riffle ^{††}	Pool [†]	Riffle ^{††}	Pool [†]
Channel gradient (%)	0.45	0.10	0.45	0.10	0.45	0.10
Bankfull gradient (%)	0.10		0.10		0.10	
Manning's roughness coefficient, <i>n</i>	0.07	0.05	0.07	0.05	0.07	0.05
Mean bankfull velocity (m/s) *	0.64	0.47	0.69	0.50	0.72	0.51
Bankfull discharge (m ³ /s) *	2.50	2.58	3.26	3.33	3.74	3.78
Discharge to accommodate (m ³ /s)	2.50		3.26		3.74	
Tractive force at bankfull (N/m ²)	42	13	48	15	51	15
Stream power (W/m)	112	25	141	33	166	37
Unit stream power (W/m ²)	19	4	23	4	26	5
Froude Number (unitless)	0.25	0.17	0.25	0.17	0.26	0.17
Maximum grain size entrained (m) **	0.04	0.01	0.05	0.02	0.05	0.02
Mean grain size entrained **	0.03	0.01	0.04	0.01	0.04	0.01

† Based on bankfull gradient

†† Based on riffle gradient

* Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative

** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)

As an approximation, crossings typically span at least three times the bankfull channel width to accommodate potential channel adjustments. Average designed bankfull channel widths and recommended crossing span widths are provided in **Table 19**. Crossing locations are illustrated in **Figure 3** in **Appendix G**.

Table 19: Preliminary crossing recommendations

Crossing ID	Design Reach	Avg Bankfull Width (m) Proposed Conditions	Preliminary Crossing Span* (m)	Provided Crossing Span (m)
ADX5	AD Reach 3	6.48	19	18
ADX6	AD Reach 4	7.03	21	20
ADX7	AD Reach 6	7.38	22	20
ADX8	AD Reach 6	7.38	22	22
LDX1	LD Reach 2	3.08	9	9

* Based on 3 times the proposed average channel bankfull width

The provided structure spans for ADX5 to ADX7 are slightly narrower than the recommended crossing spans based on three times the average bankfull width; however, the crossing spans are greater than 3 times the proposed riffle width, which typically governs the erosion hazard given the pools contain ineffective space. Additionally, the stone through the crossings will be hydraulically sized to withstand the largest anticipated velocities and the channel is unlikely to migrate within the structures. The spans still allow for an approximately 6 m toe erosion allowance on either side of the channel.

The recommended spans noted above are to also be considered in tandem with the requirements of other disciplines (i.e. terrestrial ecology, engineering). Channel geometries for the conceptual were sized using 2-yr storm events which is a conservative approach. As the design progresses to detailed design the geometries will be refined. From a fluvial geomorphological perspective, the proposed culverts are adequately sized.

Fish passage will be addressed through the crossings by incorporating riffle-pool morphology, which provides an opportunity for low-flow refugia for fish within the pool features. However, the near-bed velocity of the channel within the crossings should also be reviewed at the detailed design stage to determine whether fish passage is possible under a range of conditions expected for the low-flow channel. The assessment should consider passage potential for species commonly found within the watershed.

9 Recommended Post-Construction Monitoring Program

A post-construction monitoring program is recommended to assess the performance of the implemented channel designs. Monitoring observations can also be used to determine the need for remedial works. Monitoring is recommended for ten calendar years or until 80% build out (whichever is greater) and includes semi-annual (i.e., spring and fall) visual inspections and annual surveys. It is recommended that monitoring be completed in years 1, 2, 3, 5 and 9 with monitoring reports provided following completion of each monitoring period and a summary report provided in Year 10. Monitoring activities should be undertaken by a qualified fluvial geomorphologist.

The following monitoring and reporting activities are suggested for the channels and wetlands in each realigned corridor:

- Document general observations of the channel and wetland works after construction and after the first large flooding event to identify any potential areas of erosion concern
- Complete visual monitoring two times per monitoring year, after the spring freshet and prior to the onset of winter conditions for the duration of the monitoring program
- Collect a detailed photographic record of site conditions, including monumented and georeferenced photographs at various intervals along the entire length of the realigned channels and constructed wetlands
- Conduct a physical review of wetland features once during each monitoring year to ensure stability and vegetation establishment
- Complete a total station survey of the longitudinal profile and 8-10 cross sections following construction. Channel cross-section surveys should be an equal mix of geomorphic unit types. At least two (2) of the cross-section surveys should be monumented and georeferenced. The longitudinal profile and monumented channel cross sections would serve as the as-built reference condition for use in comparing surveys completed in subsequent years
- Re-survey the longitudinal profile and cross sections in subsequent monitoring years after construction
- Install erosion pins at monumented cross sections after construction and re-measure erosion pins during subsequent monitoring years
- Characterize bed material based on Wolman (1954) pebble counts at all cross sections as part of the initial total station survey and at monumented cross sections in subsequent monitoring years
- Conduct general vegetation surveys each monitoring year after construction for the duration of the monitoring period

- Prepare annual reporting to summarize construction activities (i.e., design implementation), and milestone reports in years 2, 4, 6 and 10

The above recommended monitoring plan is subject to refinement during subsequent project stages.

10 Summary

GEO Morphix completed a fluvial geomorphology assessment and prepared conceptual natural corridor designs as part of the EIR prepared in support of the Draft Plan of Subdivision Applications for Phase 1 of the Alloa Secondary Plan Area in the Town of Caledon. The assessment and conceptual natural corridor design drawings documented herein build upon the LSS prepared by Crozier et al. (2026). GEO Morphix also completed HDF assessments and an erosion mitigation assessment in support of the stormwater management strategy, which are provided under separate cover.

Multiple planning level studies have been completed downstream of the subject lands in support of adjacent development, including the Mayfield West lands and the Mount Pleasant lands. This reporting was reviewed in detail as part of the current assessment. The desktop assessment also included a review of surficial geology and topographic mapping and historical and recent aerial imagery to understand existing conditions and inform the field work program.

All watercourse reaches within the subject lands have been impacted by agricultural land uses, with the majority of reaches consisting of municipal drains known as the Alloa Drain and Lyons Drain. Rapid assessment tools, such as the RGA (MOE, 2003) and RSAT (Galli, 1996), were used to evaluate the stability and overall health of watercourse reaches in the subject lands. All watercourse reaches were evaluated to be stable, with erosion limited to localized areas along select reaches. Overall stream health was generally evaluated to be fair. This was largely due to limited natural riparian vegetation, limited morphologic variability, and evidence of siltation, particularly along the Alloa Drain.

Historical impacts due to agricultural land uses provide an opportunity to realign and restore watercourses and drainage features within the Phase 1 lands. To help inform the proposed realignments, detailed geomorphological assessments were completed along sections of the Alloa Drain and Lyons Drain in 2024. Overall, the proposed designs result in a significant increase in channel length, improvements to the conveyance of flow and sediment, increases in morphological and substrate variability and a more natural floodplain form when compared to existing conditions. In addition, Wetland 7 is proposed for removal as part of future development. The proposed conceptual design demonstrates that wetland replication can be easily accommodated in the realigned Alloa Drain corridor.

We trust this report satisfies your requirements at this time. Should you have any questions or concerns, please contact the undersigned.

Respectfully submitted,



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Appendix A: Study Area and Reach Delineation



Legend

Reach Break and ID	OHN Waterbody
Watercourse	Participating Properties
Headwater Drainage Feature	Non-Participating Properties, Access
Municipal Drain	Non-Participating Property, No Access
Tile Drain	Phase 1 Lands
Municipal Drain Not Field Assessed	Phase 2 Lands
Not Field Assessed	Alloa Secondary Plan Area and Primary Study Area

Figure 1
Reach Delineation
Phase 1 Alloa Secondary Plan Area
 Caledon, Ontario

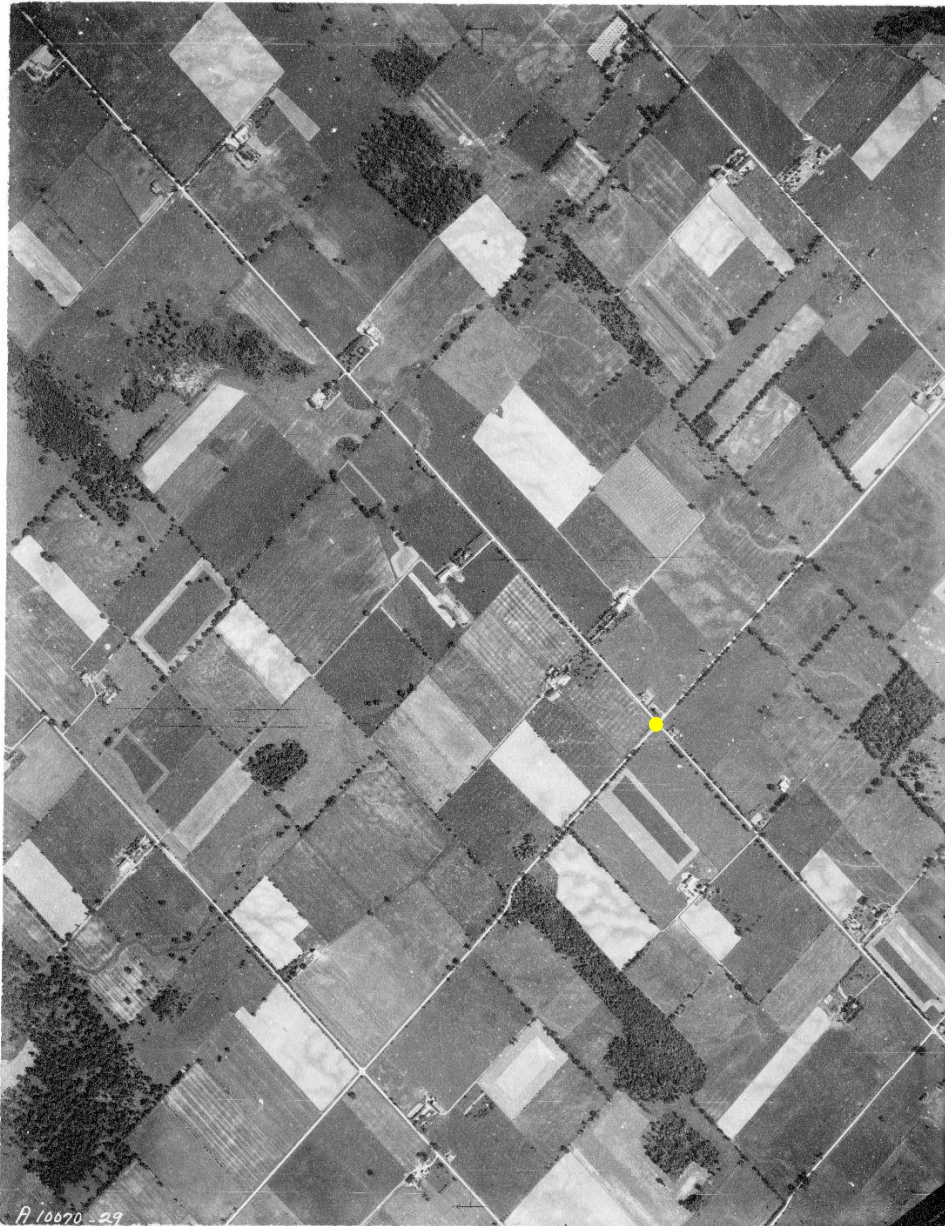
GEO MORPHIX™

0 150 300
 Metres

Imagery: Google Earth, 2022. Waterbody, Watercourse: MNR, 2023. Alloa Phase 1 & 2 Lands, Alloa Secondary Plan Area: Crozier, 2024. HDfs, Watercourse: GEO Morphix Ltd., 2024. Proposed Road Network, Proposed SWM Pond Location: Urbantech, 2024. Crossing Locations: GEO Morphix Ltd., 2024. Participating Properties, Wetlands, Dripline, Woodland: Crozier, 2024. PN24009. Print Date: March 2026. Drawn By: R.A., M.O., S.S.O., K.W., D.B.

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Appendix B: Historical Aerial Imagery



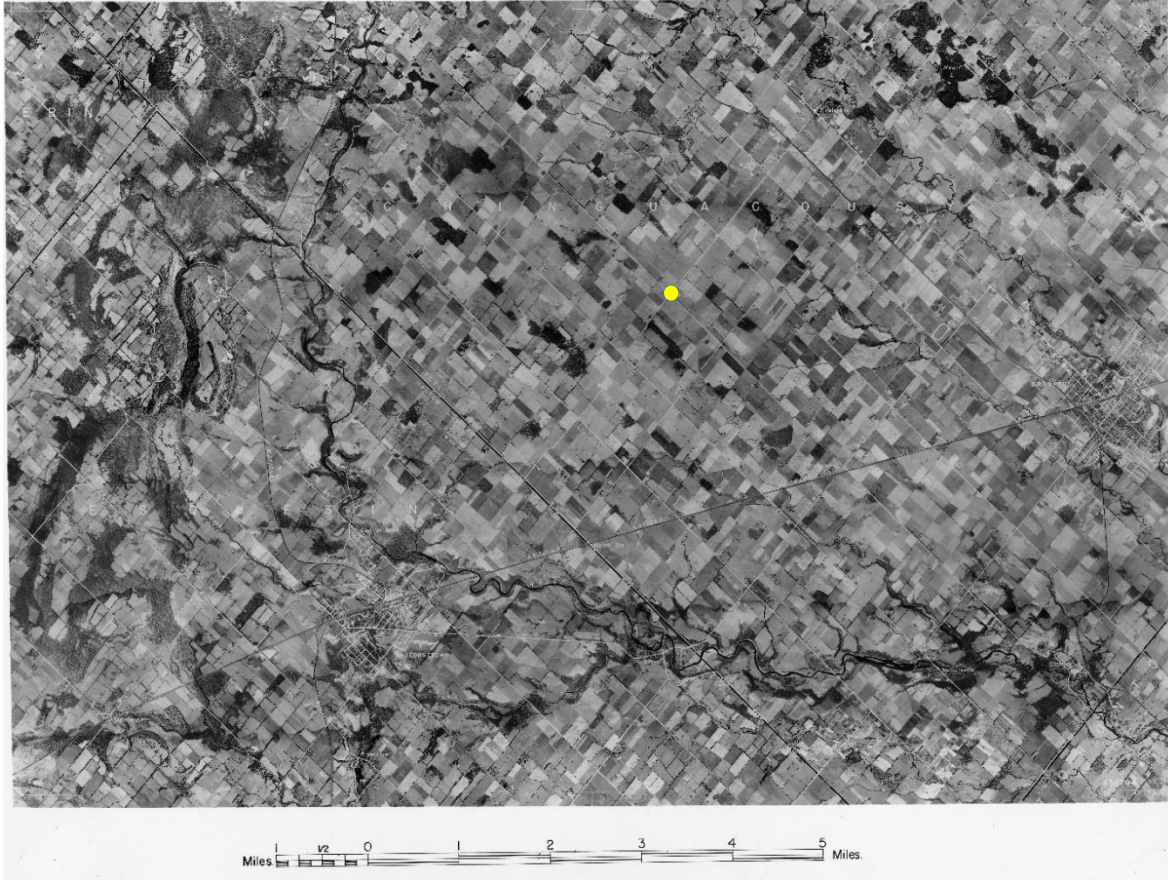
Location: Caledon, ON

Year: 1946

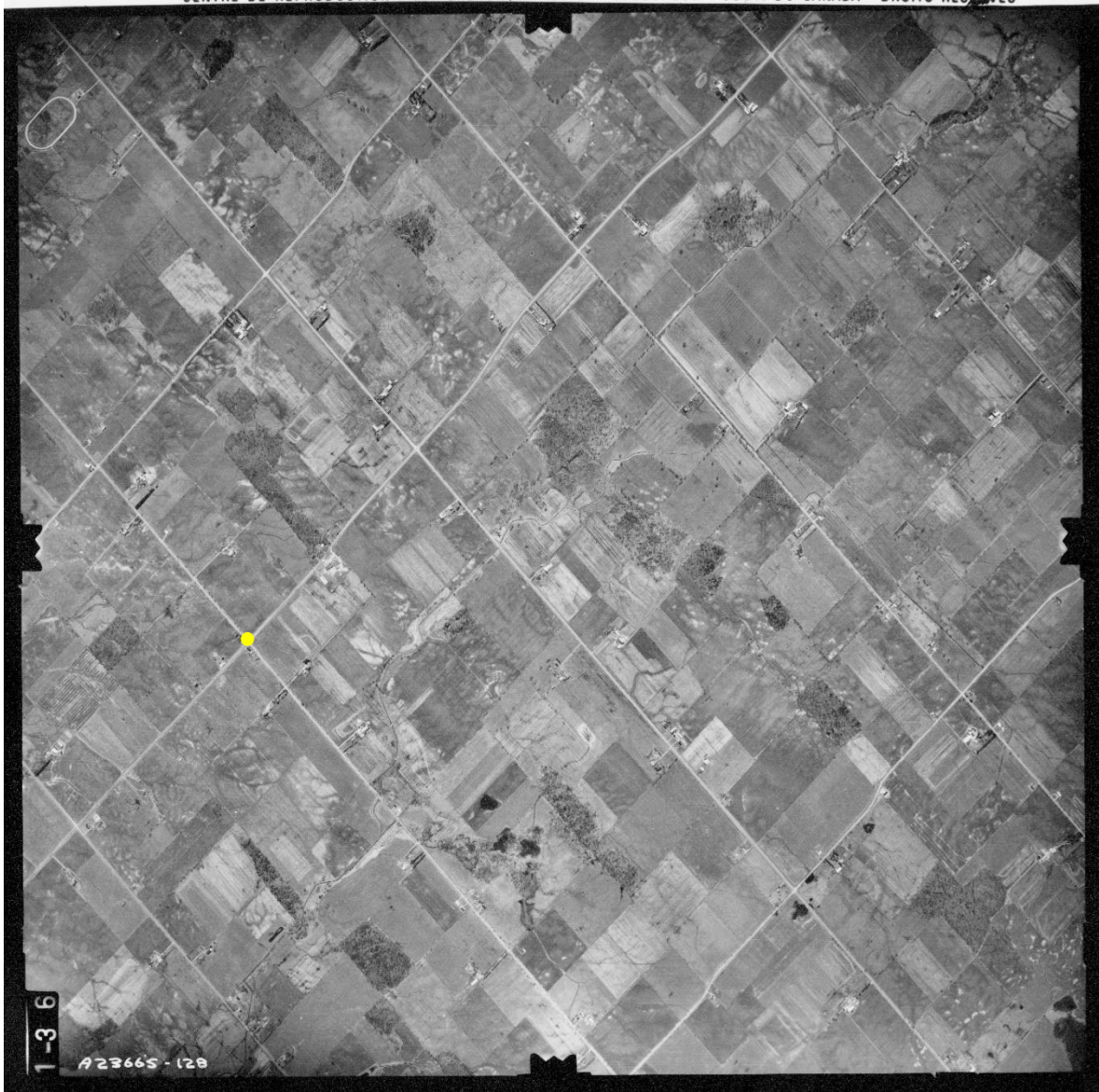
Scale: 1:20000

Source: NAPL

Yellow Point: Intersection of Mayfield Road and Creditview Road



Location: Caledon, ON
Year: 1954
Source: University of Toronto
Yellow Point: Intersection of Mayfield Road and Creditview Road



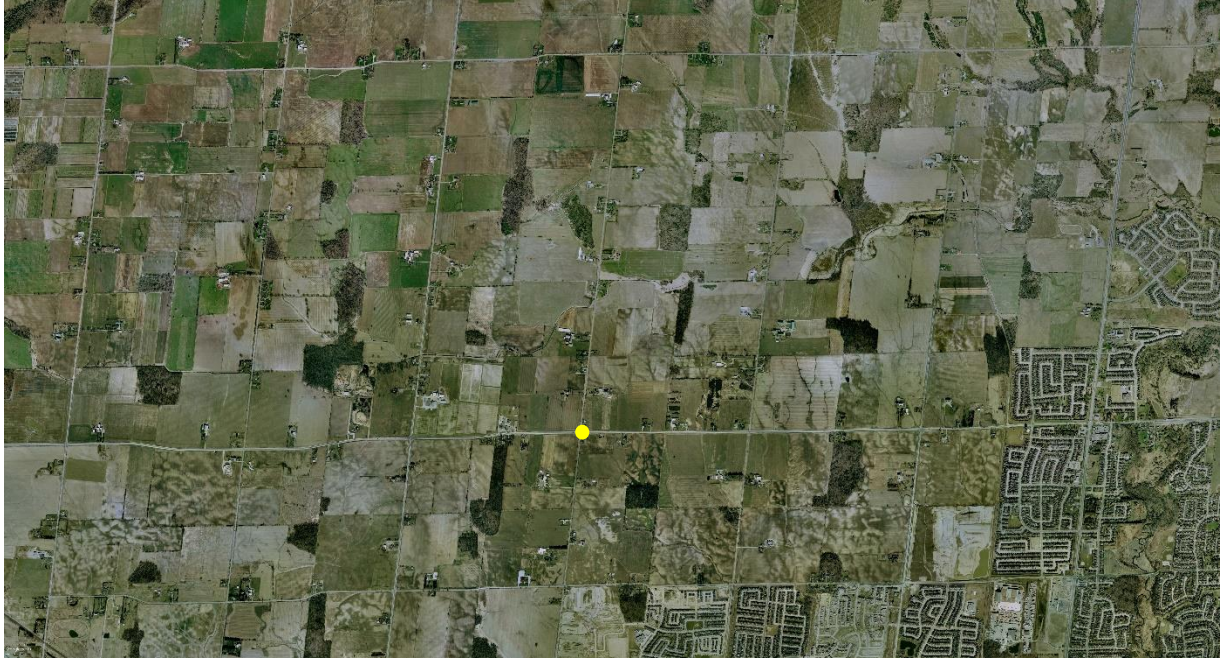
Location: Caledon, ON

Year: 1974

Scale: 1:25000

Source: NAPL

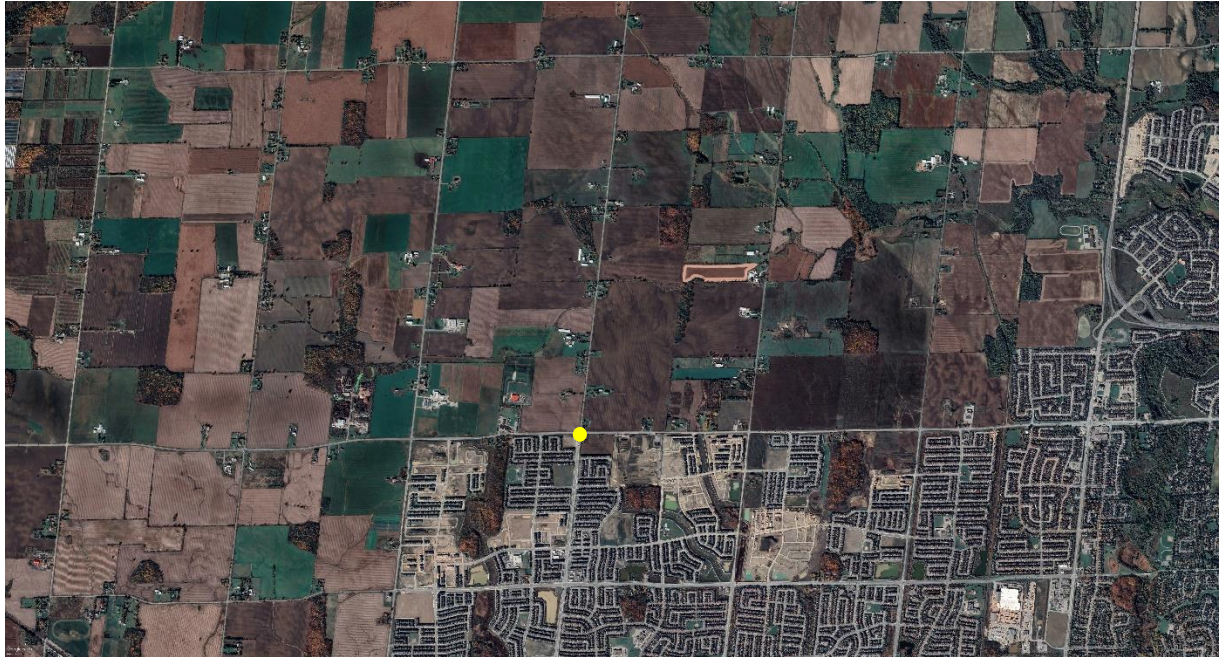
Yellow Point: Intersection of Mayfield Road and Creditview Road



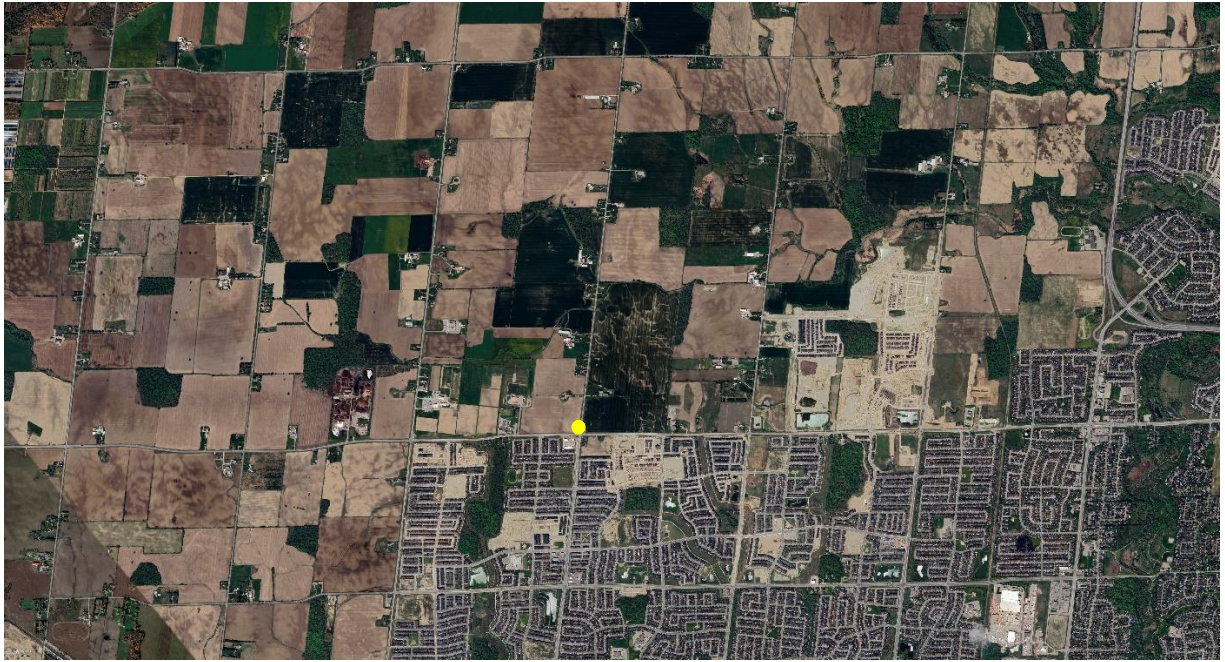
Location: Caledon, ON
Year: 2005
Scale: Digital Orthoimagery
Source: Google Earth Pro
Yellow Point: Intersection of Mayfield Road and Creditview Road




Location: Caledon, ON
Year: 2016
Scale: Digital Orthoimagery
Source: Google Earth Pro
Yellow Point: Intersection of Mayfield Road and Creditview Road



Location: Caledon, ON
Year: 2019
Scale: Digital Orthoimagery
Source: Google Earth Pro
Yellow Point: Intersection of Mayfield Road and Creditview Road



Location: Caledon, ON
Year: 2022
Scale: Digital Orthoimagery
Source: Google Earth Pro
Yellow Point: Intersection of Mayfield Road and Creditview Road

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Appendix C: Photographic Record

Photo 1
Alloa Drain - Reach AD2, Caledon, Ontario



The bed and bank substrate consisted of clay/silt and sand. The reach was dominated by runs with very few riffles and pools.

Photo 2
Alloa Drain - Reach AD2, Caledon, Ontario



An exposed tile drain that was previously buried was observed at an outer bank of a meander bend and was in poor condition.

Photo 3
Alloa Drain - Reach AD2, Caledon, Ontario



Minimal erosion was observed within the reach, with localized undercutting in the downstream extent. Undercuts of up to 0.30 metres were measured.

Photo 4
Alloa Drain - Reach AD2, Caledon, Ontario



The channel was straight, flowed between agricultural fields and was moderately entrenched.

Photo 5
Alloa Drain - Reach AD3, Caledon, Ontario



Generally, the reach was run dominant; however, approximately 25% of the reach contained riffles.

Photo 6
Alloa Drain - Reach AD3, Caledon, Ontario



Poor longitudinal sorting of bed materials was observed throughout the reach, with bed substrate ranging from clay/silt to cobbles. A few boulders were also present.

Photo 7
Alloa Drain - Reach AD3, Caledon, Ontario



One localized area in the downstream portion of the reach showed evidence of recent dredging (sloped bare banks).

Photo 8
Alloa Drain - Reach AD3, Caledon, Ontario



The riparian vegetation consisted of primarily grasses and shrubs. The grasses encroached into the channel in various locations throughout the reach. A few trees were also present, located primarily in the upstream portion of the reach.

Photo 9
Tributary of the Alloa Drain - Reach AD1-2, Caledon, Ontario



The downstream portion of the reach had rooted emergent instream vegetation throughout the channel. This vegetation was present from the forest edge to the downstream reach break.

Photo 10
Tributary of the Alloa Drain - Reach AD1-2, Caledon, Ontario



Channel banks were defined and bank angles were relatively low (i.e., up to 30 degrees).

Photo 11
Tributary of the Alloo Drain - Reach AD1-2, Caledon, Ontario



The upstream portion of the reach had multiple leaning and fallen trees, which contributed woody debris to the channel.

Photo 12
Tributary of the Alloo Drain - Reach AD1-2, Caledon, Ontario



The bed and bank substrates consisted of clay/silt and sand with organic debris on the channel bed.

Photo 13
Lyons Drain - Reach LD1, Caledon, Ontario



Leaning and fallen trees were observed along the reach.

Photo 14
Lyons Drain - Reach LD1, Caledon, Ontario



There were minimal bar forms present throughout the reach but those observed were accreting.

Photo 15
Lyons Drain - Reach LD1, Caledon, Ontario



The reach was run-dominant with a lack of riffle pool morphology. One artificial riffle was identified at the culvert at Creditview Road.

Photo 16
Lyons Drain - Reach LD1, Caledon, Ontario



The reach was a short and contained a straight channel that had minimal erosion and was moderately entrenched.

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Appendix D: Rapid Field Assessment Sheets

General Site Characteristics

Project Number: PN24009

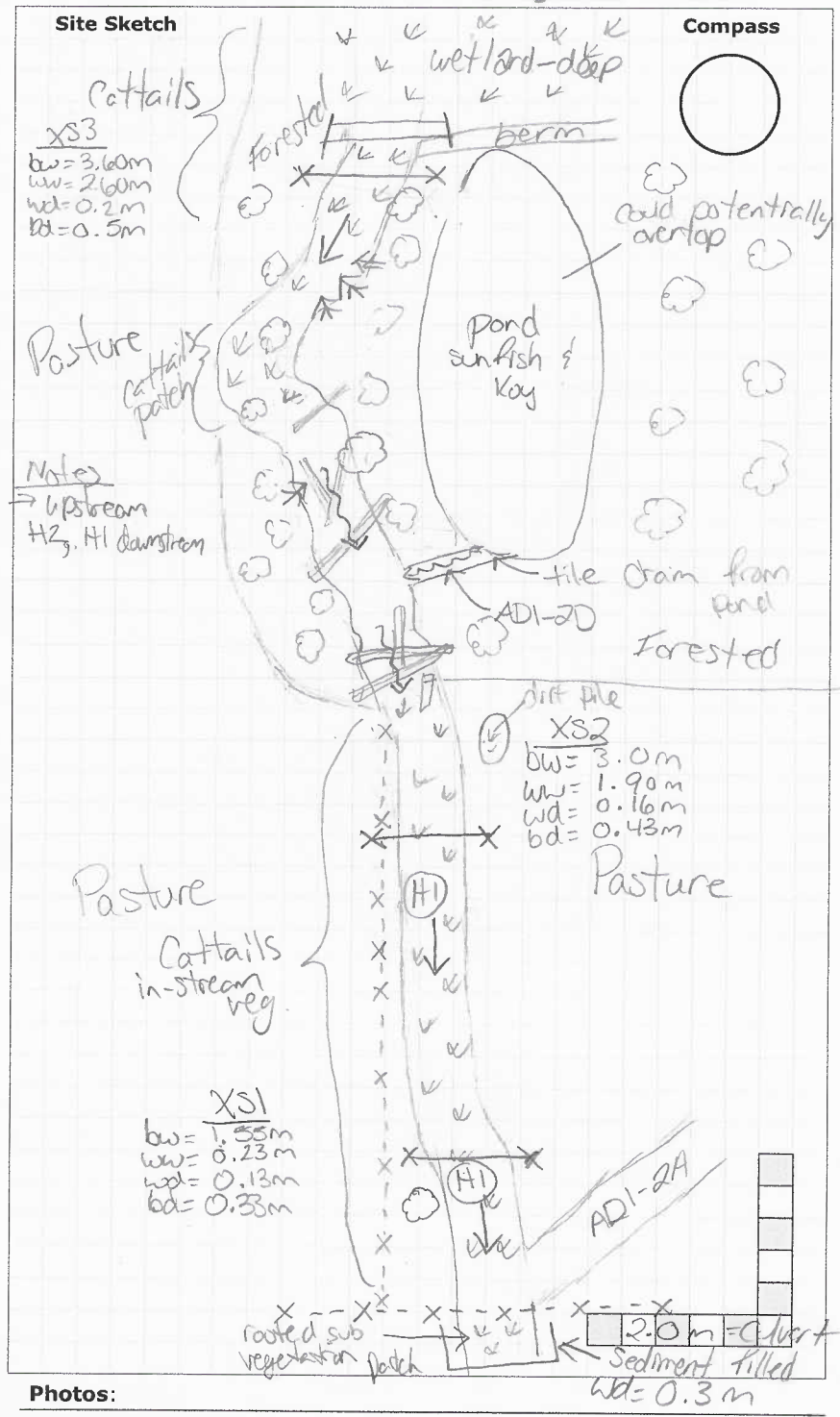
Date:	2024-05-02	Stream:	Allan Drain
Time:	2:00 pm	Reach:	ADI-2
Weather:	Sunny, 18°C	Location:	Mayfield road, Allan
Field Staff:	RA HF	Watershed/Subwatershed:	Etoobake Creek

Features	Monitoring
Reach break	Long-profile
Station location	Monumented XS
Cross-section	Monumented photo
Flow direction	Monumented photo direction
Riffle	Sediment sampling
Pool	Erosion pins
Sediment bar	Scour chains
Eroded bank/slope	Additional Symbols
Undercut bank	
Bank stabilization	
Leaning tree	
Fence	
Culvert/outfall	
Swamp/wetland	
Grasses	
Tree	
Instream log/tree	
Woody debris	
Beaver dam	
Vegetated island	

Flow Type	
H1 Standing water	H1A Back water
H2 Scarcely perceptible flow	
H3 Smooth surface flow	
H4 Upwelling	
H5 Rippled	
H6 Unbroken standing wave	
H7 Broken standing wave	
H8 Chute	
H9 Free fall	H9A Dissipates below free fall

Substrate			
S1 Silt	S6 Small boulder		
S2 Sand	S7 Large boulder		
S3 Gravel	S8 Bimodal		
S4 Small cobble	S9 Bedrock/till		
S5 Large cobble			

Other			
BM Benchmark	EP Erosion pin		
BS Backsight	RB Rebar		
DS Downstream	US Upstream		
WDJ Woody debris jam	TR Terrace		
VWC Valley wall contact	FC Flood chute		
BOS Bottom of slope	FP Flood plain		
TOS Top of slope	KP Knick point		



Photos: _____
Notes: _____

Reach Characteristics Project Number: PN24009

Date:	<u>2024-05-02</u>	Field Staff:	<u>RA HF</u>	Watershed/Subwatershed:	<u>Hydrocole Creek</u>
Time:	<u>2:00pm</u>	Stream:	<u>Aliso Chain</u>	UTM (Upstream):	
Weather:	<u>Sunny, 18°C</u>	Reach:	<u>AD1-2</u>	UTM (Downstream):	

Land Use (Table 1) 1/2 Valley Type (Table 2) 1 Channel Type (Table 3) 12 Channel Zone (Table 4) 2 Flow Type (Table 5) 1 Evidence of Groundwater Location: _____ Photo: _____

Riparian Vegetation				Aquatic & Instream Vegetation				Water Quality	
Dominant Type (Table 6)	<u>1/3</u>	Coverage	Channel Widths	Age (yrs)	Type (Table 8)	Woody Debris	WD Density	Odour (Table 16)	Turbidity (Table 17)
Encroachment (Table 7)	<u>4</u>	<input type="checkbox"/> None <input type="checkbox"/> Fragmented <input checked="" type="checkbox"/> Continuous	<input type="checkbox"/> 1 - 4 <input checked="" type="checkbox"/> 4 - 10 <input checked="" type="checkbox"/> > 10	<input type="checkbox"/> Immature (<5) <input checked="" type="checkbox"/> Established (5-30) <input type="checkbox"/> Mature (>30)	<u>1/2</u>	<input type="checkbox"/> In Cutbank <input checked="" type="checkbox"/> In Channel <input type="checkbox"/> Not Present	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Mod <input type="checkbox"/> High	<u>1</u>	<u>2</u>
				Reach Coverage %	<u>65</u>				

Channel Characteristics													
Sinuosity Type (Table 9)	Sinuosity Degree (Table 10)	Bank Angle	Bank Erosion (Table 19)	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets	Bank	Riffle	Pool
<u>1</u>	<u>1</u>	<input checked="" type="checkbox"/> 0 - 30	<input checked="" type="checkbox"/> < 5%	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gradient (Table 11)	# of Channels (Table 12)	<input type="checkbox"/> 30 - 60	<input type="checkbox"/> 5 - 30%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Entrenchment (Table 13)	Bank Failure (Table 14)	<input type="checkbox"/> 60 - 90	<input type="checkbox"/> 30 - 60%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Down's Model (Table 15)	Bankfull Indicators (Table 18)	<input type="checkbox"/> Undercut	<input type="checkbox"/> 60 - 100%	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sed Sorting (Table 20)	Sediment Transport Observed?			Bankfull Width (m)		Wetted Width (m)							
<u>Well</u>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not Visible			<u>1.55</u>	<u>3.0</u>	<u>3.60</u>	<u>0.23</u>	<u>1.90</u>	<u>2.60</u>				
Transport Mode (Table 21)	% of Bed Active			Bankfull Depth (m)		Wetted Depth (m)							
<u>3</u>	<u>N/A</u>			<u>0.33</u>	<u>0.43</u>	<u>0.50</u>	<u>0.13</u>	<u>0.16</u>	<u>0.20</u>				
Geomorphic Units (Table 22)	Mass Movement (Table 23)			Undercuts (m)		Velocity (m/s)							
<u>8/6</u>	<u>N/A</u> % runs: <u>95</u>			<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>				
Riffle-Pool Spacing (m):	% Riffles:			Pool Depth (m)		Velocity Estimate Method							
<u>N/A</u>	<u>5</u>			<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>				
	% Pools:			Riffle Length (m)		Meander Amplitude (m)							
	<u>0</u>			<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>				

Notes: → low bank angles making the channel less defined
→ Cattails heavily encroaching downstream with upstream through forest (fragmented)

Photos:

Rapid Geomorphic Assessment

Project Number: 24009

Date:	2024-05-02	Stream:	Alloa Drain Tributary
Time:	2:00 PM	Reach:	ADI-2
Weather:	Sunny, 18°C	Location:	Maudsfield Road
Field Staff:	RA HF	Watershed/Subwatershed:	Fibbscote Creek

Process	Geomorphological Indicator		Present?		Factor Value
	No.	Description	Yes	No	
Evidence of Aggradation (AI)	1	Lobate bar		✓	0/7
	2	Coarse materials in riffles embedded		✓	
	3	Siltation in pools		✓	
	4	Medial bars		✓	
	5	Accretion on point bars		✓	
	6	Poor longitudinal sorting of bed materials		✓	
	7	Deposition in the overbank zone		✓	
Sum of indices =			0	7	0.0

Evidence of Degradation (DI)	1	Exposed bridge footing(s)	N/A		0/6
	2	Exposed sanitary / storm sewer / pipeline / etc.	N/A		
	3	Elevated storm sewer outfall(s)	N/A		
	4	Undermined gabion baskets / concrete aprons / etc.	N/A		
	5	Scour pools downstream of culverts / storm sewer outlets		✓	
	6	Cut face on bar forms		✓	
	7	Head cutting due to knickpoint migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock		✓	
Sum of indices =			0	6	0.0

Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	✓		2/8
	2	Occurrence of large organic debris	✓		
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle		✓	
	6	Outflanked gabion baskets / concrete walls / etc.	N/A		
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.		✓	
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation	N/A		
Sum of indices =			2	6	0.25

Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	1/7
	2	Single thread channel to multiple channel	✓		
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase with meander form		✓	
	7	Bar forms poorly formed / reworked / removed		✓	
Sum of indices =			1	6	0.143

Notes:	Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.098		
	In Regime	In Transition/Stress	In Adjustment
	<input checked="" type="checkbox"/> 0.00 - 0.20	<input type="checkbox"/> 0.21 - 0.40	<input type="checkbox"/> 0.41

Rapid Stream Assessment Technique Project Number: *PN24009*

Date:	<i>2024-05-02</i>	Stream:	<i>Alton Dam</i>
Time:	<i>2:00pm</i>	Reach:	<i>AD1-2</i>
Weather:	<i>Sunny, 14°C</i>	Location:	<i>Mayfield road, Alton</i>
Field Staff:	<i>AHF</i>	Watershed/Subwatershed:	<i>Etobicoke Creek</i>

Category	Poor	Fair	Good	Excellent
Channel Stability	<ul style="list-style-type: none"> < 50% of bank network stable Recent bank sloughing, slumping or failure frequently observed 	<ul style="list-style-type: none"> 50-70% of bank network stable Recent signs of bank sloughing, slumping or failure fairly common 	<ul style="list-style-type: none"> 71-80% of bank network stable Infrequent signs of bank sloughing, slumping or failure 	<ul style="list-style-type: none"> > 80% of bank network stable No evidence of bank sloughing, slumping or failure
	<ul style="list-style-type: none"> Stream bend areas highly unstable Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) Bank overhang > 0.8-1.0 m 	<ul style="list-style-type: none"> Stream bend areas unstable Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) Bank overhang 0.8-0.9m 	<ul style="list-style-type: none"> Stream bend areas stable Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) Bank overhang 0.6-0.8 m 	<ul style="list-style-type: none"> Stream bend areas very stable Height < 0.6 m above stream bank (< 1.2 m above stream bank for large mainstem areas) Bank overhang < 0.6 m
	<ul style="list-style-type: none"> Young exposed tree roots abundant > 6 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Young exposed tree roots common 4-5 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots predominantly old and large, smaller young roots scarce 2-3 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots old, large and woody Generally 0-1 recent large tree falls per stream mile
	<ul style="list-style-type: none"> Bottom 1/3 of bank is highly erodible material Plant/soil matrix severely compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly erodible material Plant/soil matrix compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped
	Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input checked="" type="checkbox"/> 7 <input type="checkbox"/> 8
Channel Scouring/ Sediment Deposition	<ul style="list-style-type: none"> > 75% embedded (> 85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 50-75% embedded (60-85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 25-49% embedded (35-59% embedded for large mainstem areas) 	<ul style="list-style-type: none"> Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	<ul style="list-style-type: none"> Few, if any, deep pools Pool substrate composition >81% sand-silt 	<ul style="list-style-type: none"> Low to moderate number of deep pools Pool substrate composition 60-80% sand-silt 	<ul style="list-style-type: none"> Moderate number of deep pools Pool substrate composition 30-59% sand-silt 	<ul style="list-style-type: none"> High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) Pool substrate composition <30% sand-silt
	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits uncommon 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits absent
	<ul style="list-style-type: none"> Fresh, large sand deposits very common in channel Moderate to heavy sand deposition along major portion of overbank area 	<ul style="list-style-type: none"> Fresh, large sand deposits common in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits uncommon in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits rare or absent from channel No evidence of fresh sediment deposition on overbank
	<ul style="list-style-type: none"> Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars common, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand 	<ul style="list-style-type: none"> Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 5 <input type="checkbox"/> 6	<input checked="" type="checkbox"/> 7 <input type="checkbox"/> 8

Date:	2024-05-02		PN:	PN2409		Location:	Myhill rd, Alton	
Category	Poor	Fair	Good	Excellent				
Physical Instream Habitat	<ul style="list-style-type: none"> Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas) 	<ul style="list-style-type: none"> Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas) 	<ul style="list-style-type: none"> Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas) 	<ul style="list-style-type: none"> Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas) 				
	<ul style="list-style-type: none"> Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low) 	<ul style="list-style-type: none"> Few pools present, riffles and runs dominant. Velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate) 	<ul style="list-style-type: none"> Good mix between riffles, runs and pools Relatively diverse velocity and depth of flow 	<ul style="list-style-type: none"> Riffles, runs and pool habitat present Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water) 				
	<ul style="list-style-type: none"> Riffle substrate composition: predominantly gravel with high amount of sand < 5% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: predominantly small cobble, gravel and sand 5-24% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: good mix of gravel, cobble, and rubble material 25-49% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand > 50% cobble 				
	<ul style="list-style-type: none"> Riffle depth < 10 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth 10-15 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth 15-20 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth > 20 cm for large mainstem areas 				
	<ul style="list-style-type: none"> Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure 				
	<ul style="list-style-type: none"> Extensive channel alteration and/or point bar formation/enlargement 	<ul style="list-style-type: none"> Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement 	<ul style="list-style-type: none"> Slight amount of channel alteration and/or slight increase in point bar formation/enlargement 	<ul style="list-style-type: none"> No channel alteration or significant point bar formation/enlargement 				
	<ul style="list-style-type: none"> Riffle/Pool ratio 0.49:1 ; $\geq 1.51:1$ 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.5-0.69:1 ; 1.31-1.5:1 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.7-0.89:1 ; 1.11-1.3:1 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.9-1.1:1 ; 1.1-1.3:1 				
	<ul style="list-style-type: none"> Summer afternoon water temperature > 27°C 	<ul style="list-style-type: none"> Summer afternoon water temperature 24-27°C 	<ul style="list-style-type: none"> Summer afternoon water temperature 20-24°C 	<ul style="list-style-type: none"> Summer afternoon water temperature < 20°C 				
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8				
Water Quality	<ul style="list-style-type: none"> Substrate fouling level: High (> 50%) 	<ul style="list-style-type: none"> Substrate fouling level: Moderate (21-50%) 	<ul style="list-style-type: none"> Substrate fouling level: Very light (11-20%) 	<ul style="list-style-type: none"> Substrate fouling level: Rock underside (0-10%) 				
	<ul style="list-style-type: none"> Brown colour TDS: > 150 mg/L 	<ul style="list-style-type: none"> Grey colour TDS: 101-150 mg/L 	<ul style="list-style-type: none"> Slightly grey colour TDS: 50-100 mg/L 	<ul style="list-style-type: none"> Clear flow TDS: < 50 mg/L 				
	<ul style="list-style-type: none"> Objects visible to depth < 0.15m below surface 	<ul style="list-style-type: none"> Objects visible to depth 0.15-0.5m below surface 	<ul style="list-style-type: none"> Objects visible to depth 0.5-1.0m below surface 	<ul style="list-style-type: none"> Objects visible to depth > 1.0m below surface 				
	<ul style="list-style-type: none"> Moderate to strong organic odour 	<ul style="list-style-type: none"> Slight to moderate organic odour 	<ul style="list-style-type: none"> Slight organic odour 	<ul style="list-style-type: none"> No odour 				
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input checked="" type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8				
Riparian Habitat Conditions	<ul style="list-style-type: none"> Narrow riparian area of mostly non-woody vegetation 	<ul style="list-style-type: none"> Riparian area predominantly wooded but with major localized gaps 	<ul style="list-style-type: none"> Forested buffer generally > 31 m wide along major portion of both banks 	<ul style="list-style-type: none"> Wide (> 60 m) mature forested buffer along both banks 				
	<ul style="list-style-type: none"> Canopy coverage: < 50% shading (30% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: 50-60% shading (30-44% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: 60-79% shading (45-59% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: > 80% shading (> 60% for large mainstem areas) 				
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1	<input type="checkbox"/> 2 <input checked="" type="checkbox"/> 3	<input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7				
Total overall score (0-42) = 24		Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)			

General Site Characteristics

Project Number: PN24009

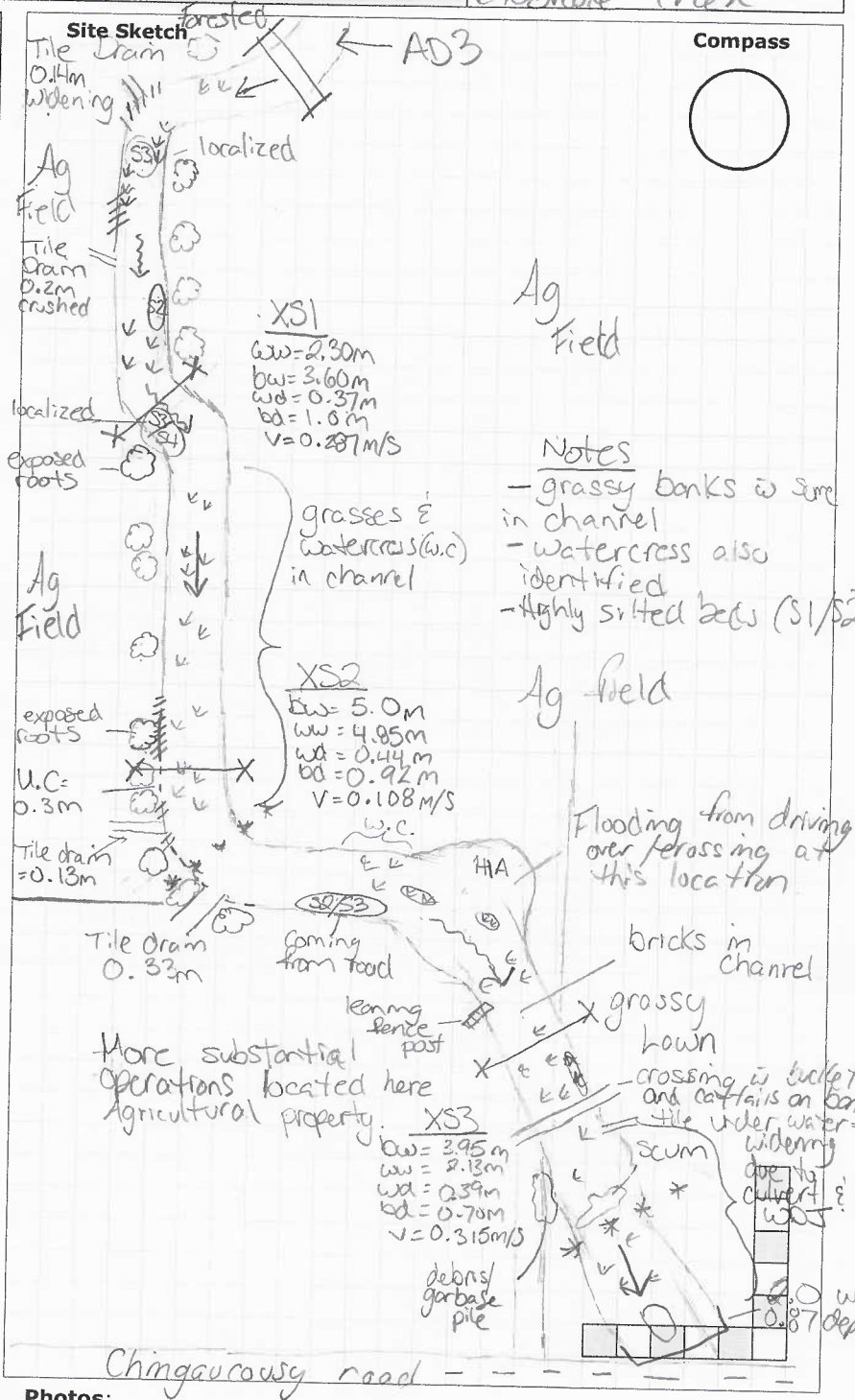
Date:	2024-05-02	Stream:	Alloa Drain
Time:	1:15pm	Reach:	AD2
Weather:	Sunny, 18°C	Location:	Mayfield road, Alloa
Field Staff:	RA HF	Watershed/Subwatershed:	Elochake Creek

Features	Monitoring
Reach break	Long-profile
Station location	Monumented XS
Cross-section	Monumented photo
Flow direction	Monumented photo direction
Riffle	Sediment sampling
Pool	Erosion pins
Sediment bar	Scour chains
Eroded bank/slope	Additional Symbols
Undercut bank	
Bank stabilization	
Leaning tree	
Fence	
Culvert/outfall	
Swamp/wetland	
Grasses	
Tree	
Instream log/tree	
Woody debris	
Beaver dam	
Vegetated island	

Flow Type	
H1 Standing water	H1A Back water
H2 Scarcely perceptible flow	
H3 Smooth surface flow	
H4 Upwelling	
H5 Rippled	
H6 Unbroken standing wave	
H7 Broken standing wave	
H8 Chute	
H9 Free fall	H9A Dissipates below free fall

Substrate	
S1 Silt	S6 Small boulder
S2 Sand	S7 Large boulder
S3 Gravel	S8 Bimodal
S4 Small cobble	S9 Bedrock/till
S5 Large cobble	

Other	
BM Benchmark	EP Erosion pin
BS Backsight	RB Rebar
DS Downstream	US Upstream
WDJ Woody debris jam	TR Terrace
VWC Valley wall contact	FC Flood chute
BOS Bottom of slope	FP Flood plain
TOS Top of slope	KP Knick point



Photos:

Notes:

Reach Characteristics Project Number: PN24009

Date:	2024-05-02	Field Staff:	RA HF	Watershed/Subwatershed:	Efobiscote Creek
Time:	1:15 pm	Stream:	Alloa Drain	UTM (Upstream):	
Weather:	Sunny, 18°C	Reach:	A02	UTM (Downstream):	

Land Use (Table 1) Valley Type (Table 2) Channel Type (Table 3) Channel Zone (Table 4) Flow Type (Table 5) Evidence of Groundwater Location: Watercress Photo: _____

Riparian Vegetation

Dominant Type (Table 6) Coverage None 1 - 4 Immature (<5)

Encroachment (Table 7) Fragmented 4 - 10 Established (5-30)

Continuous > 10 Mature (>30)

Aquatic & Instream Vegetation

Type (Table 8) Woody Debris In Cutbank In Channel Not Present

WD Density (WDJ/50m): Low Mod High

Reach Coverage %

Water Quality

Odour (Table 16) Turbidity (Table 17)

Channel Characteristics

Sinuosity Type (Table 9)	<input type="text" value="1"/>	Sinuosity Degree (Table 10)	<input type="text" value="1"/>	Bank Angle	<input type="checkbox"/> 0 - 30 <input type="checkbox"/> 30 - 60 <input checked="" type="checkbox"/> 60 - 90 <input type="checkbox"/> Undercut	Bank Erosion (Table 19)	<input checked="" type="checkbox"/> < 5% <input type="checkbox"/> 5 - 30% <input type="checkbox"/> 30 - 60% <input type="checkbox"/> 60 - 100%	Clay/Silt Bank	<input checked="" type="checkbox"/>	Sand	<input checked="" type="checkbox"/>	Gravel	<input type="checkbox"/>	Cobble	<input type="checkbox"/>	Boulder	<input type="checkbox"/>	Parent	<input type="checkbox"/>	Rootlets	<input type="checkbox"/>
Gradient (Table 11)	<input type="text" value="1"/>	# of Channels (Table 12)	<input type="text" value="1"/>	Bank Failure (Table 14)	<input type="text" value="2"/>	Bankfull Width (m)	<input type="text" value="3.60"/>	Riffle	<input type="checkbox"/>	Wetted Width (m)	<input type="text" value="2.3"/>	Wetted Depth (m)	<input type="text" value="0.37"/>	Velocity (m/s)	<input type="text" value="0.287"/>	Velocity Estimate Method	<input type="text" value="w. Ake Ball"/>	Meander Amplitude (m)	<input type="text" value=""/>		
Entrenchment (Table 13)	<input type="text" value="2"/>	Bankfull Indicators (Table 18)	<input type="text" value="3/5"/>	Sediment Transport Observed? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not Visible		Bankfull Depth (m)	<input type="text" value="1.0"/>	Pool	<input type="checkbox"/>	Undercuts (m)	<input type="text" value="0.30"/>	Pool Depth (m)	<input type="text" value="0.87"/>	Riffle Length (m)	<input type="text" value=""/>						
Down's Model (Table 15)	<input type="text" value="S"/>	% of Bed Active	<input type="text" value="N/A"/>	Mass Movement (Table 23)	<input type="text" value="N/A"/>	% rms:	<input type="text" value="90"/>	% Pools:	<input type="text" value="5"/>												
Sed Sorting (Table 20)	<input type="text" value="Well"/>																				
Transport Mode (Table 21)	<input type="text" value="3"/>																				
Geomorphic Units (Table 22)	<input type="text" value="8/6"/>																				
Riffle-Pool Spacing (m):	<input type="text" value=""/>																				

Notes: → Straight channel with few riffles. Those few riffles had gravel & cobble but generally the entire reach was composed of mud with clay, silt, & sand (Highly silted).

Photos: _____

Rapid Geomorphic Assessment

Project Number: 24009

Date:	2024-05-02	Stream:	Alloa Drain
Time:	1:15 pm	Reach:	A02
Weather:	Sunny, 18°C	Location:	Mayfield Road
Field Staff:	RA, HF	Watershed/Subwatershed:	Etobicoke Creek

Process	Geomorphological Indicator		Present?		Factor Value
	No.	Description	Yes	No	
Evidence of Aggradation (AI)	1	Lobate bar		✓	2/7
	2	Coarse materials in riffles embedded		✓	
	3	Siltation in pools	✓		
	4	Medial bars		✓	
	5	Accretion on point bars		✓	
	6	Poor longitudinal sorting of bed materials	✓	✓	
	7	Deposition in the overbank zone		✓	
Sum of indices =			2	5	0.286

Evidence of Degradation (DI)	1	Exposed bridge footing(s)		N/A	1/7
	2	Exposed sanitary / storm sewer / pipeline / etc.		N/A	
	3	Elevated storm sewer outfall(s) / elevated tile drain	✓		
	4	Undermined gabion baskets / concrete aprons / etc.		N/A	
	5	Scour pools downstream of culverts / storm sewer outlets		✓	
	6	Cut face on bar forms		✓	
	7	Head cutting due to knickpoint migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock		✓	
Sum of indices =			1	6	0.143

Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.		✓	1/8
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots (only few)		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle		✓	
	6	Outflanked gabion baskets / concrete walls / etc.		N/A	
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc. (tile drain)	✓	✓	
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation		N/A	
Sum of indices =			1	7	0.125

Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	1/7
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase with meander form		✓	
	7	Bar forms poorly formed / reworked / removed	✓		
Sum of indices =			1	6	0.143

Notes:	Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.174		
	In Regime	In Transition/Stress	In Adjustment
	<input checked="" type="checkbox"/> 0.00 - 0.20	<input type="checkbox"/> 0.21 - 0.40	<input type="checkbox"/> 0.41

Rapid Stream Assessment Technique Project Number: PN24009

Date:	2024-05-02	Stream:	Alloa Drain
Time:	1:15pm	Reach:	A02
Weather:	Sunny, 18°C	Location:	Mayfield road, Alloa
Field Staff:	KA AF	Watershed/Subwatershed:	Etobichale Creek

Category	Poor	Fair	Good	Excellent
Channel Stability	<ul style="list-style-type: none"> < 50% of bank network stable Recent bank sloughing, slumping or failure frequently observed 	<ul style="list-style-type: none"> 50-70% of bank network stable Recent signs of bank sloughing, slumping or failure fairly common 	<ul style="list-style-type: none"> 71-80% of bank network stable Infrequent signs of bank sloughing, slumping or failure 	<ul style="list-style-type: none"> > 80% of bank network stable No evidence of bank sloughing, slumping or failure
	<ul style="list-style-type: none"> Stream bend areas highly unstable Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) Bank overhang > 0.8-1.0 m 	<ul style="list-style-type: none"> Stream bend areas unstable Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) Bank overhang 0.8-0.9m 	<ul style="list-style-type: none"> Stream bend areas stable Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) Bank overhang 0.6-0.8 m 	<ul style="list-style-type: none"> Stream bend areas very stable Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) Bank overhang < 0.6 m
	<ul style="list-style-type: none"> Young exposed tree roots abundant > 6 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Young exposed tree roots common 4-5 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots predominantly old and large, smaller young roots scarce 2-3 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots old, large and woody Generally 0-1 recent large tree falls per stream mile
	<ul style="list-style-type: none"> Bottom 1/3 of bank is highly erodible material Plant/soil matrix severely compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly erodible material Plant/soil matrix compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped
	Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input checked="" type="checkbox"/> 7 <input type="checkbox"/> 8
Channel Scouring/ Sediment Deposition	<ul style="list-style-type: none"> > 75% embedded (> 85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 50-75% embedded (60-85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 25-49% embedded (35-59% embedded for large mainstem areas) 	<ul style="list-style-type: none"> Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	<ul style="list-style-type: none"> Few, if any, deep pools Pool substrate composition >81% sand-silt 	<ul style="list-style-type: none"> Low to moderate number of deep pools Pool substrate composition 60-80% sand-silt 	<ul style="list-style-type: none"> Moderate number of deep pools Pool substrate composition 30-59% sand-silt 	<ul style="list-style-type: none"> High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) Pool substrate composition <30% sand-silt
	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits uncommon 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits absent
	<ul style="list-style-type: none"> Fresh, large sand deposits very common in channel Moderate to heavy sand deposition along major portion of overbank area 	<ul style="list-style-type: none"> Fresh, large sand deposits common in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits uncommon in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits rare or absent from channel No evidence of fresh sediment deposition on overbank
	<ul style="list-style-type: none"> Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars common, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars small and stable well-vegetated and/or armoured with little or no fresh sand 	<ul style="list-style-type: none"> Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 5 <input checked="" type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8

Date: 2024-05-02 PN: A24009 Location: Mayfield road, Alton

Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	<ul style="list-style-type: none"> Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas) Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low) 	<ul style="list-style-type: none"> Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas) Few pools present, riffles and runs dominant. Velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate) 	<ul style="list-style-type: none"> Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas) Good mix between riffles, runs and pools Relatively diverse velocity and depth of flow 	<ul style="list-style-type: none"> Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas) Riffles, runs and pool habitat present Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	<ul style="list-style-type: none"> Riffle substrate composition: predominantly gravel with high amount of sand < 5% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: predominantly small cobble, gravel and sand 5-24% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: good mix of gravel, cobble, and rubble material 25-49% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand > 50% cobble
	<ul style="list-style-type: none"> Riffle depth < 10 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth 10-15 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth 15-20 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth > 20 cm for large mainstem areas
	<ul style="list-style-type: none"> Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	<ul style="list-style-type: none"> Extensive channel alteration and/or point bar formation/enlargement 	<ul style="list-style-type: none"> Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement 	<ul style="list-style-type: none"> Slight amount of channel alteration and/or slight increase in point bar formation/enlargement 	<ul style="list-style-type: none"> No channel alteration or significant point bar formation/enlargement
	<ul style="list-style-type: none"> Riffle/Pool ratio 0.49:1 ; $\geq 1.51:1$ 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.5-0.69:1 ; 1.31-1.5:1 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.7-0.89:1 ; 1.11-1.3:1 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.9-1.1:1
	<ul style="list-style-type: none"> Summer afternoon water temperature > 27°C 	<ul style="list-style-type: none"> Summer afternoon water temperature 24-27°C 	<ul style="list-style-type: none"> Summer afternoon water temperature 20-24°C 	<ul style="list-style-type: none"> Summer afternoon water temperature < 20°C
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input checked="" type="checkbox"/> 4	<input type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8
Water Quality	<ul style="list-style-type: none"> Substrate fouling level: High (> 50%) 	<ul style="list-style-type: none"> Substrate fouling level: Moderate (21-50%) 	<ul style="list-style-type: none"> Substrate fouling level: Very light (11-20%) 	<ul style="list-style-type: none"> Substrate fouling level: Rock underside (0-10%)
	<ul style="list-style-type: none"> Brown colour TDS: > 150 mg/L 	<ul style="list-style-type: none"> Grey colour TDS: 101-150 mg/L 	<ul style="list-style-type: none"> Slightly grey colour TDS: 50-100 mg/L 	<ul style="list-style-type: none"> Clear flow TDS: < 50 mg/L
	<ul style="list-style-type: none"> Objects visible to depth < 0.15m below surface 	<ul style="list-style-type: none"> Objects visible to depth 0.15-0.5m below surface 	<ul style="list-style-type: none"> Objects visible to depth 0.5-1.0m below surface 	<ul style="list-style-type: none"> Objects visible to depth > 1.0m below surface
	<ul style="list-style-type: none"> Moderate to strong organic odour 	<ul style="list-style-type: none"> Slight to moderate organic odour 	<ul style="list-style-type: none"> Slight organic odour 	<ul style="list-style-type: none"> No odour
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 5 <input checked="" type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8
Riparian Habitat Conditions	<ul style="list-style-type: none"> Narrow riparian area of mostly non-woody vegetation 	<ul style="list-style-type: none"> Riparian area predominantly wooded but with major localized gaps 	<ul style="list-style-type: none"> Forested buffer generally > 31 m wide along major portion of both banks 	<ul style="list-style-type: none"> Wide (> 60 m) mature forested buffer along both banks
	<ul style="list-style-type: none"> Canopy coverage: < 50% shading (30% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: 50-60% shading (30-44% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: 60-79% shading (45-59% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: > 80% shading (> 60% for large mainstem areas)
Point range	<input checked="" type="checkbox"/> 0 <input type="checkbox"/> 1	<input type="checkbox"/> 2 <input type="checkbox"/> 3	<input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7

Total overall score (0-42) = 23 Poor (<13) Fair (13-24) Good (25-34) Excellent (>35)

General Site Characteristics

Project Number: PN24009

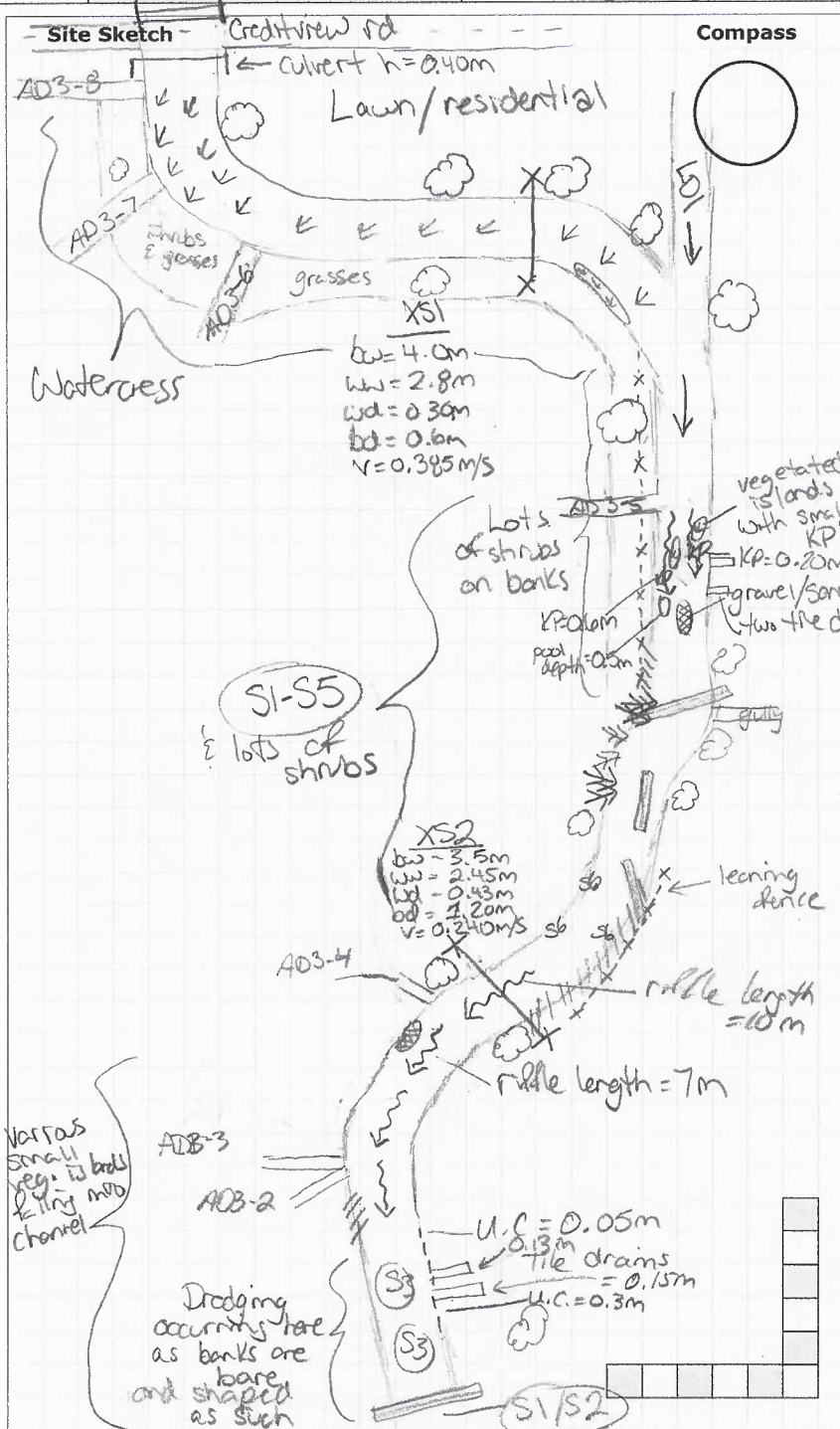
Date:	2024-05-02	Stream:	Alloa Drain
Time:	12:25 pm	Reach:	AD3
Weather:	sunny, 18°C	Location:	Mayfred rd, Alloa
Field Staff:	RA HF	Watershed/Subwatershed:	Etdoboke Creek

Features	Monitoring
Reach break	Long-profile
Station location	Monumented XS
Cross-section	Monumented photo
Flow direction	Monumented photo direction
Riffle	Sediment sampling
Pool	Erosion pins
Sediment bar	Scour chains
Eroded bank/slope	
Undercut bank	
Bank stabilization	
Leaning tree	
Fence	
Culvert/outfall	
Swamp/wetland	
Grasses	
Tree	
Instream log/tree	
Woody debris	
Beaver dam	
Vegetated island	
Additional Symbols	

Flow Type	
H1 Standing water	H1A Back water
H2 Scarcely perceptible flow	
H3 Smooth surface flow	
H4 Upwelling	
H5 Rippled	
H6 Unbroken standing wave	
H7 Broken standing wave	
H8 Chute	
H9 Free fall	H9A Dissipates below free fall

Substrate	
S1 Silt	S6 Small boulder
S2 Sand	S7 Large boulder
S3 Gravel	S8 Bimodal
S4 Small cobble	S9 Bedrock/till
S5 Large cobble	

Other	
BM Benchmark	EP Erosion pin
BS Backsight	RB Rebar
DS Downstream	US Upstream
WDJ Woody debris jam	TR Terrace
VWC Valley wall contact	FC Flood chute
BOS Bottom of slope	FP Flood plain
TOS Top of slope	KP Knick point



Photos:
Notes:

General Site Characteristics

Project Number: PN24009

Date:	2024-05-02	Stream:	Alloa Drain
Time:	12:25 pm	Reach:	AD3
Weather:	Sunny, 18°C	Location:	Mayfield rd, Alloa
Field Staff:	PA HF	Watershed/Subwatershed:	Strabrooke Creek

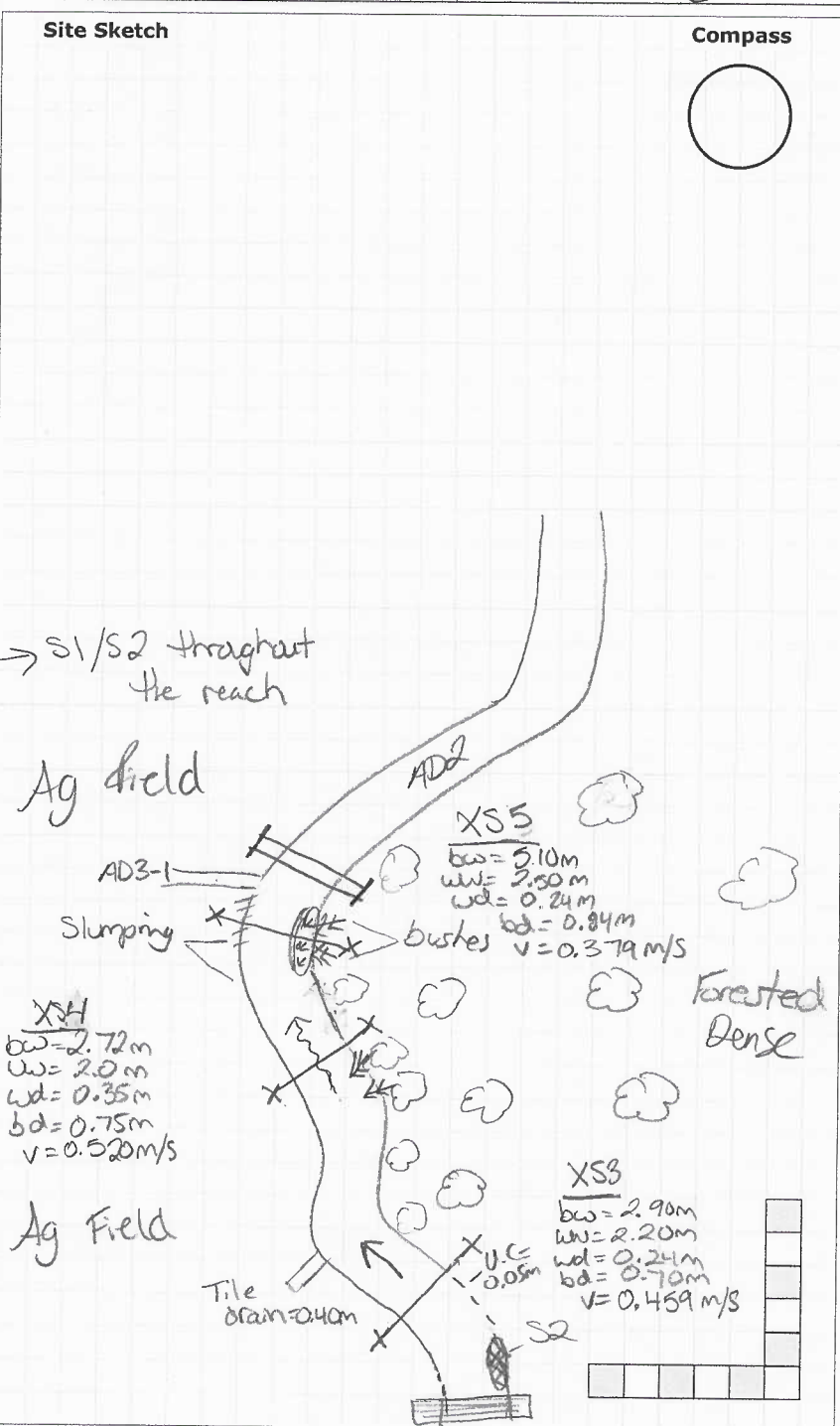
Features	Monitoring
Reach break	Long-profile
Station location	Monumented XS
Cross-section	Monumented photo
Flow direction	Monumented photo direction
Riffle	Sediment sampling
Pool	Erosion pins
Sediment bar	Scour chains
Eroded bank/slope	
Undercut bank	

Additional Symbols
Bank stabilization
Leaning tree
Fence
Culvert/outfall
Swamp/wetland
Grasses
Tree
Instream log/tree
Woody debris
Beaver dam
Vegetated island

Flow Type
H1 Standing water H1A Back water
H2 Scarcely perceptible flow
H3 Smooth surface flow
H4 Upwelling
H5 Rippled
H6 Unbroken standing wave
H7 Broken standing wave
H8 Chute
H9 Free fall H9A Dissipates below free fall

Substrate	
S1 Silt	S6 Small boulder
S2 Sand	S7 Large boulder
S3 Gravel	S8 Bimodal
S4 Small cobble	S9 Bedrock/till
S5 Large cobble	

Other	
BM Benchmark	EP Erosion pin
BS Backsight	RB Rebar
DS Downstream	US Upstream
WDJ Woody debris jam	TR Terrace
VWC Valley wall contact	FC Flood chute
BOS Bottom of slope	FP Flood plain
TOS Top of slope	KP Knick point



Photos:
Notes:

Reach Characteristics Project Number: PN24009

Date:	<u>2024-05-02</u>	Field Staff:	<u>RA HF</u>	Watershed/Subwatershed:	<u>Etobicoke Creek</u>
Time:	<u>12:25pm</u>	Stream:	<u>Alton Drain</u>	UTM (Upstream):	
Weather:	<u>sunny, 18°C</u>	Reach:	<u>A03</u>	UTM (Downstream):	

Land Use (Table 1) 3 Valley Type (Table 2) 1 Channel Type (Table 3) 12 Channel Zone (Table 4) 2 Flow Type (Table 5) 1 Evidence of Groundwater Location: watercress Photo: _____

Riparian Vegetation				Aquatic & Instream Vegetation				Water Quality		
Dominant Type (Table 6)	<u>2/3</u>	Coverage	Channel Widths	Age (yrs)	Type (Table 8)	Woody Debris	WD Density	Odour (Table 16)	Turbidity (Table 17)	
Encroachment (Table 7)	<u>2</u>	<input type="checkbox"/> None <input type="checkbox"/> Fragmented <input checked="" type="checkbox"/> Continuous	<input checked="" type="checkbox"/> 1 - 4 <input type="checkbox"/> 4 - 10 <input type="checkbox"/> > 10	<input type="checkbox"/> Immature (<5) <input checked="" type="checkbox"/> Established (5-30) <input type="checkbox"/> Mature (>30)	<u>2</u>	<input type="checkbox"/> In Cutbank <input checked="" type="checkbox"/> In Channel <input type="checkbox"/> Not Present	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Mod <input type="checkbox"/> High	WDJ/50m: <u>0.5</u>	<u>6</u> <i>Slight organic</i>	<u>2</u>

Channel Characteristics *watercress*

Sinuosity Type (Table 9)	<u>2</u>	Sinuosity Degree (Table 10)	<u>2</u>	Bank Angle	Bank Erosion (Table 19)	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Gradient (Table 11)	<u>1</u>	# of Channels (Table 12)	<u>1</u>	<input type="checkbox"/> 0 - 30 <input type="checkbox"/> 30 - 60 <input checked="" type="checkbox"/> 60 - 90	<input type="checkbox"/> < 5% <input checked="" type="checkbox"/> 5 - 30% <input type="checkbox"/> 30 - 60% <input type="checkbox"/> 60 - 100%	<input checked="" type="checkbox"/> Bank <input type="checkbox"/> Riffle <input checked="" type="checkbox"/> Pool <input type="checkbox"/> Bed (if no riffle-pool morphology)	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Entrenchment (Table 13)	<u>2</u>	Bank Failure (Table 14)	<u>2/6</u> <i>localized</i>	<input checked="" type="checkbox"/> Undercut <i>localized</i>	Bankfull Width (m)	4.0	3.5	2.90	Wetted Width (m)	2.8	2.45	2.20
Down's Model (Table 15)	<u>S</u>	Bankfull Indicators (Table 18)	<u>3/5/1</u>	Bankfull Depth (m)	0.6	1.20	0.70	Wetted Depth (m)	0.30	0.43	0.24	Velocity (m/s)
Sed Sorting (Table 20)	<u>Mod</u>	Sediment Transport Observed?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not Visible	Undercuts (m)	0.05	0.30	0.05	Velocity (m/s)	0.385	0.240	0.450	Velocity Estimate Method
Transport Mode (Table 21)	<u>2/3</u>	% of Bed Active	<u>N/A</u>	Pool Depth (m)	0.50	/	/	Velocity Estimate Method	<u>Wright Ball</u>			Meander Amplitude (m)
Geomorphic Units (Table 22)	<u>5/6/B</u>	Mass Movement (Table 23)	<u>4</u>	% Rills:	<u>65</u>							
Riffle-Pool Spacing (m):	<u>N/A</u>	% Riffles:	<u>25</u>	% Pools:	<u>10</u>	Riffle Length (m)	<u>7</u>	<u>10</u>				

Notes: X54 X55 → Various substrate along the bed. Generally clay/silt & sand with coarse sediment in riffles. Pools uncommon, and run dominant
 → generally straight/altered by humans
 → some areas dredged/dug recently.

Photos: _____

Rapid Geomorphic Assessment

Project Number: 24009

Date:	2024-05-02	Stream:	Alloa Drain
Time:	12:25 pm	Reach:	AD3
Weather:	Bunny, 18°C	Location:	Mayfield Road
Field Staff:	RA HF	Watershed/Subwatershed:	Etobicoke Creek

Process	Geomorphological Indicator		Present?		Factor Value
	No.	Description	Yes	No	
Evidence of Aggradation (AI)	1	Lobate bar		✓	2/7
	2	Coarse materials in riffles embedded		✓	
	3	Siltation in pools	✓		
	4	Medial bars		✓	
	5	Accretion on point bars		✓	
	6	Poor longitudinal sorting of bed materials	✓		
	7	Deposition in the overbank zone		✓	
Sum of indices =			2	5	0.286

Evidence of Degradation (DI)	1	Exposed bridge footing(s)		N/A	0/6
	2	Exposed sanitary / storm sewer / pipeline / etc.		N/A	
	3	Elevated storm sewer outfall(s)		N/A	
	4	Undermined gabion baskets / concrete aprons / etc.		N/A	
	5	Scour pools downstream of culverts / storm sewer outlets		✓	
	6	Cut face on bar forms		✓	
	7	Head cutting due to knickpoint migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock		✓	
Sum of indices =			0	6	0.0

Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	✓		2/8
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle		✓	
	6	Outflanked gabion baskets / concrete walls / etc.		N/A	
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.	✓		
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation		N/A	
Sum of indices =			2	6	0.25

Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	7/7
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase with meander form		✓	
	7	Bar forms poorly formed / reworked / removed	✓		
Sum of indices =			7	7	0.143

Notes:	Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.170		
	In Regime	In Transition/Stress	In Adjustment
	<input checked="" type="checkbox"/> 0.00 - 0.20	<input type="checkbox"/> 0.21 - 0.40	<input type="checkbox"/> 0.41

Rapid Stream Assessment Technique **Project Number:** PN24009

Date:	2024-05-02	Stream:	Alloa Drain
Time:	12:25 pm	Reach:	AD3
Weather:	sunny, 18°C	Location:	Mayfield rd, Alloa
Field Staff:	RA HF	Watershed/Subwatershed:	Etobrook Creek

Category	Poor	Fair	Good	Excellent
Channel Stability	<ul style="list-style-type: none"> < 50% of bank network stable Recent bank sloughing, slumping or failure frequently observed 	<ul style="list-style-type: none"> 50-70% of bank network stable Recent signs of bank sloughing, slumping or failure fairly common 	<ul style="list-style-type: none"> 71-80% of bank network stable Infrequent signs of bank sloughing, slumping or failure 	<ul style="list-style-type: none"> > 80% of bank network stable No evidence of bank sloughing, slumping or failure
	<ul style="list-style-type: none"> Stream bend areas highly unstable Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) Bank overhang > 0.8-1.0 m 	<ul style="list-style-type: none"> Stream bend areas unstable Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) Bank overhang 0.8-0.9m 	<ul style="list-style-type: none"> Stream bend areas stable Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) Bank overhang 0.6-0.8 m 	<ul style="list-style-type: none"> Stream bend areas very stable Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) Bank overhang < 0.6 m
	<ul style="list-style-type: none"> Young exposed tree roots abundant > 6 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Young exposed tree roots common 4-5 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots predominantly old and large, smaller young roots scarce 2-3 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots old, large and woody Generally 0-1 recent large tree falls per stream mile
	<ul style="list-style-type: none"> Bottom 1/3 of bank is highly erodible material Plant/soil matrix severely compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly erodible material Plant/soil matrix compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped
	Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input checked="" type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8

Channel Scouring/ Sediment Deposition	<ul style="list-style-type: none"> > 75% embedded (> 85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 50-75% embedded (60-85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 25-49% embedded (35-59% embedded for large mainstem areas) 	<ul style="list-style-type: none"> Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	<ul style="list-style-type: none"> Few, if any, deep pools Pool substrate composition >81% sand-silt 	<ul style="list-style-type: none"> Low to moderate number of deep pools Pool substrate composition 60-80% sand-silt 	<ul style="list-style-type: none"> Moderate number of deep pools Pool substrate composition 30-59% sand-silt 	<ul style="list-style-type: none"> High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) Pool substrate composition <30% sand-silt
	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits uncommon 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits absent
	<ul style="list-style-type: none"> Fresh, large sand deposits very common in channel Moderate to heavy sand deposition along major portion of overbank area 	<ul style="list-style-type: none"> Fresh, large sand deposits common in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits uncommon in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits rare or absent from channel No evidence of fresh sediment deposition on overbank
	<ul style="list-style-type: none"> Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars common, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand 	<ul style="list-style-type: none"> Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input checked="" type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8

033

Date: 2024-05-02 **PN:** PN24009 **Location:** Mayfield rd, Alloga

Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	<ul style="list-style-type: none"> Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas) 	<ul style="list-style-type: none"> Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas) 	<ul style="list-style-type: none"> Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas) 	<ul style="list-style-type: none"> Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	<ul style="list-style-type: none"> Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low) 	<ul style="list-style-type: none"> Few pools present, riffles and runs dominant. Velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate) 	<ul style="list-style-type: none"> Good mix between riffles, runs and pools Relatively diverse velocity and depth of flow 	<ul style="list-style-type: none"> Riffles, runs and pool habitat present Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	<ul style="list-style-type: none"> Riffle substrate composition: predominantly gravel with high amount of sand < 5% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: predominantly small cobble, gravel and sand 5-24% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: good mix of gravel, cobble, and rubble material 25-49% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand > 50% cobble
	<ul style="list-style-type: none"> Riffle depth < 10 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth 10-15 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth 15-20 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth > 20 cm for large mainstem areas
	<ul style="list-style-type: none"> Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	<ul style="list-style-type: none"> Extensive channel alteration and/or point bar formation/enlargement 	<ul style="list-style-type: none"> Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement 	<ul style="list-style-type: none"> Slight amount of channel alteration and/or slight increase in point bar formation/enlargement 	<ul style="list-style-type: none"> No channel alteration or significant point bar formation/enlargement
	<ul style="list-style-type: none"> Riffle/Pool ratio 0.49:1 ; $\geq 1.51:1$ Summer afternoon water temperature > 27°C 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.5-0.69:1 ; 1.31-1.5:1 Summer afternoon water temperature 24-27°C 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.7-0.89:1 ; 1.11-1.3:1 Summer afternoon water temperature 20-24°C 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.9-1.1:1 Summer afternoon water temperature < 20°C
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input checked="" type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8
Water Quality	<ul style="list-style-type: none"> Substrate fouling level: High (> 50%) 	<ul style="list-style-type: none"> Substrate fouling level: Moderate (21-50%) 	<ul style="list-style-type: none"> Substrate fouling level: Very light (11-20%) 	<ul style="list-style-type: none"> Substrate fouling level: Rock underside (0-10%)
	<ul style="list-style-type: none"> Brown colour TDS: > 150 mg/L 	<ul style="list-style-type: none"> Grey colour TDS: 101-150 mg/L 	<ul style="list-style-type: none"> Slightly grey colour TDS: 50-100 mg/L 	<ul style="list-style-type: none"> Clear flow TDS: < 50 mg/L
	<ul style="list-style-type: none"> Objects visible to depth < 0.15m below surface 	<ul style="list-style-type: none"> Objects visible to depth 0.15-0.5m below surface 	<ul style="list-style-type: none"> Objects visible to depth 0.5-1.0m below surface 	<ul style="list-style-type: none"> Objects visible to depth > 1.0m below surface
	<ul style="list-style-type: none"> Moderate to strong organic odour 	<ul style="list-style-type: none"> Slight to moderate organic odour 	<ul style="list-style-type: none"> Slight organic odour 	<ul style="list-style-type: none"> No odour
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 5 <input checked="" type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8
Riparian Habitat Conditions	<ul style="list-style-type: none"> Narrow riparian area of mostly non-woody vegetation 	<ul style="list-style-type: none"> Riparian area predominantly wooded but with major localized gaps 	<ul style="list-style-type: none"> Forested buffer generally > 31 m wide along major portion of both banks 	<ul style="list-style-type: none"> Wide (> 60 m) mature forested buffer along both banks
	<ul style="list-style-type: none"> Canopy coverage: < 50% shading (30% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: 50-60% shading (30-44% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: 60-79% shading (45-59% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: > 80% shading (> 60% for large mainstem areas)
Point range	<input type="checkbox"/> 0 <input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2 <input type="checkbox"/> 3	<input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7

Total overall score (0-42) = 23 **Poor (<13)** **Fair (13-24)** **Good (25-34)** **Excellent (>35)**

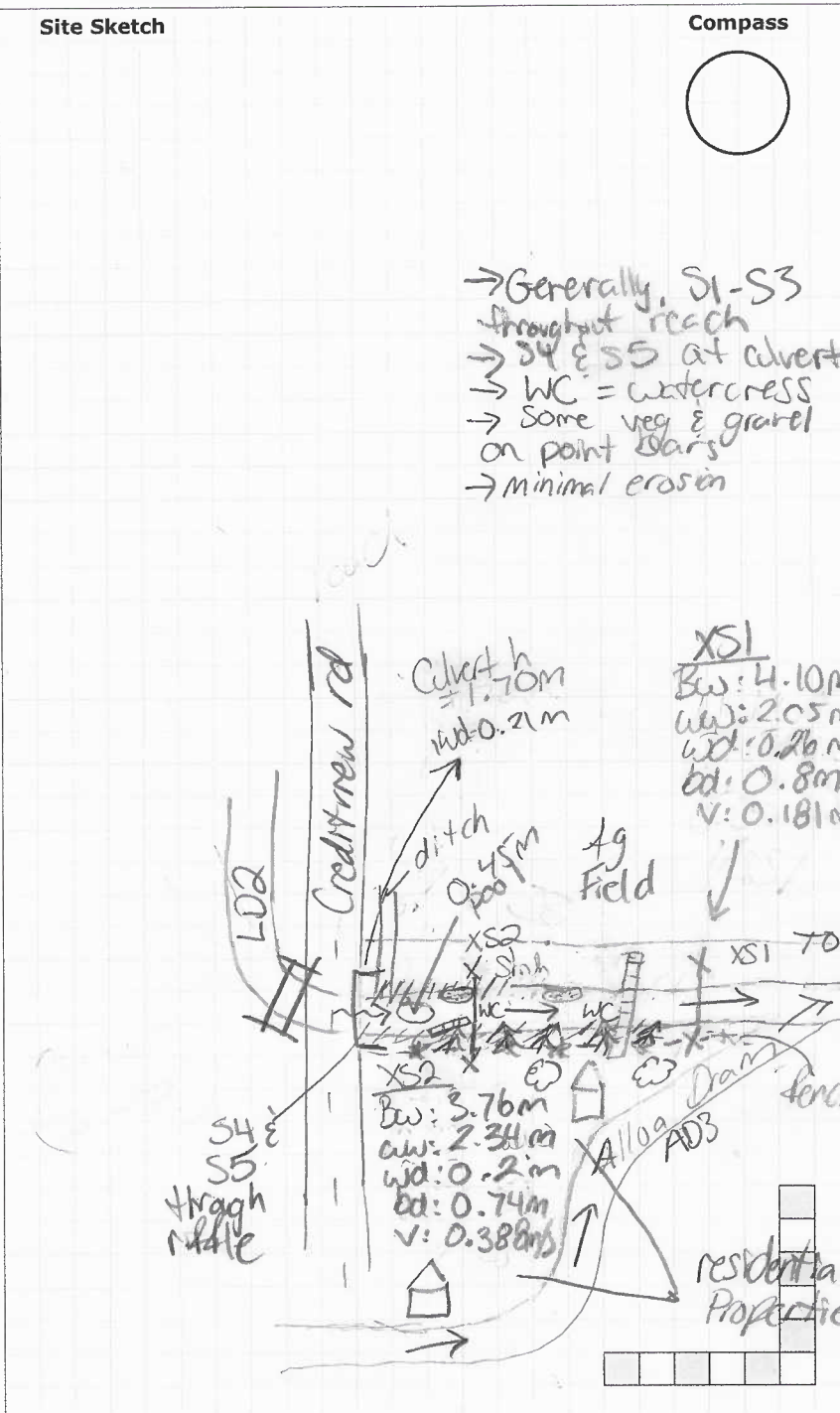
General Site Characteristics

Project Number: 24009

Date:	2021-05-02	Stream:	Lyons Drain
Time:	2:45 pm	Reach:	LD1
Weather:	Sunny 18°C	Location:	Mayfield rd, Allog
Field Staff:	KA HF	Watershed/Subwatershed:	Ebrovale Creek

Features	Monitoring
Reach break	Long-profile
Station location	Monumented XS
Cross-section	Monumented photo
Flow direction	Monumented photo direction
Riffle	Sediment sampling
Pool	Erosion pins
Sediment bar	Scour chains
Eroded bank/slope	
Undercut bank	
Bank stabilization	
Leaning tree	
Fence	
Culvert/outfall	
Swamp/wetland	
Grasses	
Tree	
Instream log/tree	
Woody debris	
Beaver dam	
Vegetated island	

Additional Symbols



Flow Type

H1 Standing water	H1A Back water
H2 Scarcely perceptible flow	
H3 Smooth surface flow	
H4 Upwelling	
H5 Rippled	
H6 Unbroken standing wave	
H7 Broken standing wave	
H8 Chute	
H9 Free fall	H9A Dissipates below free fall

Substrate

S1 Silt	S6 Small boulder
S2 Sand	S7 Large boulder
S3 Gravel	S8 Bimodal
S4 Small cobble	S9 Bedrock/till
S5 Large cobble	

Other

BM Benchmark	EP Erosion pin
BS Backsight	RB Rebar
DS Downstream	US Upstream
WDJ Woody debris jam	TR Terrace
VWC Valley wall contact	FC Flood chute
BOS Bottom of slope	FP Flood plain
TOS Top of slope	KP Knick point

Photos:

Notes:

Reach Characteristics Project Number: 24009

Date:	2024-05-02	Field Staff:	RA HE	Watershed/Subwatershed:	Etobicoke Creek
Time:	2:45 pm	Stream:	Lyons Drain	UTM (Upstream):	
Weather:	Sunny, 18°C	Reach:	LD1	UTM (Downstream):	

Land Use (Table 1) **H17** Valley Type (Table 2) **1** Channel Type (Table 3) **11** Channel Zone (Table 4) **3** Flow Type (Table 5) **1** Evidence of Groundwater Location: *Central of reach* Photo: *144617 & 144835*

Riparian Vegetation

Dominant Type (Table 6) **V2** Coverage None 1 - 4 Immature (<5)

Encroachment (Table 7) **2** Fragmented 4 - 10 Established (5-30)

Continuous > 10 Mature (>30)

Aquatic & Instream Vegetation

Type (Table 8) **2** Woody Debris In Cutbank Low Mod High

Reach Coverage % **20** In Channel Not Present

WDJ/50m: **0**

Water Quality

Odour (Table 16) **1** Turbidity (Table 17) **2**

Channel Characteristics

Sinuosity Type (Table 9)	1	Sinuosity Degree (Table 10)	1	Bank Angle	<input type="checkbox"/> 0 - 30 <input checked="" type="checkbox"/> < 5%	Bank Erosion (Table 19)	<input checked="" type="checkbox"/> < 5%	Clay/Silt	<input checked="" type="checkbox"/>	Sand	<input checked="" type="checkbox"/>	Gravel	<input type="checkbox"/>	Cobble	<input type="checkbox"/>	Boulder	<input type="checkbox"/>	Parent	<input type="checkbox"/>	Rootlets	<input type="checkbox"/>
Gradient (Table 11)	1	# of Channels (Table 12)	1	<input checked="" type="checkbox"/> 30 - 60 <input type="checkbox"/> 60 - 90	<input type="checkbox"/> 5 - 30% <input type="checkbox"/> 30 - 60%	(Artificial) Riffle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Entrenchment (Table 13)	2	Bank Failure (Table 14)	NA	<input type="checkbox"/> Undercut	<input type="checkbox"/> 60 - 100%	Pool	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Down's Model (Table 15)	S	Bankfull Indicators (Table 18)	6/3/5	Bankfull Width (m)	4.10	Bed (if no riffle-pool morphology)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sed Sorting (Table 20)	Mod	Sediment Transport Observed?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not Visible	Bankfull Depth (m)	0.8	Wetted Width (m)	2.05	2.34	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transport Mode (Table 21)	2	% of Bed Active	N/A	Undercuts (m)	<input type="checkbox"/>	Wetted Depth (m)	0.26	0.20	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Geomorphic Units (Table 22)	8	Mass Movement (Table 23)	<input type="checkbox"/>	Pool Depth (m)	0.45	Velocity (m/s)	0.181	0.388	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Riffle-Pool Spacing (m):	N/A	% Riffles:	5	% Pools:	5	Riffle Length (m)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Notes: → There was one pool/riffle sequence observed at the culvert.
 → Leaning trees & shrubs were observed on right bank while grasses (established) dominantes the left bank.
 → Small reach (reach break @ road)
 → Silty/sandy bed with some bar formation (sand, gravel, vegetation on bars)
 → Minimal erosion throughout despite leaning trees on right bank.

Photos:

Rapid Geomorphic Assessment

Project Number: 24009

Date:	2024-05-02	Stream:	Lyon's Drain
Time:	2:45 pm	Reach:	LD1
Weather:	Sunny, 18°C	Location:	Mayfield road, Alba
Field Staff:	RA HF	Watershed/Subwatershed:	Estabrooke Creek

Process	Geomorphological Indicator		Present?		Factor Value
	No.	Description	Yes	No	
Evidence of Aggradation (AI)	1	Lobate bar		✓	1/3
	2	Coarse materials in riffles embedded		✓	
	3	Siltation in pools		✓	
	4	Medial bars		✓	
	5	Accretion on point bars - minimally bars present	✓		
	6	Poor longitudinal sorting of bed materials		✓	
	7	Deposition in the overbank zone		✓	
Sum of indices =			1	6	0.143

Evidence of Degradation (DI)	1	Exposed bridge footing(s)	N/A		0/6
	2	Exposed sanitary / storm sewer / pipeline / etc.	N/A		
	3	Elevated storm sewer outfall(s)	N/A		
	4	Undermined gabion baskets / concrete aprons / etc.	N/A		
	5	Scour pools downstream of culverts / storm sewer outlets		✓	
	6	Cut face on bar forms		✓	
	7	Head cutting due to knickpoint migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock		✓	
Sum of indices =			0	6	0.0

Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	✓		1/8
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle		✓	
	6	Outflanked gabion baskets / concrete walls / etc.	N/A		
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.		✓	
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation	N/A		
Sum of indices =			1	7	0.125

Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	0/7
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase with meander form		✓	
	7	Bar forms poorly formed / reworked / removed		✓	
Sum of indices =			0	7	0.0

Notes:	Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.067		
	In Regime	In Transition/Stress	In Adjustment
	<input checked="" type="checkbox"/> 0.00 - 0.20	<input type="checkbox"/> 0.21 - 0.40	<input type="checkbox"/> 0.41

Rapid Stream Assessment Technique Project Number: *24009*

Date:	<i>2024-05-02</i>	Stream:	<i>Lyons Drain</i>
Time:	<i>2:45 pm</i>	Reach:	<i>LD1</i>
Weather:	<i>Sunny, 18°</i>	Location:	<i>Mainfield road, Aliso</i>
Field Staff:	<i>RA HF</i>	Watershed/Subwatershed:	<i>Ebbrooke Creek</i>

Category	Poor	Fair	Good	Excellent
Channel Stability	<ul style="list-style-type: none"> < 50% of bank network stable Recent bank sloughing, slumping or failure frequently observed 	<ul style="list-style-type: none"> 50-70% of bank network stable Recent signs of bank sloughing, slumping or failure fairly common 	<ul style="list-style-type: none"> 71-80% of bank network stable Infrequent signs of bank sloughing, slumping or failure 	<ul style="list-style-type: none"> > 80% of bank network stable No evidence of bank sloughing, slumping or failure
	<ul style="list-style-type: none"> Stream bend areas highly unstable Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) Bank overhang > 0.8-1.0 m 	<ul style="list-style-type: none"> Stream bend areas unstable Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) Bank overhang 0.8-0.9m 	<ul style="list-style-type: none"> Stream bend areas stable Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) Bank overhang 0.6-0.8 m 	<ul style="list-style-type: none"> Stream bend areas very stable Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) Bank overhang < 0.6 m
	<ul style="list-style-type: none"> Young exposed tree roots abundant > 6 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Young exposed tree roots common 4-5 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots predominantly old and large, smaller young roots scarce 2-3 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots old, large and woody Generally 0-1 recent large tree falls per stream mile
	<ul style="list-style-type: none"> Bottom 1/3 of bank is highly erodible material Plant/soil matrix severely compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly erodible material Plant/soil matrix compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped
	Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input checked="" type="checkbox"/> 7 <input type="checkbox"/> 8

Channel Scouring/ Sediment Deposition	<ul style="list-style-type: none"> > 75% embedded (> 85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 50-75% embedded (60-85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 25-49% embedded (35-59% embedded for large mainstem areas) 	<ul style="list-style-type: none"> Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	<ul style="list-style-type: none"> Few, if any, deep pools Pool substrate composition >81% sand-silt 	<ul style="list-style-type: none"> Low to moderate number of deep pools Pool substrate composition 60-80% sand-silt 	<ul style="list-style-type: none"> Moderate number of deep pools Pool substrate composition 30-59% sand-silt 	<ul style="list-style-type: none"> High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) Pool substrate composition <30% sand-silt
	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits uncommon 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits absent
	<ul style="list-style-type: none"> Fresh, large sand deposits very common in channel Moderate to heavy sand deposition along major portion of overbank area 	<ul style="list-style-type: none"> Fresh, large sand deposits common in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits uncommon in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits rare or absent from channel No evidence of fresh sediment deposition on overbank
	<ul style="list-style-type: none"> Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars common, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand 	<ul style="list-style-type: none"> Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input checked="" type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8

Date: 2024-05-02 PN: 24009 Location: Mayfield road Alcoa

Category	Poor	Fair	Good	Excellent
Physical Instream Habitat <i>one riffle</i> ← <i>one pool</i>	<ul style="list-style-type: none"> Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas) Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low) 	<ul style="list-style-type: none"> Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas) Few pools present, riffles and runs dominant. Velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate) 	<ul style="list-style-type: none"> Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas) Good mix between riffles, runs and pools Relatively diverse velocity and depth of flow 	<ul style="list-style-type: none"> Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas) Riffles, runs and pool habitat present Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	<ul style="list-style-type: none"> Riffle substrate composition: predominantly gravel with high amount of sand < 5% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: predominantly small cobble, gravel and sand 5-24% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: good mix of gravel, cobble, and rubble material 25-49% cobble 	<ul style="list-style-type: none"> Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand > 50% cobble
	<ul style="list-style-type: none"> Riffle depth < 10 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth 10-15 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth 15-20 cm for large mainstem areas 	<ul style="list-style-type: none"> Riffle depth > 20 cm for large mainstem areas
	<ul style="list-style-type: none"> Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure 	<ul style="list-style-type: none"> Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	<ul style="list-style-type: none"> Extensive channel alteration and/or point bar formation/enlargement 	<ul style="list-style-type: none"> Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement 	<ul style="list-style-type: none"> Slight amount of channel alteration and/or slight increase in point bar formation/enlargement 	<ul style="list-style-type: none"> No channel alteration or significant point bar formation/enlargement
	<ul style="list-style-type: none"> Riffle/Pool ratio 0.49:1 ; ≥1.51:1 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.5-0.69:1 ; 1.31-1.5:1 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.7-0.89:1 ; 1.11-1.3:1 	<ul style="list-style-type: none"> Riffle/Pool ratio 0.9-1.1:1
	<ul style="list-style-type: none"> Summer afternoon water temperature > 27°C 	<ul style="list-style-type: none"> Summer afternoon water temperature 24-27°C 	<ul style="list-style-type: none"> Summer afternoon water temperature 20-24°C 	<ul style="list-style-type: none"> Summer afternoon water temperature < 20°C
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input checked="" type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8

Water Quality	<ul style="list-style-type: none"> Substrate fouling level: High (> 50%) 	<ul style="list-style-type: none"> Substrate fouling level: Moderate (21-50%) 	<ul style="list-style-type: none"> Substrate fouling level: Very light (11-20%) 	<ul style="list-style-type: none"> Substrate fouling level: Rock underside (0-10%)
	<ul style="list-style-type: none"> Brown colour TDS: > 150 mg/L 	<ul style="list-style-type: none"> Grey colour TDS: 101-150 mg/L 	<ul style="list-style-type: none"> Slightly grey colour TDS: 50-100 mg/L 	<ul style="list-style-type: none"> Clear flow TDS: < 50 mg/L
	<ul style="list-style-type: none"> Objects visible to depth < 0.15m below surface 	<ul style="list-style-type: none"> Objects visible to depth 0.15-0.5m below surface 	<ul style="list-style-type: none"> Objects visible to depth 0.5-1.0m below surface 	<ul style="list-style-type: none"> Objects visible to depth > 1.0m below surface
	<ul style="list-style-type: none"> Moderate to strong organic odour 	<ul style="list-style-type: none"> Slight to moderate organic odour 	<ul style="list-style-type: none"> Slight organic odour 	<ul style="list-style-type: none"> No odour
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input checked="" type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8

Riparian Habitat Conditions	<ul style="list-style-type: none"> Narrow riparian area of mostly non-woody vegetation 	<ul style="list-style-type: none"> Riparian area predominantly wooded but with major localized gaps 	<ul style="list-style-type: none"> Forested buffer generally > 31 m wide along major portion of both banks 	<ul style="list-style-type: none"> Wide (> 60 m) mature forested buffer along both banks
	<ul style="list-style-type: none"> Canopy coverage: <50% shading (30% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: 50-60% shading (30-44% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: 60-79% shading (45-59% for large mainstem areas) 	<ul style="list-style-type: none"> Canopy coverage: >80% shading (> 60% for large mainstem areas)
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1	<input type="checkbox"/> 2 <input checked="" type="checkbox"/> 3	<input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7

Total overall score (0-42) = <u>25</u>	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)
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**Appendix E:
Detailed Geomorphological Assessment Summaries**

Detailed Geomorphological Assessment Summary

Reach AD1

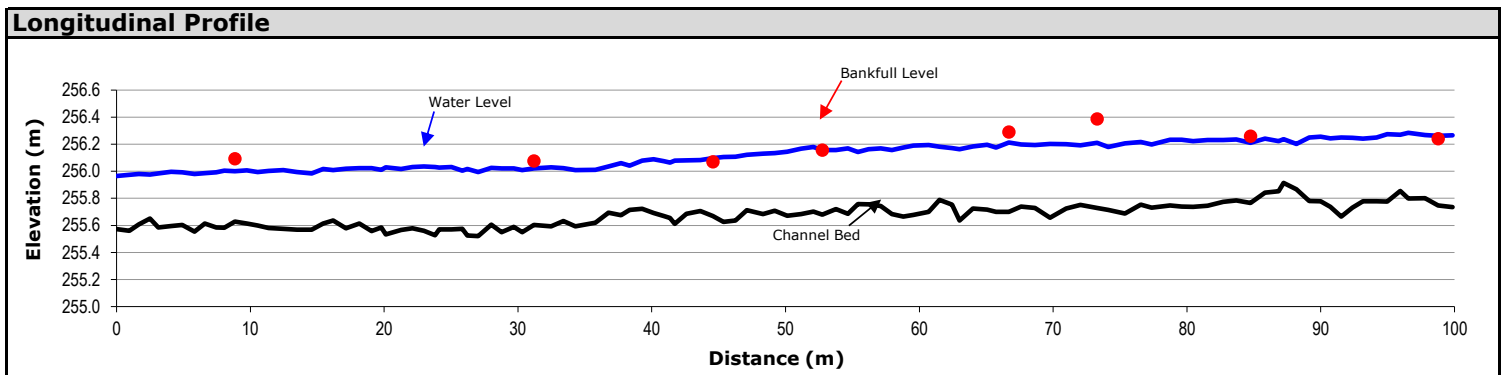
Project Number:	PN24009	Date:	2024-06-03
Client:	Alloa Landowners Group c/o GSAI	Length Surveyed (m):	99.9
Location:	Chinguacousy Road, Alloa, Ontario	# of Cross-Sections:	8

Reach Characteristics			
Drainage Area:	10.18 km ²	Dominant Riparian Vegetation Type:	Grasses
Geology/Soils:	Modern alluvial desposits (clay, silt, gravel, s	Extent of Riparian Cover:	Continuous
Surrounding Land Use:	Agriculture/Pasture	Width of Riparian Cover:	1-4 channel widths
Valley Type:	Confined	Age Class of Riparian Vegetation:	Immature
Dominant Instream Vegetation Type:	Rooted Emergent	Extent of Encroachment into Channel:	Minimal
Portion of Reach with Vegetation:	100%	Density of Woody Debris:	Low

Hydrology			
Measured Discharge (m³/s):	0.12	Calculated Bankfull Discharge (m³/s):	0.73
Modelled 2-year Discharge (m³/s):	Not modelled	Calculated Bankfull Velocity (m/s):	0.60
Modelled 2-year Velocity (m/s):	Not modelled		

Profile Characteristics	
Bankfull Gradient (%):	0.29
Channel Bed Gradient (%):	0.25
Riffle Gradient (%):	
Riffle Length (m):	No Riffle Pool Morphology
Riffle-Pool Spacing (m):	

Planform Characteristics	
Sinuosity:	1.08
Meander Belt Width (m):	Not applicable
Radius of Curvature (m):	Not applicable
Meander Amplitude (m):	Not applicable
Meander wavelength (m):	Not applicable



Bank Characteristics							
	Minimum	Maximum	Average		Minimum	Maximum	Average
Bank Height (m):	0.39	0.63	0.52				
Bank Angle (deg):	50	90	81	Torvane Value (kg/cm²):	0.15	0.75	0.4
Root Depth (m):	0.07	0.19	0.13	Penetrometer Value (kg/cm³):	0.50	1.75	1.09
Root Density (%):	75	95	90	Bank Material (range):	Clay silt with dense roots		
Bank Undercut (m):	0.00	0.18	0.04				

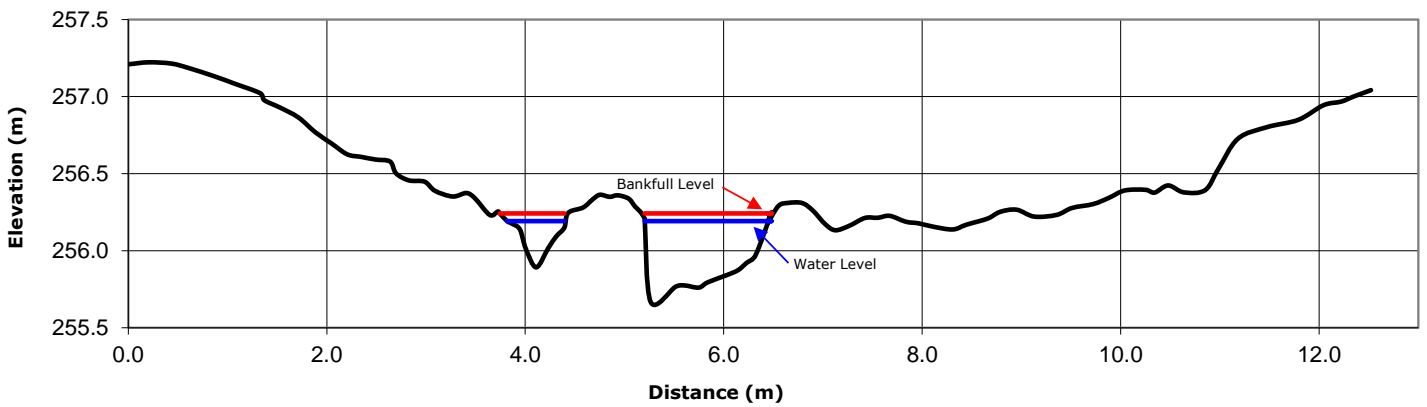
Cross-Sectional Characteristics

	Minimum	Maximum	Average
Bankfull Width (m):	1.89	7.52	4.90
Average Bankfull Depth (m):	0.19	0.37	0.25
Bankfull Width/Depth (m/m):	5	33	22
Wetted Width (m):	0.89	2.33	1.59
Average Water Depth (m):	0.14	0.40	0.24
Wetted Width/Depth (m/m):	4	14	7
Entrenchment (m):	Low entrenchment		
Entrenchment Ratio (m/m):	>2.2 m		
Maximum Water Depth (m):	0.31	0.53	0.44
Manning's n :	0.035		



Photograph at cross section 8-M (looking upstream)

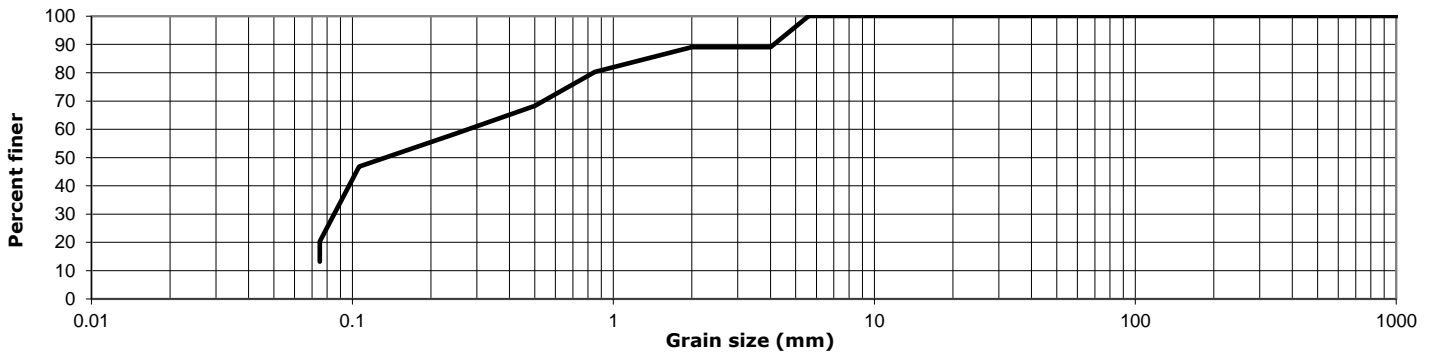
Representative Cross-Section 8-M



Substrate Characteristics

Particle Size (mm)		Subpavement:	Till Plains
D₁₀ :	<0.075	Particle shape:	Fine materials
D₅₀ :	0.1	Embeddedness (%):	100
D₈₄ :	1.3	Particle range (riffle):	No Riffle Pool Morphology
		Particle Range (pool):	

Cumulative Particle Size Distribution



Channel Thresholds			
Flow Competency (m/s):		Tractive Force at Bankfull (N/m²):	6.75
for D₅₀:	0.08	Tractive Force at 2-year flow (N/m²):	Not modelled
for D₈₄:	0.23	Critical Shear Stress (D₅₀) (N/m²):	0.11
Unit Stream Power at Bankfull (W/m²):	4.01		

General Field Observations

Channel Description

Reach AD1 consisted of a relatively straight channel flowing through agricultural pastures. The reach was run dominant with a lack of riffles and pools identified. The assessment was completed during a rain event which produced saturated banks, suspended sediment transport throughout the channel, and chutes in six of eight cross sections. The riparian zone was dominated by tall grasses, which encroached minimally. Aquatic vegetation was present throughout 100% of reach encroaching heavily on chutes, but had minimal impact on the main channel. Bed and bank materials were homogenous throughout the channel; primarily comprised of silt and clay. Minor undercutting was measured at three cross sections.

Cross Section 5 - Facing Right Bank



Detailed Geomorphological Assessment Summary

Reach AD2

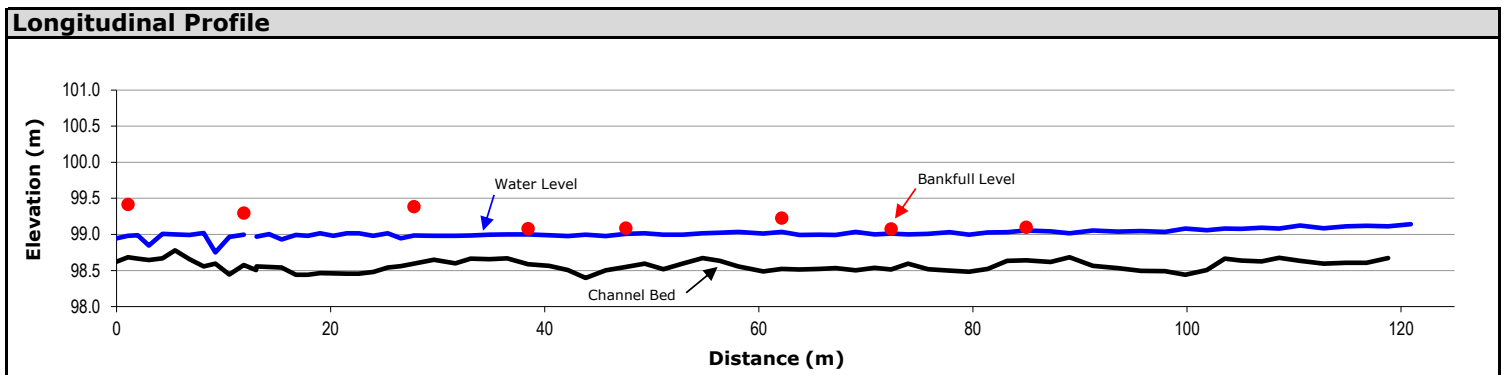
Project Number:	PN24009	Date:	2024-05-27
Client:	Alloa Landowners Group c/o GSAI	Length Surveyed (m):	120.9
Location:	Chingaucousy Road, Caledon	# of Cross-Sections:	8

Reach Characteristics			
Drainage Area:	9.632 km ²	Dominant Riparian Vegetation Type:	Grasses, few trees
Geology/Soils:	Alluvial deposits (clay, silt and sand); till	Extent of Riparian Cover:	Fragmented
Surrounding Land Use:	Agricultural	Width of Riparian Cover:	1-4 channel widths
Valley Type:	Unconfined	Age Class of Riparian Vegetation:	Established (5-30 years)
Dominant Instream Vegetation Type:	Grasses	Extent of Encroachment into Channel:	Minimal
Portion of Reach with Vegetation:	15%	Density of Woody Debris:	Low

Hydrology			
Measured Discharge (m³/s):	1.11	Calculated Bankfull Discharge (m³/s):	1.66
Modelled 2-year Discharge (m³/s):	Not modelled	Calculated Bankfull Velocity (m/s):	0.98
Modelled 2-year Velocity (m/s):	Not modelled		

Profile Characteristics	
Bankfull Gradient (%):	0.37
Channel Bed Gradient (%):	0.01
Riffle Gradient (%):	Poor riffle-pool morphology.
Riffle Length (m):	Channel predominately runs
Riffle-Pool Spacing (m):	

Planform Characteristics	
Sinuosity:	1.03
Meander Belt Width (m):	Not applicable
Radius of Curvature (m):	Not applicable
Meander Amplitude (m):	Not applicable
Meander wavelength (m):	Not applicable



Bank Characteristics							
	Minimum	Maximum	Average		Minimum	Maximum	Average
Bank Height (m):	1.20	1.77	1.51				
Bank Angle (deg):	30	65	48	Torvane Value (kg/cm²):	0.5	2.8	1.5
Root Depth (m):	0.10	1.00	0.66	Penetrometer Value (kg/cm³):	0.5	3.0	1.4
Root Density (%):	5	50	28	Bank Material (range):	Clay and silts		
Bank Undercut (m):	0.00	0.00	0.00				

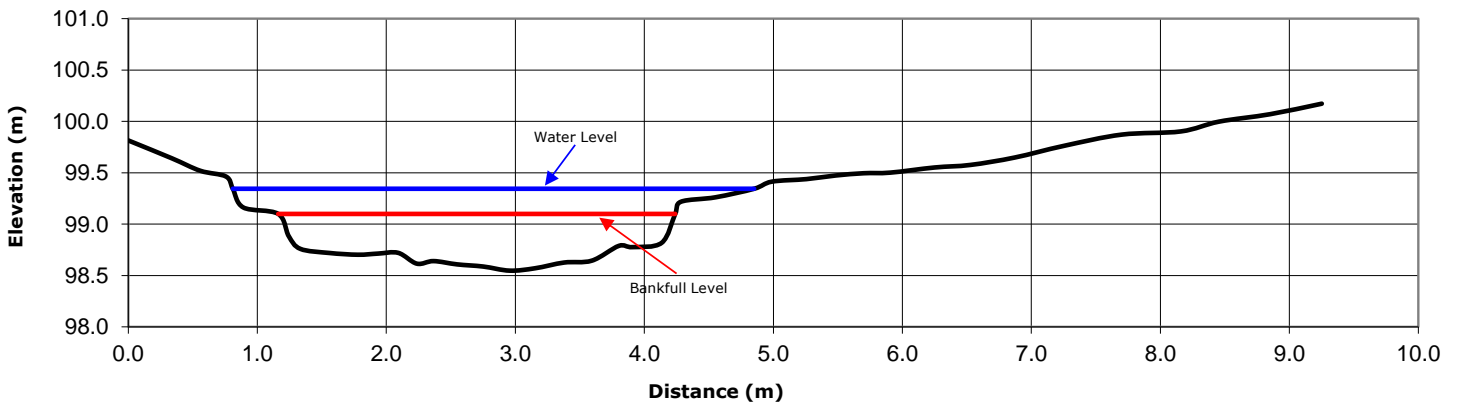
Cross-Sectional Characteristics

	Minimum	Maximum	Average
Bankfull Width (m):	3.09	5.35	4.05
Average Bankfull Depth (m):	0.31	0.52	0.42
Bankfull Width/Depth (m/m):	7	14	10
Wetted Width (m):	4.04	7.10	5.75
Average Water Depth (m):	0.50	0.66	0.58
Wetted Width/Depth (m/m):	8	13	10
Entrenchment (m):	Moderately entrenched		
Entrenchment Ratio (m/m):	ER ~1.4-2.2		
Maximum Water Depth (m):	0.80	1.12	1.00
Manning's n :	0.035		



Photograph at cross section 1M (looking upstream)

Representative Cross-Section 1M



Substrate Characteristics

Particle Size (mm): Based on laboratory data

D₁₀ :	<0.0075
D₅₀ :	0.219
D₈₄ :	0.766

Subpavement:

Till Plains

Particle shape:

Sub-angular and sub-rounded

Embeddedness (%):

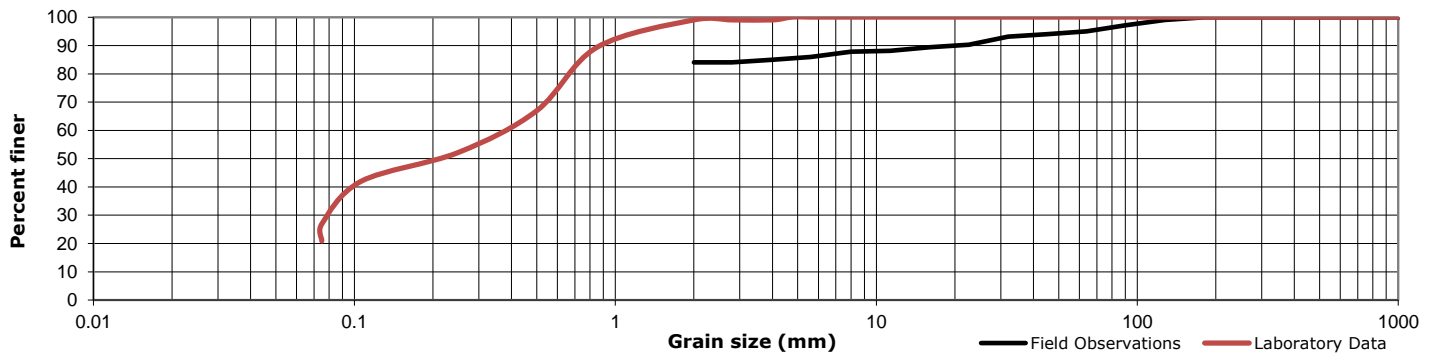
50-80%

Particle range (riffle):

No Riffle Pool Morphology

Particle Range (pool):

Cumulative Particle Size Distribution



Channel Thresholds			
Flow Competency (m/s):		Tractive Force at Bankfull (N/m²):	15.26
for D₅₀:	0.10	Tractive Force at 2-year flow (N/m²):	Not modelled
for D₈₄:	0.17	Critical Shear Stress (D₅₀) (N/m²):	0.16
Unit Stream Power at Bankfull (W/m²):	14.88		

General Field Observations

Channel Description

The reach is located west of Mississauga Road in Caledon. It is important to note that the channel was surveyed during high flow conditions after a large rain event. Water levels were over bankfull conditions, nearly overtopping the surrounding agricultural area. The channel is unconfined and widens towards the downstream extent of the surveyed portion. The channel is part of the Alloa drain and the portion surveyed was straight. There was poor riffle-pool morphology and the dominate feature was runs. The right bank had greater riparian vegetation than the left bank. The right bank had more dense grasses and mature trees, whereas the left bank was solely grasses. Instream vegetation consisted primarily of sparse grasses. The channel is U-shaped and moderately entrenched. Bed material was composed primarily of silts with some cobble. Sediment transport in the form of siltation was observed due to high flows and intense precipitation.

Cross Section 3M - Facing Downstream



Detailed Geomorphological Assessment Summary

Reach: LD2

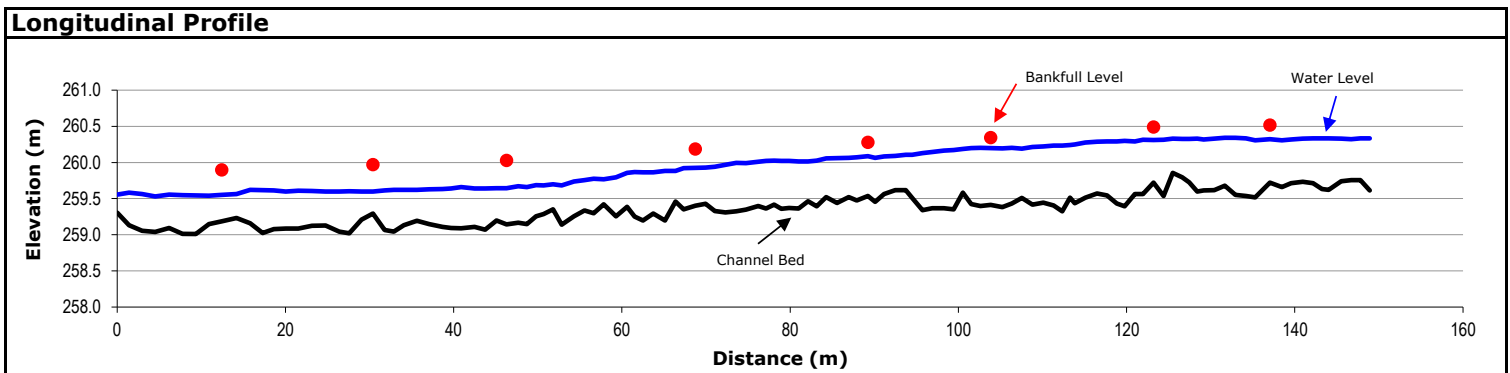
Project Number:	PN24009	Date:	2024-05-28
Client:	Alloa Landowners Group c/o GSAI	Length Surveyed (m):	156.4
Location:	Creditview Road, Alloa, Ontario	# of Cross-Sections:	8

Reach Characteristics			
Drainage Area:	2.02 km ²	Dominant Riparian Vegetation Type:	Grasses
Geology/Soils:	Glaciolacustrine deposits of silt & clay	Extent of Riparian Cover:	Continuous
Surrounding Land Use:	Agriculture	Width of Riparian Cover:	4-10 channel widths
Valley Type:	Confined	Age Class of Riparian Vegetation:	<5 years
Dominant Instream Vegetation Type:	Grasses	Extent of Encroachment into Channel:	Heavy
Portion of Reach with Vegetation:	90%	Density of Woody Debris:	Low

Hydrology			
Measured Discharge (m³/s):	0.26	Calculated Bankfull Discharge (m³/s):	2.66
Modelled 2-year Discharge (m³/s):	Not modelled	Calculated Bankfull Velocity (m/s):	1.08
Modelled 2-year Velocity (m/s):	Not modelled		

Profile Characteristics	
Bankfull Gradient (%):	0.52
Channel Bed Gradient (%):	0.38
Riffle Gradient (%):	
Riffle Length (m):	No Riffle Pool Morphology
Riffle-Pool Spacing (m):	

Planform Characteristics	
Sinuosity:	1.04
Meander Belt Width (m):	Not applicable
Radius of Curvature (m):	Not applicable
Meander Amplitude (m):	Not applicable
Meander wavelength (m):	Not applicable



Bank Characteristics							
	Minimum	Maximum	Average		Minimum	Maximum	Average
Bank Height (m):	1.13	2.00	1.73				
Bank Angle (deg):	15	80	33	Torvane Value (kg/cm²):	0.5	1.5	1.0
Root Depth (m):	0.05	0.40	0.19	Penetrometer Value (kg/cm³):	0.25	1.5	0.7
Root Density (%):	50	85	71	Bank Material (range):	Clay / Silt / Sand		
Bank Undercut (m):	0.00	0.13	0.01				

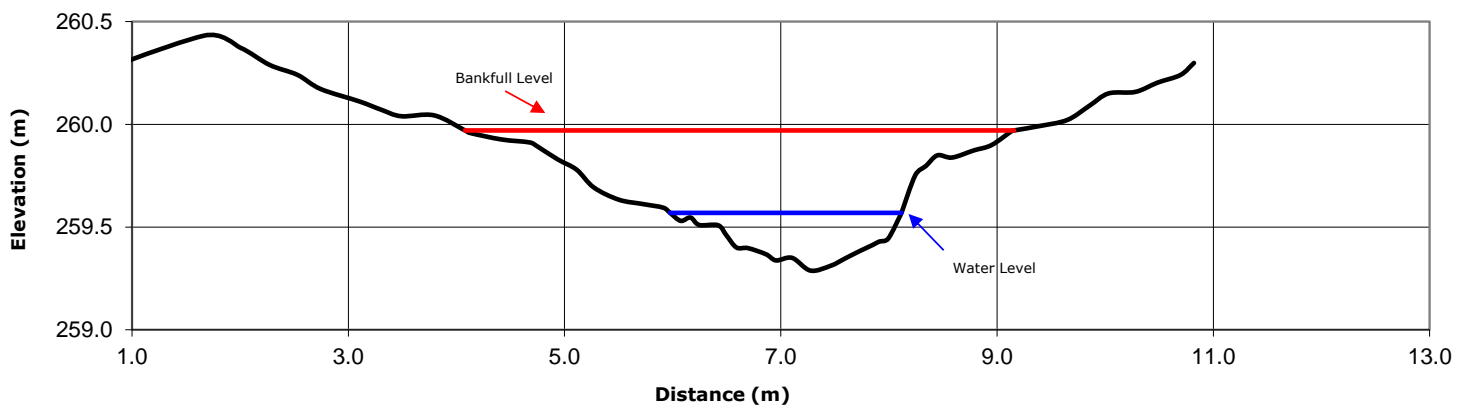
Cross-Sectional Characteristics

	Minimum	Maximum	Average
Bankfull Width (m):	4.89	7.76	6.47
Average Bankfull Depth (m):	0.34	0.39	0.38
Bankfull Width/Depth (m/m):	12	21	17
Wetted Width (m):	2.14	4.29	3.15
Average Water Depth (m):	0.13	0.36	0.22
Wetted Width/Depth (m/m):	7	24	15
Entrenchment (m):	Moderately Entrenched		
Entrenchment Ratio (m/m):	(ER: 1.4 - 2.2)		
Maximum Water Depth (m):	0.28	0.72	0.55
Manning's n :	0.035		



Photograph at cross section 7 (looking downstream)

Representative Cross-Section 2



Substrate Characteristics

Particle Size (mm): Based on laboratory analysis

D₁₀ :	<0.075
D₅₀ :	0.084
D₈₄ :	0.534

Subpavement:

Till Plains

Particle shape:

Sub-angular to Sub-Rounded

Embeddedness (%):

65%

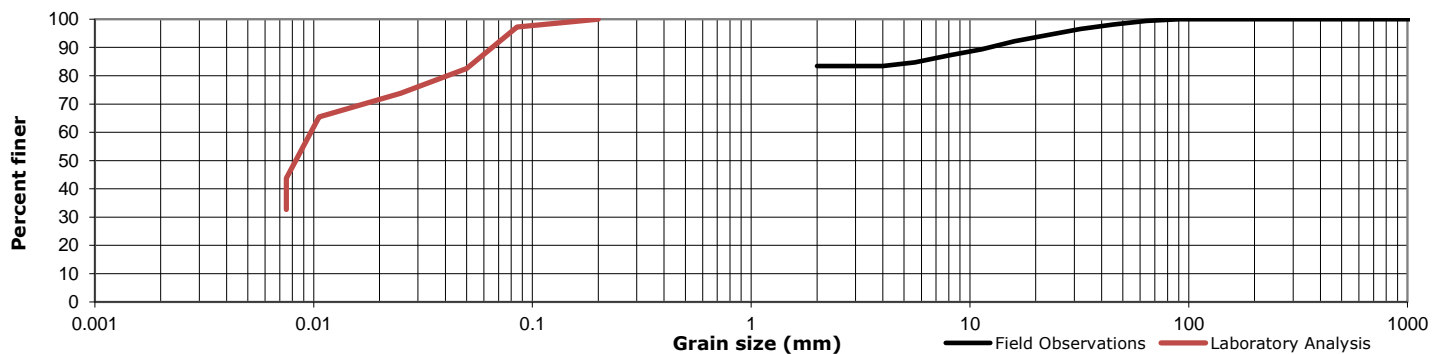
Particle range (riffle):

No Riffle Morphology

Particle Range (pool):

No Pool Morphology

Cumulative Particle Size Distribution



Channel Thresholds			
Flow Competency (m/s):		Tractive Force at Bankfull (N/m²):	19.47
for D₅₀:	0.06	Tractive Force at 2-year flow (N/m²):	Not modelled
for D₈₄:	0.15	Critical Shear Stress (D₅₀) (N/m²):	0.06
Unit Stream Power at Bankfull (W/m²):	21.08		

General Field Observations

Channel Description

Reach LD2 is a tributary of Etobicoke Creek in Alloo, ON which conveys flows within the agricultural lands north of Mayfield Rd between Creditview Rd and Mississauga Rd. Nearing the downstream extent of Lyon's Drain, the subject reach consists of a straightened roadside ditch that runs parallel to Creditview Rd with culverts at the upstream and downstream extent. Channel bed morphology was notably homogenous, characterized by run and pool features, with a distinct scour pool at the upstream extent. Channel substrates predominantly consisted of fine materials including clay, silt and sand (D₅₀: < 0.2 mm). The channel demonstrated indicators of systematic aggradation as fine sediment deposits were observed along the entirety of the channel bed, likely as a consequence of the heavily encroaching aquatic vegetation which slows incoming flows and promotes sediment settling.

Cross Section 5 - Facing Upstream



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Appendix F: Existing Conditions Erosion Hazard Delineation



Legend

- Reach Break and ID
- 0.5 m Contour
- Watercourse
- - - Headwater Drainage Feature
- Municipal Drain
- - - Tile Drain
- Municipal Drain Not Field Assessed
- Not Field Assessed
- OHN Waterbody
- Meander Belt Width
- - - Meander Belt Width (Non-Participating)
- Participating Properties
- Non-Participating Properties, Access
- Non-Participating Property, No Access
- Phase 1 Lands
- Phase 2 Lands
- Alloa Secondary Plan Area and Primary Study Area

Figure 2
**Existing Conditions
 Meander Belt Widths**
 Phase 1 Alloa Secondary Plan Area
 Caledon, Ontario

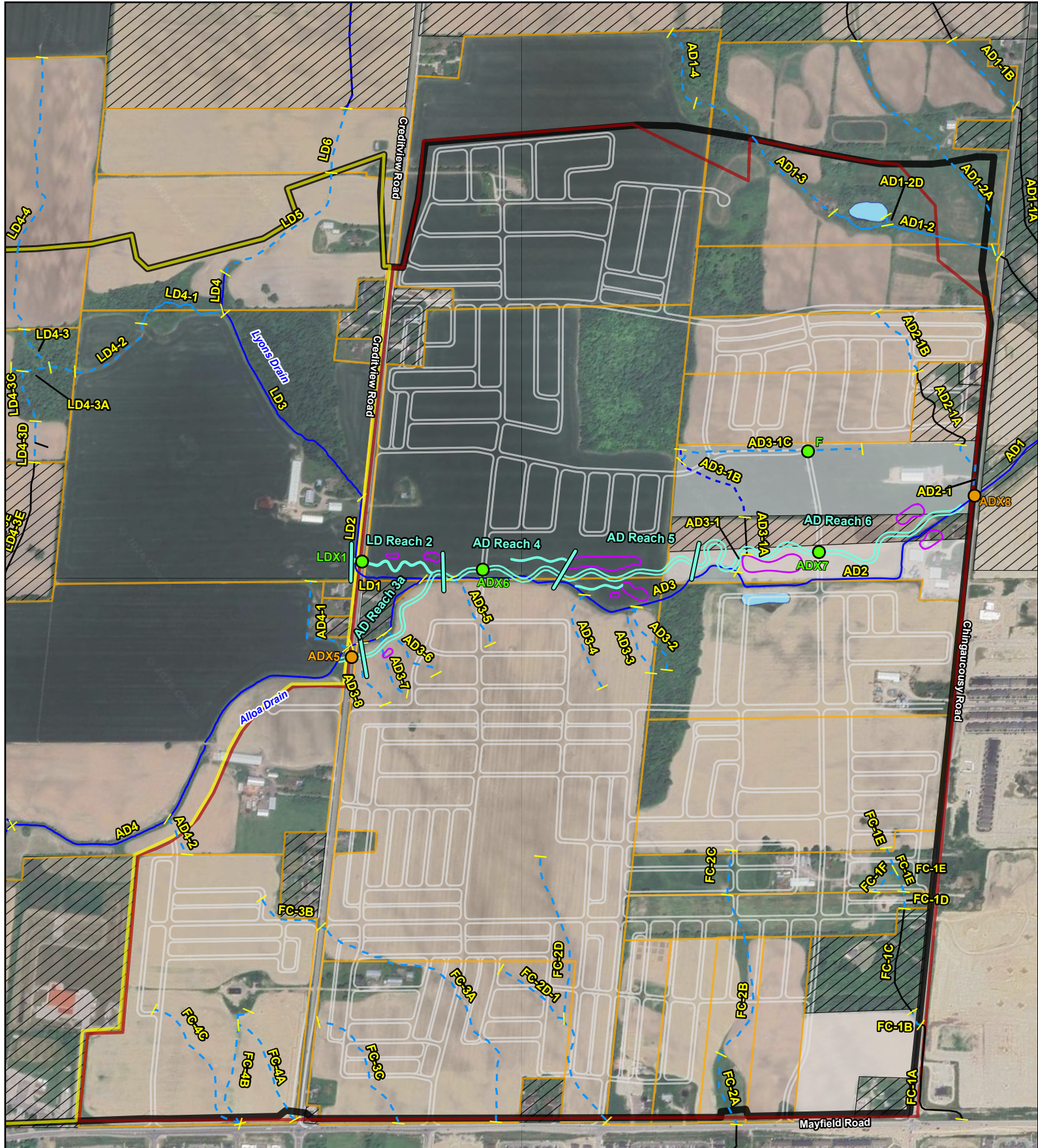
GEO MORPHIX™

0 150 300
Metres

Imagery: Google Earth, 2022. Waterbody, Watercourse: MNR, 2023. Alloa Phase 1 & 2 Lands, Alloa Secondary Plan Area: Crozier, 2024. HDFs, Watercourse, Meander Belt Width: GEO Morphix Ltd., 2024. Participating Properties, Wetlands, Driveline, Woodland: Crozier, 2024. 0.5 m Contour: MNR, 2014-2016. PN24018. Print Date: February 2026. Drawn By: R.A., M.O., S.S.O., K.W., D.B.

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Appendix G: Conceptual Natural Corridor Designs



- Legend**
- Reach Break and ID
 - Proposed New Crossing
 - Proposed Crossing Upgrade
 - Watercourse
 - Headwater Drainage Feature
 - Municipal Drain
 - Tile Drain
 - Municipal Drain Not Field Assessed
 - Not Field Assessed
 - OHN Waterbody
 - Proposed Design Channel
 - Proposed Wetland
 - Proposed Road Network
 - Participating Properties
 - Non-Participating Properties, Access
 - Non-Participating Property, No Access
 - Phase 1 Lands
 - Phase 2 Lands
 - Alloa Secondary Plan Area and Primary Study Area

Figure 3

**Design Reach and Crossing Locations
Phase 1 Alloa Secondary Plan Area**

Caledon, Ontario

GEO MORPHIX™

0 150 300
Metres

Imagery: Google Earth, 2022. Waterbody, Watercourse: MNR, 2023. Alloa Phase 1 & 2 Lands, Alloa Secondary Plan Area: Crozier, 2024. HDFs, Watercourse: GEO Morphix Ltd., 2024. Proposed Road Network: Urbantech, 2024. Crossing Locations: GEO Morphix Ltd., 2024. Participating Properties, Wetlands: Crozier, 2024. Crossing Location, Proposed Channel Design: GEO Morphix Ltd., 2026. PN24009. Print Date: March 2026. Drawn By: R.A., M.O., S.S.O., K.W., D.B.

DESIGN IMPLEMENTATION NOTES

GENERAL NOTES

1. THE ACCOMPANYING CHANNEL REALIGNMENT TECHNICAL DESIGN BRIEF PREPARED BY GEO MORPHIX LTD. (2023) PROVIDES ADDITIONAL DESIGN DETAILS AND DIRECTION FOR IMPLEMENTATION AND IS TO BE REVIEWED IN CONJUNCTION WITH THIS DRAWING SET.
2. ALL CONTRACT DRAWINGS, SPECIFICATIONS AND APPLICABLE PERMITS MUST BE KEPT ON SITE DURING CONSTRUCTION FOR REFERENCE.
3. THE CONTRACTOR MUST NOTIFY THE DESIGNER AND CONTRACT ADMINISTRATOR OF THE INTENT TO COMMENCE WORK AT LEAST 48 HOURS IN ADVANCE.
4. THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY LOCATES.
5. LAYOUT MUST BE REVIEWED AND APPROVED BY THE DESIGNER / DESIGNER REPRESENTATIVE, DESIGNATED ENGINEER, AND THE CONTRACT ADMINISTRATOR.
6. CONSTRUCTION OBSERVATION IS TO BE PERFORMED BY A CERTIFIED FLUVIAL GEOMORPHOLOGIST OR EXPERIENCED ENVIRONMENTAL INSPECTOR UNDER DIRECTION FROM THE DESIGNER.
7. ON-SITE SUPPORT FROM PROJECT ENGINEER (E.G. GEOTECHNICAL, HYDROGEOLOGICAL, AND/OR WATER RESOURCES ENGINEER) REQUIRED TO ASSESS AND ENSURE FAVOURABLE SURFICIAL AND SUBSURFACE CONDITIONS TO SUPPORT CHANNEL REALIGNMENT CONSTRUCTION.
8. BE ADVISED THAT THE LOCAL REGULATORY BODY MAY, AT ANY TIME, WITHDRAW THIS PERMISSION, IF, IN THE OPINION OF THE AUTHORITY, THE CONDITIONS OF THE PERMIT ARE NOT BEING COMPLIED WITH. THIS APPROVAL DOES NOT EXEMPT THE PROPERTY OWNER/APPLICANT/AGENT FROM THE PROVISIONS OF ANY OTHER FEDERAL, PROVINCIAL OR MUNICIPAL STATUTES, REGULATIONS OR BY-LAWS, OR ANY RIGHTS UNDER COMMON LAW.

TIMING OF WORKS

1. WORKS SHALL BE COMPLETED DURING THE DESIGNATED IN-WATER WORKS WINDOW SET OUT BY MNRF/PCF.
2. TREE CLEARING IS TO BE COMPLETED OUTSIDE THE BIRD NESTING SEASON (APRIL 1ST TO AUGUST 1ST) AND THE BAT ROOSTING WINDOW (APRIL 1ST TO SEPTEMBER 31ST) TO COMPLY WITH THE FEDERAL MIGRATORY BIRDS CONVENTION ACT AND THE PROVINCIAL ENDANGERED SPECIES ACT. ANY TREES THAT REQUIRE REMOVAL OUTSIDE OF THIS TIMING WINDOW MUST FIRST BE INSPECTED BY A QUALIFIED BIOLOGIST TO DETERMINE THE PRESENCE OF NESTING BIRDS OR BATS.
3. THE WEATHER FORECAST SHOULD BE CONTINUALLY MONITORED TO ENSURE THAT WORKS ARE UNDERTAKEN ONLY DURING FAVOURABLE WEATHER CONDITIONS.
4. COMPLETE THE WORKS WITH MINIMAL AVOIDABLE INTERRUPTIONS ONCE THEY COMMENCE.

SITE AND MATERIAL MANAGEMENT

1. ALL CONSTRUCTION EQUIPMENT AND MATERIALS (IMPORTED OR EXCAVATED) MUST BE STORED AT LEAST 30 m AWAY FROM ANY WATERBODY IN A STABLE AREA ABOVE THE ACTIVE FLOODPLAIN, OR IN A DESIGNATED STAGING/STORAGE AREA.
2. IN THE EVENT OF AN UNEXPECTED STORM, ALL UNFIXED ITEMS THAT HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW MUST BE MOVED A STABLE AREA ABOVE ACTIVE FLOODPLAIN.
3. STOCKPILES MUST BE LOCATED OUTSIDE THE ISOLATED WORK AREAS.
4. STABILIZE, TEMPORARILY OR PERMANENTLY, ANY DISTURBED AREAS AS WORK PROGRESSES, OR SOON AS CONDITIONS ALLOW.
5. MINIMIZE THE AREA OF DISTURBANCE TO THE EXTENT POSSIBLE. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 90 DAYS SHALL BE STABILIZED USING APPROPRIATE EROSION CONTROL MEASURES AT AN APPROPRIATE SEED MIX AS NOTED WITHIN THE FINAL APPROVED RESTORATION PLAN.
6. ALL VEGETATION, ADJACENT TO THE WORK AREA, MUST BE PROTECTED AND DELINEATED WITH CONSTRUCTION FENCING OR TREE PROTECTION BARRIERS.
7. ALL GRADES IN THE AREA REGULATED BY THE CONSERVATION AUTHORITY MUST BE MAINTAINED OR MATCHED, UNLESS OTHERWISE AUTHORIZED IN THE APPLICABLE PERMIT.
8. AN AFTER-HOURS CONTACT NUMBER IS TO BE VISIBLY POSTED ONSITE FOR EMERGENCIES. ALL THE PLANS SHOULD HAVE NAME AND CONTACT INFO OF THE PERSON RESPONSIBLE FOR ESC MEASURES.

EROSION AND SEDIMENT CONTROL

1. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES MUST BE INSTALLED PRIOR TO START OF WORKS.
2. FOLLOWING INSTALLATION OF THE PROPOSED ESC MEASURES, A QUALIFIED AGENT OF THE PROPONENT (E.G. CAN-CISC CERTIFIED MONITOR) WILL CONDUCT REGULAR SITE VISITS TO MONITOR ALL WORKS. PARTICULARLY THE CONDITION OF THE ESC MEASURES, DEWATERING, AND IN- OR NEAR-WATER WORKS. SHOULD CONCERNS ARISE, THE ENVIRONMENTAL MONITOR WILL CONTACT THE PROPONENT, THE CONSERVATION AUTHORITY, AND ANY OTHER APPROPRIATE PARTIES.
3. EROSION AND SEDIMENT CONTROLS MUST BE MAINTAINED DURING CONSTRUCTION, AND ANY REQUIRED REPAIRS OR REPLACEMENTS MUST BE COMPLETED WITHIN 24 HOURS AFTER THEY HAVE BEEN IDENTIFIED DURING THE MONITORING.
4. EROSION AND SEDIMENT CONTROLS MAY REQUIRE PERIODIC ADJUSTMENTS TO REFLECT CHANGING SITE CONDITIONS. THE CONTRACTOR WILL BE RESPONSIBLE FOR THESE ADJUSTMENTS TO ENSURE PROPER FUNCTION.
5. ANY CHANGES TO THE EROSION AND SEDIMENT CONTROL PLAN BEYOND MINOR ADJUSTMENTS MUST BE APPROVED BY THE CONTRACT ADMINISTRATOR.
6. ADDITIONAL EROSION AND SEDIMENT CONTROL SUPPLIES MUST BE KEPT ON SITE IN ORDER TO FACILITATE IMMEDIATE REPAIRS AND/OR UPGRADES AS NEEDED.
7. ALL TEMPORARY SEDIMENT CONTROLS MUST BE REMOVED AFTER THE CONTRACT ADMINISTRATOR DEEMS THE SITE TO BE STABLE.
8. THE PROJECT PROPONENT OR THEIR REPRESENTATIVE IS ULTIMATELY RESPONSIBLE FOR CONTROLLING SEDIMENT AND EROSION WITHIN THE CONSTRUCTION SITE FOR THE TOTAL PERIOD OF THE CONSTRUCTION.
9. IF EXCESSIVE SILTATION RESULTS FROM THE CONSTRUCTION ACTIVITIES, THE ONSITE SUPERVISOR/INSPECTOR AND/OR THE LOCAL REGULATORY BODY RESERVE THE RIGHT TO REQUEST ADDITIONAL ESC MEASURES WHICH WOULD BE INSTALLED PRIOR TO FURTHER CONSTRUCTION ACTIVITIES.

DELETERIOUS SUBSTANCE CONTROL/SPILL MANAGEMENT

1. PREVENT THE RELEASE OF SEDIMENT, SEDIMENT-LADEN WATER, RAW CONCRETE, CONCRETE LEACHATE OR ANY OTHER DELETERIOUS SUBSTANCES INTO ANY WATERBODY, RAVINE OR STORM SEWER SYSTEM.
2. ENSURE EQUIPMENT AND MACHINERY ARE IN GOOD OPERATING CONDITION (POWER WASHED), FREE OF LEAKS, EXCESS OIL, AND GREASE.
3. NO EQUIPMENT REFUELLING OR SERVICING SHOULD BE UNDERTAKEN WITHIN 30 m OF ANY WATERCOURSE OR SURFACE WATER DRAINAGE.
4. A SPILL CONTAINMENT KIT MUST BE READILY ACCESSIBLE ON SITE IN THE EVENT OF A RELEASE OF A DELETERIOUS SUBSTANCE TO THE ENVIRONMENT. ONSITE STAFF MUST BE TRAINED IN ITS USE.
5. THE CONTRACT ADMINISTRATOR MUST BE NOTIFIED IMMEDIATELY IN THE EVENT OF A SPILL OF DELETERIOUS SUBSTANCE. ANY SEDIMENT SPILL FROM THE SITE SHOULD BE REPORTED TO MINISTRY OF ENVIRONMENT (SPILL ACTION CENTER) AT 1-800-268-6060.

WORK AREA ISOLATION

1. ALL WORK IN ISOLATED WORK AREAS MUST BE COMPLETED IN THE DRY. AN ADEQUATE NUMBER OF PUMPS MUST BE USED FOR UNWATERING.
2. CROSSING AN ACTIVE WATERCOURSE OR WETLAND BY EQUIPMENT, VEHICLES, PERSONNEL, ETC. IS NOT PERMITTED UNLESS APPROVED BY THE CONSERVATION AUTHORITY. ALL ACCESS TO WORK SITES SHALL BE FROM EITHER SIDES OF THE WATERCOURSE OR WETLAND.
3. THE UNWATERING DISCHARGE LOCATION MUST BE LOCATED AT LEAST 30 m FROM ANY WATERCOURSE OR WETLAND IN AN AREA WITH DENSE VEGETATIVE GROUND COVER, AND WHERE THE DISCHARGE CAN RETURN TO THE WATERBODY DOWNSTREAM OF THE WORK AREA OVER THE GROUND COVER.
4. FISH MUST BE REMOVED FROM THE WORK AREA ONCE ISOLATED. FISH SALVAGE MUST BE COMPLETED BY A QUALIFIED TECHNICIAN WITH A LICENSE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES.




OVERVIEW OF NATURAL CHANNEL DESIGN LOCATIONS

1:15,000

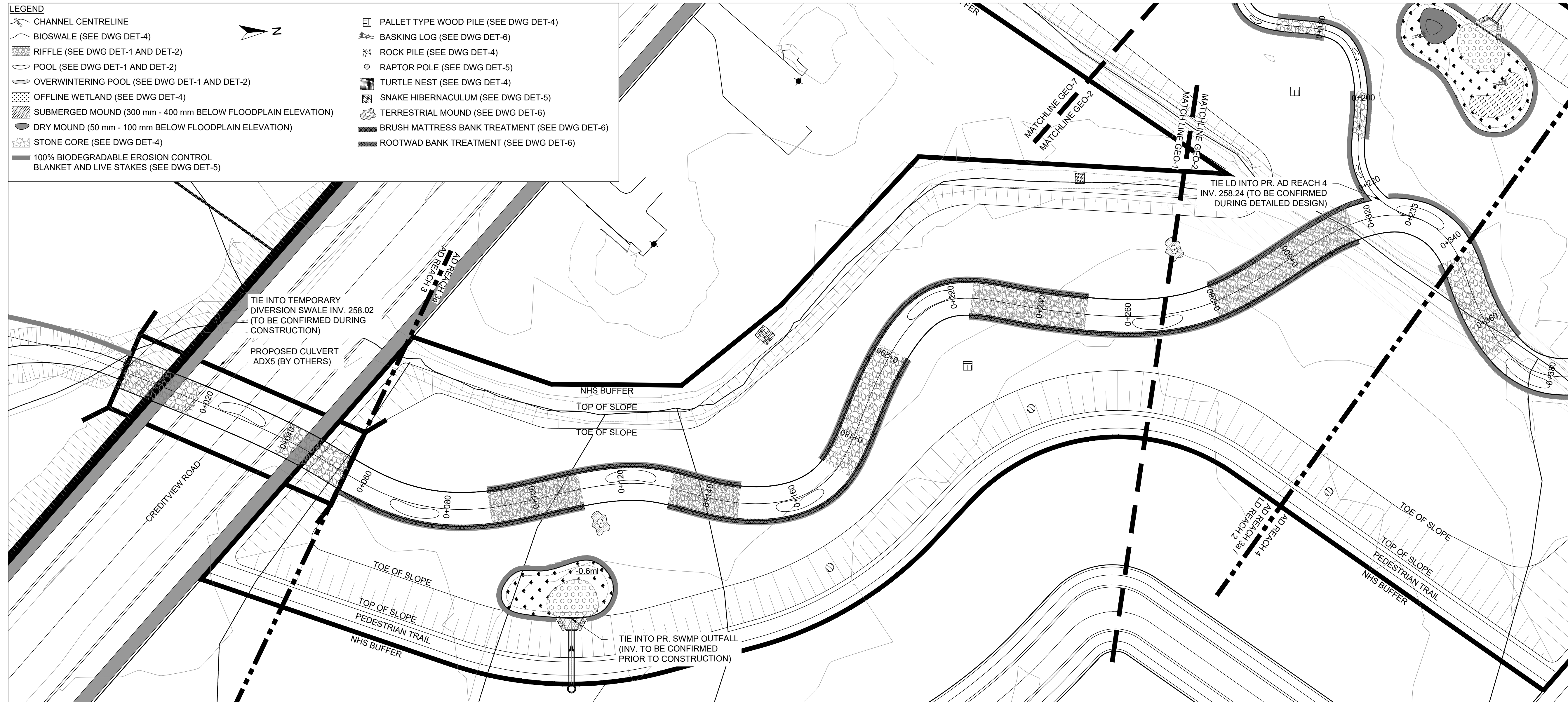
DRAWING SHEET LIST INDEX

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i	COVER	COVER SHEET, DRAWINGS INDEX
NATURAL CHANNEL DESIGN DRAWINGS		
1	GEO-1	ETOBICOKE CREEK ALLOA DRAIN - PLANFORM AND PROFILE ALLOA DRAIN REACH 3a
2	GEO-2	ETOBICOKE CREEK ALLOA DRAIN - PLANFORM AND PROFILE ALLOA DRAIN REACH 4
3	GEO-3	ETOBICOKE CREEK ALLOA DRAIN - PLANFORM AND PROFILE ALLOA DRAIN REACH 5
4	GEO-4	ETOBICOKE CREEK ALLOA DRAIN - PLANFORM AND PROFILE ALLOA DRAIN REACH 5 & 6
5	GEO-5	ETOBICOKE CREEK ALLOA DRAIN - PLANFORM AND PROFILE ALLOA DRAIN REACH 6
6	GEO-6	ETOBICOKE CREEK ALLOA DRAIN - PLANFORM AND PROFILE ALLOA DRAIN REACH 6
7	GEO-7	ETOBICOKE CREEK ALLOA DRAIN - PLANFORM AND PROFILE LYONS DRAIN - REACH 2
8	DET-1	ETOBICOKE CREEK ALLOA DRAIN - CHANNEL DETAILS
9	DET-2	ETOBICOKE CREEK ALLOA DRAIN - CHANNEL DETAILS
10	DET-3	ETOBICOKE CREEK ALLOA DRAIN - CULVERT DETAILS
11	DET-4	ETOBICOKE CREEK ALLOA DRAIN - WETLAND AND RESTORATION DETAILS
12	DET-5	ETOBICOKE CREEK ALLOA DRAIN - RESTORATION DETAILS
13	DET-6	ETOBICOKE CREEK ALLOA DRAIN - RESTORATION DETAILS
14	GEO-8	ETOBICOKE CREEK ALLOA DRAIN - WETLAND COMPENSATION PLANFORM AND CROSS SECTIONS
15	DET-7	ETOBICOKE CREEK ALLOA DRAIN - WETLAND COMPENSATION RESTORATION DETAILS

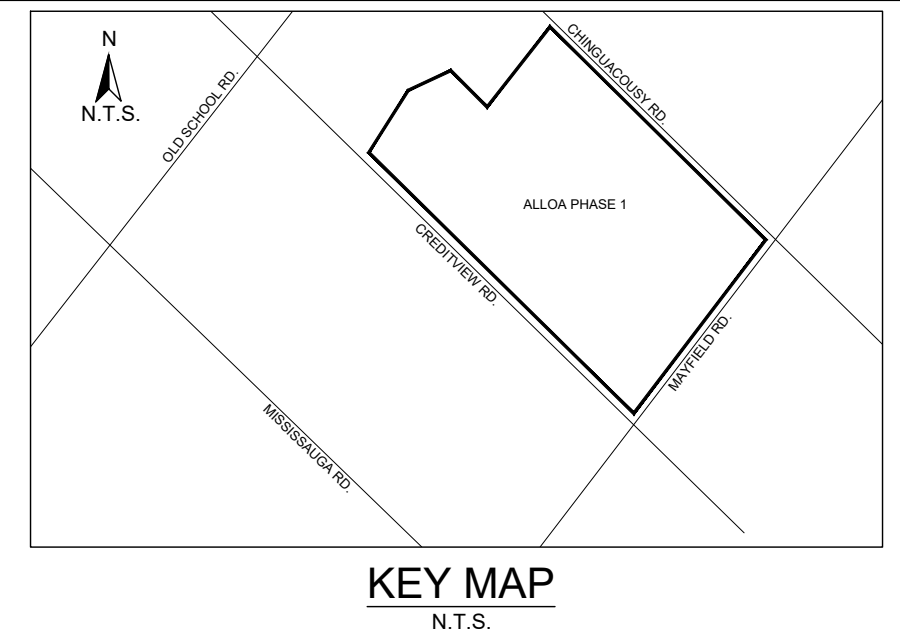
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1.0	16/09/2024	AS	FIRST EIR SUBMISSION
	DATE	BY	REVISIONS
DESIGNED BY: LD/AS		CHECKED BY: PV	
DRAWN BY: SC/RS		DATE: MARCH 2026	
DRAFT FOR INTERNAL DISCUSSION		 <p>GEO MORPHIX™ 36 Main St N., P.O. Box 205 Campbellville, Ontario L0P 1B0 T: 416.920.0926 www.geomorphix.com</p>	
NOT FOR CONSTRUCTION			
ALLOA SPA TOWN OF CALEDON			
ETOBICOKE CREEK - ALLOA DRAIN CONCEPTUAL CHANNEL DESIGN COVERPAGE			
PROJECT No.: 24018		DRAWING No.: COVERPAGE	
SCALE: AS NOTED		SHEET i OF 15	

SCALED FOR PLOT ON 'ARCH D'

- LEGEND**
- CHANNEL CENTRELINE
 - BIOSWALE (SEE DWG DET-4)
 - RIFFLE (SEE DWG DET-1 AND DET-2)
 - POOL (SEE DWG DET-1 AND DET-2)
 - OVERWINTERING POOL (SEE DWG DET-1 AND DET-2)
 - OFFLINE WETLAND (SEE DWG DET-4)
 - SUBMERGED MOUND (300 mm - 400 mm BELOW FLOODPLAIN ELEVATION)
 - DRY MOUND (50 mm - 100 mm BELOW FLOODPLAIN ELEVATION)
 - STONE CORE (SEE DWG DET-4)
 - 100% BIODEGRADABLE EROSION CONTROL BLANKET AND LIVE STAKES (SEE DWG DET-5)
 - PALLET TYPE WOOD PILE (SEE DWG DET-4)
 - BASKING LOG (SEE DWG DET-6)
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 - TERRESTRIAL MOUND (SEE DWG DET-6)
 - BRUSH MATTRESS BANK TREATMENT (SEE DWG DET-6)
 - ROOTWAD BANK TREATMENT (SEE DWG DET-6)



PLANFORM
1:500



- GENERAL NOTES**
- THE ACCOMPANYING CHANNEL REALIGNMENT TECHNICAL DESIGN BRIEF PREPARED BY GEO MORPHIX LTD. (2025) PROVIDES ADDITIONAL DESIGN DETAILS AND DIRECTION FOR IMPLEMENTATION AND IS TO BE REVIEWED IN CONJUNCTION WITH THIS DRAWING SET.
 - ALL CONTRACT DRAWINGS, SPECIFICATIONS AND APPLICABLE PERMITS MUST BE KEPT ON SITE DURING CONSTRUCTION FOR REFERENCE.
 - THE CONTRACTOR MUST NOTIFY THE DESIGNER AND CONTRACT ADMINISTRATOR OF THE INTENT TO COMMENCE WORK AT LEAST 48 HOURS IN ADVANCE.
 - THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY LOCATES.
 - LAYOUT MUST BE REVIEWED AND APPROVED BY THE DESIGNER / DESIGNER REPRESENTATIVE, DESIGNATED ENGINEER, AND THE CONTRACT ADMINISTRATOR.
 - CONSTRUCTION OBSERVATION IS TO BE PERFORMED BY A CERTIFIED FLUVIAL GEOMORPHOLOGIST OR EXPERIENCED ENVIRONMENTAL INSPECTOR UNDER DIRECTION FROM THE DESIGNER.
 - ON-SITE SUPPORT FROM PROJECT ENGINEER (E.G. GEO/TECHNICAL, HYDROLOGICAL, AND/OR WATER RESOURCES ENGINEER) REQUIRED TO ASSESS AND ENSURE FAVOURABLE SURFICIAL AND SUBSURFACE CONDITIONS TO SUPPORT CHANNEL REALIGNMENT CONSTRUCTION.
 - BE ADVISED THAT THE LOCAL REGULATORY BODY MAY, AT ANY TIME, WITHDRAW THIS PERMISSION, IF, IN THE OPINION OF THE AUTHORITY, THE CONDITIONS OF THE PERMIT ARE NOT BEING COMPLIED WITH. THIS APPROVAL DOES NOT EXEMPT THE PROPERTY OWNERSHIP/LOCATOR FROM THE PROVISIONS OF ANY OTHER FEDERAL, PROVINCIAL, OR MUNICIPAL STATUTES, REGULATIONS OR BY-LAWS, OR ANY RIGHTS UNDER COMMON LAW.

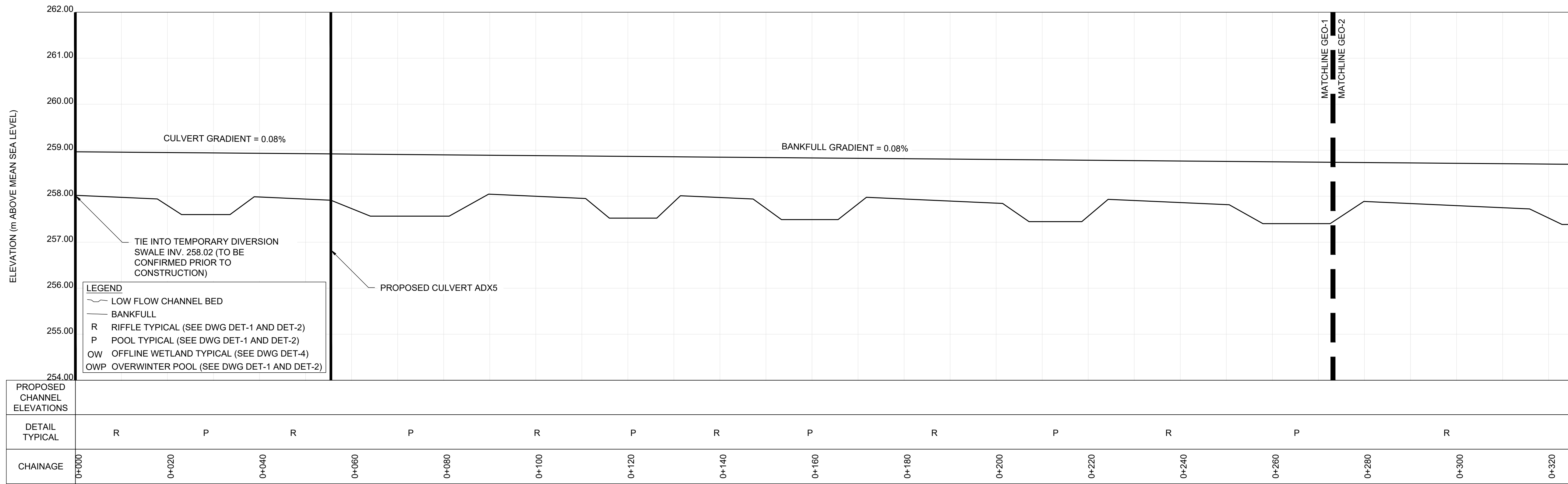
- TIMING OF WORKS**
- WORKS SHALL BE COMPLETED DURING THE DESIGNATED IN-WATER WORKS WINDOW SET OUT BY MNR/DFPO.
 - TREE CLEARING IS TO BE COMPLETED OUTSIDE THE BIRD NESTING SEASON (APRIL 1ST TO AUGUST 1ST) AND THE BAT ROOSTING WINDOW (APRIL 1ST TO SEPTEMBER 31ST) TO COMPLY WITH THE FEDERAL, MIGRATORY BIRD CONVENTION ACT AND THE PROVINCIAL ENDANGERED SPECIES ACT. ANY TREES THAT REQUIRE REMOVAL OUTSIDE OF THIS TIMING WINDOW MUST FIRST BE INSPECTED BY A QUALIFIED BIOLOGIST TO DETERMINE THE PRESENCE OF NESTING BIRDS OR BATS.
 - THE WEATHER FORECAST SHOULD BE CONTINUALLY MONITORED TO ENSURE THAT WORKS ARE UNDERTAKEN ONLY DURING FAVOURABLE WEATHER CONDITIONS.
 - COMPLETE THE WORKS WITH MINIMAL AVOIDABLE INTERRUPTIONS ONCE THEY COMMENCE.

- SITE AND MATERIAL MANAGEMENT**
- ALL CONSTRUCTION EQUIPMENT AND MATERIALS (IMPORTED OR EXCAVATED) MUST BE STORED AT LEAST 30 m AWAY FROM ANY WATERBODY IN A STABLE AREA ABOVE THE ACTIVE FLOODPLAIN, OR IN A DESIGNATED STAGING/STORAGE AREA.
 - IN THE EVENT OF AN UNEXPECTED STORM, ALL UNFIXED ITEMS THAT HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW MUST BE MOVED TO A STABLE AREA ABOVE ACTIVE FLOODPLAIN.
 - STOCKPILES MUST BE LOCATED OUTSIDE THE ISOLATED WORK AREAS.
 - STABILIZE, TEMPORARILY OR PERMANENTLY, ANY DISTURBED AREAS AS WORK PROGRESSES, OR SOON AS CONDITIONS ALLOW.
 - MINIMIZE THE AREA OF DISTURBANCE TO THE EXTENT POSSIBLE. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED USING APPROPRIATE EROSION CONTROL MEASURES AND AN APPROPRIATE SEED MIX AS NOTED WITHIN THE FINAL APPROVED RESTORATION PLAN.
 - ALL VEGETATION, ADJACENT TO THE WORK AREA, MUST BE PROTECTED AND DELINEATED WITH CONSTRUCTION FENCING OR TREE PROTECTION BARRIERS.
 - ALL GRADES IN THE AREA REGULATED BY THE CONSERVATION AUTHORITY MUST BE MAINTAINED OR MATCHED, UNLESS OTHERWISE AUTHORIZED IN THE APPLICABLE PERMIT.
 - AN AFTER-HOURS CONTACT NUMBER IS TO BE VISIBLY POSTED ON SITE FOR EMERGENCIES. ALL THE PLANS SHOULD HAVE NAME AND CONTACT INFO OF THE PERSON RESPONSIBLE FOR ESC MEASURES.

- EROSION AND SEDIMENT CONTROL**
- ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES MUST BE INSTALLED PRIOR TO START OF WORKS. FOLLOWING INSTALLATION OF THE PROPOSED ESC MEASURES, A QUALIFIED AGENT OF THE PROPONENT (E.G. CIVIL/ENGINEER, CERTIFIED MONITOR) WILL CONDUCT REGULAR SITE VISITS TO MONITOR ALL WORKS, PARTICULARLY THE CONDITION OF THE ESC MEASURES, DEWATERING, AND IN- OR NEAR-WATER WORKS. SHOULD CONCERNS ARISE, THE ENVIRONMENTAL MONITOR WILL CONTACT THE PROPONENT, THE CONSERVATION AUTHORITY, AND ANY OTHER APPROPRIATE PARTIES.
 - EROSION AND SEDIMENT CONTROL MEASURES MUST BE MAINTAINED DURING CONSTRUCTION, AND ANY REQUIRED REPAIRS OR REPLACEMENTS MUST BE COMPLETED WITHIN 24 HOURS AFTER THEY HAVE BEEN IDENTIFIED DURING THE MONITORING.
 - EROSION AND SEDIMENT CONTROLS MAY REQUIRE PERIODIC ADJUSTMENTS TO REFLECT CHANGING SITE CONDITIONS. THE CONTRACTOR WILL BE RESPONSIBLE FOR THESE ADJUSTMENTS TO ENSURE PROPER FUNCTION.
 - ANY CHANGES TO THE EROSION AND SEDIMENT CONTROL PLAN BEYOND MINOR ADJUSTMENTS MUST BE APPROVED BY THE CONTRACT ADMINISTRATOR.
 - ADDITIONAL EROSION AND SEDIMENT CONTROL SUPPLIES MUST BE KEPT ON SITE IN ORDER TO FACILITATE IMMEDIATE REPAIRS AND/OR UPGRADES AS NEEDED.
 - ALL TEMPORARY SEDIMENT CONTROLS MUST BE REMOVED AFTER THE CONTRACT ADMINISTRATOR DEEMS THE SITE TO BE STABLE.
 - THE PROJECT PROPONENT OR THEIR REPRESENTATIVE IS ULTIMATELY RESPONSIBLE FOR CONTROLLING SEDIMENT AND EROSION WITHIN THE CONSTRUCTION SITE FOR THE TOTAL PERIOD OF THE CONSTRUCTION.
 - IF EXCESSIVE SILTATION RESULTS FROM THE CONSTRUCTION ACTIVITIES, THE ON-SITE SUPERVISOR/INSPECTOR AND/OR THE LOCAL REGULATORY BODY RESERVE THE RIGHT TO REQUEST ADDITIONAL ESC MEASURES WHICH WOULD BE INSTALLED PRIOR TO FURTHER CONSTRUCTION ACTIVITIES.

- DELETERIOUS SUBSTANCE CONTROL/SPILL MANAGEMENT**
- PREVENT THE RELEASE OF SEDIMENT, SEDIMENT-LADEN WATER, RAW CONCRETE, CONCRETE LEACHATE OR ANY OTHER DELETERIOUS SUBSTANCES INTO ANY WATERBODY, RAVINE OR STORM SEWER SYSTEM.
 - ENSURE EQUIPMENT AND MACHINERY ARE IN GOOD OPERATING CONDITION (POWER WASHED), FREE OF LEAKS, EXCESS OIL AND GREASE.
 - NO EQUIPMENT REFUELLING OR SERVICING SHOULD BE UNDERTAKEN WITHIN 30 m OF ANY WATERCOURSE OR SURFACE WATER DRAINAGE.
 - A SPILL CONTAINMENT KIT MUST BE READILY ACCESSIBLE ON SITE IN THE EVENT OF A RELEASE OF A DELETERIOUS SUBSTANCE TO THE ENVIRONMENT. ON-SITE STAFF MUST BE TRAINED IN ITS USE.
 - THE CONTRACT ADMINISTRATOR MUST BE NOTIFIED IMMEDIATELY IN THE EVENT OF A SPILL OF DELETERIOUS SUBSTANCE. ANY SEDIMENT SPILL FROM THE SITE SHOULD BE REPORTED TO MINISTRY OF ENVIRONMENT (SPILL ACTION CENTER) AT 1-800-368-6066.

- WORK AREA ISOLATION**
- ALL WORK IN ISOLATED WORK AREAS MUST BE COMPLETED IN THE DRY. AN ADEQUATE NUMBER OF PUMPS MUST BE USED FOR UNWATERING.
 - CROSSING AN ACTIVE WATERCOURSE OR WETLAND BY EQUIPMENT, VEHICLES, PERSONNEL, ETC. IS NOT PERMITTED UNLESS APPROVED BY THE CONSERVATION AUTHORITY. ALL ACCESS TO WORK SITES SHALL BE FROM EITHER SIDES OF THE WATERCOURSE OR WETLAND.
 - THE UNWATERING DISCHARGE LOCATION MUST BE LOCATED AT LEAST 30 m FROM ANY WATERCOURSE OR WETLAND IN AN AREA WITH DENSE VEGETATIVE GROUNDCOVER, AND WHERE THE DISCHARGE CAN RETURN TO THE WATERBODY DOWNSTREAM OF THE WORK AREA OVER THE GROUNDCOVER.
 - FISH MUST BE REMOVED FROM THE WORK AREA ONCE ISOLATED. FISH SALVAGE MUST BE COMPLETED BY A QUALIFIED TECHNICIAN WITH A LICENSE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES.



PROFILE
H= 1:500 V= 1:50

NO.	DATE	BY	REVISIONS
2.0	17/03/2026	AS	SECOND EIR SUBMISSION
1.0	16/09/2024	AS	FIRST EIR SUBMISSION

DESIGNED BY: LD/AS
DRAWN BY: SC/RS

CHECKED BY: PV
DATE: MARCH 2026

DRAFT FOR INTERNAL DISCUSSION

NOT FOR CONSTRUCTION

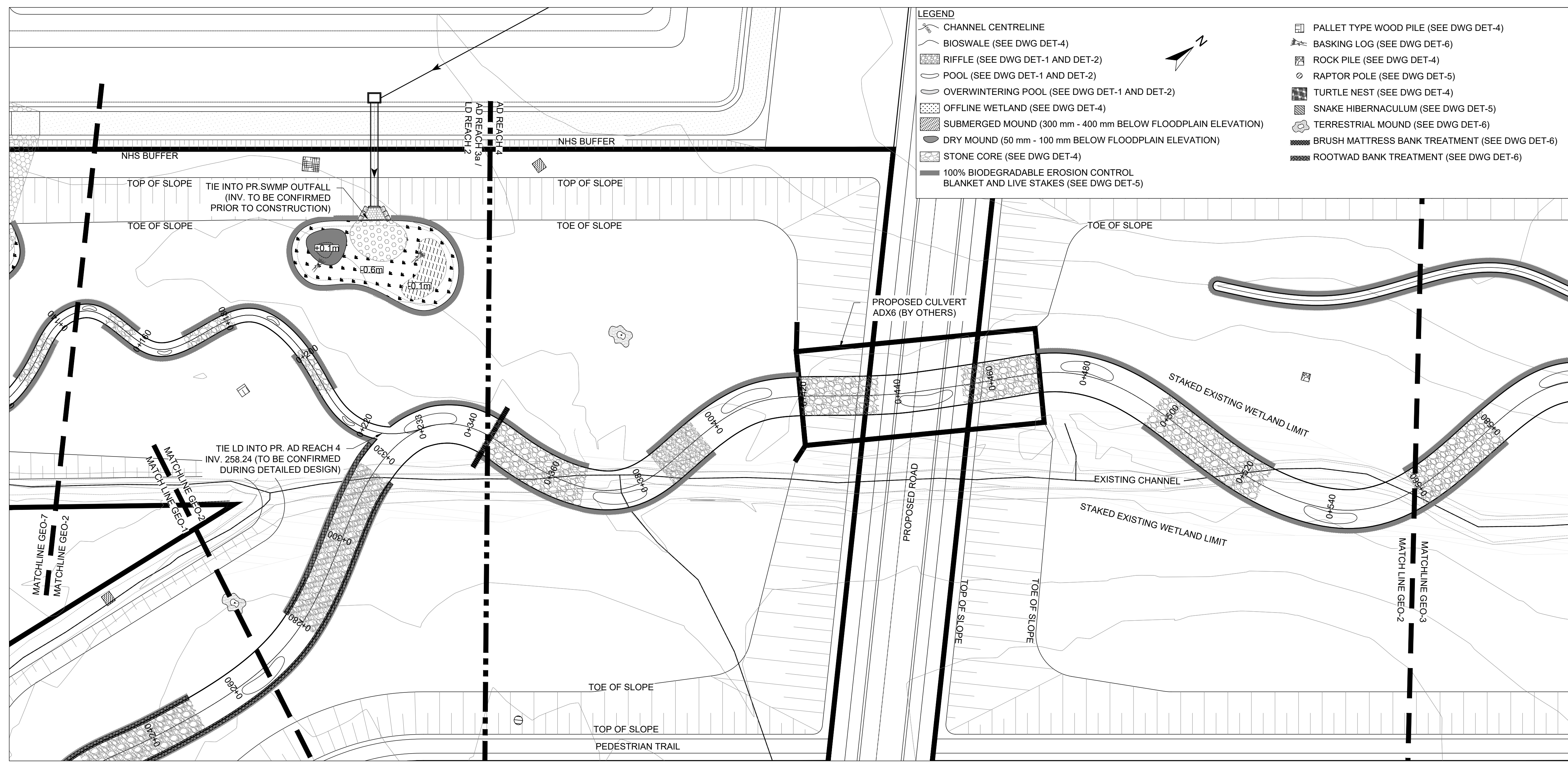
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Campbellville, Ontario L0P 1B0
T: 416.920.0926
www.geomorphix.com

**ALLOA SPA PHASE 1
TOWN OF CALEDON**

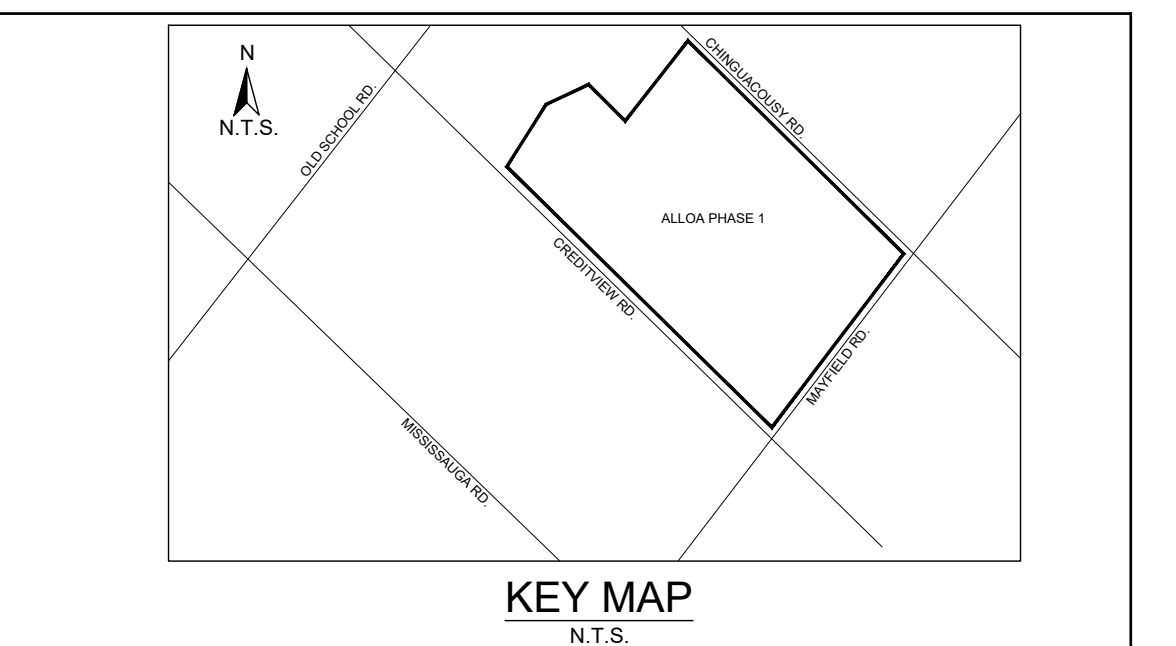
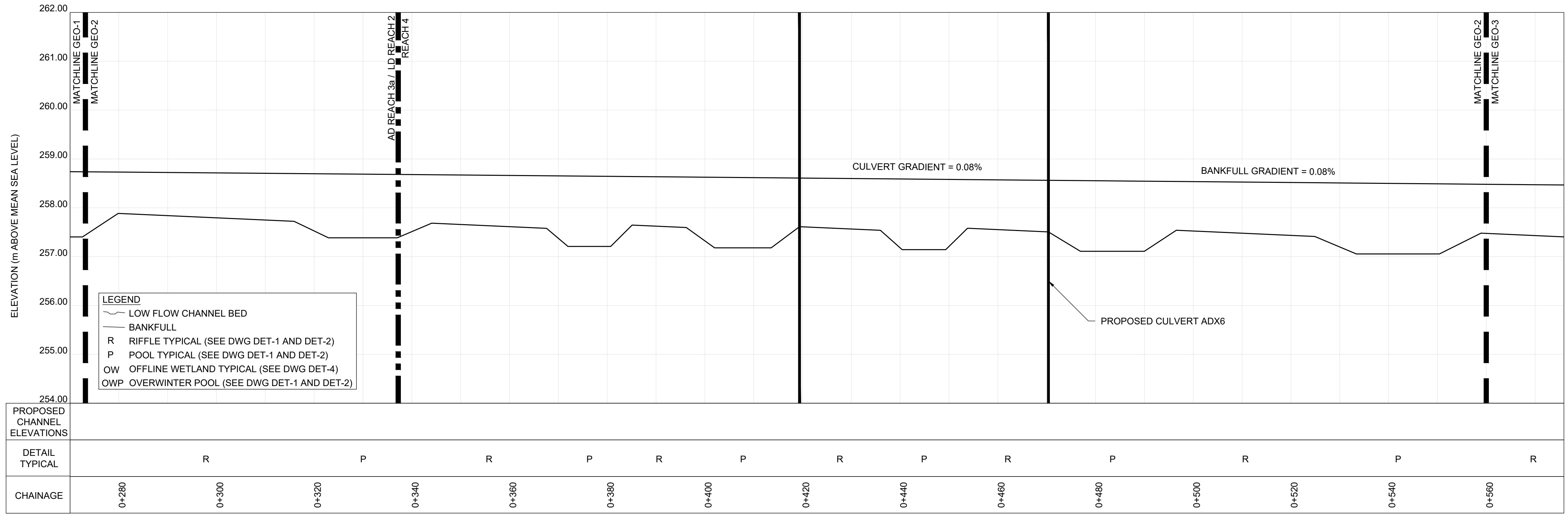
**ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
PLANFORM AND PROFILE
ALLOA DRAIN - REACH 3a**

PROJECT No.: PN24018	DRAWING No.: GEO-1
SCALE: AS NOTED	SHEET 1 OF 15

SCALED FOR PLOT ON 'ARCH D'



PLANFORM
1:500



DATE	BY	REVISIONS
2.0	17/03/2026	AS SECOND EIR SUBMISSION
1.0	16/09/2024	AS FIRST EIR SUBMISSION

DESIGNED BY: LD/AS
DRAWN BY: SC/RS

CHECKED BY: PV
DATE: MARCH 2026

DRAFT FOR INTERNAL DISCUSSION

NOT FOR CONSTRUCTION

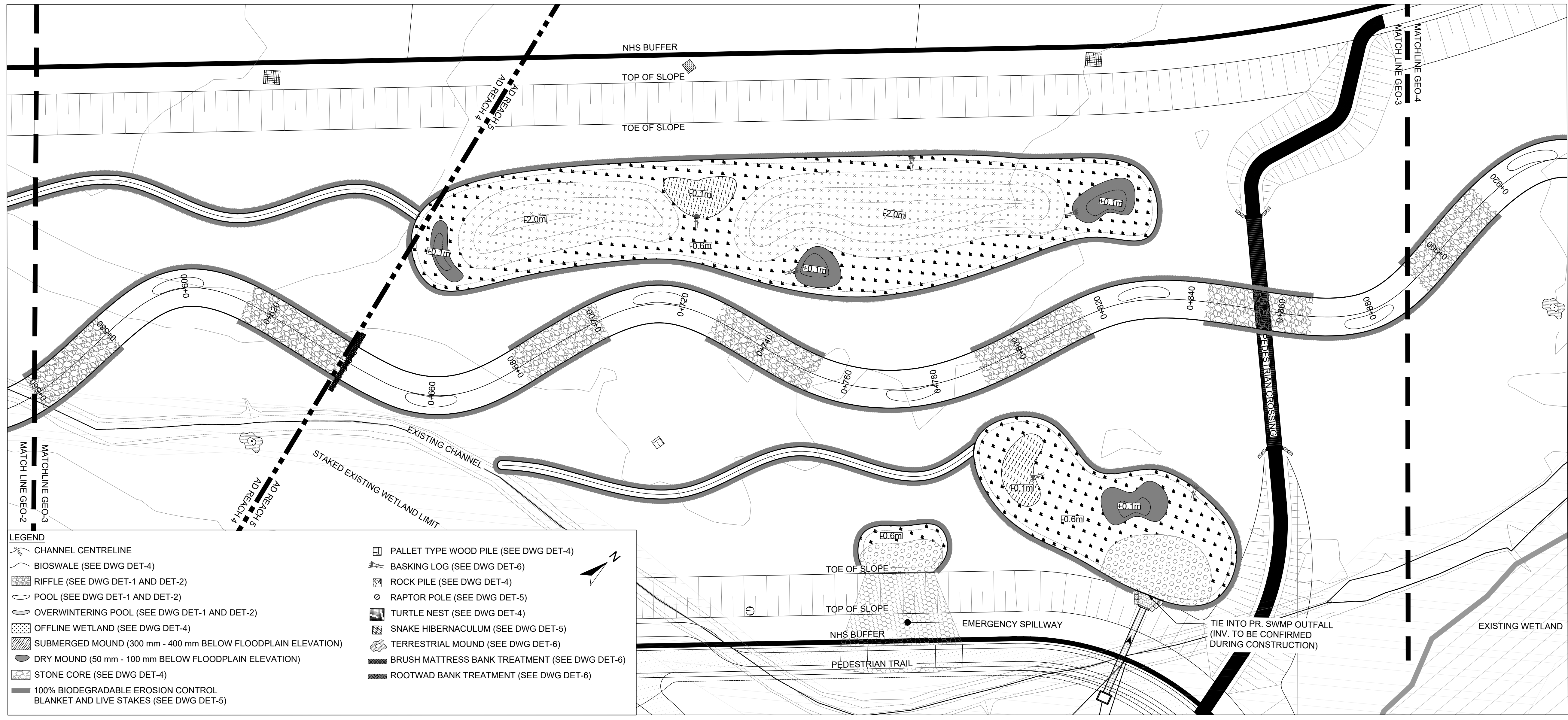
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ALLOA SPA PHASE 1 TOWN OF CALEDON

ETOBICOKE CREEK - ALLOA DRAIN CONCEPTUAL CHANNEL DESIGN PLANFORM AND PROFILE ALLOA DRAIN - REACH 4

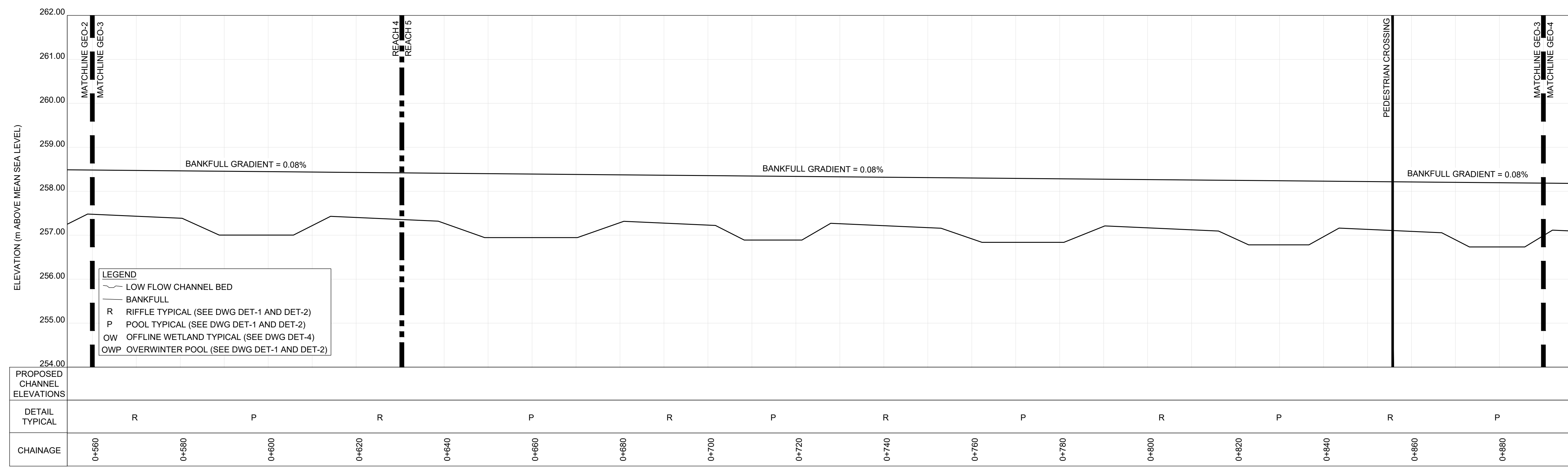
PROJECT No.: PN24018	DRAWING No.: GEO-2
SCALE: AS NOTED	SHEET 2 OF 15

SCALED FOR PLOT ON 'ARCH D'

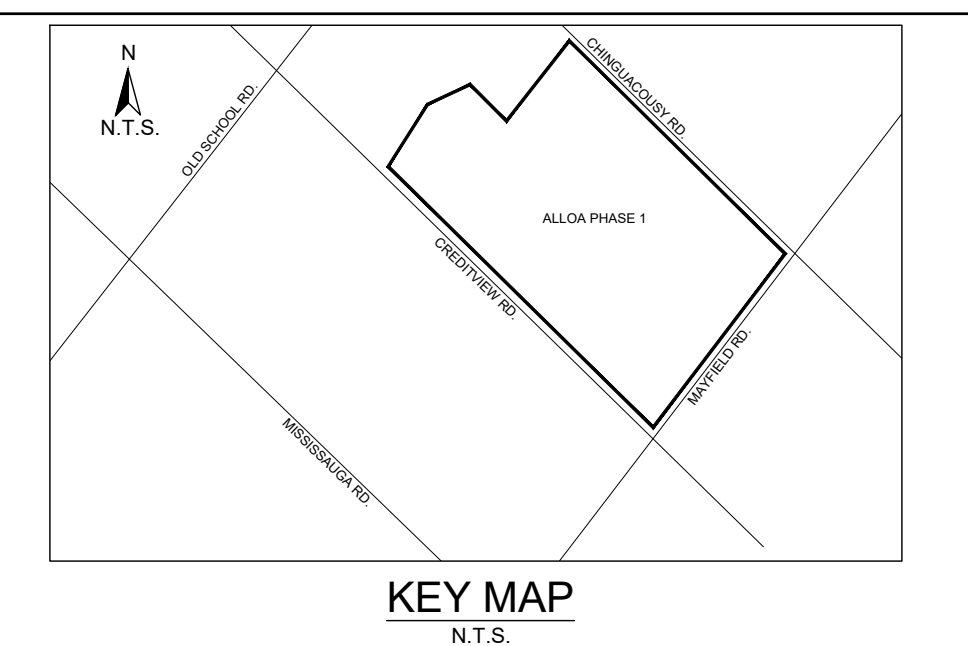


- LEGEND**
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 - BIOSWALE (SEE DWG DET-4)
 - RIFFLE (SEE DWG DET-1 AND DET-2)
 - POOL (SEE DWG DET-1 AND DET-2)
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PLANFORM
1:500



PROFILE
H= 1:500 V= 1:50



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NO.	DATE	BY	REVISIONS
2.0	17/03/2026	AS	SECOND EIR SUBMISSION
1.0	16/09/2024	AS	FIRST EIR SUBMISSION

DESIGNED BY: LD/AS
DRAWN BY: SC/RS

CHECKED BY: PV
DATE: MARCH 2026

DRAFT FOR INTERNAL DISCUSSION

NOT FOR CONSTRUCTION

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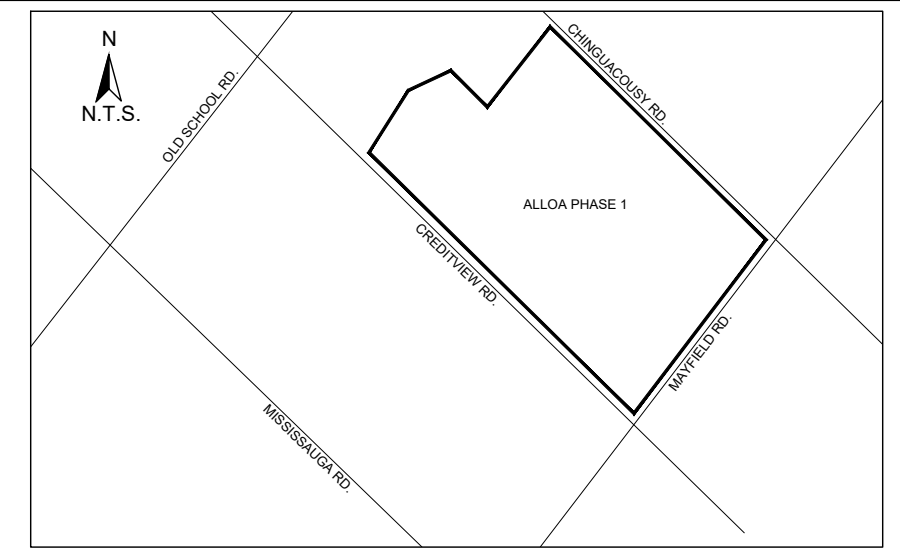
ALLOA SPA PHASE 1
TOWN OF CALEDON

ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
PLANFORM AND PROFILE
ALLOA DRAIN - REACH 4 & 5

PROJECT No.: PN24018	DRAWING No.: GEO-3
SCALE: AS NOTED	SHEET 3 OF 15

SCALED FOR PLOT ON 'ARCH D'

- LEGEND**
- CHANNEL CENTRELINE
 - BIOSWALE (SEE DWG DET-4)
 - RIFLE (SEE DWG DET-1 AND DET-2)
 - POOL (SEE DWG DET-1 AND DET-2)
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 - SNAKE HIBERNACULUM (SEE DWG DET-5)
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 - BRUSH MATTRESS BANK TREATMENT (SEE DWG DET-6)
 - ROOTWAD BANK TREATMENT (SEE DWG DET-6)



KEY MAP
N.T.S.

GENERAL NOTES

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- WORKS SHALL BE COMPLETED DURING THE DESIGNATED IN-WATER WORKS WINDOW SET OUT BY MNRF/DFO.
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SITE AND MATERIAL MANAGEMENT

- ALL CONSTRUCTION EQUIPMENT AND MATERIALS (IMPORTED OR EXCAVATED) MUST BE STORED AT LEAST 30 m AWAY FROM ANY WATERBODY IN A STABLE AREA ABOVE THE ACTIVE FLOODPLAIN, OR IN A DESIGNATED STORAGE/STORAGE AREA.
- IN THE EVENT OF AN UNEXPECTED STORM, ALL UNFIXED ITEMS THAT HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW MUST BE MOVED TO A STABLE AREA ABOVE ACTIVE FLOODPLAIN.
- STOCKPILES MUST BE LOCATED OUTSIDE THE ISOLATED WORK AREAS.
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- ALL VEGETATION, ADJACENT TO THE WORK AREA, MUST BE PROTECTED AND DELINEATED WITH CONSTRUCTION FENCING OR TREE PROTECTION BARRIERS.
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EROSION AND SEDIMENT CONTROL

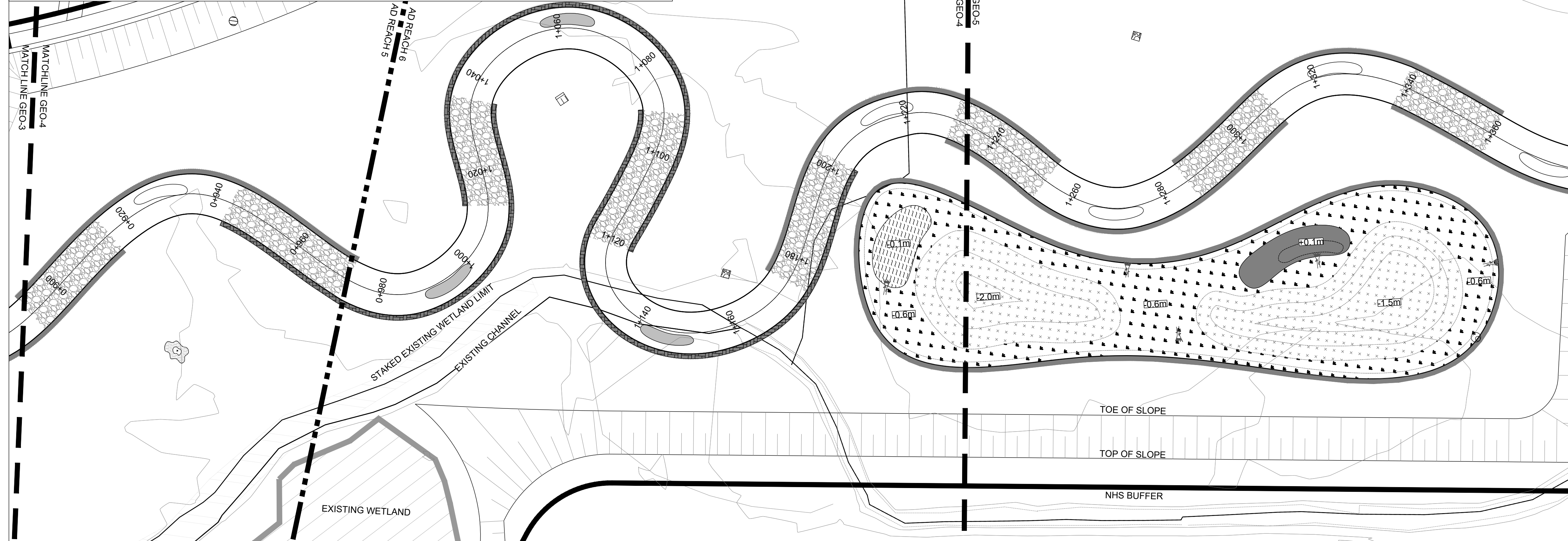
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DELETERIOUS SUBSTANCE CONTROL/SPILL MANAGEMENT

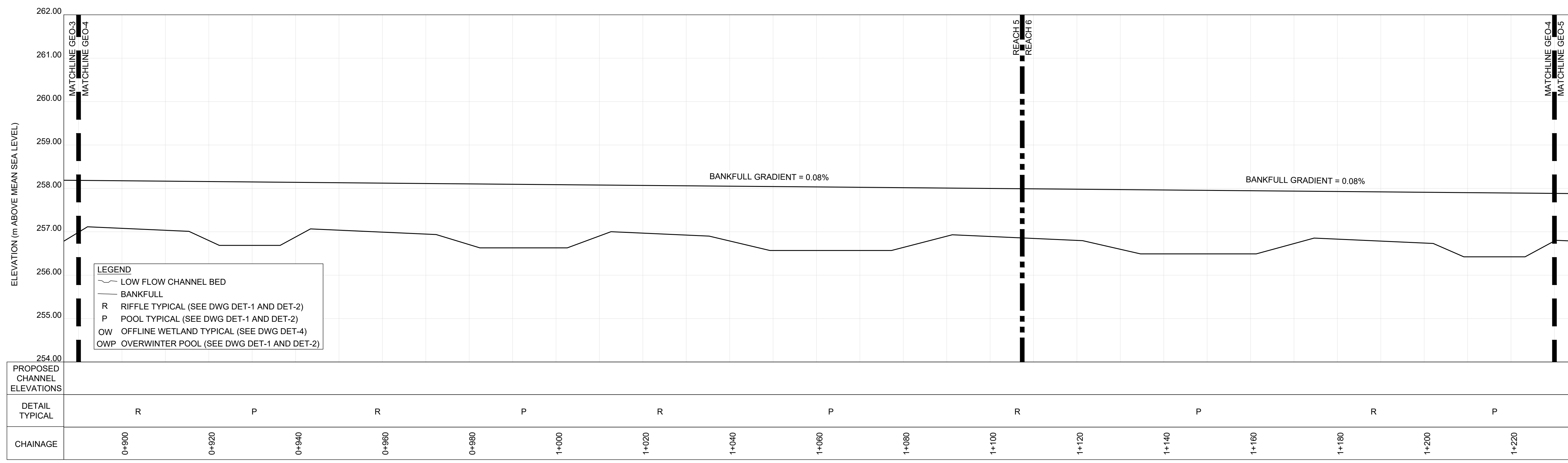
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- ENSURE EQUIPMENT AND MACHINERY ARE IN GOOD OPERATING CONDITION (POWER WASHED), FREE OF LEAKS, EXCESS OIL, AND GREASE.
- NO EQUIPMENT REFUELLING OR SERVICING SHOULD BE UNDERTAKEN WITHIN 30 m OF ANY WATERCOURSE OR SURFACE WATER DRAINAGE.
- A SPILL CONTAINMENT KIT MUST BE READILY ACCESSIBLE ON SITE IN THE EVENT OF A RELEASE OF A DELETERIOUS SUBSTANCE TO THE ENVIRONMENT. ON-SITE STAFF MUST BE TRAINED IN ITS USE.
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PLANFORM
1:500



PROFILE
H= 1:500 V= 1:50

PROPOSED CHANNEL ELEVATIONS	DETAIL TYPICAL	CHAINAGE
262.00		
261.00		
260.00		
259.00		
258.00		
257.00		
256.00		
255.00		
254.00		
	R	0+500
	P	0+920
	R	0+940
	R	0+960
	P	0+980
	R	1+000
	P	1+020
	R	1+040
	P	1+060
	R	1+080
	R	1+100
	P	1+120
	R	1+140
	P	1+160
	R	1+180
	P	1+200
	R	1+220

DATE	BY	REVISIONS
2.0	17/03/2026	AS SECOND EIR SUBMISSION
1.0	16/09/2024	AS FIRST EIR SUBMISSION

DESIGNED BY: LD/AS
DRAWN BY: SC/R/S

CHECKED BY: PV
DATE: MARCH 2026

DRAFT FOR INTERNAL DISCUSSION
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GEO MORPHIX
36 Main St N., P.O. Box 205
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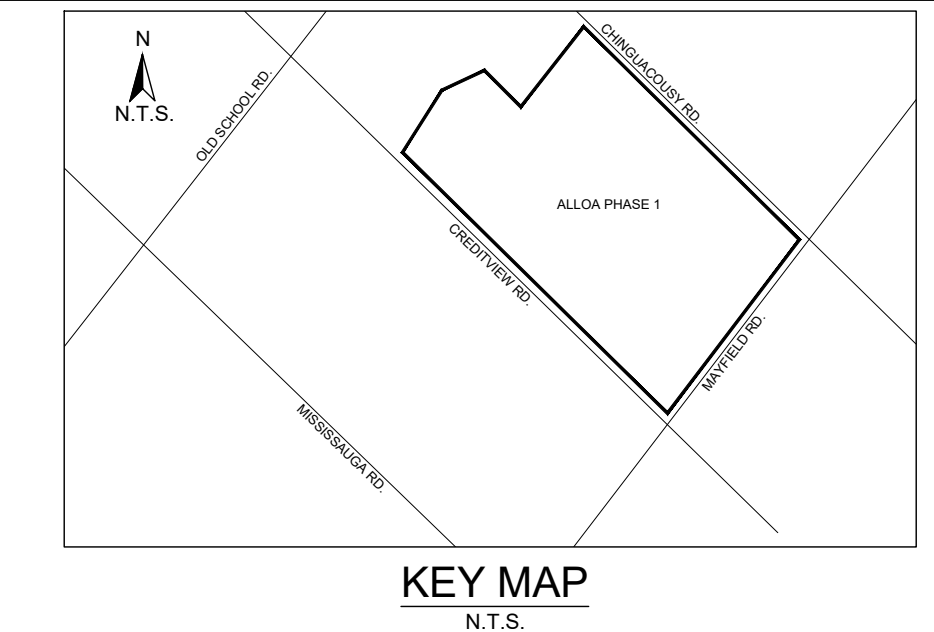
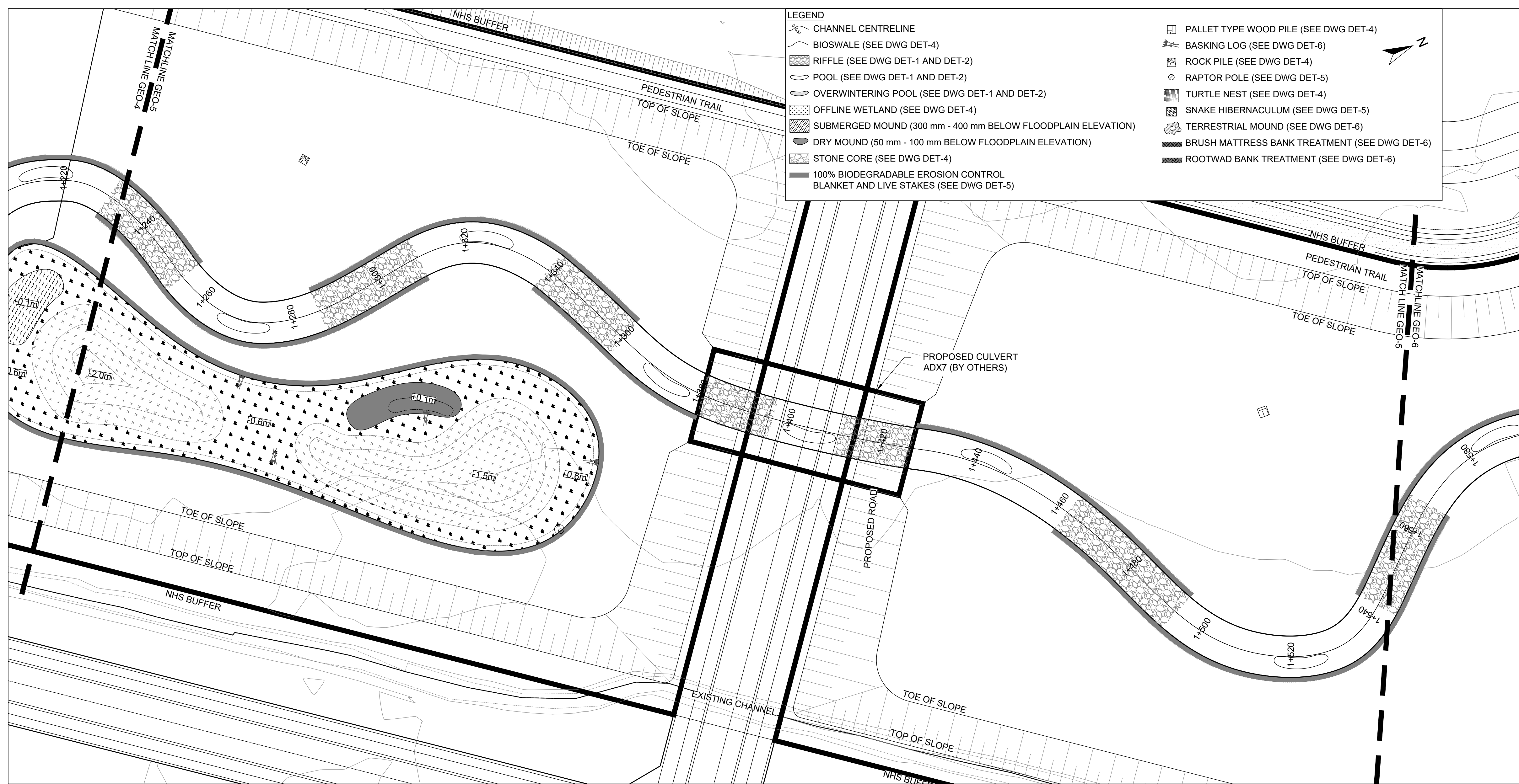
ALLOA SPA PHASE 1
TOWN OF CALEDON

ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
PLANFORM AND PROFILE
ALLOA DRAIN - REACH 5 & 6

PROJECT No.: PN24018
DRAWING No.: GEO-4

SCALE: AS NOTED
SHEET 4 OF 15

SCALED FOR PLOT ON 'ARCH D'



- GENERAL NOTES**
1. THE ACCOMPANYING CHANNEL REALIGNMENT TECHNICAL DESIGN BRIEF PREPARED BY GEO MORPHIX LTD. (2025) PROVIDES ADDITIONAL DESIGN DETAILS AND DIRECTION FOR IMPLEMENTATION AND IS TO BE REVIEWED IN CONJUNCTION WITH THIS DRAWING SET.
 2. ALL CONTRACT DRAWINGS, SPECIFICATIONS AND APPLICABLE PERMITS MUST BE KEPT ON SITE DURING CONSTRUCTION FOR REFERENCE.
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 4. THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY LOCATES.
 5. LAYOUT MUST BE REVIEWED AND APPROVED BY THE DESIGNER / DESIGNER REPRESENTATIVE, DESIGNATED ENGINEER, AND THE CONTRACT ADMINISTRATOR.
 6. CONSTRUCTION OBSERVATION IS TO BE PERFORMED BY A CERTIFIED FLUVIAL GEOMORPHOLOGIST OR EXPERIENCED ENVIRONMENTAL INSPECTOR UNDER DIRECTION FROM THE DESIGNER.
 7. ON-SITE SUPPORT FROM PROJECT ENGINEER (E.G. GEO-TECHNICAL, HYDROLOGICAL, AND/OR WATER RESOURCES ENGINEER) REQUIRED TO ASSESS AND ENSURE FAVOURABLE SURFICIAL AND SUBSURFACE CONDITIONS TO SUPPORT CHANNEL REALIGNMENT CONSTRUCTION.
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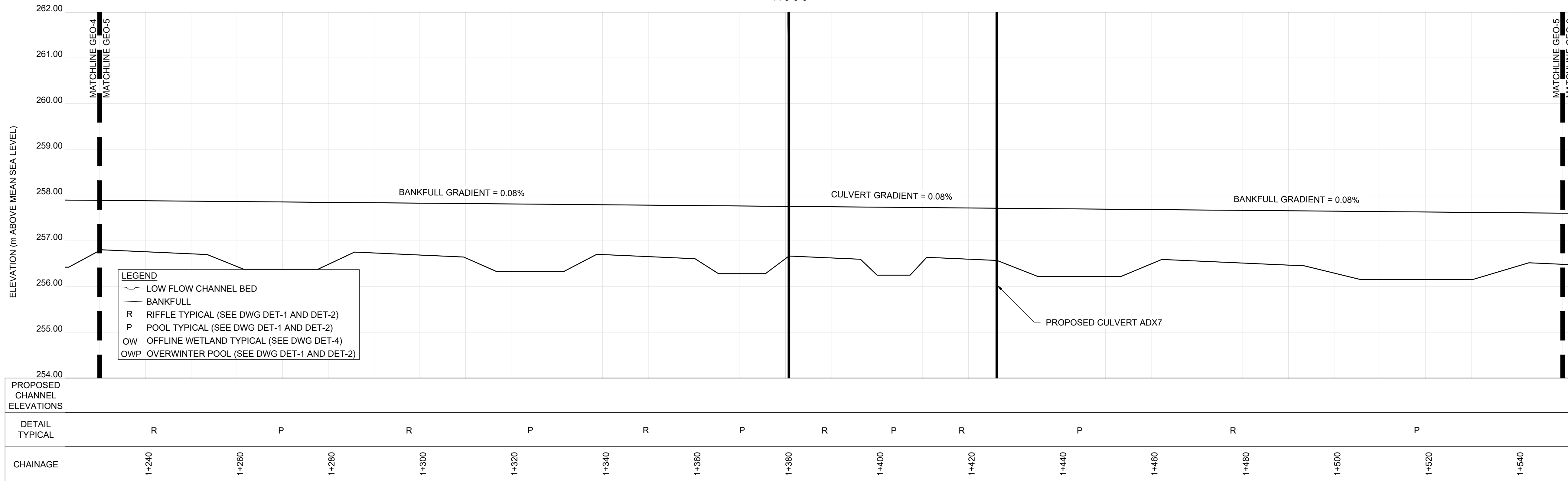
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ALLOA SPA PHASE 1
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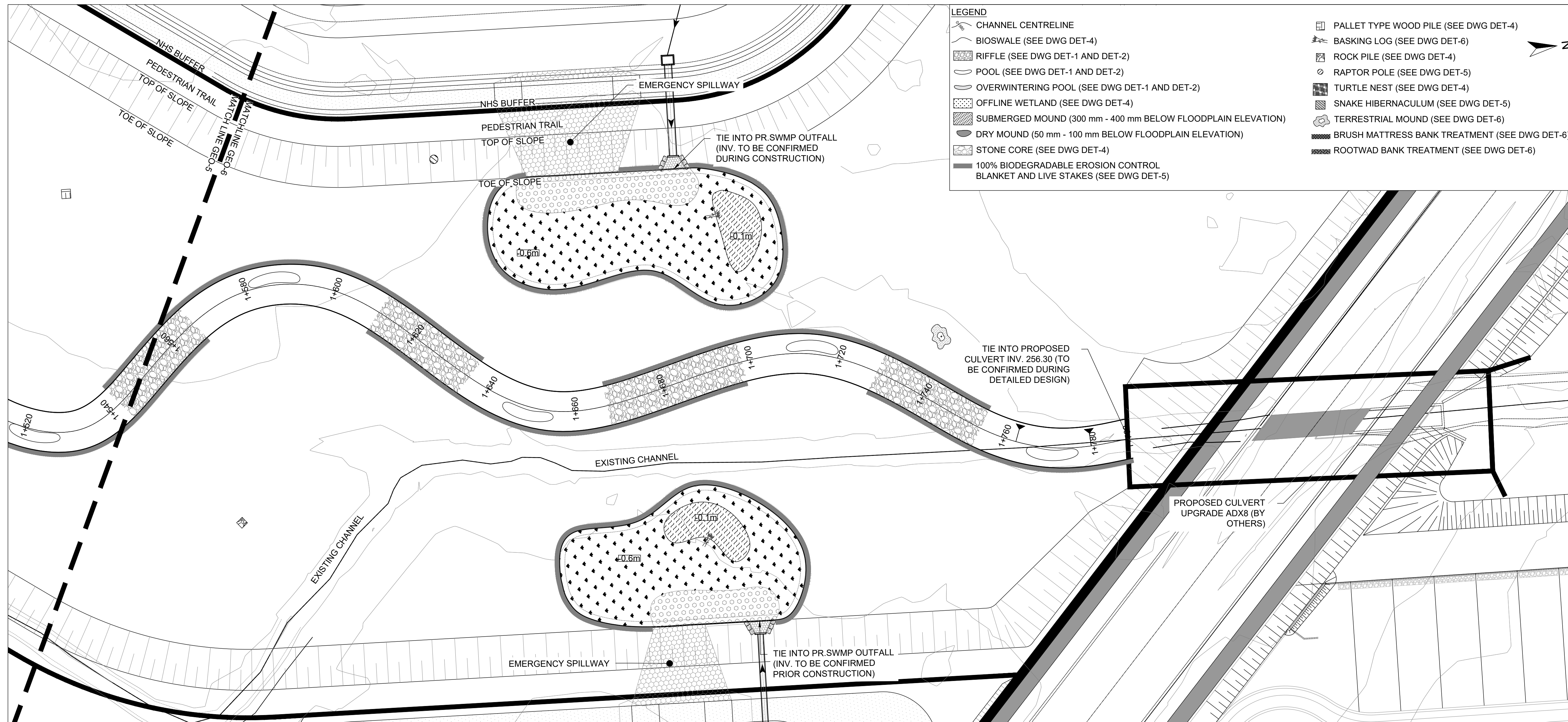
ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
PLANFORM AND PROFILE
ALLOA DRAIN - REACH 6



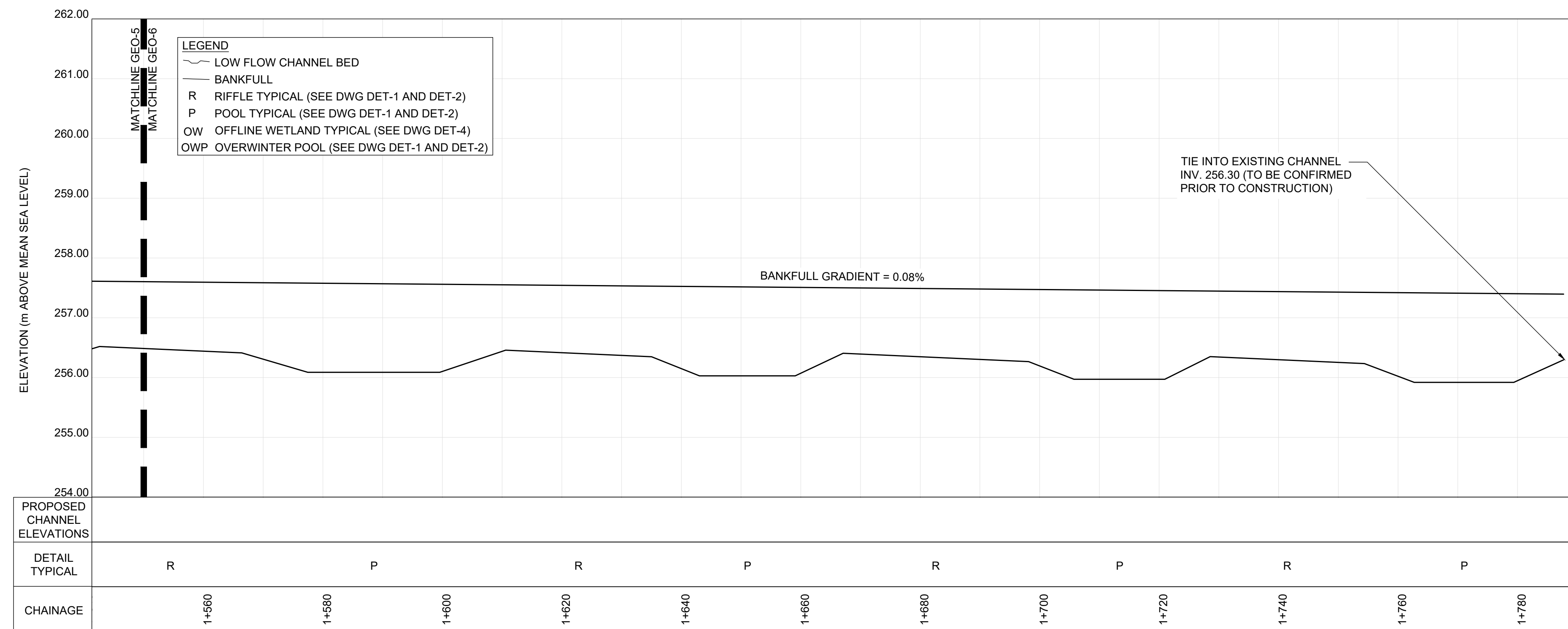
PLANFORM
1:500

PROFILE
H= 1:500 V = 1:50

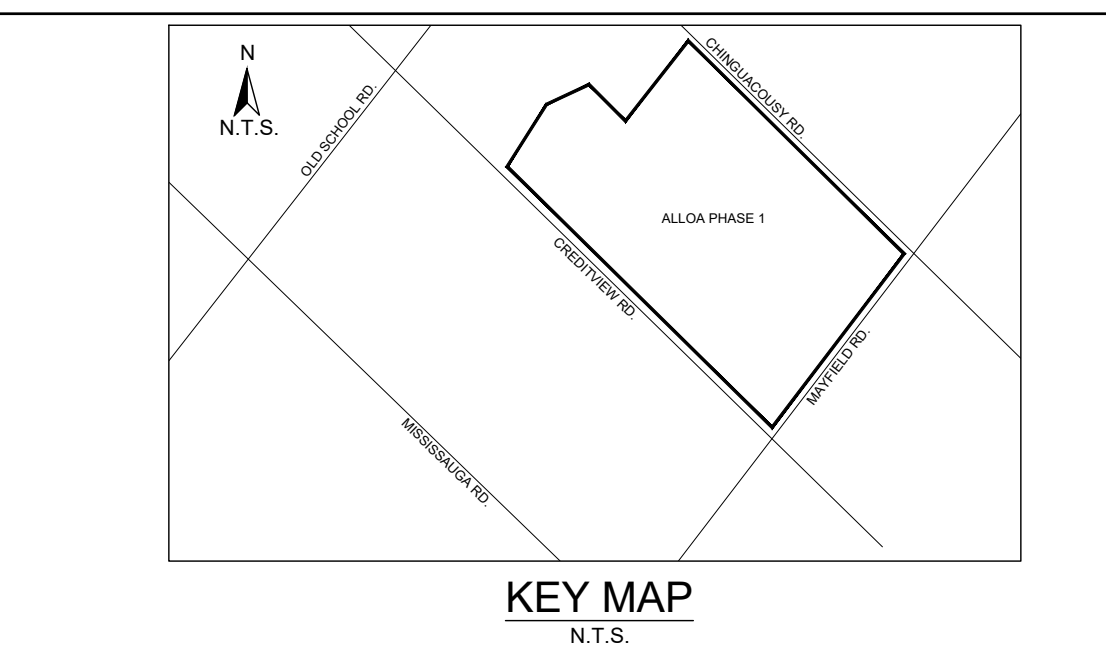
SCALED FOR PLOT ON 'ARCH D'



PLANFORM
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PROFILE
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DATE	BY	REVISIONS
2.0	17/03/2026	SECOND EIR SUBMISSION
1.0	16/09/2024	FIRST EIR SUBMISSION

DESIGNED BY: LD/AS CHECKED BY: PV
 DRAWN BY: SC/Rs DATE: MARCH 2026

DRAFT FOR INTERNAL DISCUSSION

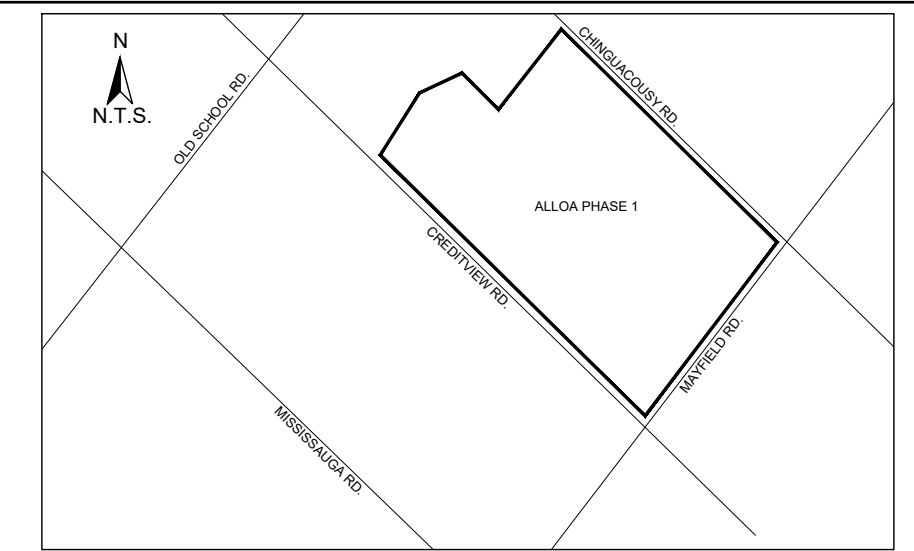
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ALLOA SPA PHASE 1
TOWN OF CALEDON

ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
PLANFORM AND PROFILE
ALLOA DRAIN - REACH 6

SCALED FOR PLOT ON 'ARCH D'



KEY MAP
N.T.S.

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1. THE ACCOMPANYING CHANNEL REALIGNMENT TECHNICAL DESIGN BRIEF PREPARED BY GEO MORPHIX LTD. (2025) PROVIDES ADDITIONAL DESIGN DETAILS AND DIRECTION FOR IMPLEMENTATION AND IS TO BE REVIEWED IN CONJUNCTION WITH THIS DRAWING SET.
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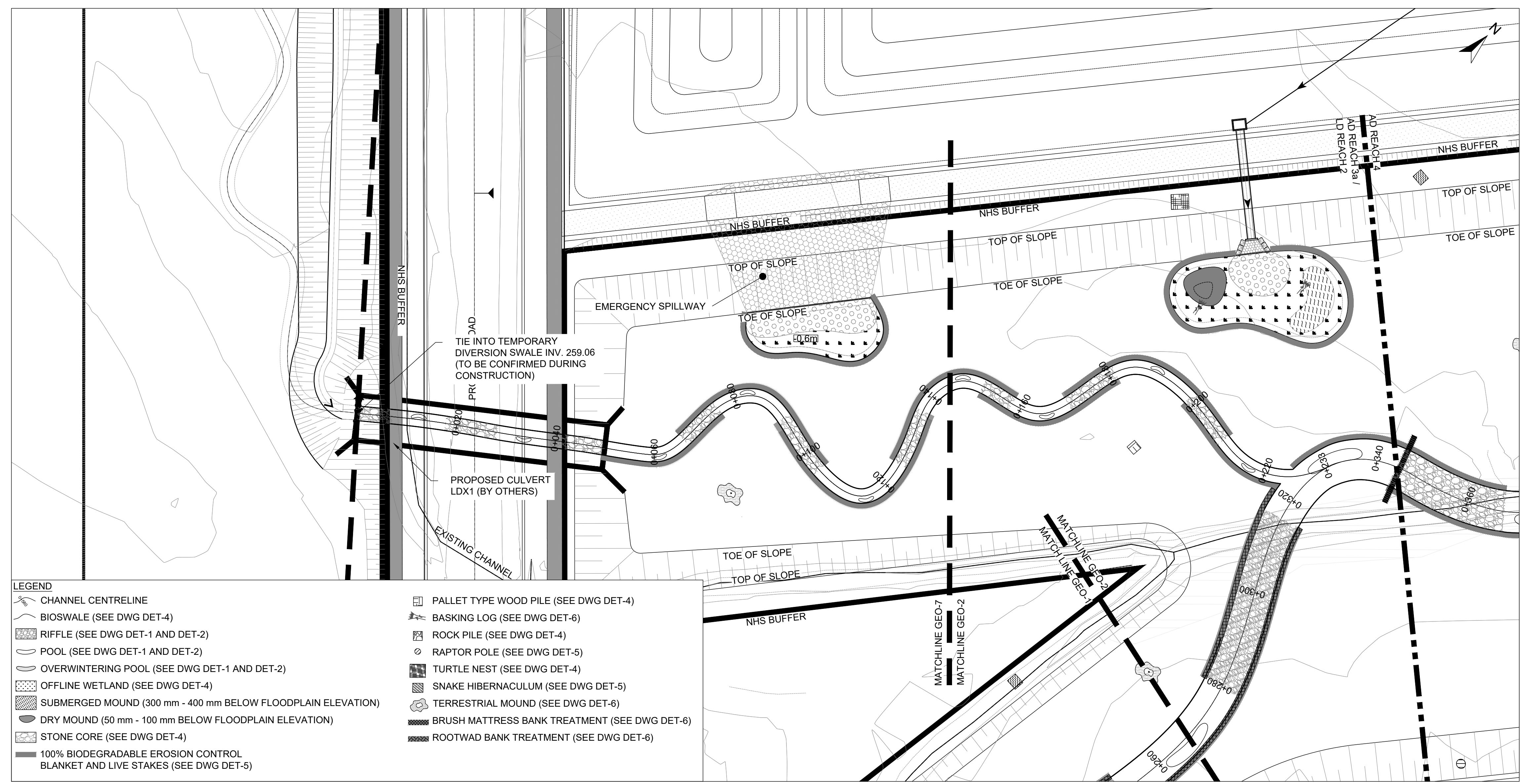
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 3. EROSION AND SEDIMENT CONTROLS MUST BE MAINTAINED DURING CONSTRUCTION, AND ANY REQUIRED REPAIRS OR RE-ADJUSTMENTS MUST BE COMPLETED WITHIN 24 HOURS AFTER THEY HAVE BEEN IDENTIFIED DURING THE MONITORING.
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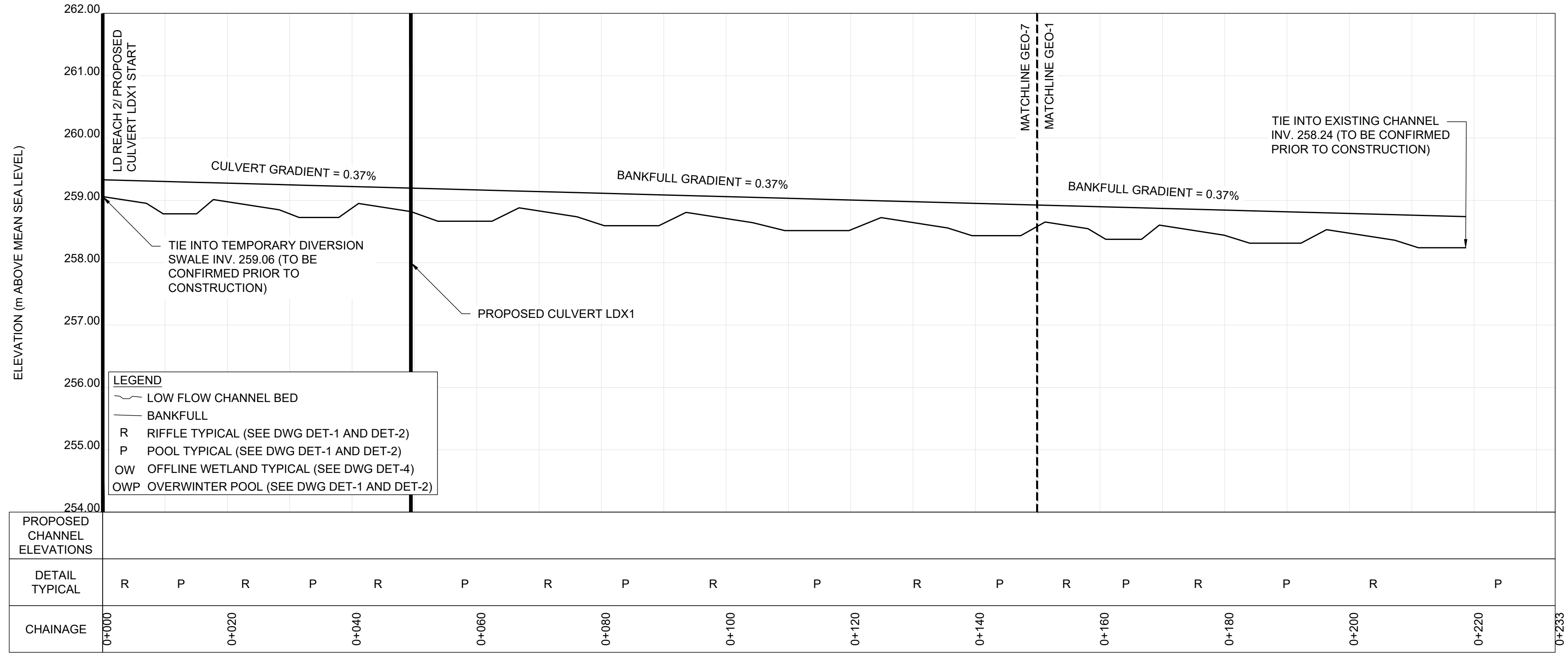
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- LEGEND**
- CHANNEL CENTRELINE
 - BIOSWALE (SEE DWG DET-4)
 - RIFFLE (SEE DWG DET-1 AND DET-2)
 - POOL (SEE DWG DET-1 AND DET-2)
 - OVERWINTERING POOL (SEE DWG DET-1 AND DET-2)
 - OFFLINE WETLAND (SEE DWG DET-4)
 - SUBMERGED MOUND (300 mm - 400 mm BELOW FLOODPLAIN ELEVATION)
 - DRY MOUND (50 mm - 100 mm BELOW FLOODPLAIN ELEVATION)
 - STONE CORE (SEE DWG DET-4)
 - 100% BIODEGRADABLE EROSION CONTROL BLANKET AND LIVE STAKES (SEE DWG DET-5)
 - PALLET TYPE WOOD PILE (SEE DWG DET-4)
 - BASKING LOG (SEE DWG DET-6)
 - ROCK PILE (SEE DWG DET-4)
 - RAPTOR POLE (SEE DWG DET-5)
 - TURTLE NEST (SEE DWG DET-4)
 - OFFLINE HIBERNACULUM (SEE DWG DET-5)
 - TERRESTRIAL MOUND (SEE DWG DET-6)
 - BRUSH MATTRESS BANK TREATMENT (SEE DWG DET-6)
 - ROOTWAD BANK TREATMENT (SEE DWG DET-6)

PLANFORM
1:500



PROFILE
H= 1:500 V = 1:50

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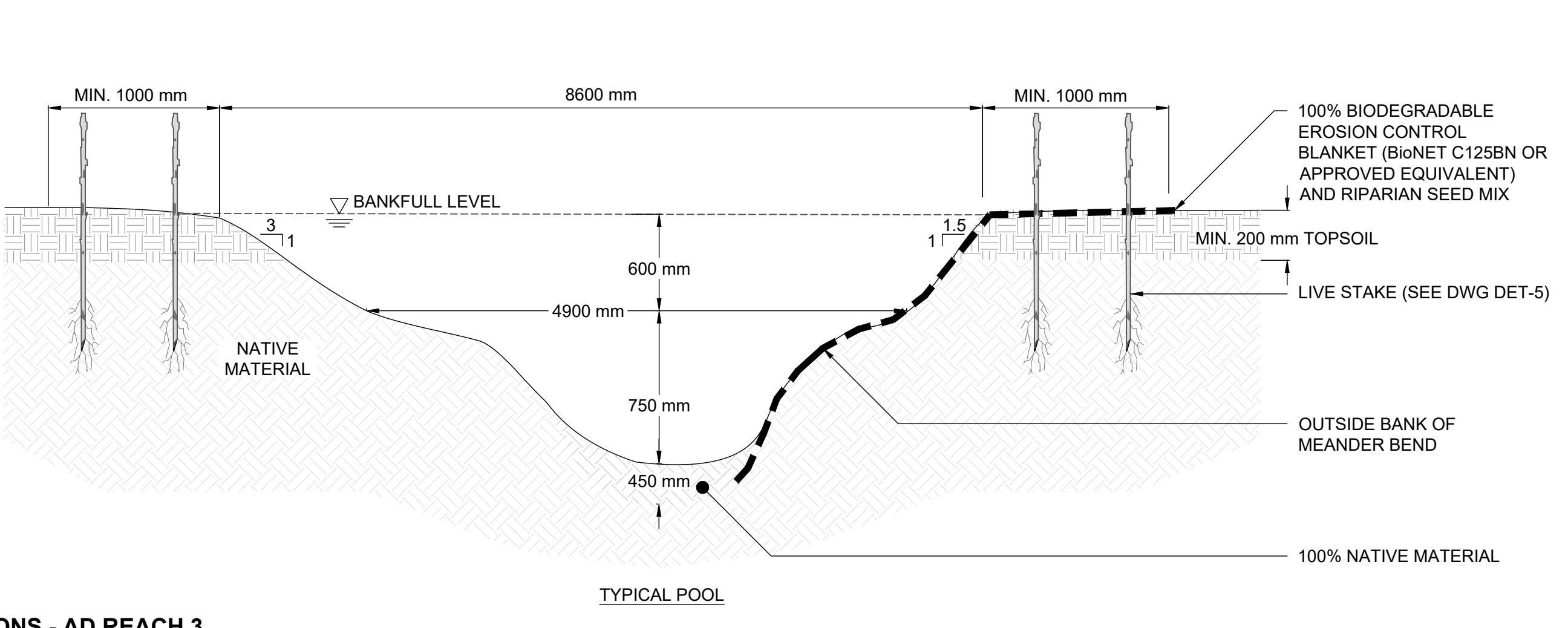
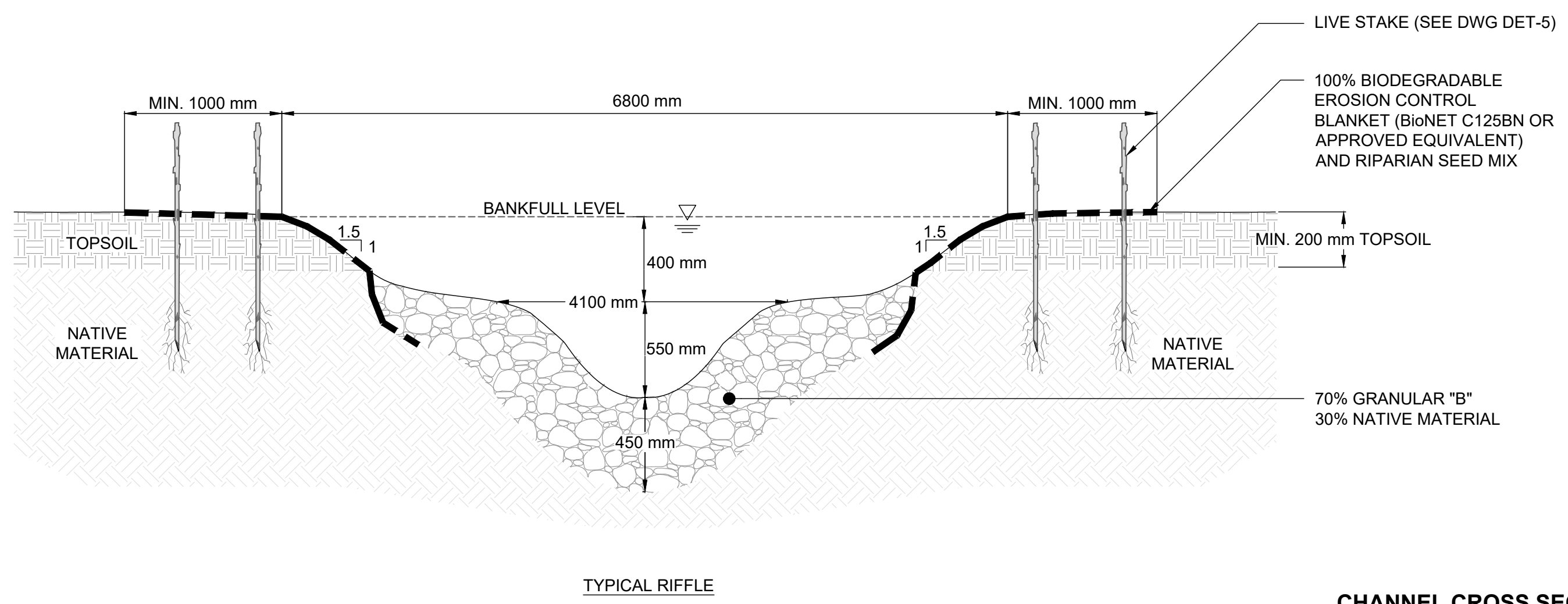
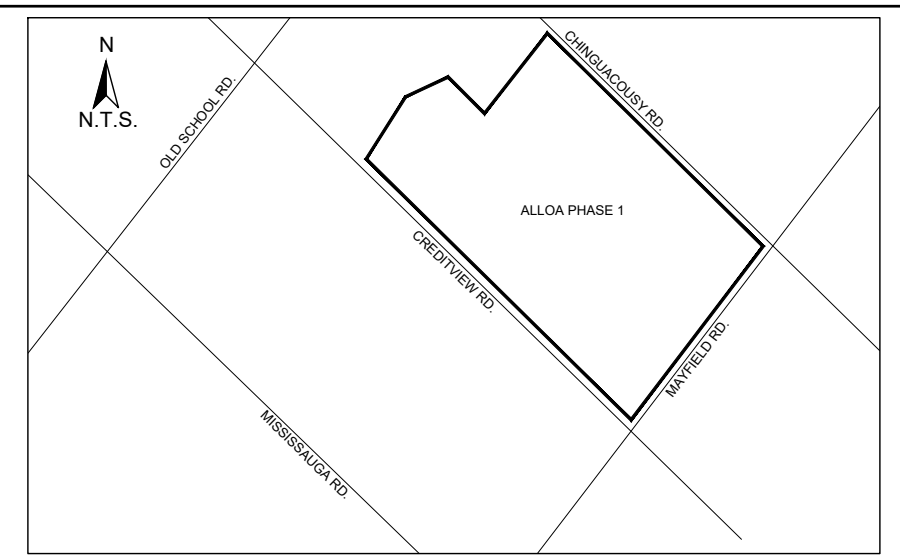
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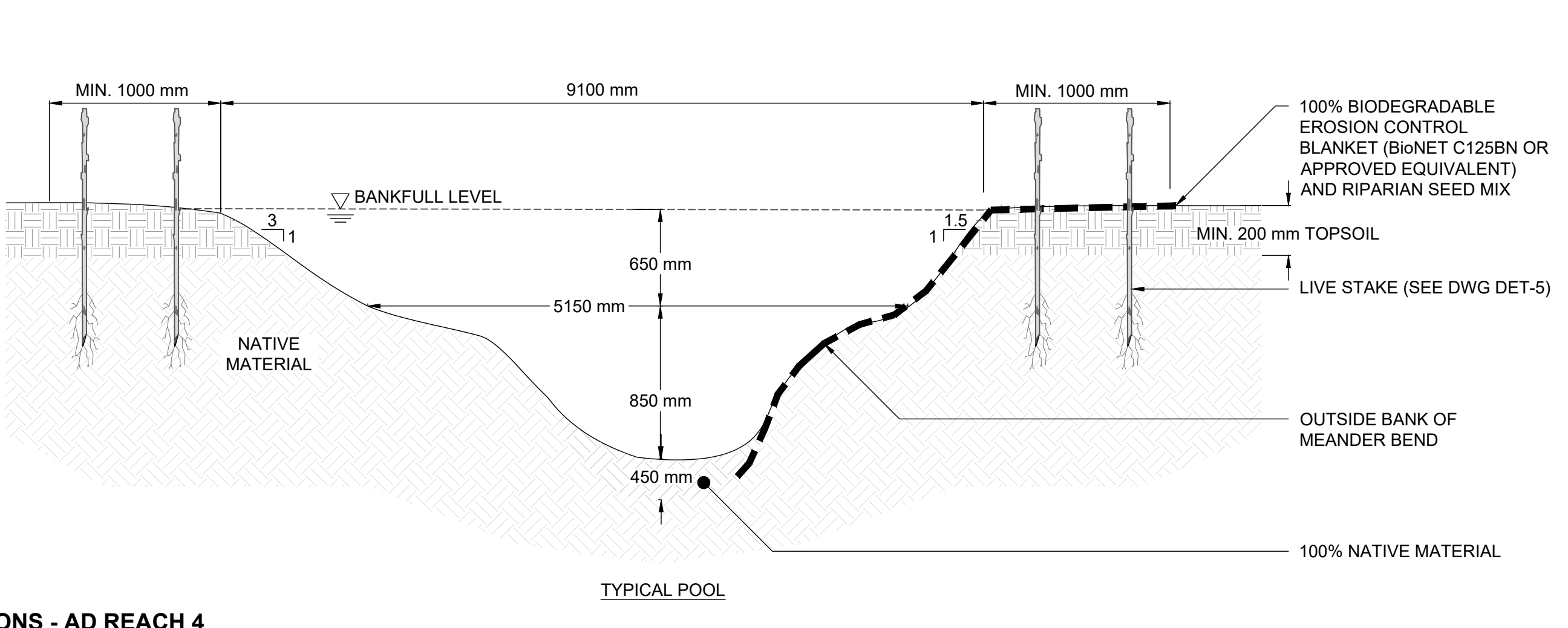
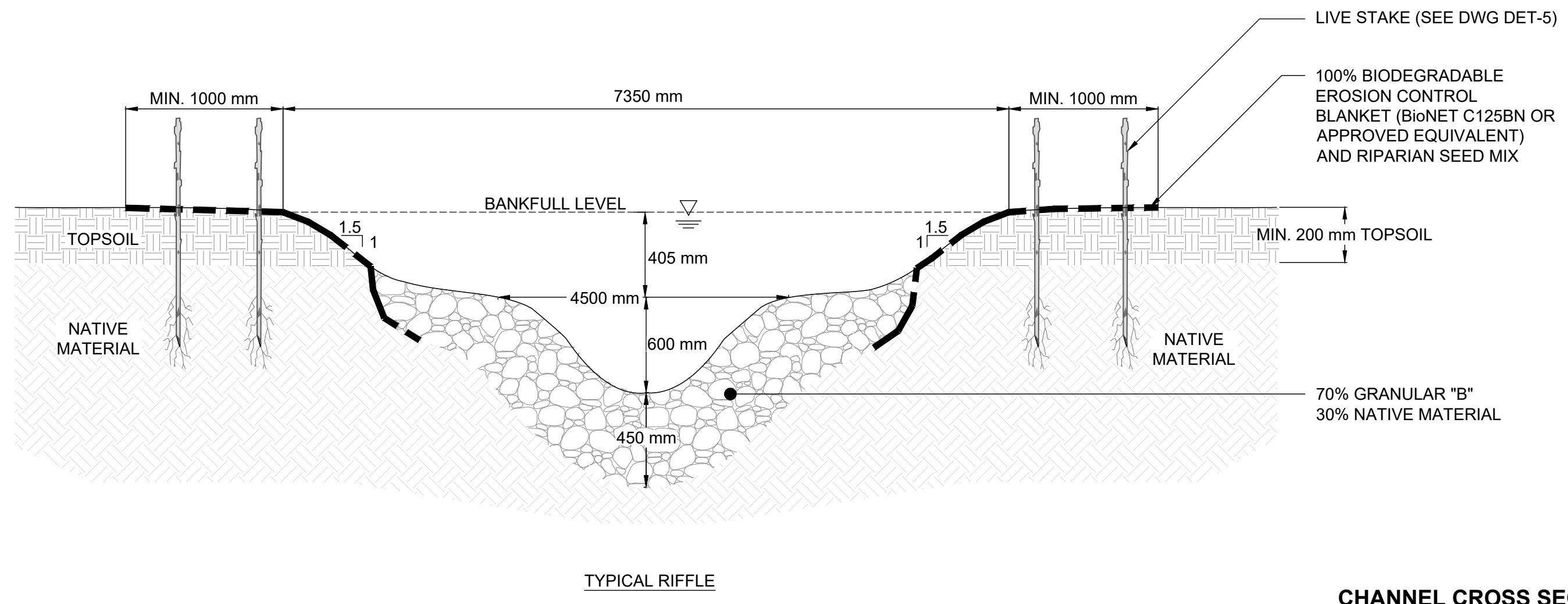
ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
PLANFORM AND PROFILE
LYONS DRAIN - REACH 2

PROJECT No.: PN24018	DRAWING No.: GEO-7
SCALE: AS NOTED	SHEET 7 OF 15

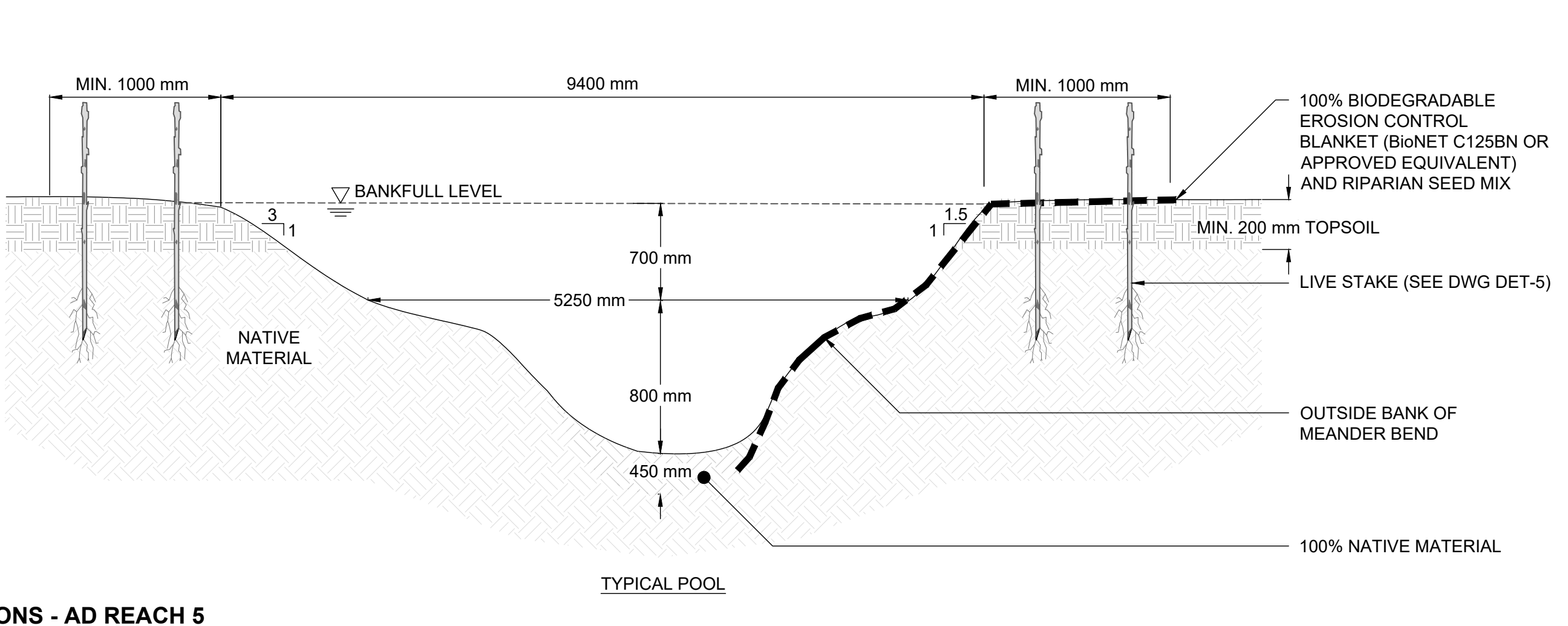
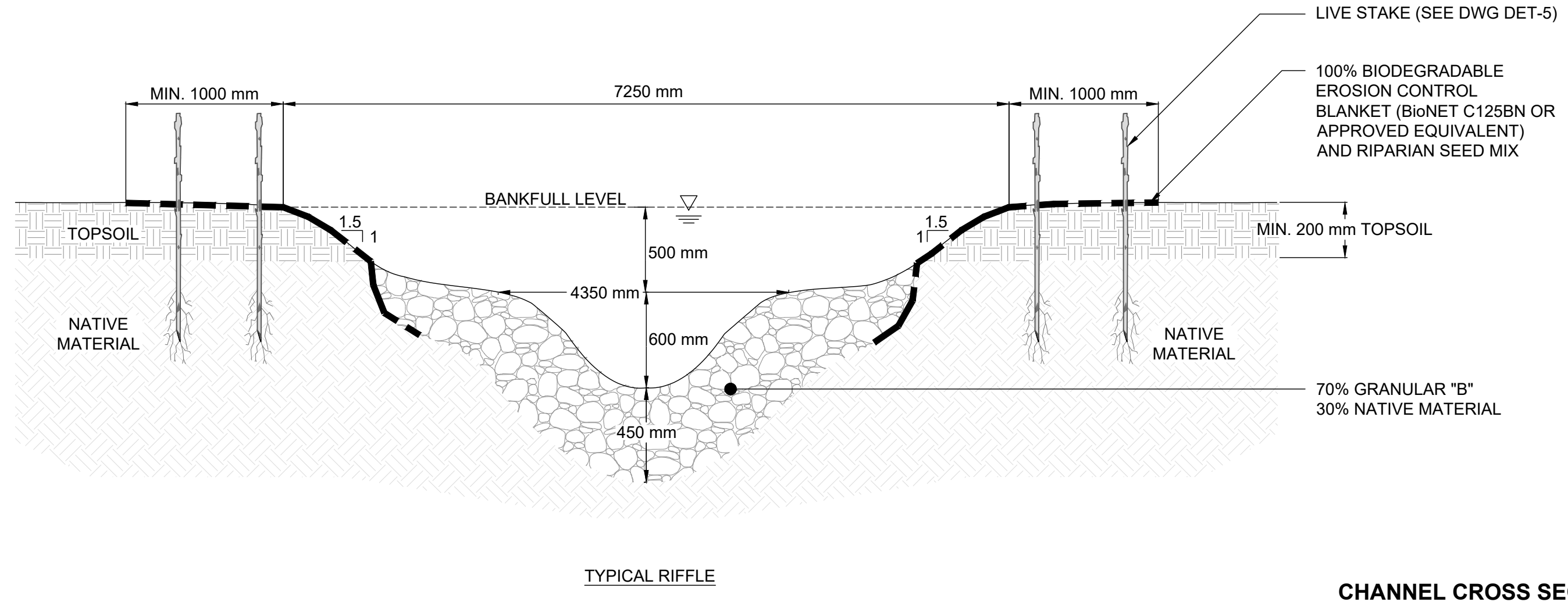
SCALED FOR PLOT ON 'ARCH D'



CHANNEL CROSS SECTIONS - AD REACH 3
N.T.S.



CHANNEL CROSS SECTIONS - AD REACH 4
N.T.S.



CHANNEL CROSS SECTIONS - AD REACH 5
N.T.S.

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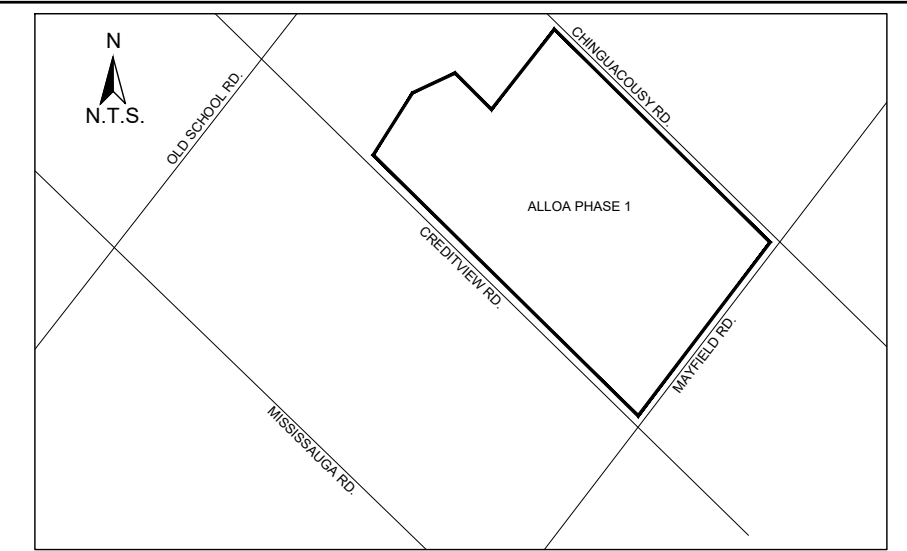
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<p>DRAFT FOR INTERNAL DISCUSSION</p> <p>NOT FOR CONSTRUCTION</p>		<p>MORPHIX™ 36 Main St N., P.O. Box 205 Campbellville, Ontario L0P 1B0 T: 416.920.0926 www.geomorphix.com</p>	
<p>ETOBICOKE CREEK - ALLOA DRAIN CONCEPTUAL CHANNEL DESIGN CHANNEL CROSS SECTION DETAILS</p>			

SCALED FOR PLOT ON 'ARCH D'



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4. STABILIZE, TEMPORARILY OR PERMANENTLY, ANY DISTURBED AREAS AS WORK PROGRESSES, OR SOON AS CONDITIONS ALLOW.
5. MINIMIZE THE AREA OF DISTURBANCE TO THE EXTENT POSSIBLE. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED USING APPROPRIATE EROSION CONTROL MEASURES AND AN APPROPRIATE SEED MIX AS NOTED WITHIN THE FINAL APPROVED RESTORATION PLAN.
6. ALL VEGETATION, ADJACENT TO THE WORK AREA, MUST BE PROTECTED AND DELINEATED WITH CONSTRUCTION FENCING OR TREE PROTECTION BARRIERS.
7. ALL GRADES IN THE AREA REGULATED BY THE CONSERVATION AUTHORITY MUST BE MAINTAINED OR MATCHED, UNLESS OTHERWISE AUTHORIZED IN THE APPLICABLE PERMIT.
8. AN AFTER-HOURS CONTACT NUMBER IS TO BE VISIBLY POSTED ON-SITE FOR EMERGENCIES. ALL PLANS SHOULD HAVE NAME AND CONTACT INFO OF THE PERSON RESPONSIBLE FOR ESC MEASURES.

EROSION AND SEDIMENT CONTROL

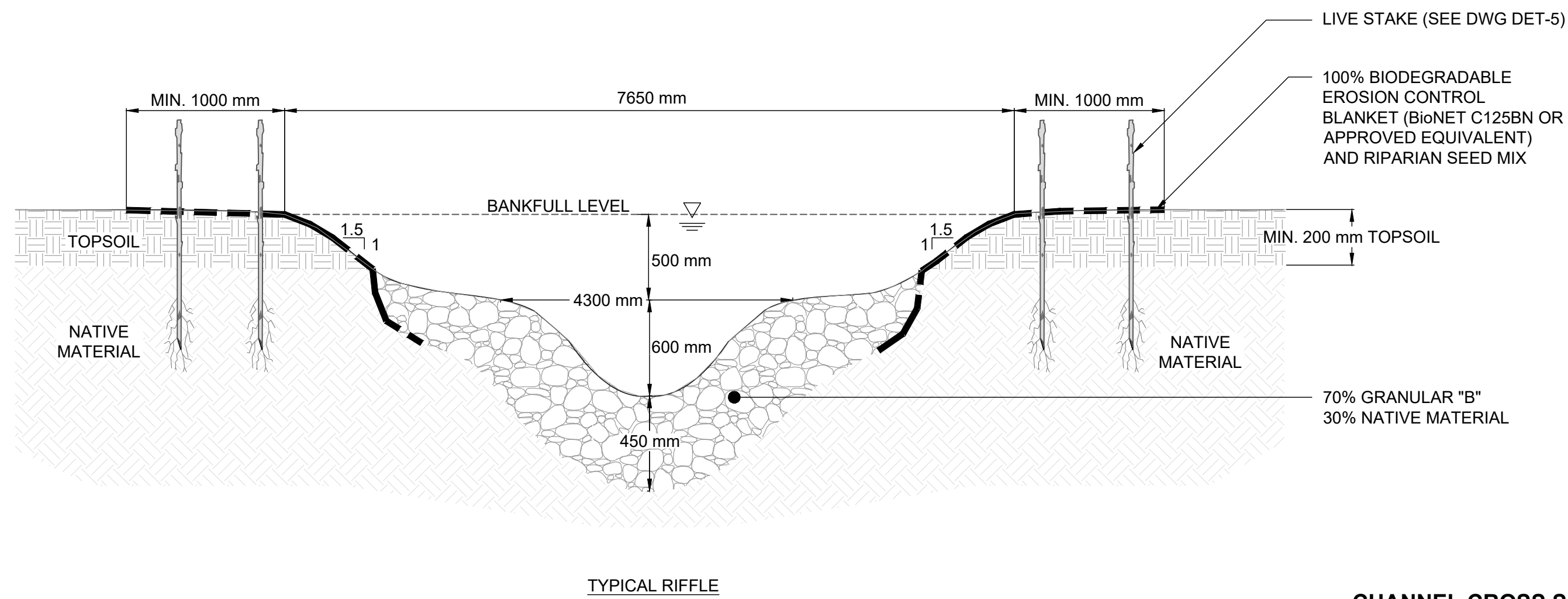
1. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES MUST BE INSTALLED PRIOR TO START OF WORKS.
2. FOLLOWING INSTALLATION OF THE PROPOSED ESC MEASURES, A QUALIFIED AGENT OF THE PROPONENT (E.G. CAN/CSCE CERTIFIED MONITOR) WILL CONDUCT REGULAR SITE VISITS TO MONITOR ALL WORKS, PARTICULARLY THE CONDITION OF THE ESC MEASURES, DEWATERING, AND IN- OR NEAR-WATER WORKS. SHOULD CONCERNS ARISE, THE ENVIRONMENTAL MONITOR WILL CONTACT THE PROPONENT, THE CONSERVATION AUTHORITY, AND ANY OTHER APPROPRIATE PARTIES.
3. EROSION AND SEDIMENT CONTROLS MUST BE MAINTAINED DURING CONSTRUCTION, AND ANY REQUIRED REPAIRS OR REPLACEMENTS MUST BE COMPLETED WITHIN 24 HOURS AFTER THEY HAVE BEEN IDENTIFIED DURING THE MONITORING.
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DELETERIOUS SUBSTANCE CONTROL/SPILL MANAGEMENT

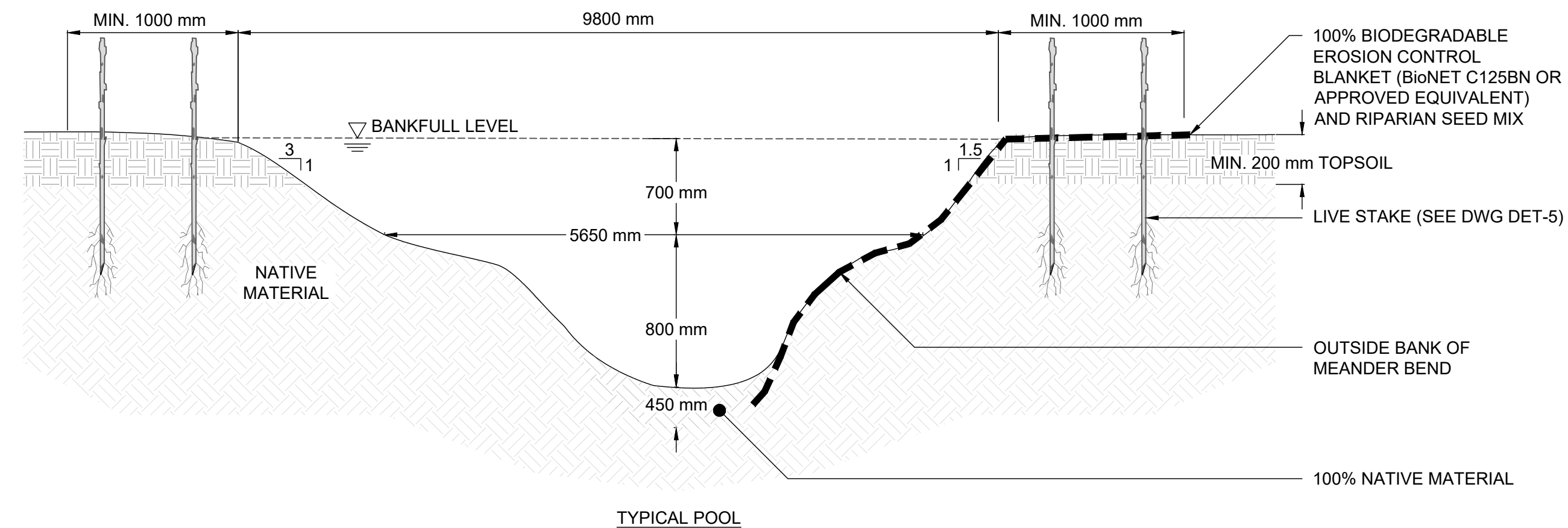
1. PREVENT THE RELEASE OF SEDIMENT, SEDIMENT-LOADED WATER, RAW CONCRETE, CONCRETE LEACHATE OR ANY OTHER DELETERIOUS SUBSTANCES INTO ANY WATERBODY, RAVINE OR STORM SEWER SYSTEM.
2. ENSURE EQUIPMENT AND MACHINERY ARE IN GOOD OPERATING CONDITION (POWER WASHED), FREE OF LEAKS, EXCESS OIL, AND GREASE.
3. NO EQUIPMENT REFUELLING OR SERVICING SHOULD BE UNDERTAKEN WITHIN 30 m OF ANY WATERCOURSE OR SURFACE WATER DRAINAGE.
4. A SPILL CONTAINMENT KIT MUST BE READILY ACCESSIBLE ON-SITE IN THE EVENT OF A RELEASE OF A DELETERIOUS SUBSTANCE TO THE ENVIRONMENT. ON-SITE STAFF MUST BE TRAINED IN ITS USE.
5. THE CONTRACT ADMINISTRATOR MUST BE NOTIFIED IMMEDIATELY IN THE EVENT OF A SPILL OF DELETERIOUS SUBSTANCE. ANY SEDIMENT SPILL FROM THE SITE SHOULD BE REPORTED TO MINISTRY OF ENVIRONMENT (SPILL ACTION CENTER) AT 1-800-268-0900.

WORK AREA ISOLATION

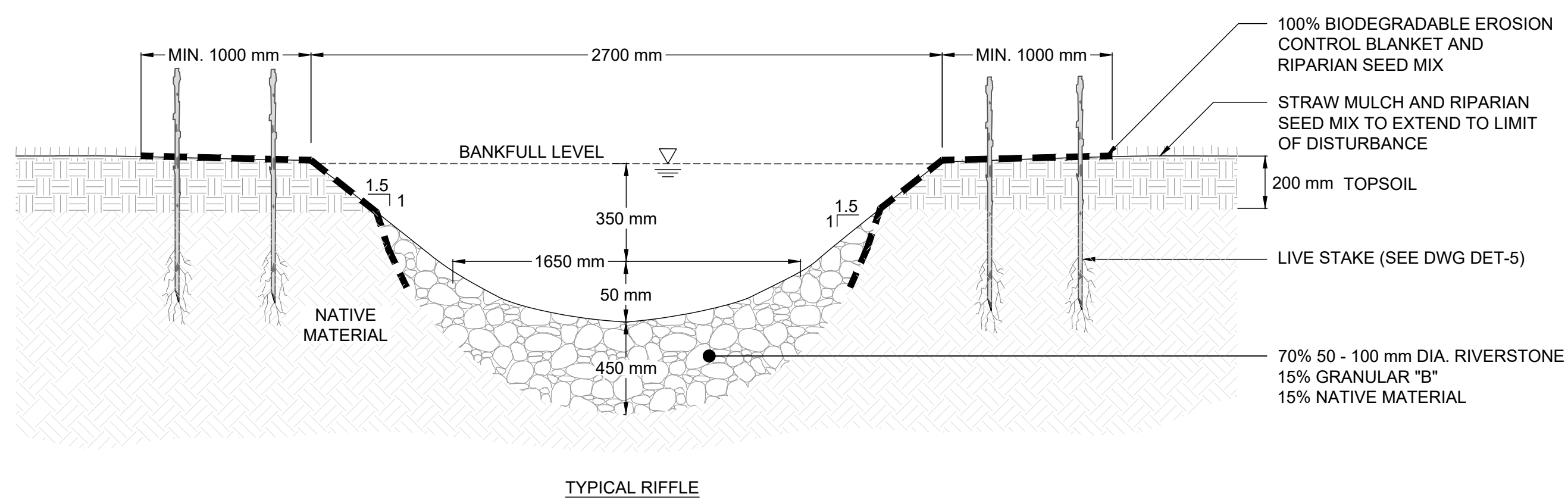
1. ALL WORK IN ISOLATED WORK AREAS MUST BE COMPLETED IN THE DRY. AN ADEQUATE NUMBER OF PUMPS MUST BE USED FOR UNWATERING.
2. CROSSING AN ACTIVE WATERCOURSE OR WETLAND BY EQUIPMENT, VEHICLES, PERSONNEL, ETC. IS NOT PERMITTED UNLESS APPROVED BY THE CONSERVATION AUTHORITY. ALL ACCESS TO WORK SITES SHALL BE FROM EITHER SIDES OF THE WATERCOURSE OR WETLAND.
3. THE UNWATERING DISCHARGE LOCATION MUST BE LOCATED AT LEAST 30 m FROM ANY WATERCOURSE OR WETLAND IN AN AREA WITH DENSE VEGETATIVE GROUND COVER, AND WHERE THE DISCHARGE CAN RETURN TO THE WATERBODY DOWNSTREAM OF THE WORK AREA OVER THE GROUND COVER.
4. FISH MUST BE REMOVED FROM THE WORK AREA ONCE ISOLATED. FISH SALVAGE MUST BE COMPLETED BY A QUALIFIED TECHNICIAN WITH A LICENSE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES.



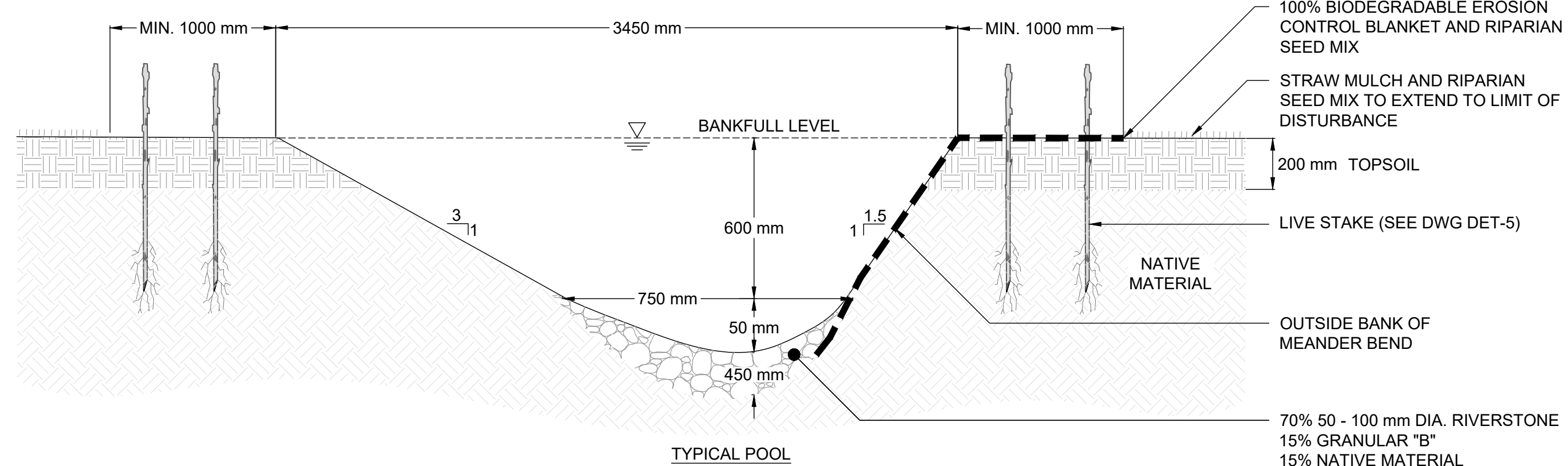
CHANNEL CROSS SECTIONS - AD REACH 6
N.T.S.



TYPICAL POOL



CHANNEL CROSS SECTIONS - LD REACH 2
N.T.S.



TYPICAL POOL

2.0	17/03/2026	AS	SECOND EIR SUBMISSION
1.0	16/09/2024	AS	FIRST EIR SUBMISSION

DATE	BY	REVISIONS
DESIGNED BY: LD/AS	CHECKED BY: PV	
DRAWN BY: SC/RS	DATE: MARCH 2026	

DRAFT FOR INTERNAL DISCUSSION

NOT FOR CONSTRUCTION

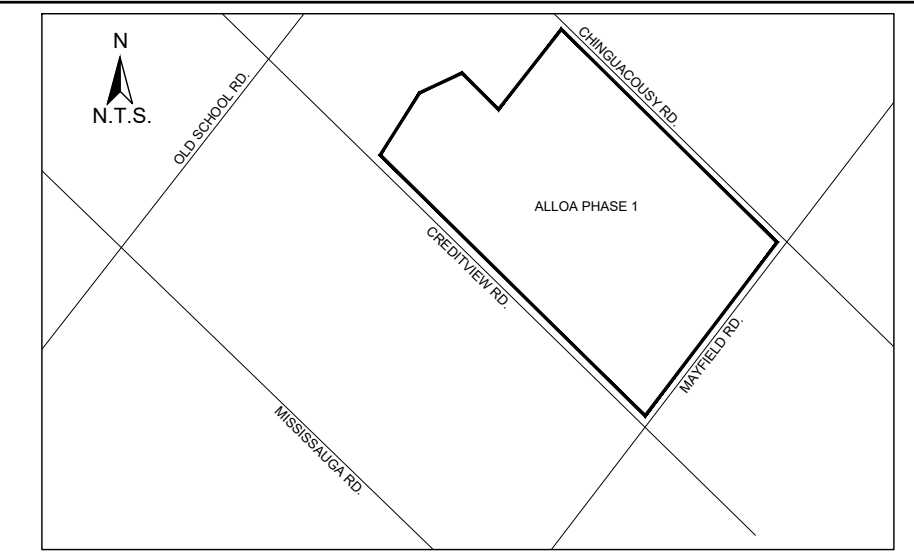
GEO MORPHIX™
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T: 416.920.0926
www.geomorphix.com

ALLOA SPA PHASE 1
TOWN OF CALEDON

ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
CHANNEL CROSS SECTION DETAILS

PROJECT No.: PN24018	DRAWING No.: DET-2
SCALE: AS NOTED	SHEET 9 OF 15

SCALED FOR PLOT ON 'ARCH D'



KEY MAP
N.T.S.

GENERAL NOTES

1. THE ACCOMPANYING CHANNEL REALIGNMENT TECHNICAL DESIGN BRIEF PREPARED BY GEO MORPHIX LTD. (2025) PROVIDES ADDITIONAL DESIGN DETAILS AND DIRECTION FOR IMPLEMENTATION AND IS TO BE REVIEWED IN CONJUNCTION WITH THIS DRAWING SET.
2. ALL CONTRACT DRAWINGS, SPECIFICATIONS AND APPLICABLE PERMITS MUST BE KEPT ON SITE DURING CONSTRUCTION FOR REFERENCE.
3. THE CONTRACTOR MUST NOTIFY THE DESIGNER AND CONTRACT ADMINISTRATOR OF THE INTENT TO COMMENCE WORK AT LEAST 48 HOURS IN ADVANCE.
4. THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY LOCATES.
5. LAYOUT MUST BE REVIEWED AND APPROVED BY THE DESIGNER/DESIGNER REPRESENTATIVE, DESIGNATED ENGINEER AND THE CONTRACT ADMINISTRATOR.
6. CONSTRUCTION OBSERVATION IS TO BE PERFORMED BY A CERTIFIED FLUVIAL GEOMORPHOLOGIST OR EXPERIENCED ENVIRONMENTAL INSPECTOR UNDER DIRECTION FROM THE DESIGNER.
7. ON-SITE SUPPORT FROM PROJECT ENGINEERS (E.G. GEOTECHNICAL, HYDROGEOLOGICAL, AND/OR WATER RESOURCES ENGINEERS) REQUIRED TO ASSESS AND ENSURE FAVOURABLE SURFICIAL AND SUBSURFACE CONDITIONS TO SUPPORT CHANNEL REALIGNMENT CONSTRUCTION.
8. BE ADVISED THAT THE LOCAL REGULATORY BODY MAY, AT ANY TIME, WITHDRAW THIS PERMISSION, IF, IN THE OPINION OF THE AUTHORITY, THE CONDITIONS OF THE PERMIT ARE NOT BEING COMPLIED WITH. THIS APPROVAL DOES NOT EXEMPT THE PROPERTY OWNER/APPLICANT/AGENT FROM THE PROVISIONS OF ANY OTHER FEDERAL, PROVINCIAL OR MUNICIPAL STATUTES, REGULATIONS OR BY-LAWS, OR ANY RIGHTS UNDER COMMON LAW.

TIMING OF WORKS

1. WORKS SHALL BE COMPLETED DURING THE DESIGNATED IN-WATER WORKS WINDOW SET OUT BY MNRF/DFO.
2. TREE CLEARING IS TO BE COMPLETED OUTSIDE THE BIRD NESTING SEASON (APRIL 1ST TO AUGUST 1ST) AND THE BAIT ROOSTING WINDOW (APRIL 1ST TO SEPTEMBER 31ST) TO COMPLY WITH THE FEDERAL MIGRATORY BIRDS CONVENTION ACT AND THE PROVINCIAL ENDANGERED SPECIES ACT. ANY TREES THAT REQUIRE REMOVAL OUTSIDE OF THIS TIMING WINDOW MUST FIRST BE INSPECTED BY A QUALIFIED BIOLOGIST TO DETERMINE THE PRESENCE OF NESTING BIRDS OR BATS.
3. THE WEATHER FORECAST SHOULD BE CONTINUALLY MONITORED TO ENSURE THAT WORKS ARE UNDERTAKEN ONLY DURING FAVOURABLE WEATHER CONDITIONS.
4. COMPLETE THE WORKS WITH MINIMAL AVOIDABLE INTERRUPTIONS ONCE THEY COMMENCE.

SITE AND MATERIAL MANAGEMENT

1. ALL CONSTRUCTION EQUIPMENT AND MATERIALS (IMPORTED OR EXCAVATED) MUST BE STORED AT LEAST 30 m AWAY FROM ANY WATERBODY IN A STABLE AREA ABOVE THE ACTIVE FLOODPLAIN, OR IN A DESIGNATED STORAGE AREA.
2. IN THE EVENT OF AN UNEXPECTED STORM, ALL UNFIXED ITEMS THAT HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW MUST BE MOVED TO A STABLE AREA ABOVE ACTIVE FLOODPLAIN.
3. STOCKPILES MUST BE LOCATED OUTSIDE THE ISOLATED WORK AREAS.
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EROSION AND SEDIMENT CONTROL

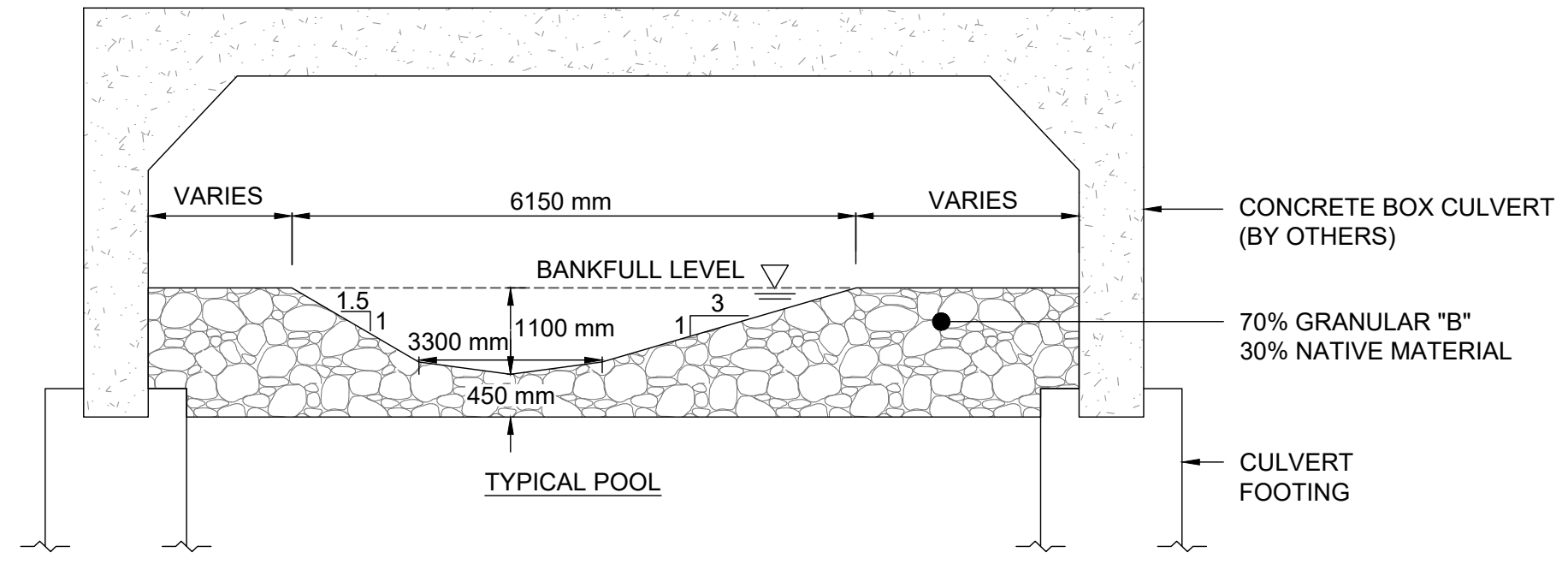
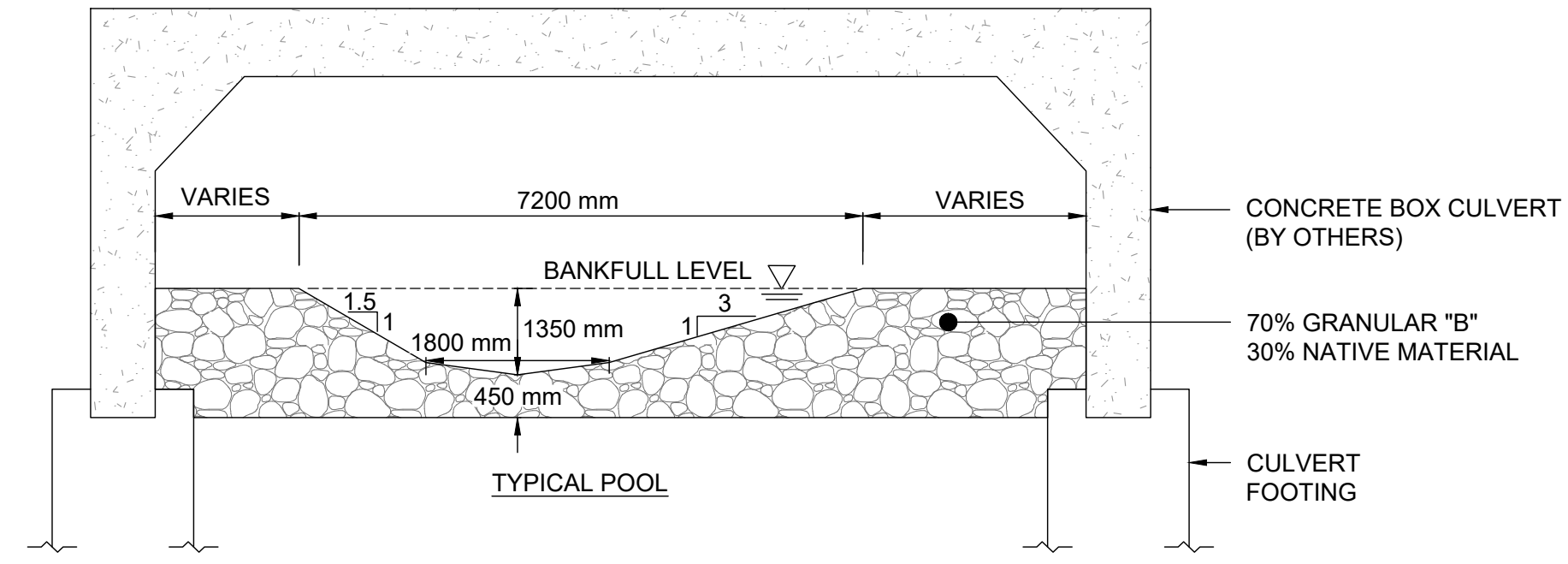
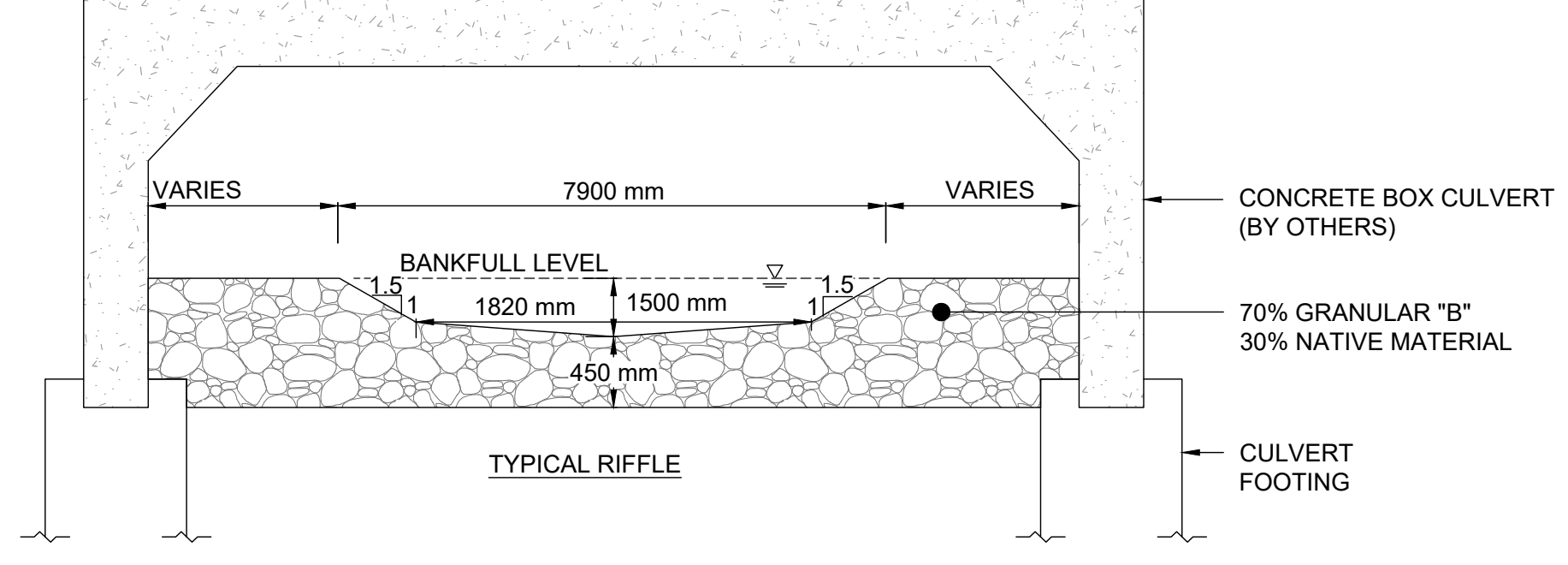
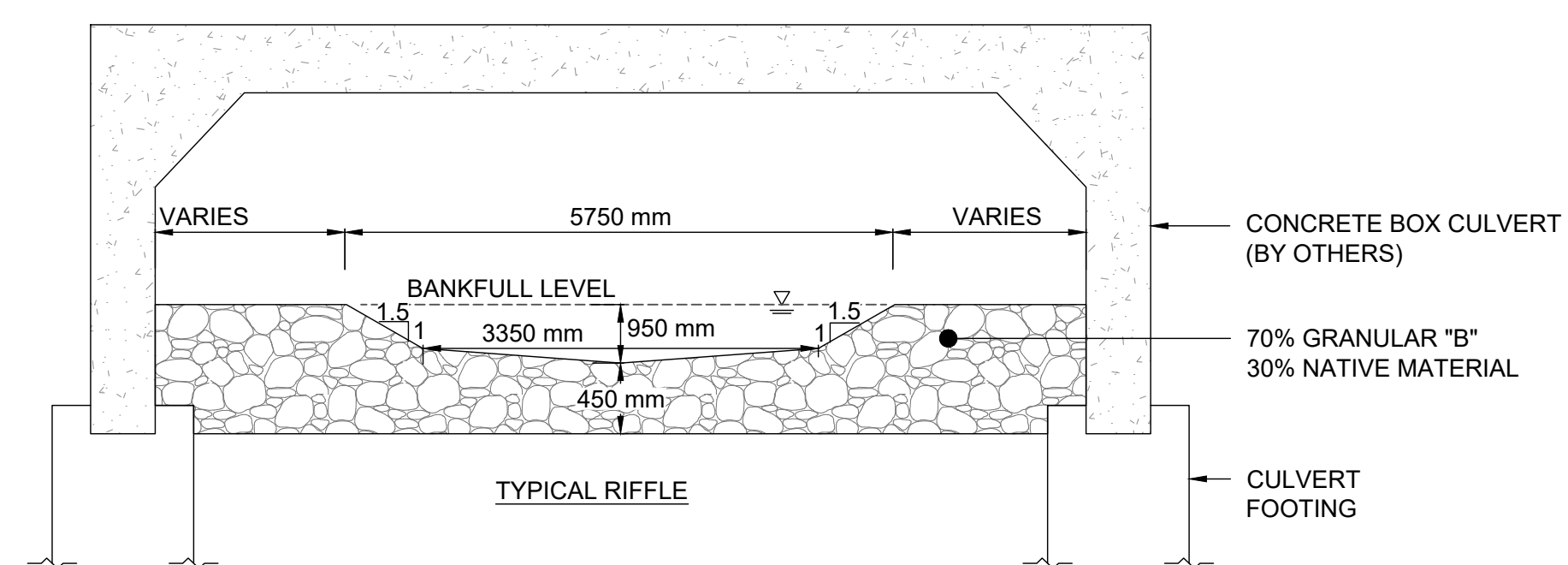
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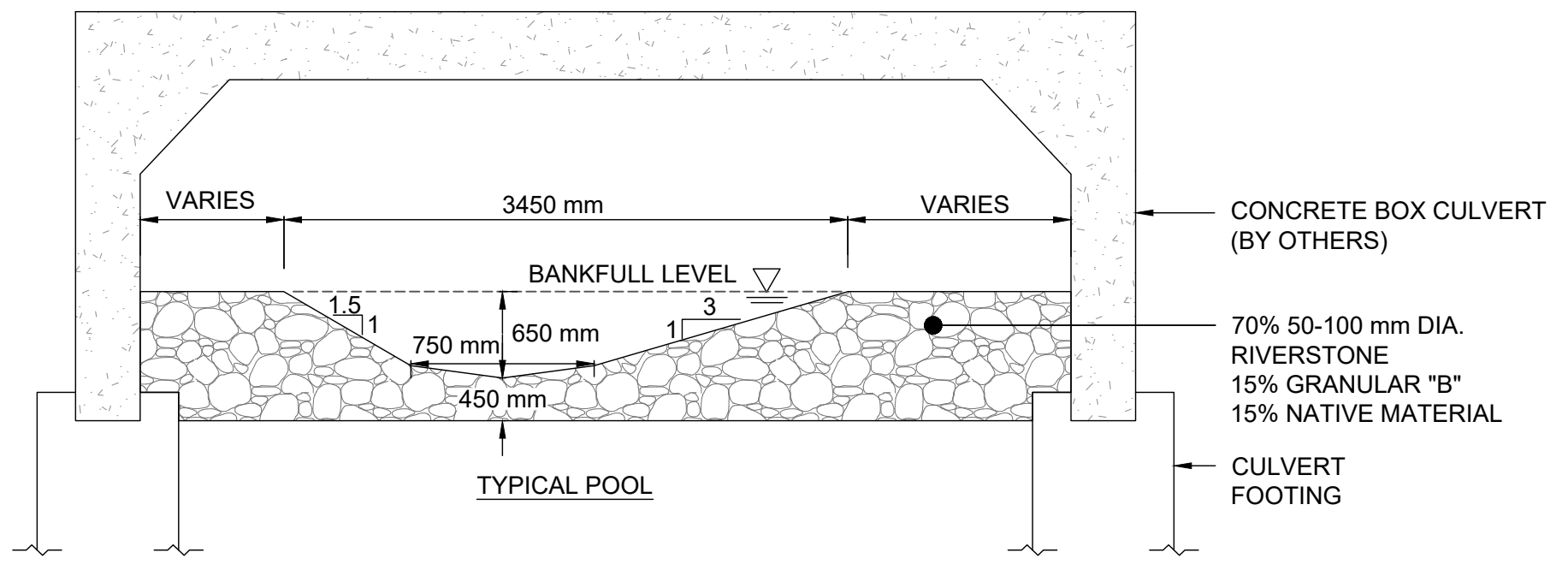
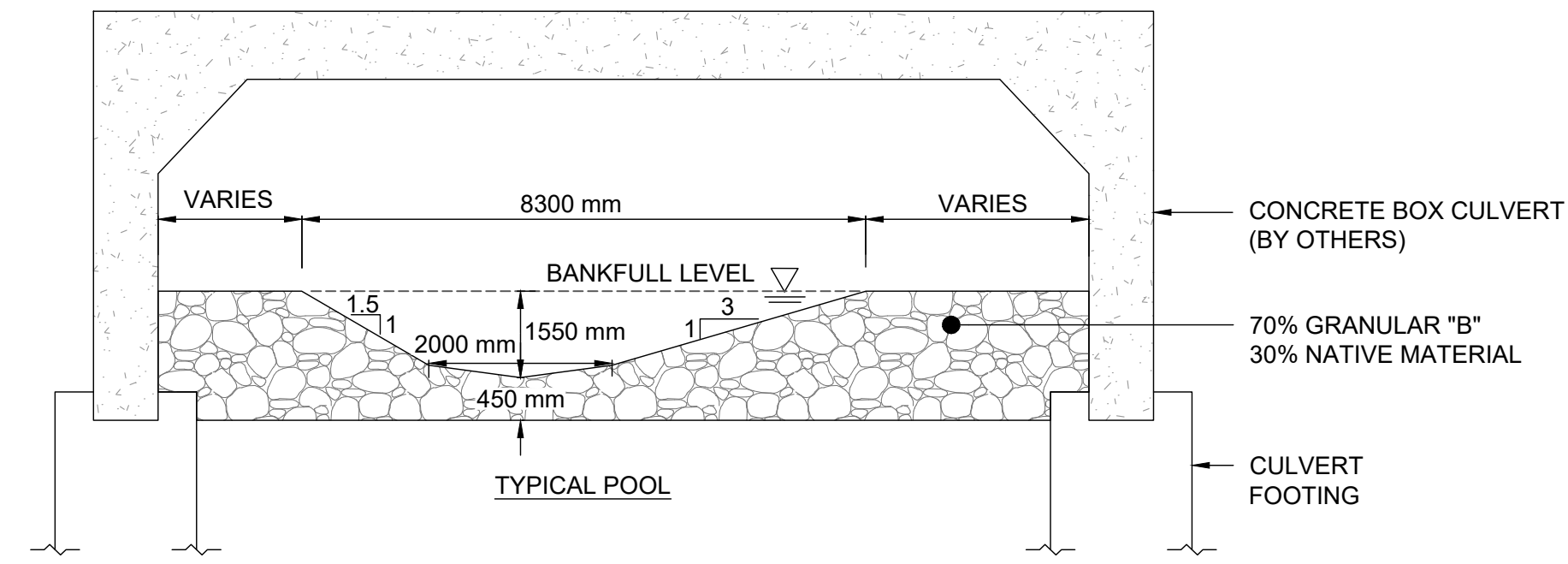
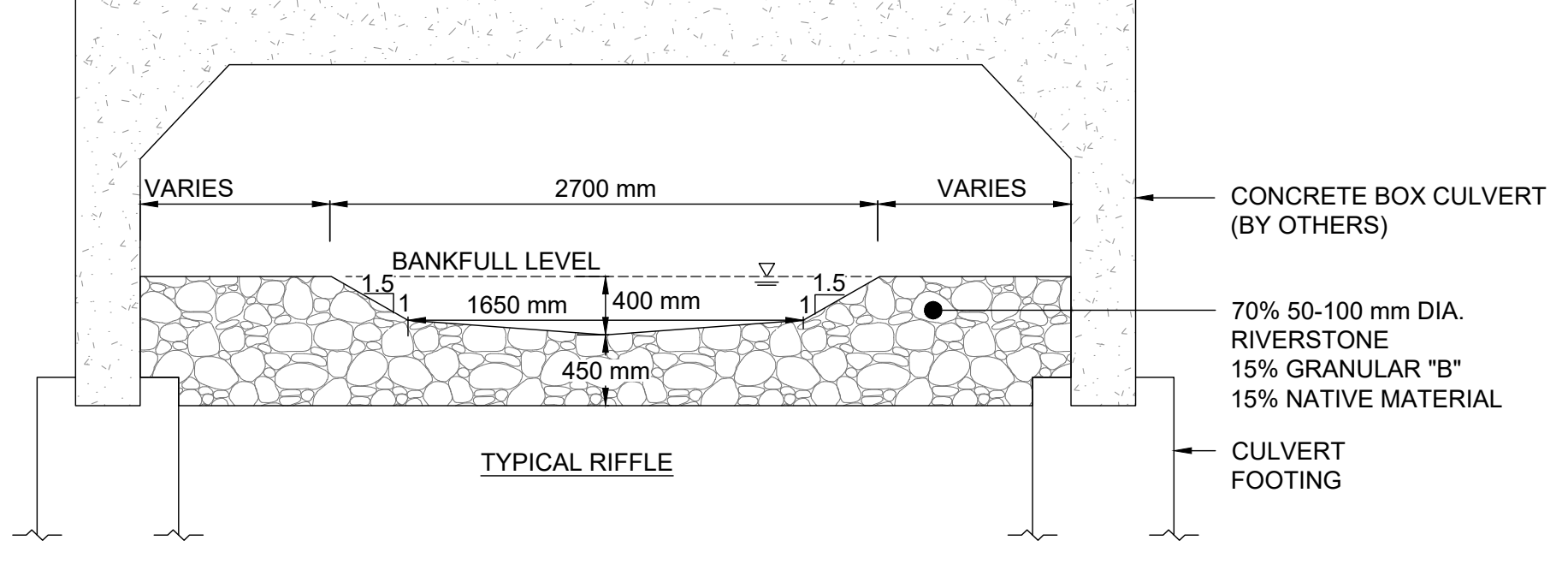
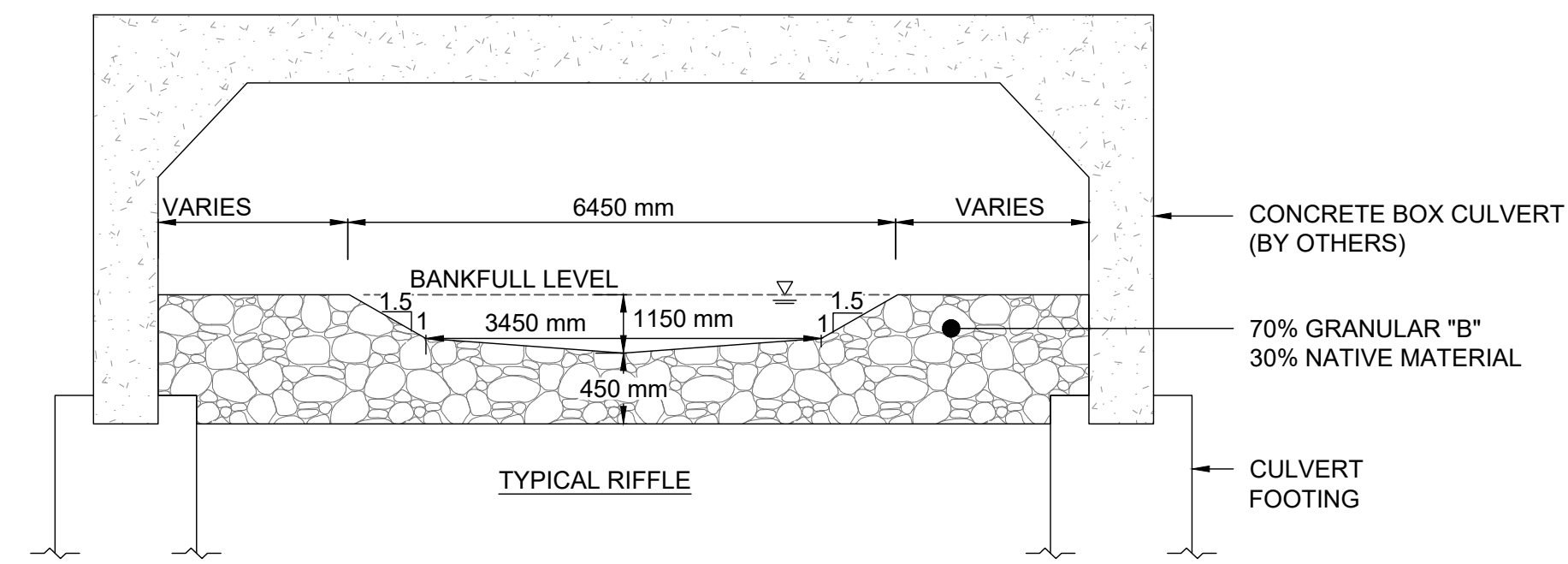
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CROSS SECTIONS WITHIN CULVERTS AD REACH 3
N.T.S.

CROSS SECTIONS WITHIN CULVERTS AD REACH 4
N.T.S.



CROSS SECTIONS WITHIN CULVERTS AD REACH 6
N.T.S.

CROSS SECTIONS WITHIN CULVERTS LD REACH 2
N.T.S.

2.0	17/03/2026	AS	SECOND EIR SUBMISSION
1.0	16/09/2024	AS	FIRST EIR SUBMISSION
	DATE	BY	REVISIONS
DESIGNED BY: LD/AS		CHECKED BY: PV	
DRAWN BY: SC/RS		DATE: MARCH 2026	

DRAFT FOR INTERNAL DISCUSSION

NOT FOR CONSTRUCTION

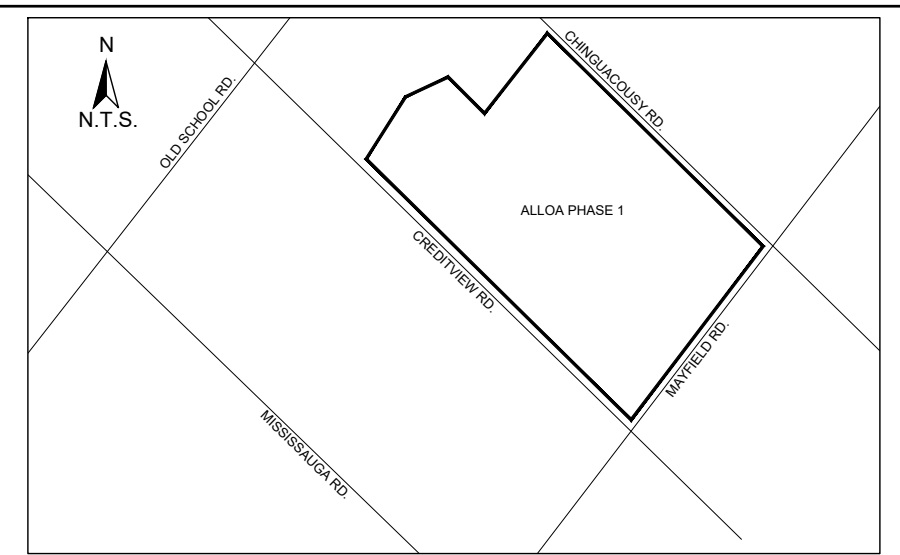
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ALLOA SPA PHASE 1
TOWN OF CALEDON

ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
CULVERT CROSS SECTION DETAILS

PROJECT No.: PN24018	DRAWING No.: DET-3
SCALE: AS NOTED	SHEET 10 OF 15

SCALED FOR PLOT ON 'ARCH D'



KEY MAP
N.T.S.

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 - CROSSING AN ACTIVE WATERCOURSE OR WETLAND BY EQUIPMENT, VEHICLES, PERSONNEL, ETC. IS NOT PERMITTED UNLESS APPROVED BY THE CONSERVATION AUTHORITY. ALL ACCESS TO WORK SITES SHALL BE FROM EITHER SIDES OF THE WATERCOURSE OR WETLAND.
 - THE UNWATERING DISCHARGE LOCATION MUST BE LOCATED AT LEAST 30 m FROM ANY WATERCOURSE OR WETLAND IN AN AREA WITH DENSE VEGETATIVE GROUNDCOVER, AND WHERE THE DISCHARGE CAN RETURN TO THE WATERBODY DOWNSTREAM OF THE WORK AREA OVER THE GROUNDCOVER.
 - FISH MUST BE REMOVED FROM THE WORK AREA ONCE ISOLATED. FISH SALVAGE MUST BE COMPLETED BY A QUALIFIED TECHNICIAN WITH A LICENSE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES.

2.0	17/03/2026	AS	SECOND EIR SUBMISSION
1.0	16/09/2024	AS	FIRST EIR SUBMISSION
	DATE	BY	REVISIONS
DESIGNED BY: LD/AS		CHECKED BY: PV	
DRAWN BY: SC/RS		DATE: MARCH 2026	

DRAFT FOR INTERNAL DISCUSSION

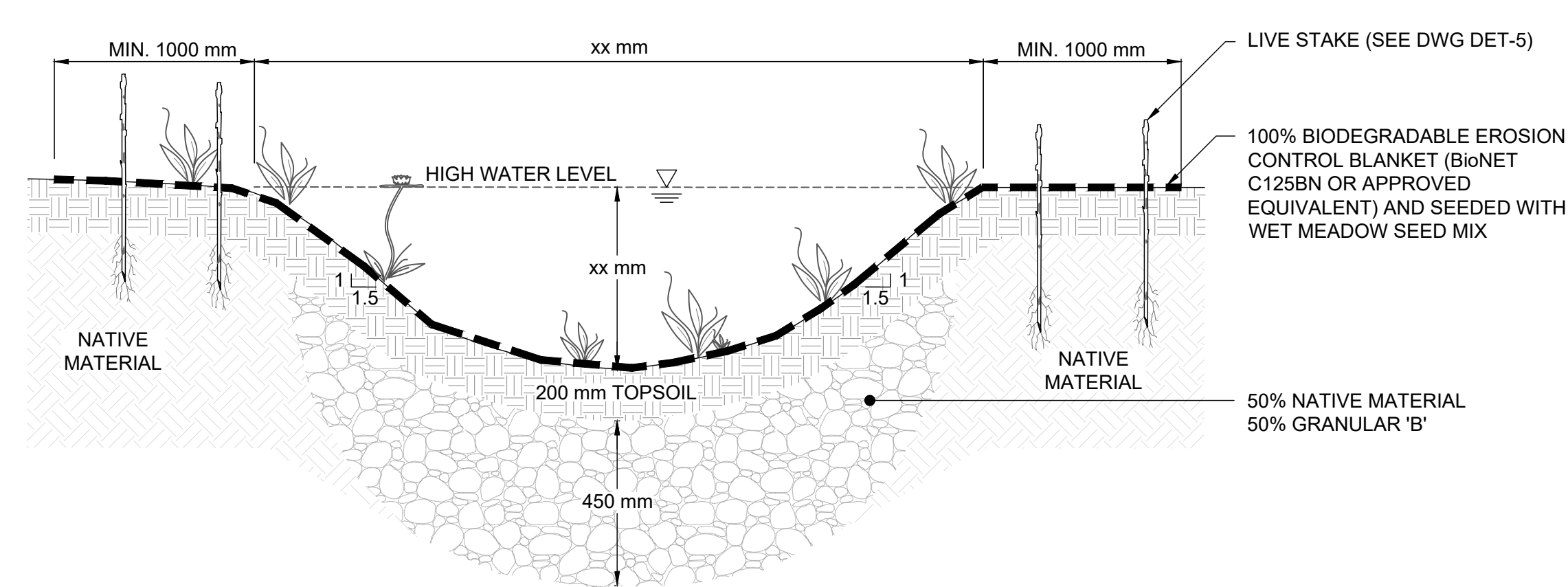
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ALLOA SPA PHASE 1
TOWN OF CALEDON

ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
WETLAND CROSS SECTION AND
RESTORATION DETAILS

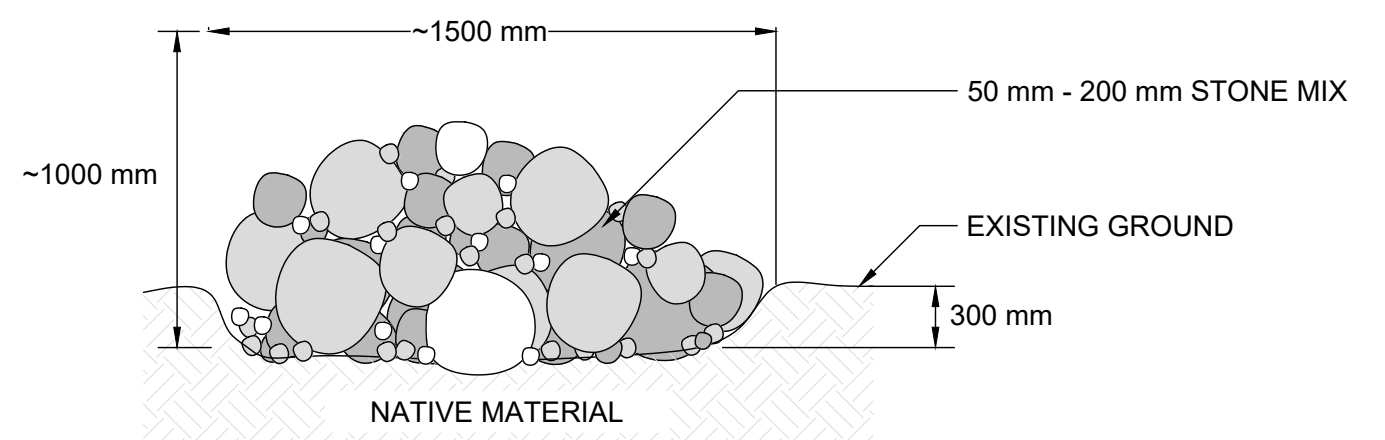
PROJECT No.: PN24018	DRAWING No.: DET-4
SCALE: AS NOTED	SHEET 11 OF 15



NOTES

- SUBSTRATES TO BE COMPACTED TO 90% SPD TO PREVENT PIPING/FLOW-THROUGH.
- FINE NATIVE MATERIAL TO BE ADDED TO SUBSTRATE MIX TO FILL INTERSTITIAL VOIDS, AS REQUIRED.
- GRANULAR 'B' TO BE SOURCED FROM PIT-RUN MATERIAL AND ROUNDED IN NATURE. NO CRUSHED ROCK, LIMESTONE OR POST-CONSTRUCTION MATERIALS ARE TO BE USED WITHIN THE CHANNEL.
- HYDRAULIC SIZING TO BE CONFIRMED AT DETAILED DESIGN.
- SEED IS TO BE PLACED PRIOR TO INSTALLATION OF EROSION CONTROL BLANKET. SEE DWG DET-5 FOR SEED MIX SPECIFICATION.

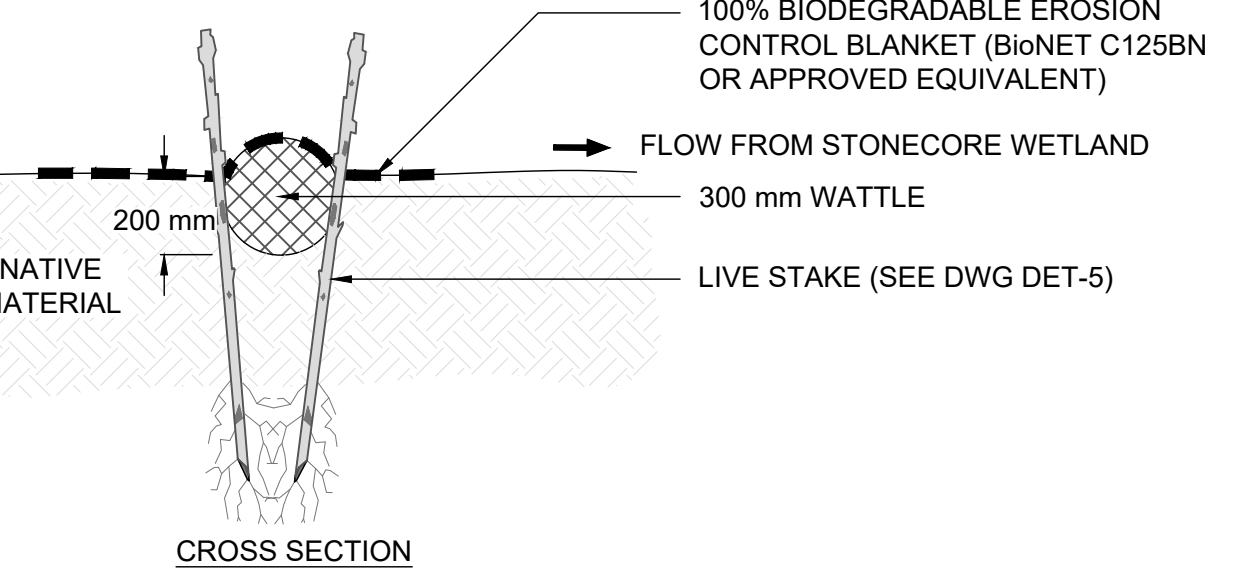
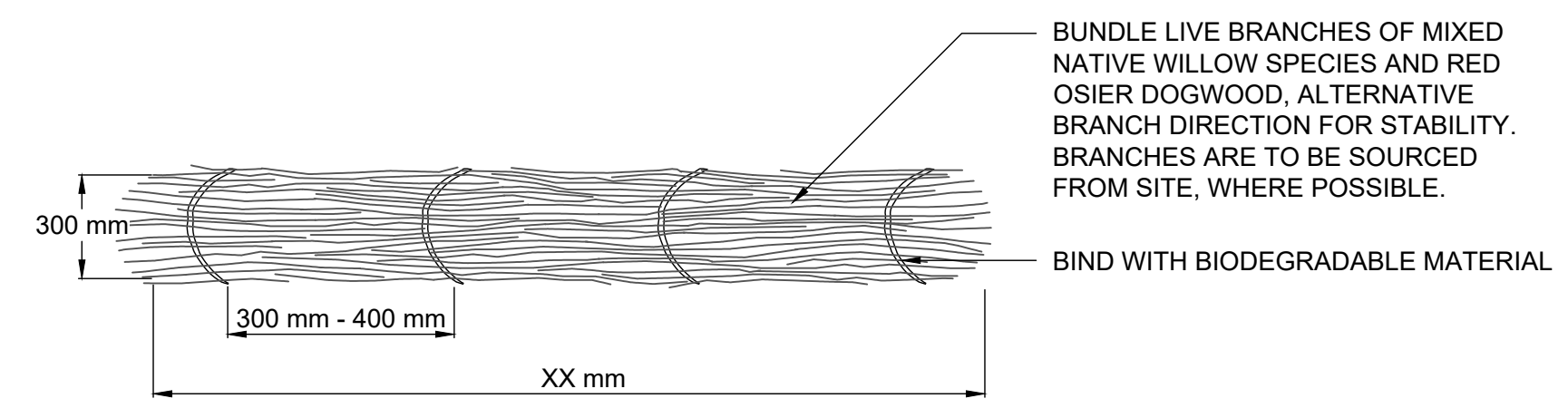
TYPICAL BIOSWALE CROSS SECTION
N.T.S.



NOTES

- 50 mm - 200 mm STONE MIX WITH SOME ANGULAR STONES.
- THE STONE MIX SHOULD PROVIDE A VARIETY OF INTERSTITIAL SPACES.
- PILES ARE AT LEAST 1500 mm IN DIAMETER AND ~1000 mm HIGH.
- EMBED ROCK PILE 300 mm TO AVOID ROCKFALL.

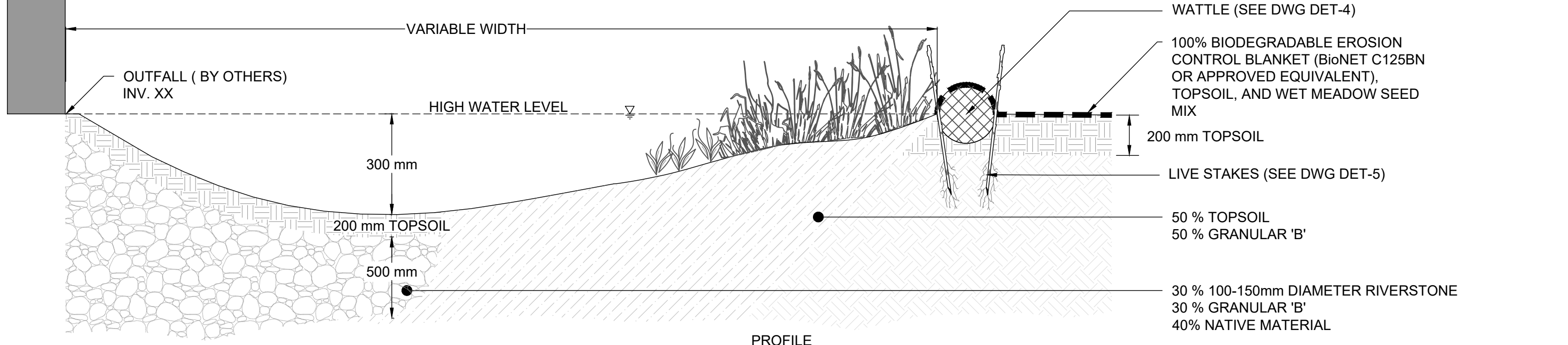
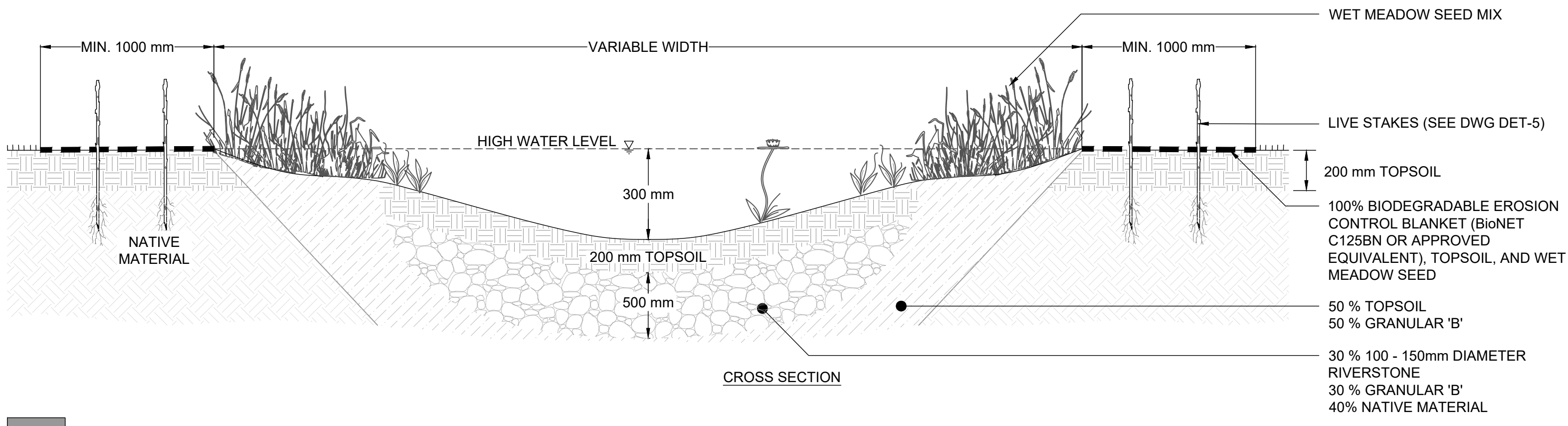
ROCK PILE
N.T.S.



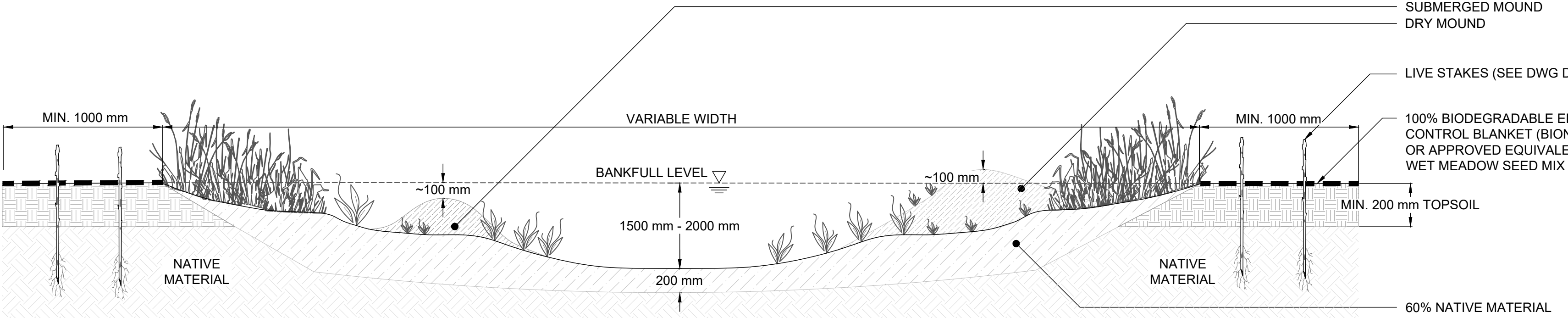
NOTES

- WATTLES TO BE INSTALLED IN A 200 mm WIDE TRENCH AND STAKED EVERY METER.
- WATTLE AND GRADING INSTALLATION TO RESULT IN A LEVEL BERM WITHOUT BREAKS.

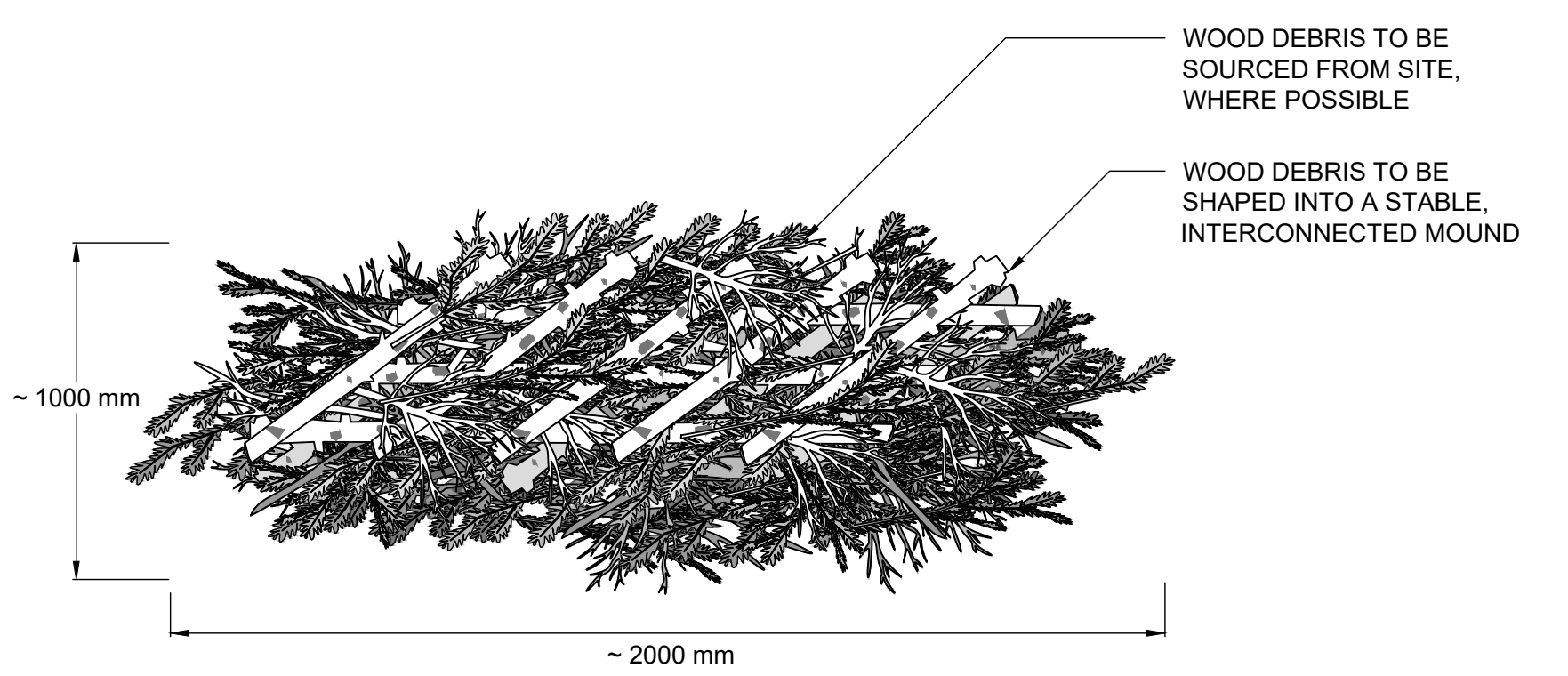
WATTLE/ FASCINE DETAIL
N.T.S.



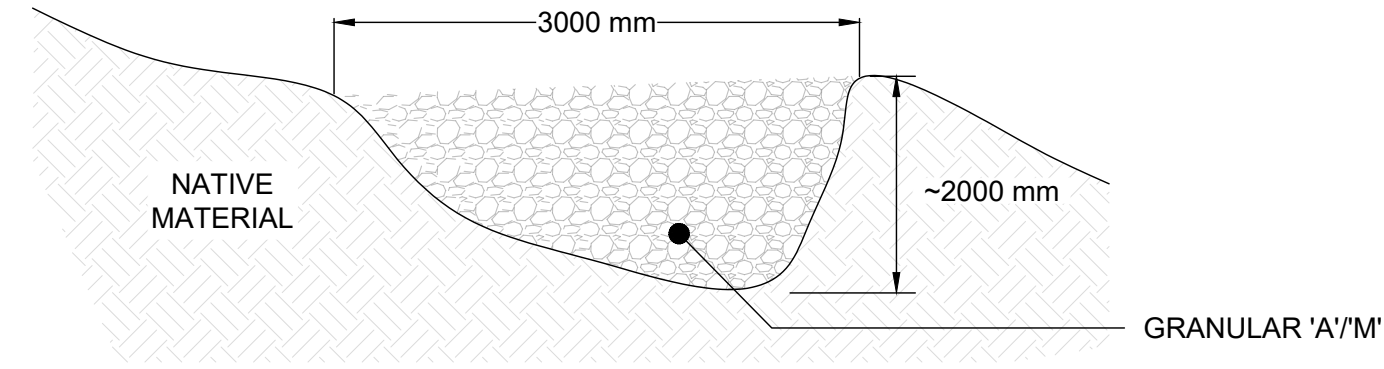
STONE CORE WETLAND
N.T.S.



OFFLINE WETLAND
N.T.S.



PALLET TYPE WOOD PILE
N.T.S.

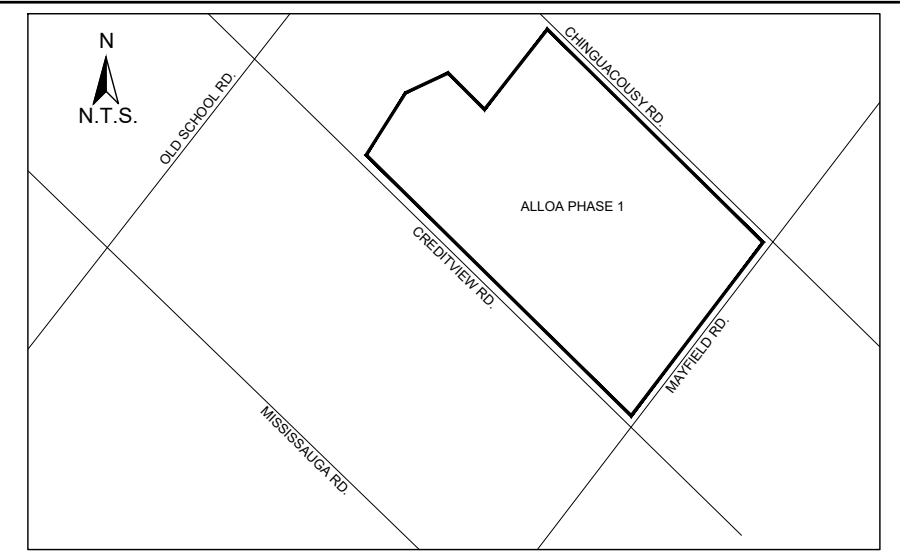


NOTES

- TURTLE NESTING SITE TO BE INSTALLED ON SLOPES AWAY FROM THE WATERCOURSE AND ON SOUTH OR WEST FACING SLOPES.
- FEATURE TO BE CONSTRUCTED USING ROAD SHOULDER GRANULAR 'A/M' TYPE MATERIAL ONLY.
- NO VEGETATION OR WOODY DEBRIS IS TO BE INCLUDED.

TURTLE NEST
N.T.S.

- NOTES**
- LARGEST AND HEAVIEST LOG MATERIAL SHOULD BE PLACED ON THE BASE OF THE BRUSH PILE. THE SMALLEST BRUSH MATERIAL SHOULD BE PLACED AT THE TOP.
 - LOGS SHOULD BE FORMED INTO A PALLET SHAPE.
 - HEIGHT OF BRUSH PILE IS NOT TO EXCEED 1000 mm.
 - A MIX OF HARDWOOD AND SOFTWOOD SHOULD BE USED.
 - PLANT WITH NATIVE FRUIT BEARING VINES.



KEY MAP
N.T.S.

- GENERAL NOTES**
1. THE ACCOMPANYING CHANNEL REALIGNMENT TECHNICAL DESIGN BRIEF PREPARED BY GEO MORPHIX LTD. (2025) PROVIDES ADDITIONAL DESIGN DETAILS AND DIRECTION FOR IMPLEMENTATION AND IS TO BE REVIEWED IN CONJUNCTION WITH THIS DRAWING SET.
 2. ALL CONTRACT DRAWINGS, SPECIFICATIONS AND APPLICABLE PERMITS MUST BE KEPT ON SITE DURING CONSTRUCTION FOR REFERENCE.
 3. THE CONTRACTOR MUST NOTIFY THE DESIGNER AND CONTRACT ADMINISTRATOR OF THE INTENT TO COMMENCE WORK AT LEAST 48 HOURS IN ADVANCE.
 4. THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY LOCATES.
 5. LAYOUT MUST BE REVIEWED AND APPROVED BY THE DESIGNER / DESIGNER REPRESENTATIVE, DESIGNATED ENGINEER AND THE CONTRACT ADMINISTRATOR.
 6. CONSTRUCTION OBSERVATION IS TO BE PERFORMED BY A CERTIFIED FLUVIAL GEOMORPHOLOGIST OR EXPERIENCED ENVIRONMENTAL INSPECTOR UNDER DIRECTION FROM THE DESIGNER.
 7. ON-SITE SUPPORT FROM PROJECT ENGINEER (E.G. GEOTECHNICAL, HYDROGEOLOGICAL, AND/OR WATER RESOURCES ENGINEERS) REQUIRED TO ASSESS AND ENSURE FAVOURABLE SURFICIAL AND SUBSURFACE CONDITIONS TO SUPPORT CHANNEL REALIGNMENT CONSTRUCTION.
 8. BE ADVISED THAT THE LOCAL REGULATORY BODY MAY, AT ANY TIME, WITHDRAW THIS PERMISSION, IF, IN THE OPINION OF THE AUTHORITY, THE CONDITIONS OF THE PERMIT ARE NOT BEING COMPLIED WITH. THIS APPROVAL DOES NOT EXEMPT THE PROPERTY OWNER/APPLICANT/AGENT FROM THE PROVISIONS OF ANY OTHER FEDERAL, PROVINCIAL OR MUNICIPAL STATUTES, REGULATIONS OR BY-LAWS, OR ANY RIGHTS UNDER COMMON LAW.

- TIMING OF WORKS**
1. WORKS SHALL BE COMPLETED DURING THE DESIGNATED IN-WATER WORKS WINDOW SET OUT BY MNRF/DFO.
 2. TREE CLEARING IS TO BE COMPLETED OUTSIDE THE BIRD NESTING SEASON (APRIL 1ST TO AUGUST 1ST) AND THE BIRD ROOSTING WINDOW (APRIL 1ST TO SEPTEMBER 31ST) TO COMPLY WITH THE FEDERAL MIGRATORY BIRD CONVENTION ACT AND THE PROVINCIAL ENDANGERED SPECIES ACT. ANY TREES THAT REQUIRE REMOVAL OUTSIDE OF THIS TIMING WINDOW MUST FIRST BE INSPECTED BY A QUALIFIED BIOLOGIST TO DETERMINE THE PRESENCE OF NESTING BIRDS OR NESTS.
 3. THE WEATHER FORECAST SHOULD BE CONTINUALLY MONITORED TO ENSURE THAT WORKS ARE UNDERTAKEN ONLY DURING FAVOURABLE WEATHER CONDITIONS.
 4. COMPLETE THE WORKS WITH MINIMAL AVOIDABLE INTERRUPTIONS ONCE THEY COMMENCE.

- SITE AND MATERIAL MANAGEMENT**
1. ALL CONSTRUCTION EQUIPMENT AND MATERIALS (IMPORTED OR EXCAVATED) MUST BE STORED AT LEAST 30 m AWAY FROM ANY WATERBODY IN A STABLE AREA ABOVE THE ACTIVE FLOODPLAIN, OR IN A DESIGNATED STORAGE AREA.
 2. IN THE EVENT OF AN UNEXPECTED STORM, ALL UNFIXED ITEMS THAT HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW MUST BE MOVED TO A STABLE AREA ABOVE ACTIVE FLOODPLAIN.
 3. STOCKPILES MUST BE LOCATED OUTSIDE THE ISOLATED WORK AREAS.
 4. STABILIZE, TEMPORARILY OR PERMANENTLY, ANY DISTURBED AREAS AS WORK PROGRESSES, OR SOON AS CONDITIONS ALLOW.
 5. MINIMIZE THE AREA OF DISTURBANCE TO THE EXTENT POSSIBLE. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED USING APPROPRIATE EROSION CONTROL MEASURES AND AN APPROPRIATE SEED MIX WITHIN THE FINAL APPROVED RESTORATION PLAN.
 6. ALL VEGETATION ADJACENT TO THE WORK AREA MUST BE PROTECTED AND DELINEATED WITH CONSTRUCTION FENCING OR TREE PROTECTION BARRIERS.
 7. ALL GRADES IN THE AREA REGULATED BY THE CONSERVATION AUTHORITY MUST BE MAINTAINED OR MATCHED, UNLESS OTHERWISE AUTHORIZED IN THE APPLICABLE PERMIT.
 8. AN AFTER-HOURS CONTACT NUMBER IS TO BE VISIBLY POSTED ON-SITE FOR EMERGENCIES. ALL PLANS SHOULD HAVE NAME AND CONTACT INFO OF THE PERSON RESPONSIBLE FOR ESC MEASURES.

- EROSION AND SEDIMENT CONTROL**
1. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES MUST BE INSTALLED PRIOR TO START OF WORKS.
 2. FOLLOWING INSTALLATION OF THE PROPOSED ESC MEASURES, A QUALIFIED AGENT OF THE PROPONENT (E.G. CAN/CSQ CERTIFIED MONITOR) WILL CONDUCT REGULAR SITE VISITS TO MONITOR ALL WORKS, PARTICULARLY THE CONDITION OF THE ESC MEASURES, DEWATERING, AND IN- OR NEAR-WATER WORKS. SHOULD CONCERNS ARISE, THE ENVIRONMENTAL MONITOR WILL CONTACT THE PROPONENT, THE CONSERVATION AUTHORITY, AND ANY OTHER APPROPRIATE PARTIES.
 3. EROSION AND SEDIMENT CONTROLS MUST BE MAINTAINED DURING CONSTRUCTION, AND ANY REQUIRED REPAIRS OR RE-ADJUSTMENTS MUST BE COMPLETED WITHIN 24 HOURS AFTER THEY HAVE BEEN IDENTIFIED DURING THE MONITORING.
 4. EROSION AND SEDIMENT CONTROLS MAY REQUIRE PERIODIC ADJUSTMENTS TO REFLECT CHANGING SITE CONDITIONS. THE CONTRACTOR WILL BE RESPONSIBLE FOR THESE ADJUSTMENTS TO ENSURE PROPER FUNCTION.
 5. ANY CHANGES TO THE EROSION AND SEDIMENT CONTROL PLAN BEYOND MINOR ADJUSTMENTS MUST BE APPROVED BY THE CONTRACT ADMINISTRATOR.
 6. ADDITIONAL EROSION AND SEDIMENT CONTROL SUPPLIES MUST BE KEPT ON SITE IN ORDER TO FACILITATE IMMEDIATE REPAIRS AND/OR UPGRADES AS NEEDED.
 7. ALL TEMPORARY SEDIMENT CONTROLS MUST BE REMOVED AFTER THE CONTRACT ADMINISTRATOR DEEMS THE SITE TO BE STABLE.
 8. THE PROJECT PROPONENT OR THEIR REPRESENTATIVE IS ULTIMATELY RESPONSIBLE FOR CONTROLLING SEDIMENT AND EROSION WITHIN THE CONSTRUCTION SITE FOR THE TOTAL PERIOD OF THE CONSTRUCTION.
 9. IF EXCESSIVE SILTATION RESULTS FROM THE CONSTRUCTION ACTIVITIES, THE ON-SITE SUPERVISOR/INSPECTOR AND/OR THE LOCAL REGULATORY BODY RESERVE THE RIGHT TO REQUEST ADDITIONAL ESC MEASURES WHICH WOULD BE INSTALLED PRIOR TO FURTHER CONSTRUCTION ACTIVITIES.

- DELETERIOUS SUBSTANCE CONTROL/SPILL MANAGEMENT**
1. PREVENT THE RELEASE OF SEDIMENT, SEDIMENT-LOADED WATER, RAW CONCRETE, CONCRETE LEACHATE OR ANY OTHER DELETERIOUS SUBSTANCES INTO ANY WATERBODY, RAVINE OR STORM SEWER SYSTEM.
 2. ENSURE EQUIPMENT AND MACHINERY ARE IN GOOD OPERATING CONDITION (POWER WASHED), FREE OF LEAKS, EXCESS OIL, AND GRISE.
 3. NO EQUIPMENT REFUELLING OR SERVICING SHOULD BE UNDERTAKEN WITHIN 30 m OF ANY WATERCOURSE OR SURFACE WATER DRAINAGE.
 4. A SPILL CONTAINMENT KIT MUST BE READILY ACCESSIBLE ON SITE IN THE EVENT OF A RELEASE OF A DELETERIOUS SUBSTANCE TO THE ENVIRONMENT. ON-SITE STAFF MUST BE TRAINED IN ITS USE.
 5. THE CONTRACT ADMINISTRATOR MUST BE NOTIFIED IMMEDIATELY IN THE EVENT OF A SPILL OF DELETERIOUS SUBSTANCE. ANY SEDIMENT SPILL FROM THE SITE SHOULD BE REPORTED TO MINISTRY OF ENVIRONMENT (SPILL ACTION CENTER) AT 1-800-268-6969.

- WORK AREA ISOLATION**
1. ALL WORK IN ISOLATED WORK AREAS MUST BE COMPLETED IN THE DRY. AN ADEQUATE NUMBER OF PUMPS MUST BE USED FOR UNWATERING.
 2. CROSSING AN ACTIVE WATERCOURSE OR WETLAND BY EQUIPMENT, VEHICLES, PERSONNEL, ETC. IS NOT PERMITTED UNLESS APPROVED BY THE CONSERVATION AUTHORITY. ALL ACCESS TO WORK SITES SHALL BE FROM EITHER SIDES OF THE WATERCOURSE OR WETLAND.
 3. THE UNWATERING DISCHARGE LOCATION MUST BE LOCATED AT LEAST 30 m FROM ANY WATERCOURSE OR WETLAND IN AN AREA WITH DENSE VEGETATIVE GROUND COVER, AND WHERE THE DISCHARGE CAN RETURN TO THE WATERBODY DOWNSTREAM OF THE WORK AREA OVER THE GROUND COVER.
 4. FISH MUST BE REMOVED FROM THE WORK AREA ONCE ISOLATED. FISH SALVAGE MUST BE COMPLETED BY A QUALIFIED TECHNICIAN WITH A LICENSE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES.

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1.0	16/09/2024	AS	FIRST EIR SUBMISSION
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DESIGNED BY: LD/AS		CHECKED BY: PV	
DRAWN BY: SC/RS		DATE: MARCH 2026	

DRAFT FOR INTERNAL DISCUSSION

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**ALLOA SPA PHASE 1
TOWN OF CALEDON**

**ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
RESTORATION DETAILS**

PROJECT No.: PN24018	DRAWING No.: DET-5
SCALE: AS NOTED	SHEET 12 OF 15

SCALED FOR PLOT ON 'ARCH D'

TRCA - ONTARIO WET MEADOW

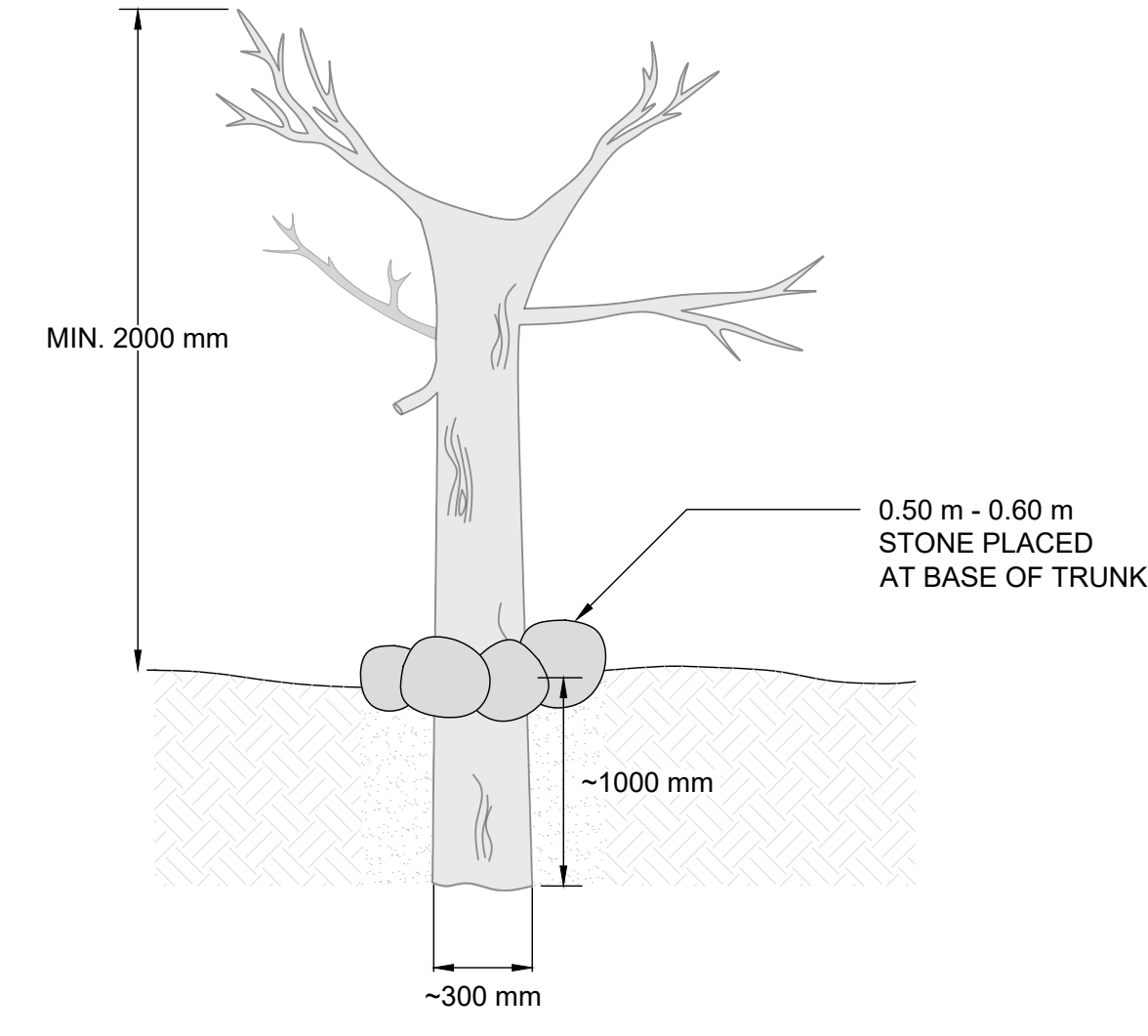
SCIENTIFIC NAME	COMMON NAME	PERCENTAGE
ASCLEPIAS INCARNATA	SWAMP MILKWEED	2%
BROMUS CILIATUS	FRINGED BROME	2%
CAREX BEBBII	BEBB'S SEDGE*	1%
CAREX STIPATA	AWL-FRUITED SEDGE	1%
CAREX VULPINOIDEA	FOX SEDGE	5%
DOELLINGERIA UMBELLATA	FLAT-TOPPED ASTER	1%
ELYMUS RIPARIUS	RIVERBANK RYE	10%
ELYMUS VIRGINICUS	VIRGINIA WLID RYE	10%
EUPATORIUM MACULATUM	JOE-PYE WEED	3%
EUPATORIUM PERFOOLIATUM	BONESET	2%
GLYCERIA STRIATA	FOWL MANNA GRASS	3%
JUNCUS ARTICULATUS	JOINTED RUSH	2%
JUNCUS BALTICUS	BALTIC RUSH	1%
JUNCUS EFFUSUS	SOFT RUSH	1%
JUNCUS TENUIS	PATH RUSH	2%
JUNCUS TORREYI	TORREY'S RUSH*	1%
LIATRIS SPICATA	DENSE BLAZING STAR	1%
LOBELIA CARDINALIS	CARDINAL FLOWER	1%
LOBELIA SIPHILITICA	BLUE LOBELIA	1%
MIMULUS RINGENS	MONKEY FLOWER	1%
MONARDA FISTULOSA	WILD BERGAMONT	3%
OENOTHERA BIENNIS	EVENING PRIMROSE	2%
PANICUM VIRIGATUM	SWITCH GRASS	10%
PENSTEMON DIGITALIS	FOXGLOVE BEARDTONGUE	2%
PHYSOSTEGIA VIRGINIANA SSP. VIRGINIANA	FALSE DRAGONHEAD OR OBEDIENT PLANT	2%
RUDBECKIA HIRTA	BLACK EYED SUSAN	5%
RUDBECKIA LACINIATA	GREEN CONEFLOWER*	1%
SCIRPUS ATROVIRENS	GREEN BULRUSH	3%
SCIRPUS CYPERINUS	WOOLGRASS BULRUSH	3%
SOLIDAGO GRAMINIFOLIA	LANCE-LEAVED GOLDENROD*	1%
SORGHASTRUM NUTANS	INDIAN GRASS	7%
SYMPHYOTRICHUM ERICOIDES	HEATH ASTER	2%
SYMPHYOTRICHUM NOVAE-ANGLIAE	NEW ENGLAND ASTER	1%
SYMPHYOTRICHUM PILOSUM	HAIRY ASTER	2%
SYMPHYOTRICHUM PUNICEUM	SWAMP ASTER	2%
VERBENA HASTATA	BLUE VERVAIN	3%

- NOTES:**
1. APPLY SEED MIX AT A RATE OF 16 kg PER HECTARE.
 2. SEEDING SHALL OVERLAP ADJACENT GROUND COVER BY 300 mm.
 3. SIMULTANEOUSLY APPLY A NURSE CROP AT A RATE OF 30 kg PER HECTARE
 4. WATER SOIL AFTER SEED APPLICATION.

TRCA - RIPARIAN MIX

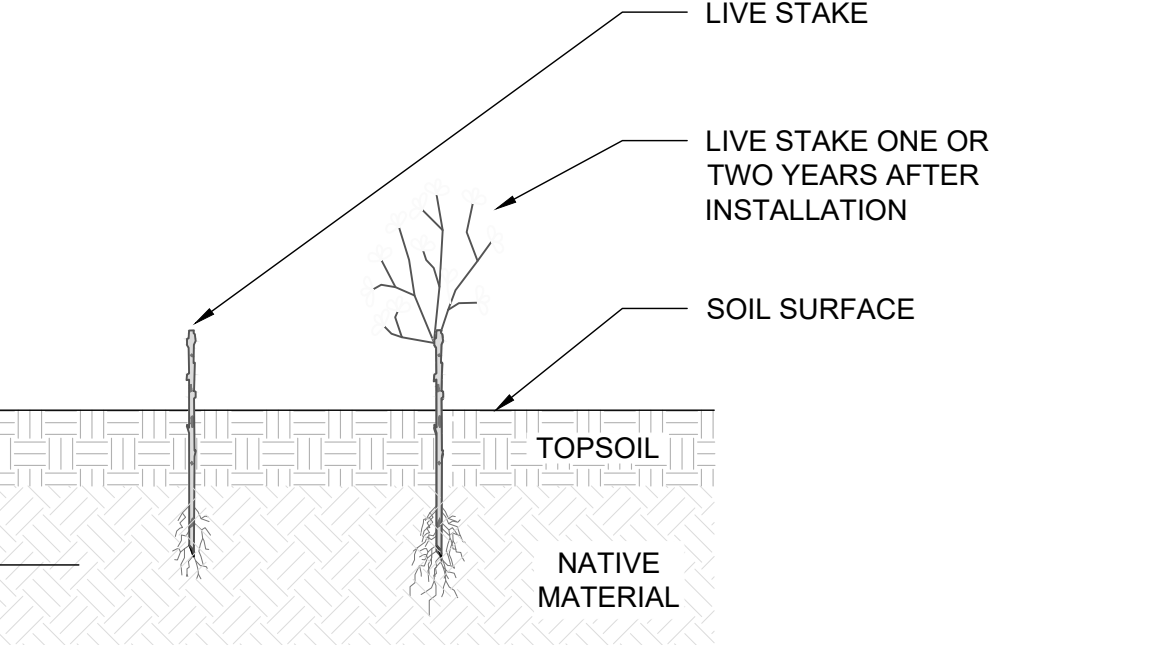
SCIENTIFIC NAME	COMMON NAME	PERCENTAGE
ASCLEPIAS INCARNATA	SWAMP MILKWEED	1.0%
BROMUS CILIATUS	FRINGED BROME	5.0%
CAREX BEBBII	BEBB'S SEDGE*	1.0%
CAREX STIPATA	AWL-FRUITED SEDGE	1.0%
CAREX VULPINOIDEA	FOX SEDGE	5.0%
DOELLINGERIA UMBELLATA	FLAT-TOPPED ASTER	1.0%
ELYMUS RIPARIUS	RIVERBANK RYE	15.0%
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	20.0%
EUPATORIUM MACULATUM	JOE-PYE WEED	2.0%
EUPATORIUM PERFOOLIATUM	BONESET	2.0%
GLYCERIA STRIATA	FOWL MANNA GRASS	5.0%
JUNCUS ARTICULATUS	JOINTED RUSH	1.0%
JUNCUS BALTICUS	BALTIC RUSH	1.0%
JUNCUS EFFUSUS	SOFT RUSH	1.0%
JUNCUS TENUIS	PATH RUSH	1.0%
JUNCUS TORREYI	TORREY'S RUSH*	1.0%
LIATRIS SPICATA	DENSE BLAZING STAR	1.0%
LOBELIA CARDINALIS	CARDINAL FLOWER	1.0%
LOBELIA SIPHILITICA	BLUE LOBELIA	1.0%
MIMULUS RINGENS	MONKEY FLOWER	1.0%
MONARDA FISTULOSA	WILD BERGAMONT	4.0%
OENOTHERA BIENNIS	EVENING PRIMROSE	1.0%
PANICUM VIRIGATUM	SWITCH GRASS	5.0%
PENSTEMON DIGITALIS	FOXGLOVE BEARDTONGUE	2.0%
PHYSOSTEGIA VIRGINIANA SSP. VIRGINIANA	FALSE DRAGONHEAD OR OBEDIENT PLANT	2.0%
RUDBECKIA HIRTA	BLACK EYED SUSAN	2.0%
RUDBECKIA LACINIATA	GREEN CONEFLOWER*	1.0%
SCIRPUS ATROVIRENS	GREEN BULRUSH	4.0%
SCIRPUS CYPERINUS	WOOLGRASS BULRUSH	4.0%
SOLIDAGO GRAMINIFOLIA	LANCE-LEAVED GOLDENROD*	1.0%
SYMPHYOTRICHUM NOVAE-ANGLIAE	NEW ENGLAND ASTER	2.0%
SYMPHYOTRICHUM PILOSUM	HAIRY ASTER	2.0%
SYMPHYOTRICHUM PUNICEUM	SWAMP ASTER	1.0%
VERBENA HASTATA	BLUE VERVAIN	2.0%

- NOTES:**
1. APPLY SEED MIX AT A RATE OF 22 kg PER HECTARE.
 2. SEEDING SHALL OVERLAP ADJACENT GROUND COVER BY 300 mm.
 3. SIMULTANEOUSLY APPLY A NURSE CROP AT A RATE OF 30 kg PER HECTARE
 4. WATER SOIL AFTER SEED APPLICATION.



- NOTES**
1. CONSTRUCT WITH CONIFER TRUNKS WITH TWO OR MORE NATURAL BRANCHES.
 2. AT LEAST 75% OF THE BARK SHOULD BE INTACT.
 3. AUGER HOLE TO A DEPTH OF ~1.0 m INSTALL TRUNK AND TAMP IN SAND AROUND BASE.
 4. ~1.0 m OF TRUNK IS TO BE BURIED.
 5. PLACE 0.50 m - 0.60 m STONE AROUND BASE FOR ADDITIONAL SUPPORT.
 6. IF ROOT WAD IS USED PLACE ROOT AT TOP.
 7. LOGS SHOULD BE SOURCED ON SITE (WHERE POSSIBLE).

RAPTOR POLE
N.T.S.



DIVERSE STREAM BANK PLANTING

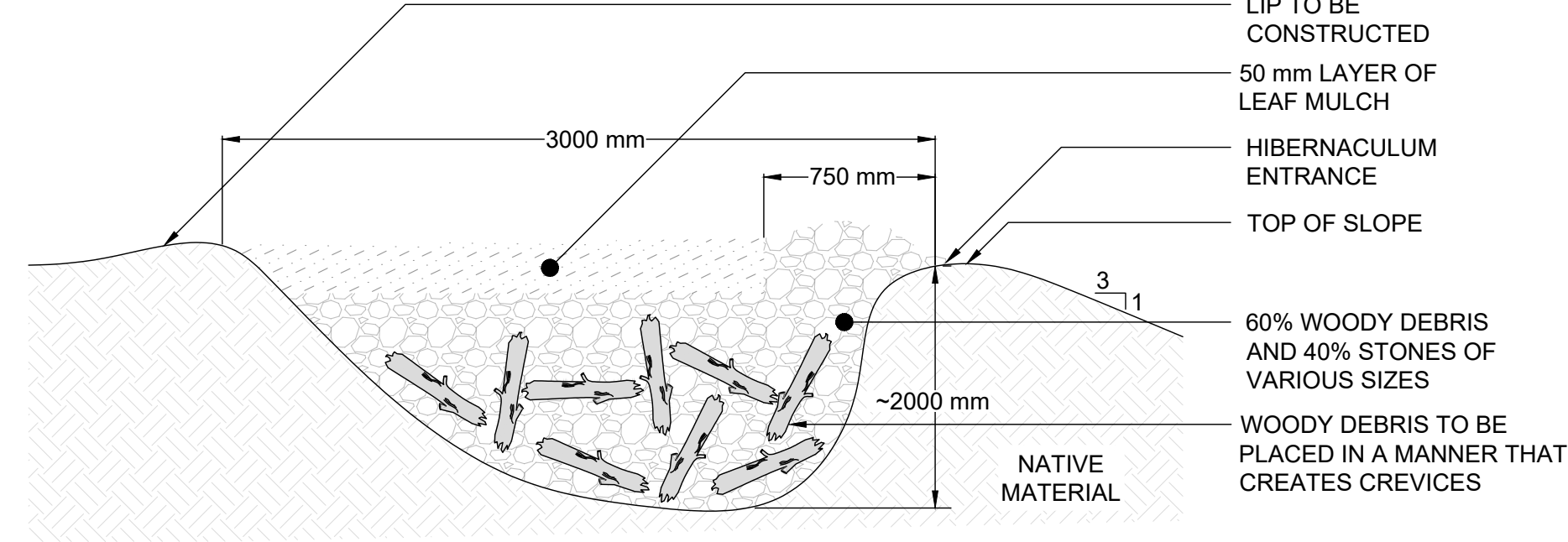
SCIENTIFIC NAME	COMMON NAME	CONDITION
CORNUS SERICEA	RED OSIER DOGWOOD	1 m, LIVE STAKE
PHYSOCARPUS OPULIFOLIUS	COMMON NINEBARK	1 m, LIVE STAKE
SALIX BEBBIANA	BEBB'S WILLOW	1 m, LIVE STAKE
SALIX DISCOLOR	PUSSY WILLOW	1 m, LIVE STAKE
SALIX EXIGUA	SANDBAR WILLOW	1 m, LIVE STAKE
SALIX LUCIDA	SHINING WILLOW	1 m, LIVE STAKE
SAMBUCUS CANADENSIS	COMMON ELDERBERRY	1 m, LIVE STAKE

- NOTES**
1. QUANTITY TO BE DETERMINED BASED ON AREA OF DISTURBANCE TO BE RESTORED
 2. LIVE STAKES SHOULD BE FROM AT MINIMUM 2-YEAR OLD STOCK.
 3. LIVE STAKES ARE TO BE INSTALLED AT A DENSITY OF 3 STAKES PER SQUARE METRE.
 4. LIVE STAKES SHOULD BE PRE-SOAKED (SUBMERGED IN WATER) FOR AT LEAST 24 HOURS AFTER HARVESTING AND IMMEDIATELY BEFORE INSTALLATION.
 5. LIVE STAKES SHOULD NOT BE STORED FOR A PERIOD LONGER THAN 2 DAYS, UNLESS THEY ARE BEING SOAKED.
 6. THE CONTRACTOR SHALL PROTECT PLANT MATERIALS FROM DRYING FROM THE TIME OF HARVEST UNTIL INSTALLED.
 7. LIVE STAKES ARE TO BE A MINIMUM OF 25 mm IN DIAMETER AND CUT TO A LENGTH OF 1000 mm.
 8. CUT ANGLE AT THE BOTTOM OF THE STAKE AND FLAT ON THE TOP.
 9. TRIM ALL SIDE BRANCHES WHILE TAKING CARE NOT TO DAMAGE THE BARK.
 10. INSTALL STAKES WITH BUDS POINTING UPWARDS AND THICKER STEM IN THE BED.
 11. LIVE STAKES SHOULD BE INSTALLED USING A LARGE RUBBER Mallet.
 12. 80% OF THE STAKE IS TO BE BELOW SURFACE.
 13. TAMP THE LIVE STAKE INTO THE GROUND AT RIGHT ANGLE TO THE SURFACE.
 14. IN COMPACT SOIL A PILOT HOLE SHOULD BE USED TO LIMIT DAMAGE TO THE STAKES.
 15. IF USING A PILOT HOLE REPACK SOIL AROUND THE LIVE STAKE.
 16. LIVE STAKES SHOULD STAND FIRM FROM THE SOIL FOLLOWING INSTALLATION.
 17. ALL STAKES NOT PLANTED TO THE SPECIFICATIONS ABOVE WILL BE REPLACED AT THE CONTRACTOR'S EXPENSE.

LIVE STAKING
N.T.S.

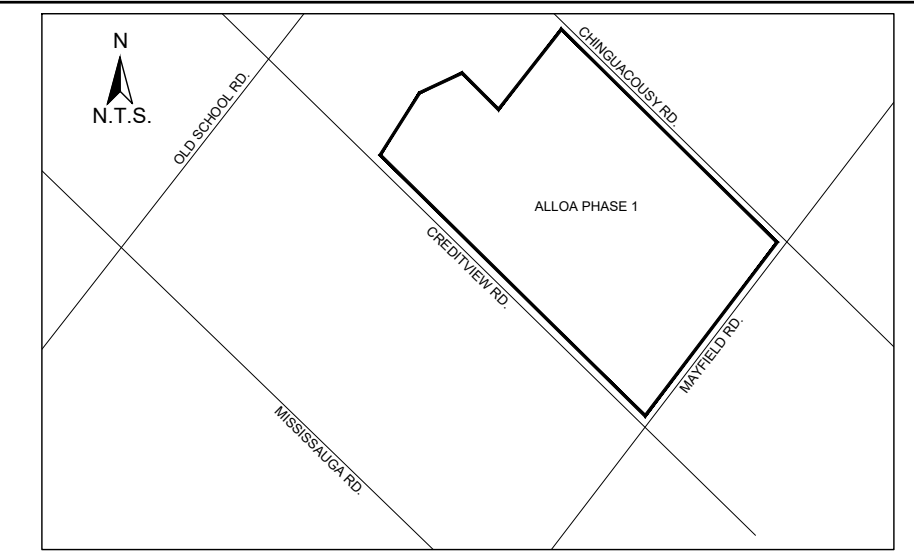
EROSION CONTROL BLANKET SPECIFICATIONS

1. A BIODEGRADABLE EROSION CONTROL BLANKET (ECB) SHALL BE INSTALLED ON ALL DISTURBED NATURAL SURFACES FOLLOWING THE PLACEMENT OF TOPSOIL AND APPLICATION OF THE NATIVE SEED MIX.
2. THE ECB MUST BE CONSTRUCTED OF 100% WOVEN COCONUT FIBRE (E.G. COIR) OR STRAW MAT WITHIN A GEOJUTE NETTING (TOP AND BOTTOM) WITH BIODEGRADABLE THREAD. NON-BIODEGRADABLE MATERIAL INCLUDING POLYPROPYLENE OR PLASTICS WITH A BIODEGRADABLE RATING ARE NOT ACCEPTABLE. THE MINIMUM WEIGHT OF THE ECB MUST BE 400 g/m² (12 oz./yd²).
3. TO INSTALL, THE ECB MUST BE UNROLLED DOWNSLOPE OR IN DIRECTION OF WATER FLOW. ADJACENT ECBs SHOULD OVERLAP A MINIMUM OF 150 mm ALONG THE EDGES. AT THE END OF EACH ROLL, FOLD BACK 100 mm TO 200 mm OF THE ECB. OVERLAP THIS 100 mm TO 200 mm OVER THE START OF THE NEXT ROLL. SECURE THE TWO LAYERS TO THE GROUND SECURELY.
4. BIODEGRADABLE OR TAPERED WOODEN STAKES SHALL BE USED TO SECURE THE BLANKET. STAKES SHALL BE INSTALLED AT THE SPACING RECOMMENDED BY THE ECB MANUFACTURER TO PREVENT SURFACE RUNOFF FROM ERODING THE UNDERLYING SOIL.



- NOTES**
1. SNAKE HIBERNACULUM PLACEMENT TO BE CONFIRMED BY A QUALIFIED BIOLOGIST.
 2. SNAKE HIBERNACULUM TO BE CONSTRUCTED INTO TOP OF SLOPE (SEE PLAN) ALONG WEST OR SOUTH FACING SLOPES IN A LOCATION FREE OF SHADE.
 3. A LIP IS TO BE CONSTRUCTED ALONG THE TOP OF SLOPE TO PREVENT RUNOFF FROM ENTERING THE HIBERNACULUM.
 4. LARGER STONES WITH BRUSH TO BE INSTALLED AT OPENING. DO NOT FILL VOIDS OR COMPACT MATERIAL AROUND STONES. CREATE CREVICES TO PROMOTE ENTRANCE INTO HIBERNACULUM.
 5. LOOSELY PLACE ANGULAR STONE RANGING IN SIZE FROM 0.10 m - 0.50 m AND WOODY DEBRIS SUCH THAT VOIDS REMAIN.
 6. CONCRETE DEBRIS MAY BE USED IF SOURCED ON SITE.
 7. HARDWOOD OR SOFTWOOD SPECIES ARE ACCEPTABLE FOR WOODY DEBRIS. LOGS SHOULD BE SOURCED ON SITE (WHERE POSSIBLE).

SNAKE HIBERNACULUM
N.T.S.



KEY MAP
N.T.S.

- GENERAL NOTES**
1. THE ACCOMPANYING CHANNEL REALIGNMENT TECHNICAL DESIGN BRIEF PREPARED BY GEO MORPHIX LTD. (2025) PROVIDES ADDITIONAL DESIGN DETAILS AND DIRECTION FOR IMPLEMENTATION AND IS TO BE REVIEWED IN CONJUNCTION WITH THIS DRAWING SET.
 2. ALL CONTRACT DRAWINGS, SPECIFICATIONS AND APPLICABLE PERMITS MUST BE KEPT ON SITE DURING CONSTRUCTION FOR REFERENCE.
 3. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGNER AND CONTRACT ADMINISTRATOR OF THE INTENT TO COMMENCE WORK AT LEAST 48 HOURS IN ADVANCE.
 4. THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY LOCATES.
 5. LAYOUT MUST BE REVIEWED AND APPROVED BY THE DESIGNER / DESIGNER REPRESENTATIVE, DESIGNATED ENGINEER AND THE CONTRACT ADMINISTRATOR.
 6. CONSTRUCTION OBSERVATION IS TO BE PERFORMED BY A CERTIFIED FLUVIAL, GEOMORPHOLOGIST OR EXPERIENCED ENVIRONMENTAL INSPECTOR UNDER DIRECTION FROM THE DESIGNER.
 7. ON-SITE SUPPORT FROM PROJECT ENGINEER (E.G., GEOTECHNICAL, HYDROGEOLOGICAL, AND/OR WATER RESOURCES ENGINEER) REQUIRED TO ASSESS AND ENSURE FAVOURABLE SURFICIAL AND SUBSURFACE CONDITIONS TO SUPPORT CHANNEL REALIGNMENT CONSTRUCTION.
 8. BE ADVISED THAT THE LOCAL REGULATORY BODY MAY, AT ANY TIME, WITHDRAW THIS PERMISSION, IF, IN THE OPINION OF THE AUTHORITY, THE CONDITIONS OF THE PERMIT ARE NOT BEING COMPLIED WITH. THIS APPROVAL DOES NOT EXEMPT THE PROPERTY OWNER/APPLICANT/AGENT FROM THE PROVISIONS OF ANY OTHER FEDERAL, PROVINCIAL OR MUNICIPAL STATUTES, REGULATIONS OR BY-LAWS, OR ANY RIGHTS UNDER COMMON LAW.

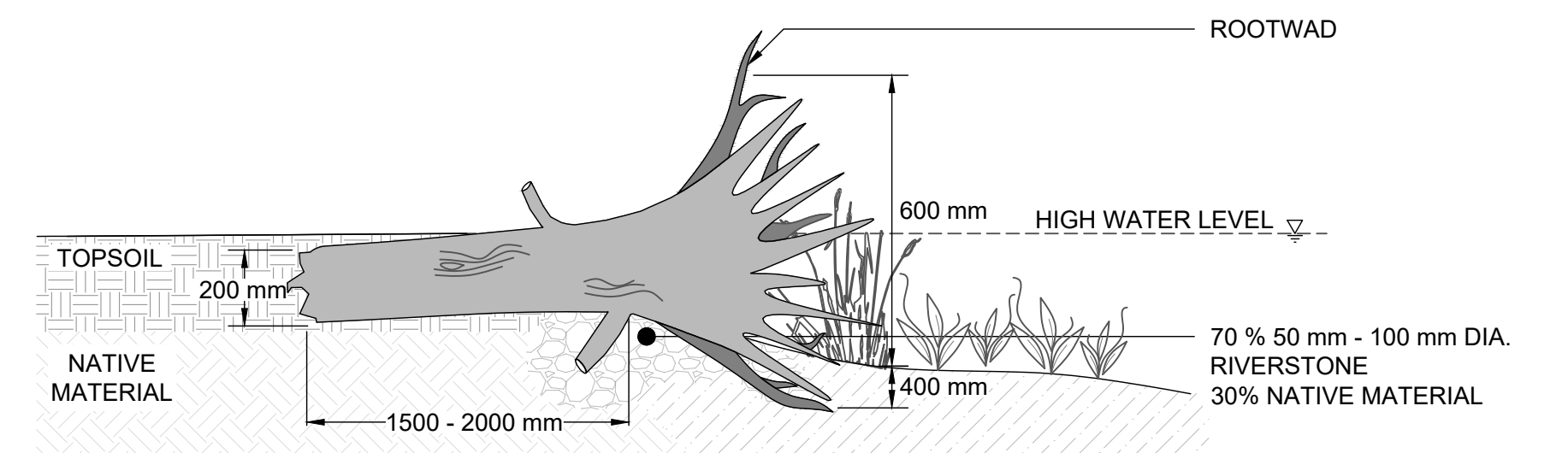
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 3. THE WEATHER FORECAST SHOULD BE CONTINUALLY MONITORED TO ENSURE THAT WORKS ARE UNDERTAKEN ONLY DURING FAVOURABLE WEATHER CONDITIONS.
 4. COMPLETE THE WORKS WITH MINIMAL AVOIDABLE INTERRUPTIONS ONCE THEY COMMENCE.

- SITE AND MATERIAL MANAGEMENT**
1. ALL CONSTRUCTION EQUIPMENT AND MATERIALS (IMPORTED OR EXCAVATED) MUST BE STORED AT LEAST 30 m AWAY FROM ANY WATERBODY IN A STABLE AREA ABOVE THE ACTIVE FLOODPLAIN, OR IN A DESIGNATED STORAGE AREA.
 2. IN THE EVENT OF AN UNEXPECTED STORM, ALL UNFIXED ITEMS THAT HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW MUST BE MOVED TO A STABLE AREA ABOVE ACTIVE FLOODPLAIN.
 3. STOCKPILES MUST BE LOCATED OUTSIDE THE ISOLATED WORK AREAS.
 4. STABILIZE, TEMPORARILY OR PERMANENTLY, ANY DISTURBED AREAS AS WORK PROGRESSES, OR SOON AS CONDITIONS ALLOW.
 5. MINIMIZE THE AREA OF DISTURBANCE TO THE EXTENT POSSIBLE. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED USING APPROPRIATE EROSION CONTROL MEASURES AND AN APPROPRIATE SEED MIX AS NOTED WITHIN THE FINAL APPROVED RESTORATION PLAN.
 6. ALL VEGETATION ADJACENT TO THE WORK AREA MUST BE PROTECTED AND DELINEATED WITH CONSTRUCTION FENCING OR TREE PROTECTION BARRIERS.
 7. ALL GRADES IN THE AREA REGULATED BY THE CONSERVATION AUTHORITY MUST BE MAINTAINED OR MATCHED, UNLESS OTHERWISE AUTHORIZED IN THE APPLICABLE PERMIT.
 8. AN AFTER-HOURS CONTACT NUMBER IS TO BE VISIBLY POSTED ON-SITE FOR EMERGENCIES. ALL THE PLANS SHOULD HAVE NAME AND CONTACT INFO OF THE PERSON RESPONSIBLE FOR ESC MEASURES.

- EROSION AND SEDIMENT CONTROL**
1. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES MUST BE INSTALLED PRIOR TO START OF WORKS.
 2. FOLLOWING INSTALLATION OF THE PROPOSED ESC MEASURES, A QUALIFIED AGENT OF THE PROPONENT (E.G. CAN/CSCE CERTIFIED MONITOR) WILL CONDUCT REGULAR SITE VISITS TO MONITOR ALL WORKS, PARTICULARLY THE CONDITION OF THE ESC MEASURES, DEWATERING, AND IN- OR NEAR-WATER WORKS. SHOULD CONCERNS ARISE, THE ENVIRONMENTAL MONITOR WILL CONTACT THE PROPONENT, THE CONSERVATION AUTHORITY, AND ANY OTHER APPROPRIATE PARTIES.
 3. EROSION AND SEDIMENT CONTROLS MUST BE MAINTAINED DURING CONSTRUCTION, AND ANY REQUIRED REPAIRS OR RE-ADJUSTMENTS MUST BE COMPLETED WITHIN 24 HOURS AFTER THEY HAVE BEEN IDENTIFIED DURING THE MONITORING.
 4. EROSION AND SEDIMENT CONTROLS MAY REQUIRE PERIODIC ADJUSTMENTS TO REFLECT CHANGING SITE CONDITIONS. THE CONTRACTOR WILL BE RESPONSIBLE FOR THESE ADJUSTMENTS TO ENSURE PROPER FUNCTION.
 5. ANY CHANGES TO THE EROSION AND SEDIMENT CONTROL PLAN BEYOND MINOR ADJUSTMENTS MUST BE APPROVED BY THE CONTRACT ADMINISTRATOR.
 6. ADDITIONAL EROSION AND SEDIMENT CONTROL SUPPLIES MUST BE KEPT ON SITE IN ORDER TO FACILITATE IMMEDIATE REPAIRS AND/OR UPGRADES AS NEEDED.
 7. ALL TEMPORARY SEDIMENT CONTROLS MUST BE REMOVED AFTER THE CONTRACT ADMINISTRATOR DEEMS THE SITE TO BE STABLE.
 8. THE PROJECT PROPONENT OR THEIR REPRESENTATIVE IS ULTIMATELY RESPONSIBLE FOR CONTROLLING SEDIMENT AND EROSION WITHIN THE CONSTRUCTION SITE FOR THE TOTAL PERIOD OF THE CONSTRUCTION.
 9. IF EXCESSIVE SILTATION RESULTS FROM THE CONSTRUCTION ACTIVITIES, THE ON-SITE SUPERVISOR/INSPECTOR AND/OR THE LOCAL REGULATORY BODY RESERVE THE RIGHT TO REQUEST ADDITIONAL ESC MEASURES WHICH WOULD BE INSTALLED PRIOR TO FURTHER CONSTRUCTION ACTIVITIES.

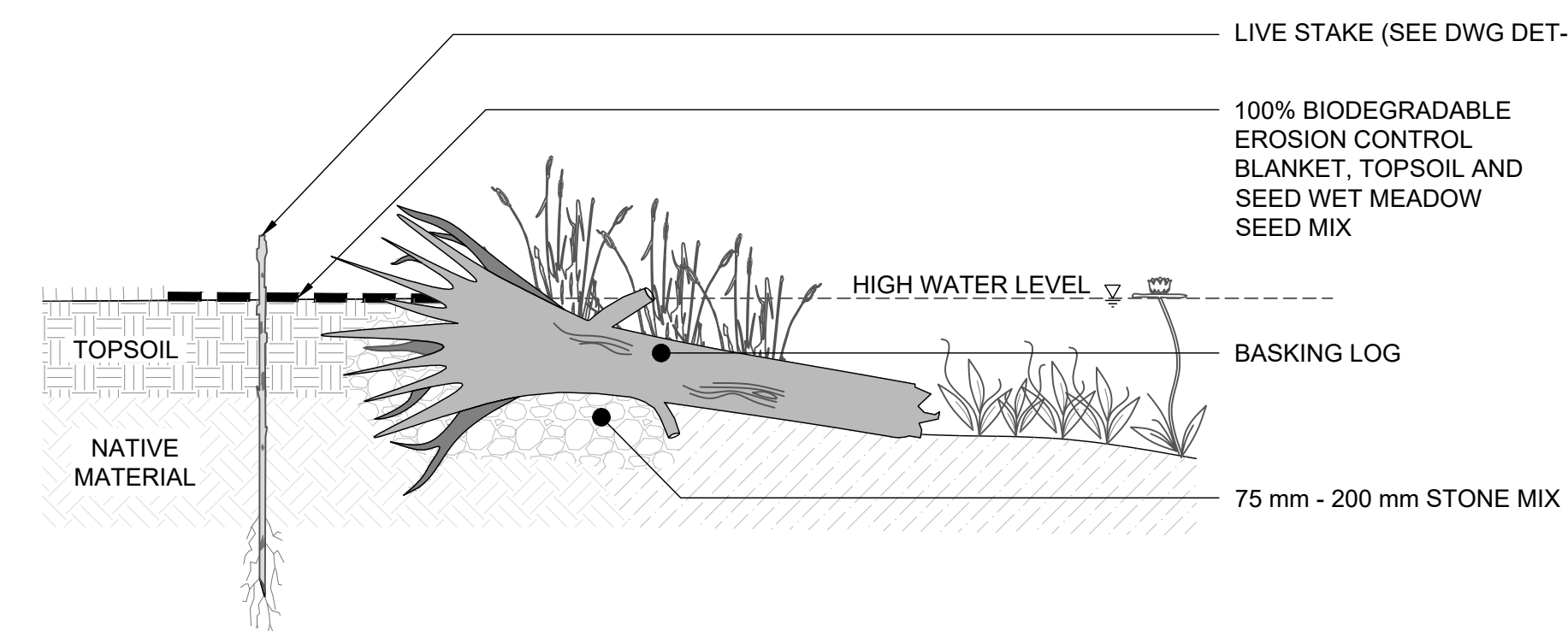
- DELETERIOUS SUBSTANCE CONTROL/SPILL MANAGEMENT**
1. PREVENT THE RELEASE OF SEDIMENT, SEDIMENT-LOADED WATER, RAW CONCRETE, CONCRETE LEACHATE OR ANY OTHER DELETERIOUS SUBSTANCES INTO ANY WATERBODY, RAVINE OR STORM SEWER SYSTEM.
 2. ENSURE EQUIPMENT AND MACHINERY ARE IN GOOD OPERATING CONDITION (POWER WASHED), FREE OF LEAKS, EXCESS OIL, AND GREASE.
 3. NO EQUIPMENT REFUELLING OR SERVICING SHOULD BE UNDERTAKEN WITHIN 30 m OF ANY WATERCOURSE OR SURFACE WATER DRAINAGE.
 4. A SPILL CONTAINMENT KIT MUST BE READILY ACCESSIBLE ON SITE IN THE EVENT OF A RELEASE OF A DELETERIOUS SUBSTANCE TO THE ENVIRONMENT. ON-SITE STAFF MUST BE TRAINED IN ITS USE.
 5. THE CONTRACT ADMINISTRATOR MUST BE NOTIFIED IMMEDIATELY IN THE EVENT OF A SPILL OF DELETERIOUS SUBSTANCE. ANY SEDIMENT SPILL FROM THE SITE SHOULD BE REPORTED TO MINISTRY OF ENVIRONMENT (SPILL ACTION CENTER) AT 1-800-268-6969.

- WORK AREA ISOLATION**
1. ALL WORK IN ISOLATED WORK AREAS MUST BE COMPLETED IN THE DRY. AN ADEQUATE NUMBER OF PUMPS MUST BE USED FOR UNWATERING.
 2. CROSSING AN ACTIVE WATERCOURSE OR WETLAND BY EQUIPMENT, VEHICLES, PERSONNEL, ETC. IS NOT PERMITTED UNLESS APPROVED BY THE CONSERVATION AUTHORITY. ALL ACCESS TO WORK SITES SHALL BE FROM EITHER SIDES OF THE WATERCOURSE OR WETLAND.
 3. THE UNWATERING DISCHARGE LOCATION MUST BE LOCATED AT LEAST 30 m FROM ANY WATERCOURSE OR WETLAND IN AN AREA WITH DENSE VEGETATIVE GROUND COVER, AND WHERE THE DISCHARGE CAN RETURN TO THE WATERBODY DOWNSTREAM OF THE WORK AREA OVER THE GROUND COVER.
 4. FISH MUST BE REMOVED FROM THE WORK AREA ONCE ISOLATED. FISH SALVAGE MUST BE COMPLETED BY A QUALIFIED TECHNICIAN WITH A LICENSE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES.



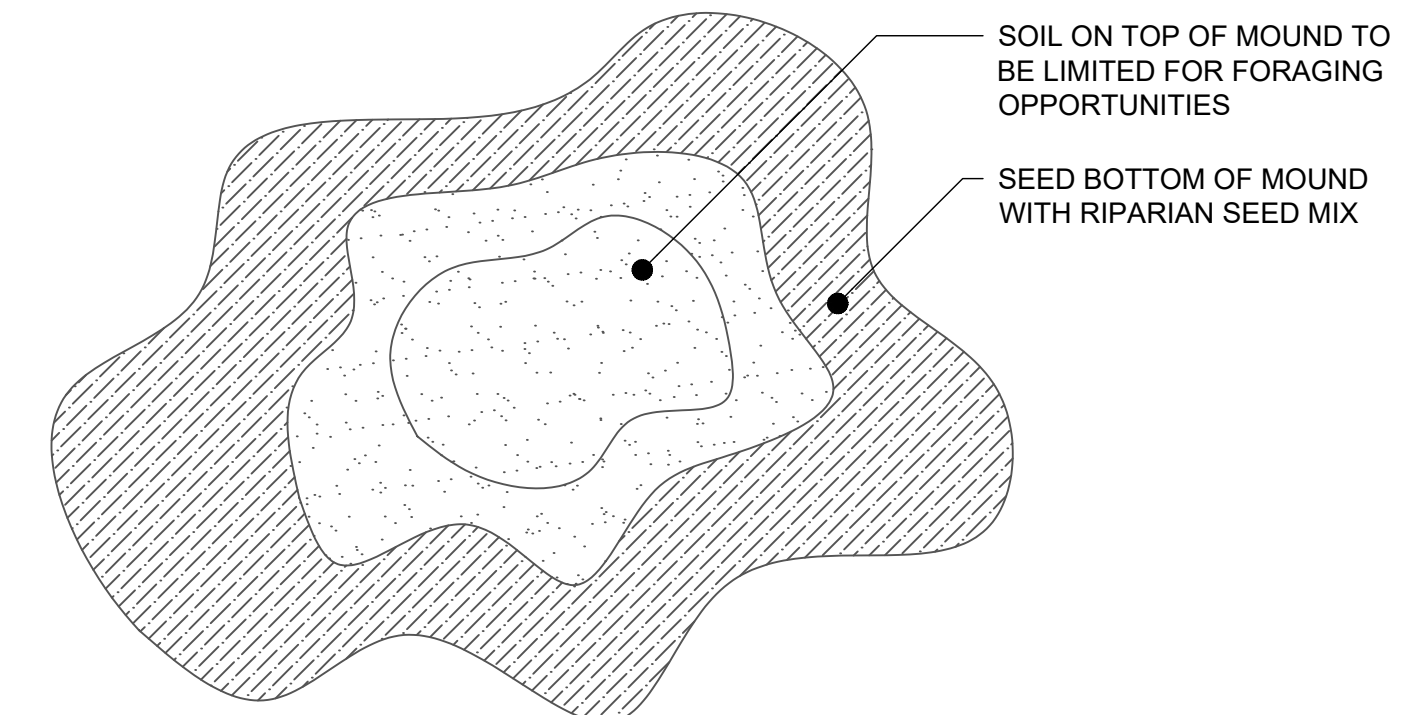
- NOTES**
1. SALVAGE NATIVE TREES ON SITE, IF POSSIBLE, AND CUT TO DIMENSIONS SHOWN.
 2. ROOT BALL TO BE ~1000 mm IN DIAMETER AND ~2000 mm IN LENGTH.
 3. INSTALL BOTTOM 1/3 OF LIVE ROOT WAD INTO WETLAND.

ROOT WAD
N.T.S.



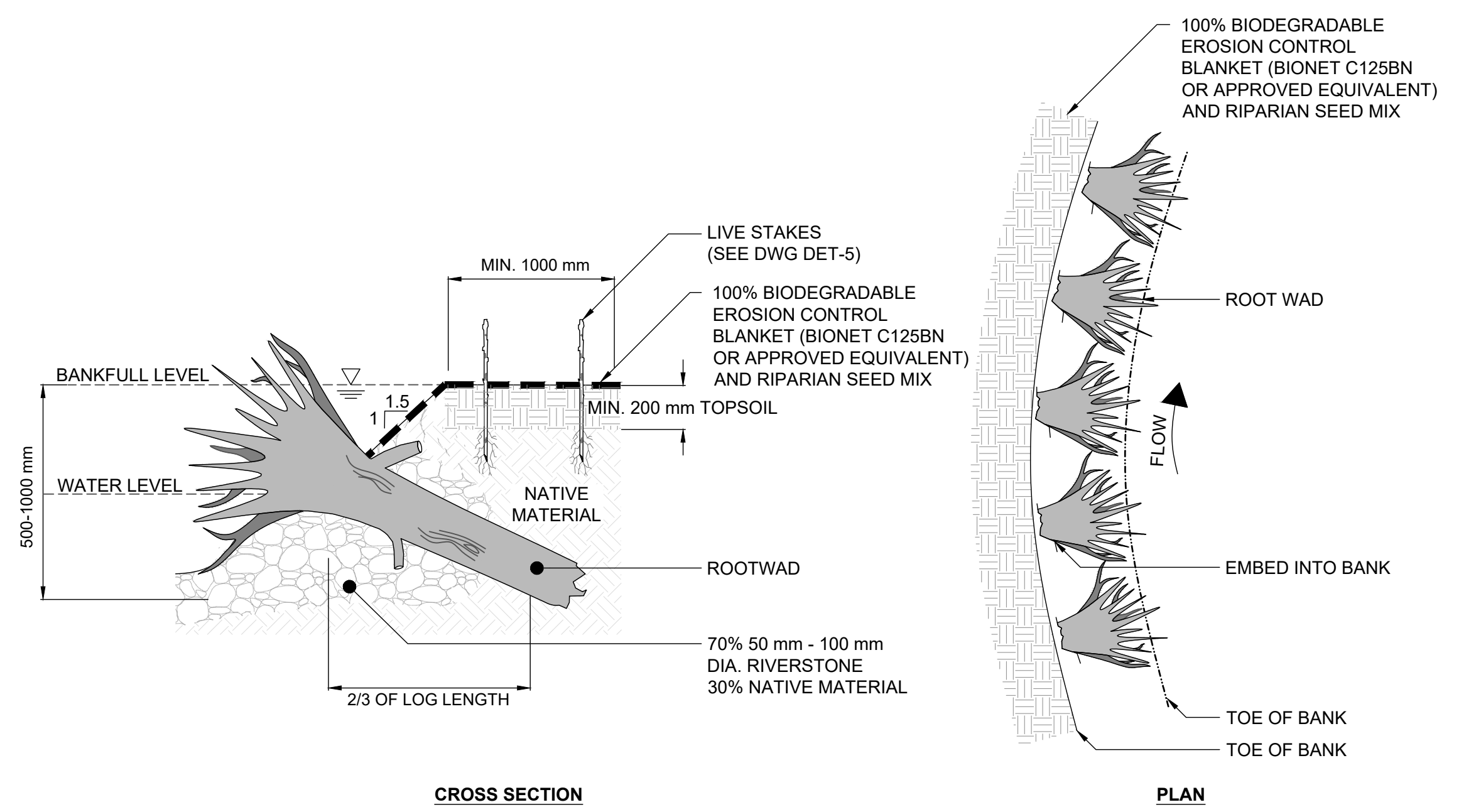
- NOTES**
1. ANCHOR AND SUPPORT BASKING LOGS WITH 75 mm - 200 mm STONE MIX.
 2. FIRMLY COMPACT STONE MIX TO PREVENT THROUGH FLOW.
 3. BURY 1/3 OF LOG INTO SOIL.
 4. LENGTH OF BASKING LOGS ARE TO BE INSTALLED 1000 - 1500 mm INTO WET AREA.
 5. BASKING LOGS TO BE A MINIMUM 500 mm IN DIAMETER AND 2000 - 2500 mm IN LENGTH.
 6. BASKING LOGS SHOULD BE ANGLED TO PROMOTE TURTLE BASKING.
 7. BASKING LOGS SHOULD BE A MIXTURE OF SUITABLE HARDWOOD AND SOFTWOOD SPECIES.

BASKING LOG
N.T.S.



- NOTES**
1. HEIGHT OF TERRESTRIAL MOUND SHALL BE 500 mm TO 1000 mm.
 2. LOCATION OF VEGETATED TERRESTRIAL MOUND IS TO BE DETERMINED BY THE DESIGNER IN FIELD, IN DRY AREAS ONLY.
 3. CONSTRUCTION OF MOUND TO BE COMPLETED IN CONJUNCTION WITH VERNAL POOL EXCAVATION.
 4. TERRESTRIAL MOUNDS TO BE GRADED TO MATCH EXISTING GROUND AND/OR TIE INTO EXISTING SLOPES.
 5. TERRESTRIAL MOUND TO BE SLIGHTLY CONCAVE/DIMPLED ON TOP.
 6. TERRESTRIAL MOUND TO BE SEEDED AND COVERED WITH 100% BIODEGRADABLE EROSION CONTROL BLANKET (BioNET C125BN OR APPROVED EQUIVALENT) IMMEDIATELY FOLLOWING SHAPING. EROSION CONTROL BLANKET TO BE SECURED WITH WOOD STAKES.
 7. SEED MIX TO BE COMPRISED OF WOODLAND SPECIES. SEE DET-1 DRAWINGS FOR SEED MIX SPECIFICATIONS.

TERRESTRIAL MOUND
N.T.S.

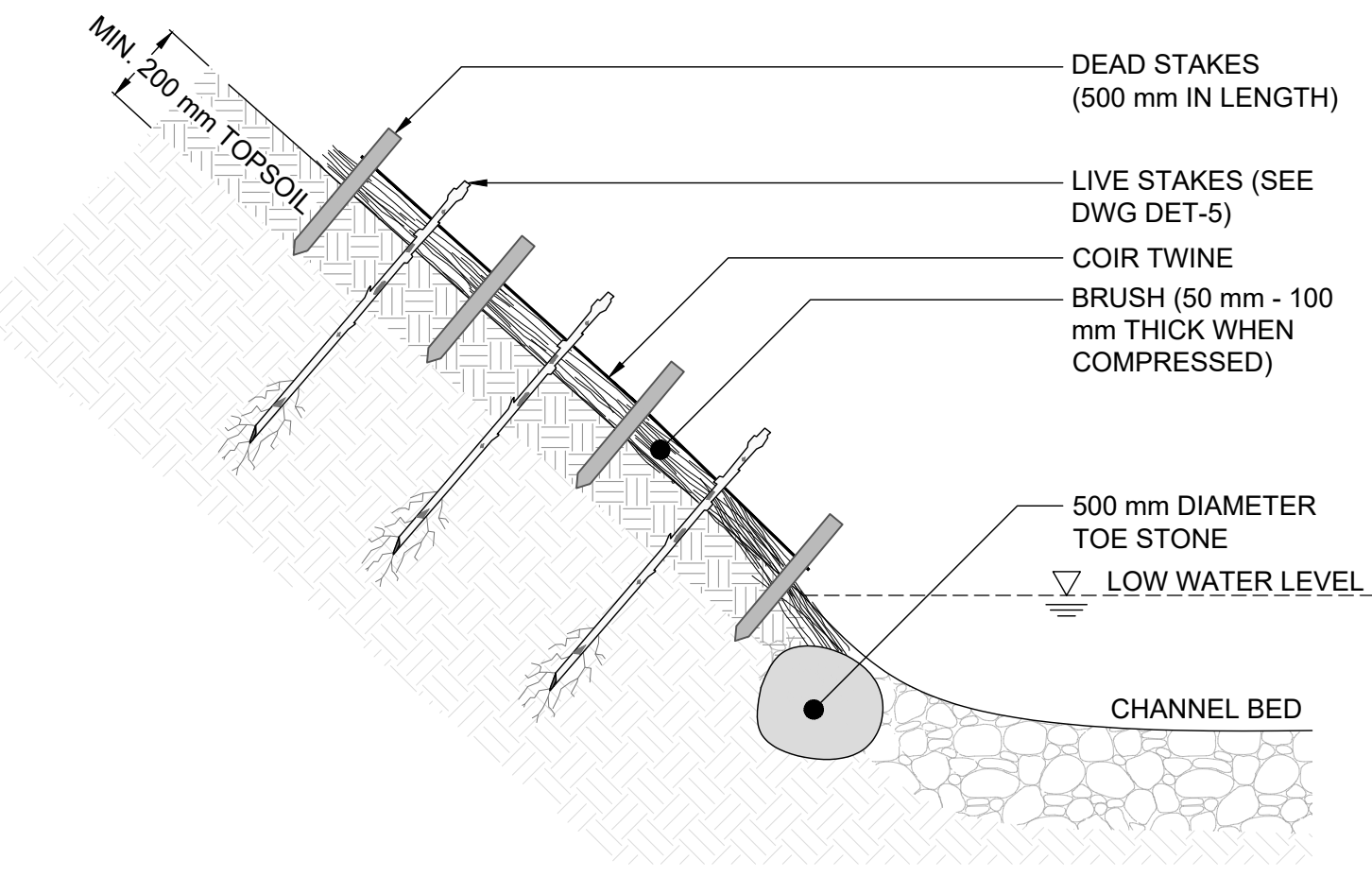


CROSS SECTION

PLAN

- NOTES**
1. ROOT WADS TO BE SOURCED ON-SITE.
 2. ANCHOR ROOT WADS INTO BANK AND SUPPORT WITH STONE.
 3. ROOT WAD LOGS TO BE A MINIMUM 500 mm IN DIAMETER AND 2000 mm IN LENGTH WITH A 1000 - 1500 mm ROOT BALL.
 4. BURY 2/3 OF THE ROOT WAD LOG (APPROXIMATELY 1000 mm) INTO THE CHANNEL BANK.
 5. ROOT WADS TO BE SPACED SUCH THAT ROOT STEMS OVERLAP.

ROOT WAD BANK ENHANCEMENT
N.T.S.



CROSS SECTION

PLAN

- NOTES**
1. LIVE BRANCHES TO CONSIST OF WILLOW AND DOGWOOD SPECIES, APPROXIMATELY 1 m IN LENGTH AND 50 mm - 100 mm IN WIDTH.
 2. BRANCHES TO BE KEPT IN MOIST AND COLD CONDITION UNTIL INSTALLATION.
 3. BRUSH MATTRESS TO BE INSTALLED WHILE BRANCHES ARE DORMANT.
 4. BRANCHES TO BE PLACED ON SLOPE WITH BUTT END TOWARDS VALLEY FLOOR AND PUSHED INTO SOIL.
 5. BRANCHES MUST BE FLEXIBLE ENOUGH TO CONFORM TO THE SLOPE SURFACE IRREGULARITIES.
 6. POUND DEAD STAKES TO HALF THEIR LENGTH INTO SOIL BETWEEN BRANCHES. TIE COIR TWINE AROUND DEAD STAKES AND TIGHTLY OVER BRANCHES. USE A CLOVE HITCH TO SECURE STAKES. POUND STAKES INTO SLOPE TO COMPRESS BRANCHES AGAINST GROUND.
 7. TAMP LIVE STAKES BETWEEN DEAD STAKES.
 8. FILL VOIDS BETWEEN BRANCHES OF THE BRUSH MATTRESS WITH SOIL TO PROMOTE ROOTING.

BRUSH MATTRESS
N.T.S.

2.0	17/03/2026	AS	SECOND EIR SUBMISSION
1.0	16/09/2024	AS	FIRST EIR SUBMISSION
DATE		BY	REVISIONS
DESIGNED BY: LD/AS		CHECKED BY: PV	
DRAWN BY: SC/RS		DATE: MARCH 2026	

DRAFT FOR INTERNAL DISCUSSION

NOT FOR CONSTRUCTION

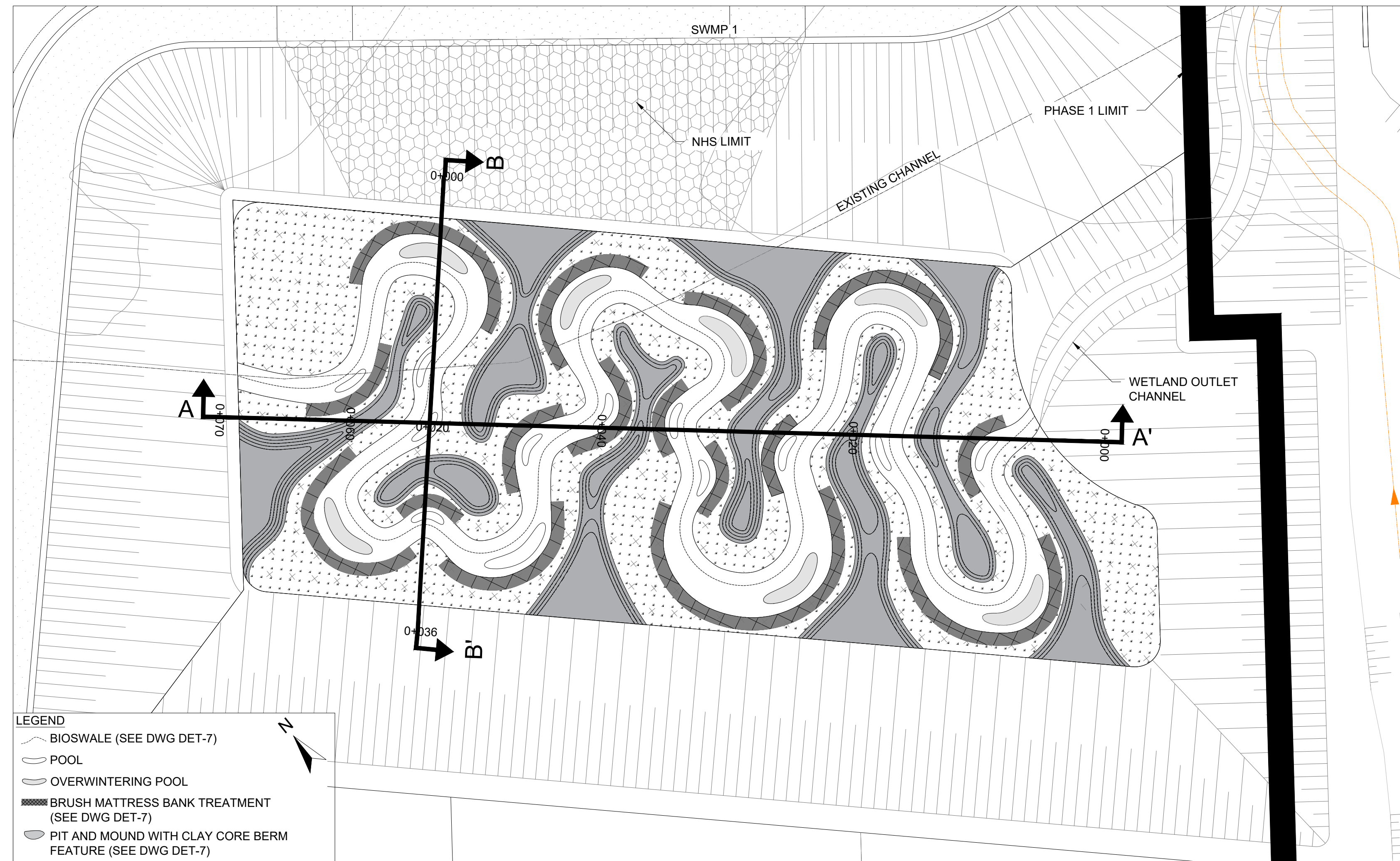
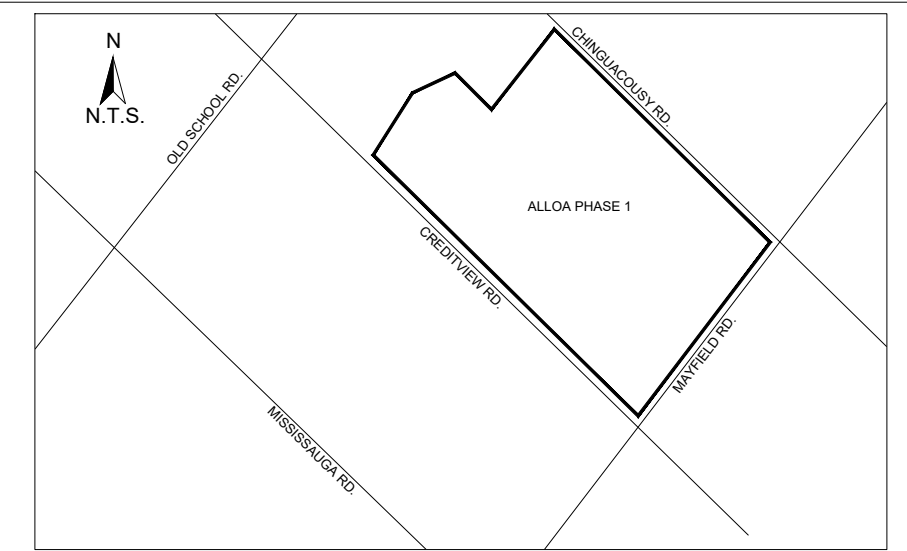
GEO MORPHIX™
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T: 416.920.0926
www.geomorphix.com

**ALLOA SPA PHASE 1
TOWN OF CALEDON**

**ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
RESTORATION DETAILS**

PROJECT No.: PN24018	DRAWING No.: DET-6
SCALE: AS NOTED	SHEET 13 OF 15

SCALED FOR PLOT ON 'ARCH D'



- LEGEND**
- BIOSWALE (SEE DWG DET-7)
 - POOL
 - OVERWINTERING POOL
 - ▨ BRUSH MATTRESS BANK TREATMENT (SEE DWG DET-7)
 - PIT AND MOUND WITH CLAY CORE BERM FEATURE (SEE DWG DET-7)

PLANFORM
1:250

- GENERAL NOTES**
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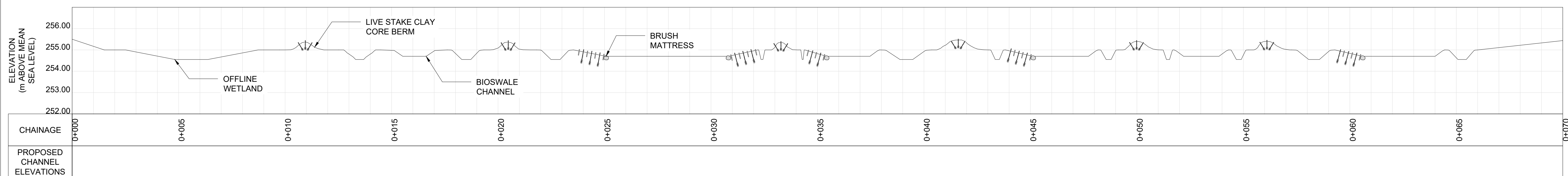
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- ALL CONSTRUCTION EQUIPMENT AND MATERIALS (IMPORTED OR EXCAVATED) MUST BE STORED AT LEAST 30 m AWAY FROM ANY WATERBODY IN A STABLE AREA ABOVE THE ACTIVE FLOODPLAIN, OR IN A DESIGNATED STORAGE AREA.
 - IN THE EVENT OF AN UNEXPECTED STORM, ALL UNFIXED ITEMS THAT HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW MUST BE MOVED TO A STABLE AREA ABOVE ACTIVE FLOODPLAIN.
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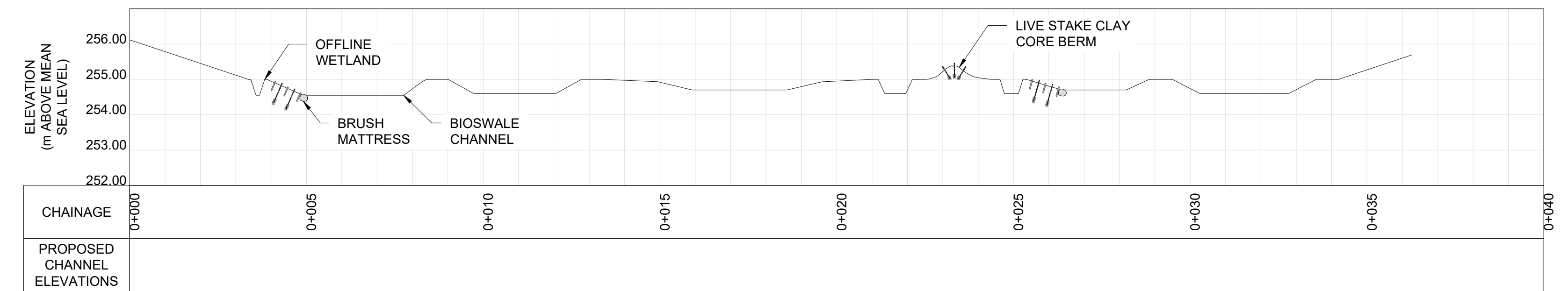
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- WORK AREA ISOLATION**
- ALL WORK IN ISOLATED WORK AREAS MUST BE COMPLETED IN THE DRY. AN ADEQUATE NUMBER OF PUMPS MUST BE USED FOR UNWATERING.
 - CROSSING AN ACTIVE WATERCOURSE OR WETLAND BY EQUIPMENT, VEHICLES, PERSONNEL, ETC. IS NOT PERMITTED UNLESS APPROVED BY THE CONSERVATION AUTHORITY. ALL ACCESS TO WORK SITES SHALL BE FROM EITHER SIDES OF THE WATERCOURSE OR WETLAND.
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 - FISH MUST BE REMOVED FROM THE WORK AREA ONCE ISOLATED. FISH SALVAGE MUST BE COMPLETED BY A QUALIFIED TECHNICIAN WITH A LICENSE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES.



CROSS SECTION A-A'
H = 1:10; V = 1:10



CROSS SECTION B-B'
H = 1:10; V = 1:10

2.0	17/03/2026	AS	SECOND EIR SUBMISSION
1.0	16/09/2024	AS	FIRST EIR SUBMISSION
DATE	BY	REVISIONS	
DESIGNED BY:	LD/AS	CHECKED BY: PV	
DRAWN BY:	SC/RS	DATE: MARCH 2026	

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NOT FOR CONSTRUCTION

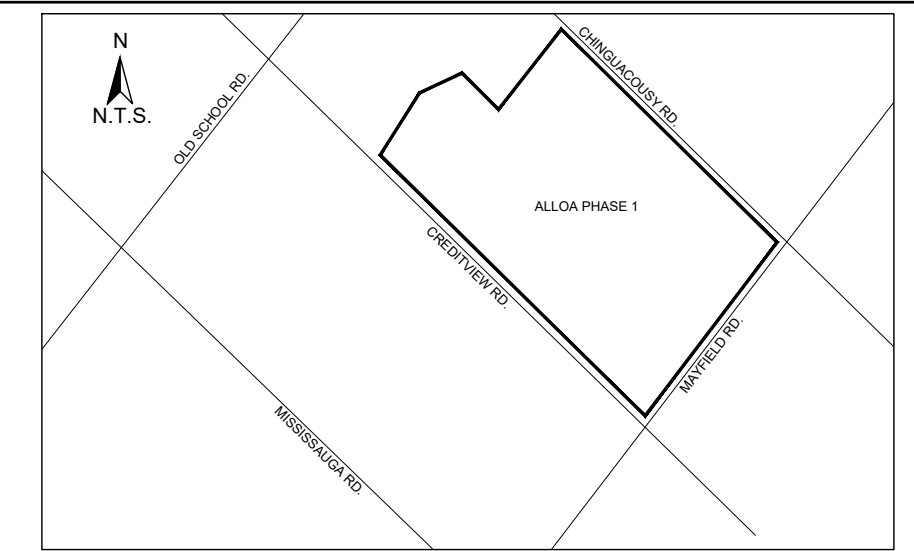
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**ALLOA SPA PHASE 1
TOWN OF CALEDON**

**ETOBICOKE CREEK - ALLOA DRAIN
CONCEPTUAL CHANNEL DESIGN
SWM POND WETLAND COMPENSATION**

PROJECT No.: PN24018	DRAWING No.: GEO-8
SCALE: AS NOTED	SHEET 14 OF 15

SCALED FOR PLOT ON 'ARCH D'



KEY MAP
N.T.S.

GENERAL NOTES

1. THE ACCOMPANYING CHANNEL REALIGNMENT TECHNICAL DESIGN BRIEF PREPARED BY GEO MORPHIX LTD. (2025) PROVIDES ADDITIONAL DESIGN DETAILS AND DIRECTION FOR IMPLEMENTATION AND IS TO BE REVIEWED IN CONJUNCTION WITH THIS DRAWING SET.
2. ALL CONTRACT DRAWINGS, SPECIFICATIONS AND APPLICABLE PERMITS MUST BE KEPT ON SITE DURING CONSTRUCTION FOR REFERENCE.
3. THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING THE DESIGNER AND CONTRACT ADMINISTRATOR OF THE INTENT TO COMMENCE WORK AT LEAST 48 HOURS IN ADVANCE.
4. THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY LOCATES.
5. LAYOUT MUST BE REVIEWED AND APPROVED BY THE DESIGNER / DESIGNER REPRESENTATIVE, DESIGNATED ENGINEER AND THE CONTRACT ADMINISTRATOR.
6. CONSTRUCTION OBSERVATION IS TO BE PERFORMED BY A CERTIFIED FLUVIAL GEOMORPHOLOGIST OR EXPERIENCED ENVIRONMENTAL INSPECTOR UNDER DIRECTION FROM THE DESIGNER.
7. ON-SITE SUPPORT FROM PROJECT ENGINEER (E.G. GEOTECHNICAL, HYDROGEOLOGICAL, AND/OR WATER RESOURCES ENGINEER) REQUIRED TO ASSESS AND ENSURE FAVOURABLE SURFICIAL AND SUBSURFACE CONDITIONS TO SUPPORT CHANNEL REALIGNMENT CONSTRUCTION.
8. BE ADVISED THAT THE LOCAL REGULATORY BODY MAY, AT ANY TIME, WITHDRAW THIS PERMISSION, IF, IN THE OPINION OF THE AUTHORITY, THE CONDITIONS OF THE PERMIT ARE NOT BEING COMPLIED WITH. THIS APPROVAL DOES NOT EXEMPT THE PROPERTY OWNER/APPLICANT/AGENT FROM THE PROVISIONS OF ANY OTHER FEDERAL, PROVINCIAL OR MUNICIPAL STATUTES, REGULATIONS OR BY-LAWS, OR ANY RIGHTS UNDER COMMON LAW.

TIMING OF WORKS

1. WORKS SHALL BE COMPLETED DURING THE DESIGNATED IN-WATER WORKS WINDOW SET OUT BY MNRF/DFO.
2. TREE CLEARING IS TO BE COMPLETED OUTSIDE THE BIRD NESTING SEASON (APRIL 1ST TO AUGUST 1ST) AND THE BIRD ROOSTING WINDOW (APRIL 1ST TO SEPTEMBER 31ST) TO COMPLY WITH THE FEDERAL MIGRATORY BIRDS CONVENTION ACT AND THE PROVINCIAL ENDANGERED SPECIES ACT. ANY TREES THAT REQUIRE REMOVAL OUTSIDE OF THIS TIMING WINDOW MUST FIRST BE INSPECTED BY A QUALIFIED BIOLOGIST TO DETERMINE THE PRESENCE OF NESTING BIRDS OR BATS.
3. THE WEATHER FORECAST SHOULD BE CONTINUALLY MONITORED TO ENSURE THAT WORKS ARE UNDERTAKEN ONLY DURING FAVOURABLE WEATHER CONDITIONS.
4. COMPLETE THE WORKS WITH MINIMAL AVOIDABLE INTERRUPTIONS ONCE THEY COMMENCE.

SITE AND MATERIAL MANAGEMENT

1. ALL CONSTRUCTION EQUIPMENT AND MATERIALS (IMPORTED OR EXCAVATED) MUST BE STORED AT LEAST 30 m AWAY FROM ANY WATERBODY IN A STABLE AREA ABOVE THE ACTIVE FLOODPLAIN, OR IN A DESIGNATED STORAGE AREA.
2. IN THE EVENT OF AN UNEXPECTED STORM, ALL UNFIXED ITEMS THAT HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW MUST BE MOVED TO A STABLE AREA ABOVE ACTIVE FLOODPLAIN.
3. STOCKPILES MUST BE LOCATED OUTSIDE THE ISOLATED WORK AREAS.
4. STABILIZE, TEMPORARILY OR PERMANENTLY, ANY DISTURBED AREAS AS WORK PROGRESSES, OR SOON AS CONDITIONS ALLOW.
5. MINIMIZE THE AREA OF DISTURBANCE TO THE EXTENT POSSIBLE. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED USING APPROPRIATE EROSION CONTROL MEASURES AND AN APPROPRIATE SEED MIX AS NOTED WITHIN THE FINAL APPROVED RESTORATION PLAN.
6. ALL VEGETATION, ADJACENT TO THE WORK AREA, MUST BE PROTECTED AND DELINEATED WITH CONSTRUCTION FENCING OR TREE PROTECTION BARRIERS.
7. ALL GRADES IN THE AREA REGULATED BY THE CONSERVATION AUTHORITY MUST BE MAINTAINED OR MATCHED, UNLESS OTHERWISE AUTHORIZED IN THE APPLICABLE PERMIT.
8. AN AFTER-HOURS CONTACT NUMBER IS TO BE VISIBLY POSTED ON-SITE FOR EMERGENCIES. ALL THE PLANS SHOULD HAVE NAME AND CONTACT INFO OF THE PERSON RESPONSIBLE FOR ESC MEASURES.

EROSION AND SEDIMENT CONTROL

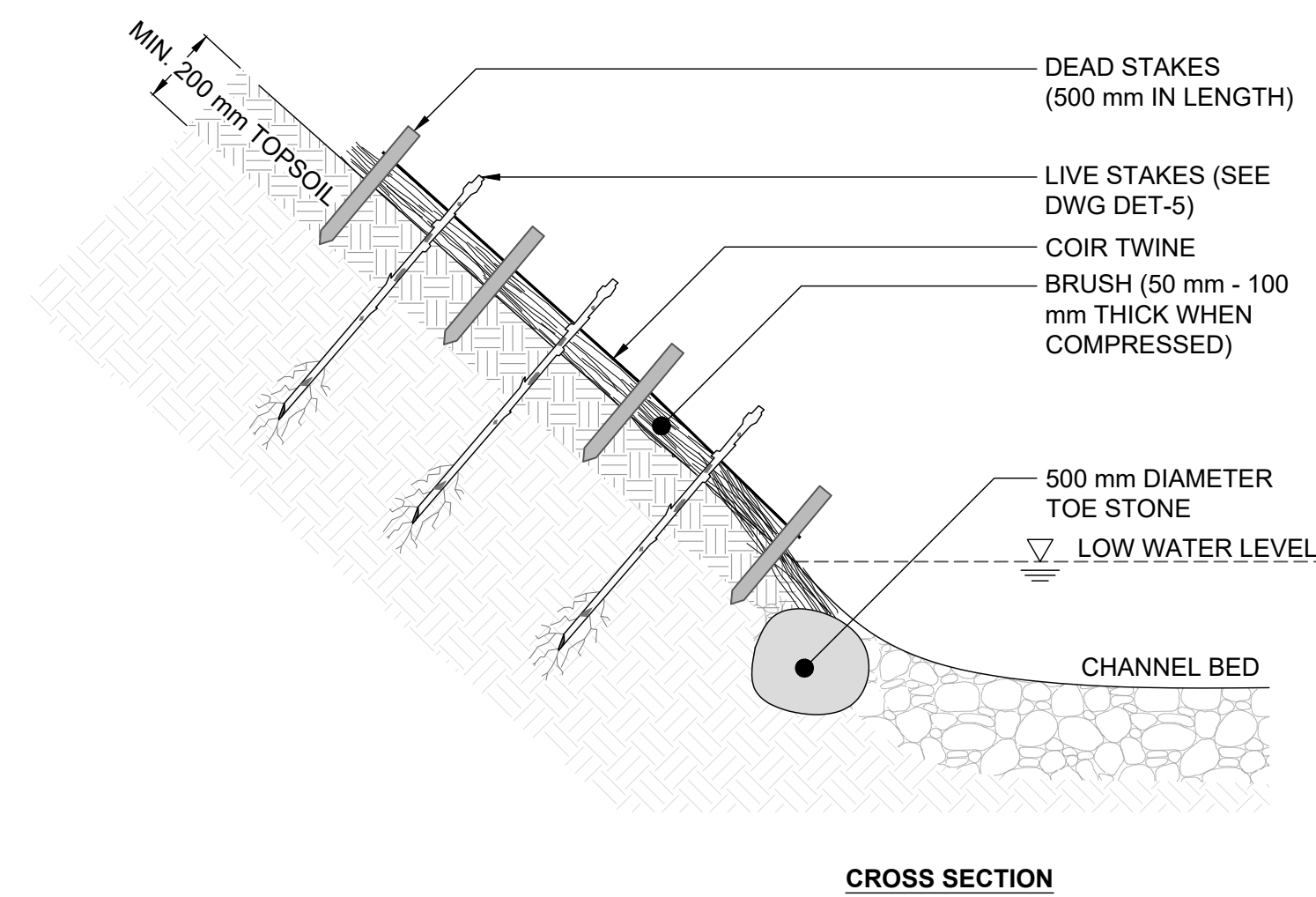
1. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES MUST BE INSTALLED PRIOR TO START OF WORKS.
2. FOLLOWING INSTALLATION OF THE PROPOSED ESC MEASURES, A QUALIFIED AGENT OF THE PROPONENT (E.G. CAN-CSEC CERTIFIED MONITOR) WILL CONDUCT REGULAR SITE VISITS TO MONITOR ALL WORKS, PARTICULARLY THE CONDITION OF THE ESC MEASURES, DEWATERING, AND IN- OR NEAR-WATER WORKS. SHOULD CONCERNS ARISE, THE ENVIRONMENTAL MONITOR WILL CONTACT THE PROPONENT, THE CONSERVATION AUTHORITY, AND ANY OTHER APPROPRIATE PARTIES.
3. EROSION AND SEDIMENT CONTROLS MUST BE MAINTAINED DURING CONSTRUCTION, AND ANY REQUIRED REPAIRS OR REPLACEMENTS MUST BE COMPLETED WITHIN 24 HOURS AFTER THEY HAVE BEEN IDENTIFIED DURING THE MONITORING.
4. EROSION AND SEDIMENT CONTROLS MAY REQUIRE PERIODIC ADJUSTMENTS TO REFLECT CHANGING SITE CONDITIONS. THE CONTRACTOR WILL BE RESPONSIBLE FOR THESE ADJUSTMENTS TO ENSURE PROPER FUNCTION.
5. ANY CHANGES TO THE EROSION AND SEDIMENT CONTROL PLAN BEYOND MINOR ADJUSTMENTS MUST BE APPROVED BY THE CONTRACT ADMINISTRATOR.
6. ADDITIONAL EROSION AND SEDIMENT CONTROL SUPPLIES MUST BE KEPT ON SITE IN ORDER TO FACILITATE IMMEDIATE REPAIRS AND/OR UPGRADES AS NEEDED.
7. ALL TEMPORARY SEDIMENT CONTROLS MUST BE REMOVED AFTER THE CONTRACT ADMINISTRATOR DEEMS THE SITE TO BE STABLE.
8. THE PROJECT PROPONENT OR THEIR REPRESENTATIVE IS ULTIMATELY RESPONSIBLE FOR CONTROLLING SEDIMENT AND EROSION WITHIN THE CONSTRUCTION SITE FOR THE TOTAL PERIOD OF THE CONSTRUCTION.
9. IF EXCESSIVE SILTATION RESULTS FROM THE CONSTRUCTION ACTIVITIES, THE ON-SITE SUPERVISOR/INSPECTOR AND/OR THE LOCAL REGULATORY BODY RESERVE THE RIGHT TO REQUEST ADDITIONAL ESC MEASURES WHICH WOULD BE INSTALLED PRIOR TO FURTHER CONSTRUCTION ACTIVITIES.

DELETERIOUS SUBSTANCE CONTROL/SPILL MANAGEMENT

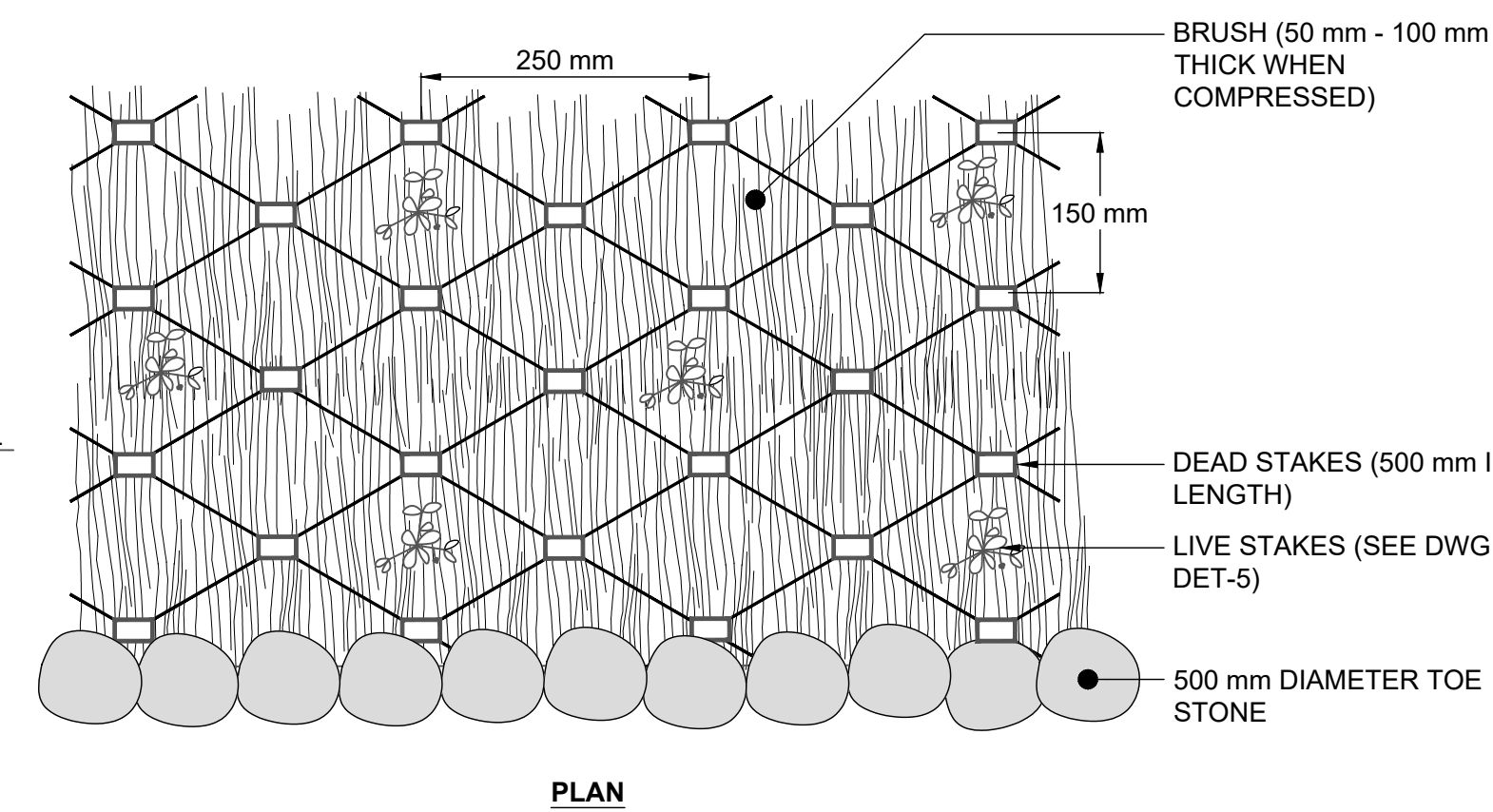
1. PREVENT THE RELEASE OF SEDIMENT, SEDIMENT-LADEN WATER, RAW CONCRETE, CONCRETE LEACHATE OR ANY OTHER DELETERIOUS SUBSTANCES INTO ANY WATERBODY, RAVINE OR STORM SEWER SYSTEM.
2. ENSURE EQUIPMENT AND MACHINERY ARE IN GOOD OPERATING CONDITION (POWER WASHED), FREE OF LEAKS, EXCESS OIL, AND GREASE.
3. NO EQUIPMENT REFUELLING OR SERVICING SHOULD BE UNDERTAKEN WITHIN 30 m OF ANY WATERCOURSE OR SURFACE WATER DRAINAGE.
4. A SPILL CONTAINMENT KIT MUST BE READILY ACCESSIBLE ON SITE IN THE EVENT OF A RELEASE OF A DELETERIOUS SUBSTANCE TO THE ENVIRONMENT. ON-SITE STAFF MUST BE TRAINED IN ITS USE.
5. THE CONTRACT ADMINISTRATOR MUST BE NOTIFIED IMMEDIATELY IN THE EVENT OF A SPILL OF DELETERIOUS SUBSTANCE. ANY SEDIMENT SPILL FROM THE SITE SHOULD BE REPORTED TO MINISTRY OF ENVIRONMENT (SPILL ACTION CENTER) AT 1-800-268-0900.

WORK AREA ISOLATION

1. ALL WORK IN ISOLATED WORK AREAS MUST BE COMPLETED IN THE DRY. AN ADEQUATE NUMBER OF PUMPS MUST BE USED FOR UNWATERING.
2. CROSSING AN ACTIVE WATERCOURSE OR WETLAND BY EQUIPMENT, VEHICLES, PERSONNEL, ETC. IS NOT PERMITTED UNLESS APPROVED BY THE CONSERVATION AUTHORITY. ALL ACCESS TO WORK SITES SHALL BE FROM EITHER SIDES OF THE WATERCOURSE OR WETLAND.
3. THE UNWATERING DISCHARGE LOCATION MUST BE LOCATED AT LEAST 30 m FROM ANY WATERCOURSE OR WETLAND IN AN AREA WITH DENSE VEGETATIVE GROUNDCOVER, AND WHERE THE DISCHARGE CAN RETURN TO THE WATERBODY DOWNSTREAM OF THE WORK AREA OVER THE GROUND COVER.
4. FISH MUST BE REMOVED FROM THE WORK AREA ONCE ISOLATED. FISH SALVAGE MUST BE COMPLETED BY A QUALIFIED TECHNICIAN WITH A LICENSE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES.



CROSS SECTION

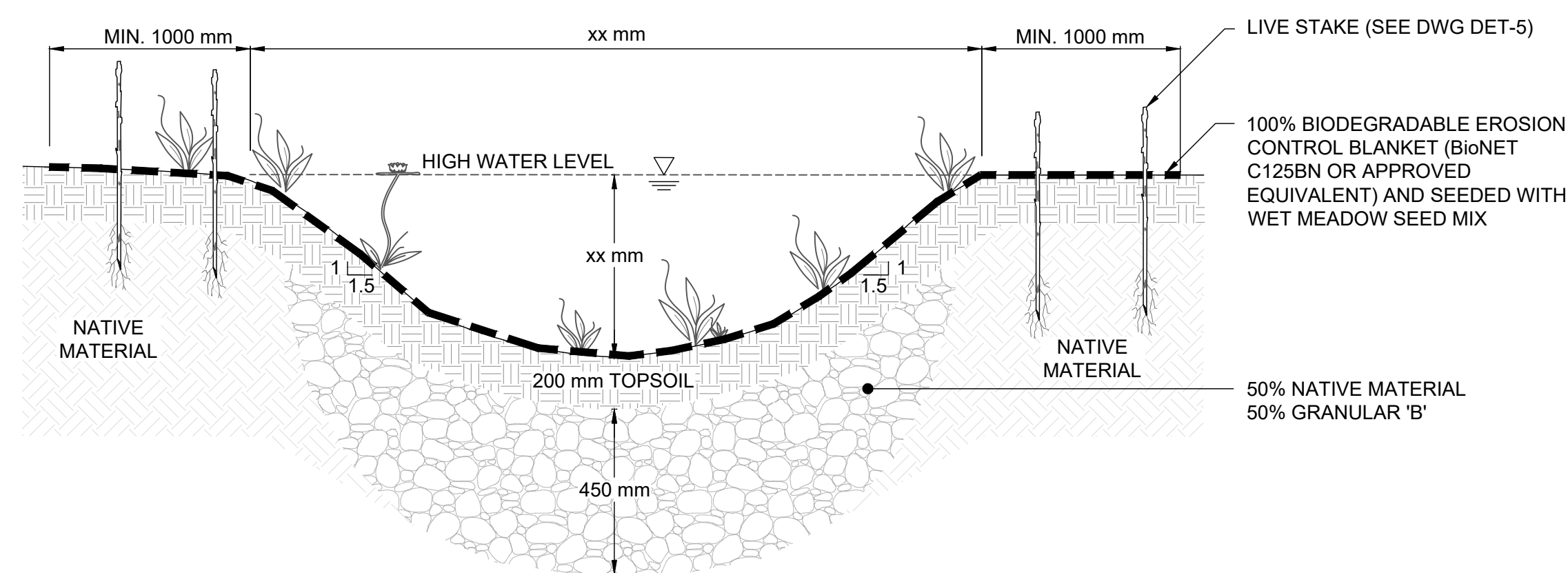


PLAN

NOTES

1. LIVE BRANCHES TO CONSIST OF WILLOW AND DOGWOOD SPECIES, APPROXIMATELY 1 m IN LENGTH AND 50 mm - 100 mm IN WIDTH.
2. BRANCHES TO BE KEPT IN MOIST AND COLD CONDITION UNTIL INSTALLATION.
3. BRUSH MATTRESSES TO BE INSTALLED WHILE BRANCHES ARE DORMANT.
4. BRANCHES TO BE PLACED ON SLOPE WITH BUTT END TOWARDS VALLEY FLOOR AND PUSHED INTO SOIL.
5. BRANCHES MUST BE FLEXIBLE ENOUGH TO CONFORM TO THE SLOPE SURFACE IRREGULARITIES.
6. POUND DEAD STAKES TO HALF THEIR LENGTH INTO SOIL BETWEEN BRANCHES. TIE COIR TWINE AROUND DEAD STAKES AND TIGHTLY OVER BRANCHES. USE A CLOVE HITCH TO SECURE STAKES. POUND STAKES INTO SLOPE TO COMPRESS BRANCHES AGAINST GROUND.
7. TAMP LIVE STAKES BETWEEN DEAD STAKES.
8. FILL VOIDS BETWEEN BRANCHES OF THE BRUSH MATTRESS WITH SOIL TO PROMOTE ROOTING.

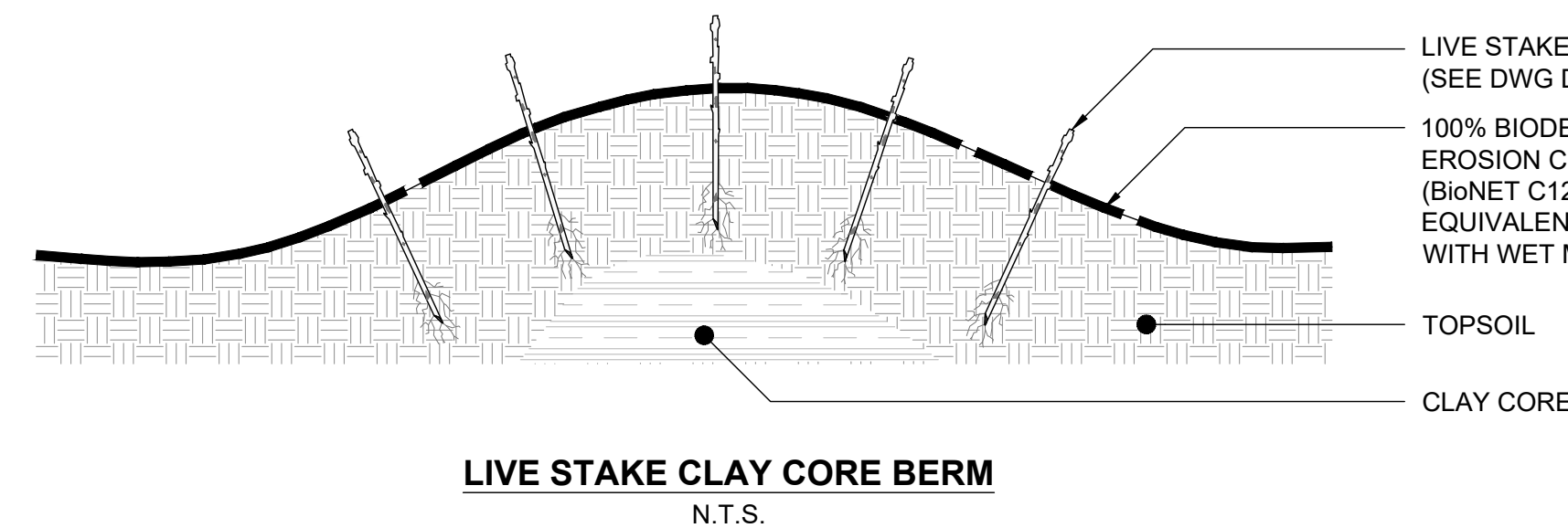
BRUSH MATTRESS
N.T.S.



NOTES

1. SUBSTRATES TO BE COMPACTED TO 90% SPD TO PREVENT PIPING/FLOW-THROUGH.
2. FINE NATIVE MATERIAL TO BE ADDED TO SUBSTRATE MIX TO FILL INTERSTITIAL VOIDS, AS REQUIRED.
3. GRANULAR 'B' TO BE SOURCED FROM PIT-RUN MATERIAL AND ROUNDED IN NATURE. NO CRUSHED ROCK, LIMESTONE OR POST-CONSTRUCTION MATERIALS ARE TO BE USED WITHIN THE CHANNEL.
4. HYDRAULIC SIZING TO BE CONFIRMED AT DETAILED DESIGN.
5. SEED IS TO BE PLACED PRIOR TO INSTALLATION OF EROSION CONTROL BLANKET. SEE DWG DET-5 FOR SEED MIX SPECIFICATION.

TYPICAL BIOSWALE CROSS SECTION
N.T.S.

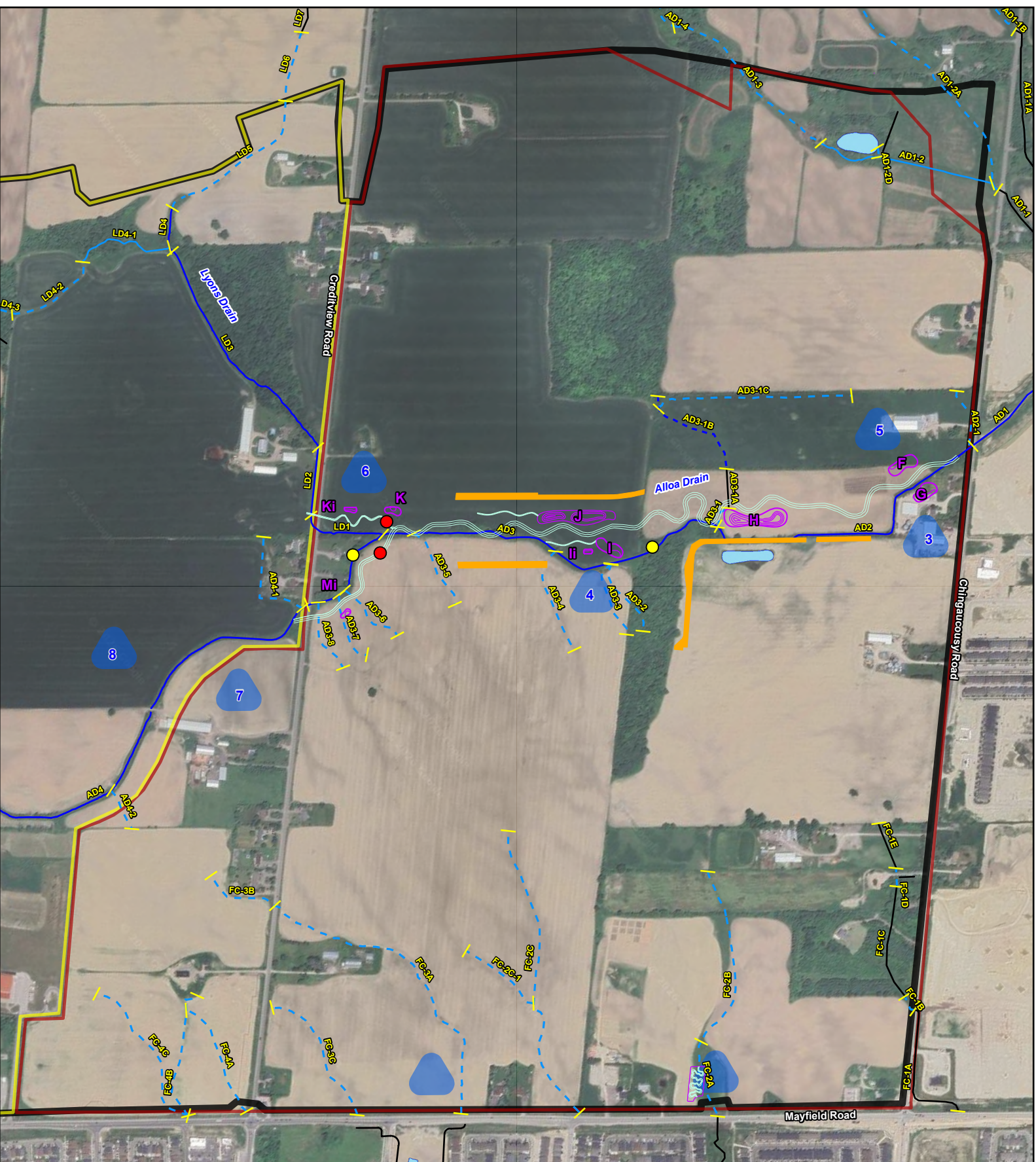


LIVE STAKE CLAY CORE BERM
N.T.S.

2.0	17/03/2026	AS	SECOND EIR SUBMISSION
1.0	16/09/2024	AS	FIRST EIR SUBMISSION
	DATE	BY	REVISIONS
DESIGNED BY:	LD/AS	CHECKED BY:	PV
DRAWN BY:	SC/RS	DATE:	MARCH 2026
DRAFT FOR INTERNAL DISCUSSION		GEO	
NOT FOR CONSTRUCTION		MORPHIX™ 36 Main St N., P.O. Box 205 Campbellville, Ontario L0P 1B0 T: 416.920.0926 www.geomorphix.com	
ALLOA SPA PHASE 1 TOWN OF CALEDON			
ETOBICOKE CREEK - ALLOA DRAIN CONCEPTUAL CHANNEL DESIGN WETLAND COMPENSATION RESTORATION DETAILS			
PROJECT No.:	PN24018	DRAWING No.:	DET-7
SCALE:	AS NOTED	SHEET	15 OF 15

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Appendix H: Wetland Water Availability Assessment Figure and Results



Legend

- Flow Node
- Piezometer
- ~ Watercourse
- - - Headwater Drainage Feature
- - - Municipal Drain
- - - Tile Drain
- - - Municipal Drain Not Field Assessed
- - - Not Field Assessed
- OHN Waterbody
- Proposed Stormwater Management Pond
- ~ Uncontrolled Backyard Runoff
- ~ Proposed Channel Design
- ~ Proposed Wetland
- Phase 1 Lands
- Phase 2 Lands
- Alloa Secondary Plan Area and Primary Study Area

Figure 4
Wetland Hydrological Assessment
Phase 1 Alloa Secondary Plan Area
 Caledon, Ontario

GEO MORPHIX™

0 150 300
Metres

Imagery: Google Earth, 2022. Waterbody, Watercourse: MNR, 2023. Alloa Phase 1 & 2 Lands, Alloa Secondary Plan Area: Crozier, 2024. HDFA, Watercourse, Detailed Assessment: GEO Morphix Ltd., 2024. Participating Properties: Crozier, 2024. Proposed Wetlands, Channel Design: GEO Morphix Ltd. Uncontrolled Backyard Runoff: Urbantech, 2026. Print Date: March 2026. PN24018. Drawn By: K.S., M.O., D.B., G.U.

Baseline Scenario													
Hydrological Values	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Wetland F													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	8543	8089	12260	16735	11832	9509	9438	13084	11566	10469	12587	8365	132479
Wetland G													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	3865	3675	5601	7902	5250	4105	4104	5801	5125	4630	5663	3876	59596
Wetland H													
Avg. Wetland Water Depth (mm)	238	300	300	300	165	0	0	0	0	0	0	111	--
Wetland Runoff (m³)	0	276	715	2199	0	0	0	0	0	0	0	0	3190
Wetland I													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	7100	6714	10123	13723	9602	7677	7639	10524	9283	8544	10297	66	101295
Wetland J													
Avg. Wetland Water Depth (mm)	300	300	300	284	300	135	0	0	181	72	53	182	--
Wetland Runoff (m³)	101	611	829	0	631	0	0	0	0	0	0	0	2173

Wetland K													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	11867	11165	16936	22459	16702	13483	13398	18396	16263	14742	17582	11644	184637
Wetland Ii													
Avg. Wetland Water Depth (mm)	121	185	276	300	148	0	0	0	0	0	0	55	--
Wetland Runoff (m³)	0	0	0	92	0	0	0	0	0	0	0	0	92
Wetland Ki													
Avg. Wetland Water Depth (mm)	125	192	286	300	149	0	0	0	0	0	0	57	--
Wetland Runoff (m³)	0	0	0	131	0	0	0	0	0	0	0	0	131
Wetland Mi													
Avg. Wetland Water Depth (mm)	124	189	282	300	149	0	0	0	0	0	0	56	--
Wetland Runoff (m³)	0	0	0	128	0	0	0	0	0	0	0	0	128

High Runoff Scenario													
Hydrological Values	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Wetland F													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	9180	8789	13285	18194	13640	9994	10041	13993	12509	11242	13649	8365	142879
Wetland G													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	4095	3941	5982	8457	6355	4291	4329	6142	5487	4922	6050	3876	63925
Wetland H													
Avg. Wetland Water Depth (mm)	238	300	300	300	300	124	0	0	0	0	0	111	--
Wetland Runoff (m³)	0	276	715	2199	1815	0	0	0	0	0	0	0	5004
Wetland I													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	7673	7337	11016	15019	11185	8129	8223	11372	10149	9239	11261	66	110669
Wetland J													
Avg. Wetland Water Depth (mm)	300	300	300	284	300	135	0	0	181	72	53	182	--
Wetland Runoff (m³)	101	611	829	0	631	0	0	0	0	0	0	0	2173

Wetland K													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	12852	12244	18819	24721	18365	14268	14718	20185	18107	15958	19560	11644	201441
Wetland Ii													
Avg. Wetland Water Depth (mm)	121	185	276	300	300	113	0	0	0	0	0	55	--
Wetland Runoff (m³)	0	0	0	92	86	0	0	0	0	0	0	0	178
Wetland Ki													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	113	300	300	300	173	300	300	--
Wetland Runoff (m³)	18	18	184	134	119	0	53	108	122	0	107	15	879
Wetland Mi													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	113	300	300	300	173	300	300	--
Wetland Runoff (m³)	18	17	182	133	118	0	52	107	121	0	106	15	867

Low Runoff Scenario													
Hydrological Values	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Wetland F													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	8120	7630	11532	14915	11167	9075	9156	12704	11240	10130	12112	8365	126146
Wetland G													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	3707	3503	5328	6795	5005	3936	3997	5658	5000	4502	5487	3876	56793
Wetland H													
Avg. Wetland Water Depth (mm)	238	300	300	263	127	0	0	0	0	0	0	111	--
Wetland Runoff (m³)	0	276	715	0	0	0	0	0	0	0	0	0	990
Wetland I													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	6704	6275	9434	12047	8981	7264	7374	10157	8959	8213	9823	66	95296
Wetland J													
Avg. Wetland Water Depth (mm)	300	300	300	284	300	135	0	0	181	72	53	182	--
Wetland Runoff (m³)	101	611	829	0	631	0	0	0	0	0	0	0	2173

Wetland K													
Avg. Wetland Water Depth (mm)	300	300	300	300	300	300	300	300	300	300	300	300	--
Wetland Runoff (m³)	11175	10397	15731	20632	15610	12777	12929	17753	15687	14159	16752	11644	175246
Wetland Ii													
Avg. Wetland Water Depth (mm)	121	185	276	181	30	0	0	0	0	0	0	55	--
Wetland Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Wetland Ki													
Avg. Wetland Water Depth (mm)	125	192	286	193	42	0	0	0	0	0	0	57	--
Wetland Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0
Wetland Mi													
Avg. Wetland Water Depth (mm)	124	189	282	189	37	0	0	0	0	0	0	56	--
Wetland Runoff (m³)	0	0	0	0	0	0	0	0	0	0	0	0	0