Kollaard Associates
Engineers

210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Materials Testing •

(613) 860-0923

FAX: (613) 258-0475

January 31, 2023

To: Mississippi Valley Conservation Authority

Re: MVCA Technical Review Memorandum (dated July 8, 2022, Revised August 24, 2022)
Slope Stability Engineering Review

Hilan Village Residential Subdivision Application,
38 Carss Street, Almonte Ontario
File Number 09-T-22003

The following engineering review comments have been provided by the Mississippi Valley Conservation Authority in response to the Slope Stability Report prepared by Kollaard Associates Inc. in support of the Hilan Village Subdivision Application. Kollaard Associates Inc.'s response is provided in italics immediately after each comment for clarity.

Stable slope allowance:

- The report concluded a total limit of hazard lands of 3.3 m, measured from the physical top of slope. Furthermore, the slope analysis determined a long term stable slope of 2.7 m towards the watercourse from the physical top of slope. If one follows through with this logic, it would be satisfactory to build structures beyond the physical top of slope, which would be unsafe, and against conservation practice. The MNRF guideline states on pg. 46 that: “Generally, development should not occur on or on top of valley walls because the long-term stability of the slope, and therefore public health and safety, cannot be guaranteed. Development should be set back from the top of valley walls far enough to avoid increases in loading forces on the top of the slope, changes in drainage patterns that would compromise slope stability or exacerbate erosion.”

The above comment uses a quote, taken out of the context of the guideline, that begins with the word "Generally" . and negates the engineering analysis completed by a geotechnical engineer to assess the stability of the slope.

*From Page 46 of the MNRF guidelines, The **stable slope** allowance can mean:*

A stable slope allowance determined by a study using accepted geotechnical principles.

It is considered that the use of Software Programs including Slope/W by GeoSlope which are designed to complete the analysis of the stability of slopes is an accepted geotechnical practice. It is further considered that a site investigation by and under the supervision of an engineer qualified by education and experience to practice geotechnical engineering in order to obtain the information necessary to build the slope stability model is also an accepted geotechnical practice. As such, by

the definition of the Stable Slope allowance, on page 46, it is within keeping of the Technical Guide to use commonly accepted geotechnical principles and practices to determine the stable slope allowance.

Also from Page 46, in the paragraphs preceding the above provided quote, are descriptions of the most common causes of slope movement. The quote provided above is predicated on these preceding paragraphs. Due to the composition of the slope (a thin layer of overburden followed by bedrock) the common factors such as erosion and changes in the ground water conditions have no effect on the overall stability of the slope and any changes in these conditions will not cause slope instability or movement.

- The report indicates that the proposed residential buildings will be secured to bedrock due to shallow overburden material, adjacent to the crest of the slope, and therefore impact on the factor of safety will be negligible. However, there appears to be thicker (~1.5 m) overburden material adjacent to sample locations TP5 and TP6. Therefore, please comment on the potential impacts of residential loading on the overburden material adjacent to TP5 and TP6, and therefore on the overall factor of safety.

*The report does not say residential buildings will be **secured** to the bedrock. The report states that the buildings will be founded on the sound bedrock. The wording has been clarified in the revised report.*

Test pit TP5 indicates 1.3 metres of overburden to bedrock. Test pit TP6 indicates 2.1 metres of overburden of bedrock. This comment ignores the findings of AH3 which is in proximity to TP6 and indicates 1.35 metres of overburden to the bedrock. Both 1.3 metres and 1.35 metres depths are well within normal excavation depths for full basements. Even if the buildings are founded on the native overburden above the sound bedrock or on engineered fill used to raise the subgrade to the underside of footing level, the load from the building will be transferred downward to the underlying bedrock. The proposed setback from the top of slope in the report is 3.3 metres. As such, even though the overburden thickness is as much as 2.1 metres, the downward distribution of the load from the foundation will be transferred to the bedrock above the top of the slope.

It is noted that the additional depth of overburden will result in a deeper excavation which will actually result in net off loading of weight from the top of slope. The weight of the excavated materials in a fully excavated basement greatly exceeds the weight of all of the materials used in the construction of a dwelling.

- Please provide a reference to the statement 'Where the minimum safe slope setback distance is below the top of slope, all slope surfaces originating at the top of slope or above the top of slope have a factor of safety of greater than 1.5 for static conditions and greater than 1.1 for seismic conditions.

This statement is a factual summary of the results of the analysis. The minimum safe slope setback distance is defined as the distance from the top of slope at which the slope will be "Safe". From the MNRF guidelines, the design minimum factor of safety FS is 1.4 to 1.5 for infrastructure and public use. Using the City of Ottawa Slope stability guidelines, a minimum FS of 1.5 is required for a stable slope. Using the City of Ottawa criteria, the minimum setback distance then is the distance

from the top of slope to a point at which all of the factors of safety originating beyond that point will be greater than 1.5. If this point, at which all of the slip surfaces originating above that location will have a factor of safety of greater than 1.5, is below the top of slope, then all of the slip surfaces originating above that location will have an FS greater than 1.5. Since this point occurs below the top of slope, all slip surfaces originating at locations above the point, which includes the remaining locations between the point and the top of slope and all locations above the top of slope, will have FS greater than 1.5. This is illustrated in all of the slope section figures attached following the text of the report.

Toe erosion allowance**:**

- It appears that Table 3 was applied correctly with respect to the slope and the chosen toe erosion allowance of 6 m. However, we note that this 6 m allowance was excluded from the overall hazard calculation, without providing any supporting inspection data/study. More details and scientific justification are required in omitting the toe erosion allowance.

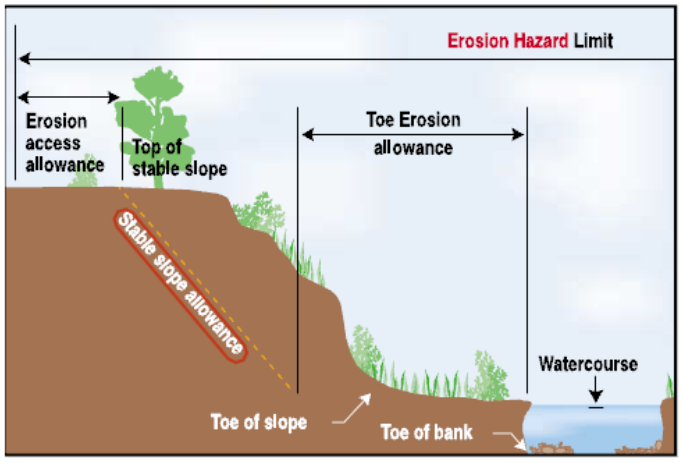


Figure 115 b - Stable Slope Allowance
(toe of valley slope ≤15m from watercourse)

Figure 115b – Stable Slope Allowance was copied from the MNRF guidelines. This figure clearly illustrates that the toe erosion allowance is measured from the toe of the slope where the toe of the slope is less than 15 metres from the toe of the bank. As discussed on page 10 and 11 of the report, the application of 6 metres of toe erosion allowance at the toe of the slope will not change the overall stability of the slope or cause the stable slope allowance to immerge past the top of the slope.
Additional analysis was completed modelling the slopes assuming 6 metres of erosion occurred at the toe of the slope. Where there was less than 6 metres of overburden (measured horizontally) between the existing toe of the slope and the bedrock, the overburden was removed to bedrock. This additional analysis has been added to the report and provides engineering support for the statements made on page 10 and 11 of the report with respect to the toe erosion allowance.

Erosion access allowance:

- The report uses access rationale to justify removing the 6 m erosion access allowance. For example, pg.11 of the report indicates “The length and height of the slope will prevent construction access to the majority of the slope for maintenance.” However, the MNR guideline states “Where municipalities and planning boards determine that the suggested 6 metre erosion

access allowance is excessive or not sufficient enough to provide the required public safety and site access, mechanisms should be incorporated into the planning process providing the flexibility to undertake a study using accepted scientific, geotechnical and engineering principles to determine the erosion access allowance."

The report has been revised to include the Erosion Access Allowance

The erosion access allowance is discussed in Section 3.4 of the Guideline.

The MNR technical Guide provides the following information:

- *In the absence of a site specific study, the erosion access allowance for river and stream systems be 6 metres.*
- *The erosion access allowance is applied following the stable slope allowance.*

The application of the erosion access allowance for confined systems is illustrated in the figures copied below.

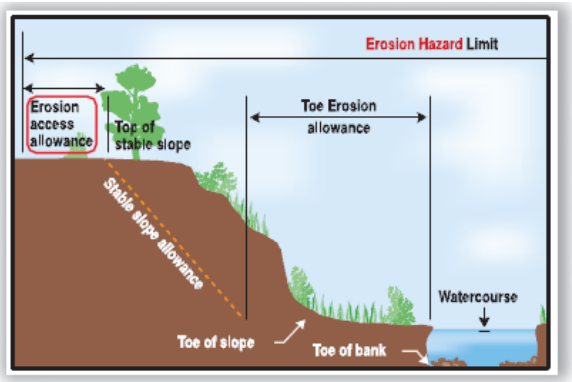


Figure 123 - Erosion Access Allowance:

Figure 124 - Erosion Access Allowance

In Figure 123, the erosion access allowance is being added to the stable slope allowance designated by a line marking the top of the stable slope. ***This line marks the top of stable slope not the top of slope.*** *The erosion access allowance is not being added beginning at the top of the slope. In Figure 124, the excavator is operating within the erosion access allowance at some point below the top of slope as the slope clearly extends upward beyond the excavator.*

The wording and illustrations in the Technical Guide state that the erosion access allowance be added to the stable slope allowance after the stable slope allowance is added to the toe erosion allowance. The Figures 95b and 115b clearly illustrate that toe erosion allowance begins at the toe of the bank or at the watercourse. Figures 115a and 115b clearly illustrate that the stable slope allowance is applied either beginning at the toe of the slope or following the toe erosion allowance.

From the MNR Technical Guide, three main principles support the inclusion of the erosion access allowance:

- *Providing for emergency access to erosion prone areas;*
- *Providing for construction access for regular maintenance and access to the site in the event of an erosion event or failure of a structure;*

- *Providing protection against unforeseen or predicted external conditions which could have an adverse effect on the natural conditions or processes acting on or within an erosion prone area of provincial interest.*

Section 5 of the MNR Technical Guide provides the following:

- *The intent of section 3 of the Provincial Policy Statement is to promote public safety and to minimize risks to life, property damage, adverse environmental impacts and social disruption.*
- *Section 5.2.1 states Established standards and procedures means the following: "Access standard, which means a method or procedure to ensure safe vehicular and pedestrian movement, and access for the maintenance and repair of protection works, during times of erosion."*

At the site in question, there is no unstable slope condition beyond the top of slope and there is no slope hazard setback beyond the top of slope. The stable slope allowances as measured from the top of slope have been added to the report. In keeping with the MNR Technical Guide the erosion access allowance is then added to the stable slope allowance.

As discussed in the slope stability assessment report, the additional analysis completed to model the effects of erosion on the overall stability of the slope indicates that erosion at the toe of the slope has no effect on the overall stability of the slope and the stable slope allowance remains as indicated in the minimum factors of safety table provided in the report.

Locating the erosion access allowance and defining the limit of hazard lands as indicated in the slope stability assessment report is in keeping with the principles for the inclusion of the erosion access allowance as defined by section 3.4 of the Guide. It is also in keeping with section 5.2 of the guide as it provided direct access to the location on the site where erosion could occur and will prevent development in the area needed to provide access to the erosion prone area. Further defining the limit of hazard lands as indicated in the assessment report is in keeping with the provincial policy statement as the remaining lands beyond the limit of hazard lands setback were proven by the slope stability assessment to not contain any hazard to development.

- The report mentions visual confirmation of erosion occurring along the slope surface. However, the active erosion locations are not shown in the report. The erosion locations are relevant given the reports claim that the 6 m erosion access allowance will not provide adequate access to areas of erosion. Please provide more information regarding the current erosion areas (photos, locations, elevations). A mobile crane along the erosion access allowance may be able to access areas along the slope if required in emergency situations or regular maintenance.

This comment misrepresents the report as this comment implies that the report states there is erosion occurring at locations on the face of the slope other than near the toe of the slope.

The report states "During normal flow conditions there is no active erosion. However, there is evidence that the shoreline is subjected to active erosion during high flow events". *This clearly indicates that the active erosion is occurring along the shoreline above the normal water level extending to the high water level and not along the slope surface above the high water level.*

*Active erosion is referenced in the MNRF guideline with respect to flow along the river or stream and is defined as "*bank material is exposed directly to stream flow under normal or flood flow

conditions where undercutting, oversteepening, slumping of a bank or down stream sediment loading is occurring".

The implication of the report without qualifying the locations of active erosion is that it is occurring all along the length of the site at the toe of the slope between the normal water level and the high water level. While there are some locations along the toe of the slope where active erosion was not observed, this is a conservative assumption as it provides a worst case scenario for each section. As such, there is no reason to further illustrate the areas of active erosion.

As stated in the report, the slope at the site has a height of between 24 and 28 metres and a horizontal length of the slope is between 65 and 90 metres. Given the site constraints, it is unreasonable to mobilize a crane to the site that can reach between 65 and 90 metres to complete erosion repairs.

- MVCA recommends a minimum 6 m erosion access allowance for this development application.

Noted. A six metre setback from the minimum safe slope setback has been provided.

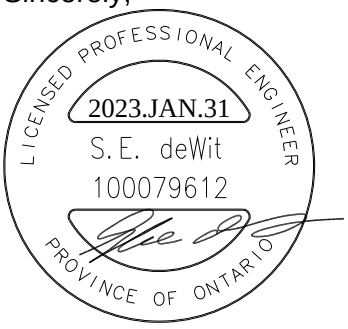
Additional recommendation:

- Limit of hazard land drawing should be signed and stamped by Geotechnical personnel licensed in the province of Ontario.

Noted.

We trust that this response provides sufficient information for your present purposes. If you have any questions concerning this response letter please do not hesitate to contact our office.

Sincerely,



Steven deWit, P.Eng.
Kollaard Associates Inc