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November 30, 2021

Westview Projects Inc.
18 Louisa Street, Suite 180
Ottawa, Ontario
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Re: Slope Stability Evaluation
Assessment of Slope Stability and Limit of Hazard Lands Setback
Proposed Residential Development
38 Carss Street, Almonte, Ontario.

Introduction and Background

Kollaard Associates Inc was retained by Westview Projects Inc to update a previously completed assessment of the stability of the existing slopes at the site of the proposed development. The purpose of the assessment was to verify the stability of the slope and to determine the limit of development along the top of the slope. Kollaard Associates was also to assess the subsurface conditions at the site to determine if there were any geotechnical consideration which could preclude the proposed development. For the purposes of this report, Carss Street is considered to be oriented along and east west axis. The site is located along the northside of Carss Street and along the east side of the Mississippi River.

The proposed residential development site consists of an 7.4 hectare parcel of land severed from an about 8.9 hectare parcel of land located immediately north of Carss Street. The retained parcel contains an existing single family dwelling and is outside of the scoop of this letter. The site is bound on the east by the former Canadian Pacific Railway line and on the west by the Mississippi River. The site has a total average depth between the former railway line and normal water level in the Mississippi River of about 203 metres. Of this depth about 74 metres is occupied by the valley slope of the Mississippi River. The site has a width along the former railway line of about 435 metres resulting in a table land above the valley slope of about 5.3 hectares.

It is understood that the client is considering a residential development consisting of a mixture of single family dwellings, semi-detached dwellings and rowhouse development. The proposed development will be serviced by municipal waterand by municipal sanitary and storm sewers. It is understood that a pumping station will be required to facilitate the sanitary sewer.

This letter summarizes the results of site visits to the above noted site carried out by the undersigned on August 21 and 22, 2019 as well as the results of a topographic survey of the site completed by Kollaard Associates August 20 to 22, 2019 and test pits advanced at the site using a rubber tire mounted backhoe on September 11, 2019.

The purpose of the site visits completed by the undersigned was to observe the condition, height and inclination of the slope at the site as well as subsurface conditions along the toe, face and top of the slope.

The purpose of the topographic survey was to obtain factual information with respect to the existing valley slope and table land at site. The purpose of the test pits was to obtain factual information with respect to the subsurface conditions on the table land near the top of slope and in general throughout the table land.

A copy of a legal survey was provided to Kollaard Associates by the client in pdf format. The survey provided property line information and indicated the horizontal location of the normal high water line at the time of the survey in May of 1982.

As previously stated, the slope stability assessment is intended to provide site specific guidance on the extent of the limit of hazard lands at the site from a geotechnical perspective. The limit of hazard lands is defined by the Ministry of Natural Resources and Forestry as the sum of the safe slope allowance, toe erosion allowance and erosion access allowance, documented in the MNRF Technical Guide for Understanding Natural Hazards. The Ontario Ministry of Natural Resources Water Resource Section Technical Guide *River & Stream Systems: Erosion Hazard Limit* was also referenced during the assessment and preparation of this letter.

For the purposes of this letter, Carss Street is considered to be oriented along an east west axis and the former railway line and the Mississippi River are considered to be oriented perpendicular to Carss Street along a north south axis.

Surface Conditions

The site is currently occupied by an existing single storey dwelling located adjacent the top of the valley slope along the south side of the site. The dwelling has been in existing for more than 20 years. This existing dwelling together with the portion of the property occupied by the dwelling will be severed from the remainder of the site at time of development. The area immediately adjacent the dwelling consists of mowed lawn with mature trees.

As previously indicated, the site has a table land area above the valley slope of about 5.4 hectares. The table land has an average depth of about 130 metres between the east property line and the top of the valley slope. The main portion of the valley slope has a height ranging from about 24 to 28 metres and is inclined downward toward the Mississippi River at an angle of between 13 and 31 degrees from horizontal. There are a number of near vertical locations where there are exposed bedrock ledges on the slope. These ledges are relatively isolated and do not significantly change the characteristics of the overall slope. The valley slope is well vegetated with a mixture of mature trees and undergrowth. The vegetation immediately above the normal water level is relatively dense. The table land is vegetated with a mixture of cultural meadow, thicket and woodland with a small portion used for agricultural purposes (sunflowers). There are some mown and maintained walking trails throughout the table land of the site.

The results of the topographic survey are provided on Kollaard Associates drawing 190712-EX. This drawing indicates the location of the existing dwelling as well as the locations where test holes were put down at the site. The drawing also indicates where the various sections used in the slope stability analysis were obtained. The locations where the slope sections were obtained were visually selected during the site visits as being representative of the various slope conditions (in terms of height and slope angle) encountered at the site.

Drawing 190713-EX also provides an overly lay of the cross sections used in the analysis. The sections indicate that the height and inclination of the slope increase from south to north along the site.

Subsurface Conditions

A review of available surficial geological maps of the area indicates that the subsurface conditions at the site consist of a thin layer of fine textured glaciomarine deposits (silt and clay, minor sand and gravel) overlying bedrock. Areas immediately adjacent the site indicate surficial bedrock. A review of available bedrock geological maps of the area indicates that the site is underlain by Dolostone and/or Sandstone of the Beekmantown Group.

A total of total of 26 test holes were put down at the site to verify the subsurface conditions on the slope, at the toe of the slope and on the table land above the slope. The test holes considered of: 7 test pits excavated on the table land adjacent the top of slope using a rubber tire mounted backhoe on September 11, 2019; 7 auger holes were advanced by hand on the face of the slope at select locations on August 22, 2019. 8 probe holes were put down at the toe of the slope and 14 probe holes were put down on the face of the slope on August 21, 2019.

The text hole logs are included following the text of this letter in Appendix A. The locations of the test holes are indicated on Drawing 190712-EX.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification was in general completed by visual-manual procedures in accordance with ASTM 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

Classification and identification of soil involves judgement and Kollaard Associates Inc. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The groundwater conditions described in this report refer only to those observed at the location and on the date the observations were noted in the report and on the test hole logs. Groundwater conditions may vary seasonally, or may be affected by construction activities on or in the vicinity of the site.

The following is a brief overview of the subsurface conditions encountered at the test pits.

Topsoil

A thin layer of topsoil was encountered from the ground surface at all of the test hole locations (with the exception of test hole TP5). The topsoil layer ranged in thickness from about 0.1 metres to 0.4 metres. The topsoil layer was thicker on the table land and at the toe of the slope. The identification of the topsoil layer is for geotechnical purposes only and does not constitute a statement as to the suitability of this layer for cultivation and sustainable plant growth. The topsoil was fully penetrated at the borehole locations.

Table Land

Fine Sand / Silty Sand

Yellow brown to red brown fine sand / silty was encountered below the topsoil layer in test pits TP2, TP3 and TP4. The sand was fully penetrated at depths of 1.05, 0.4 and 0.9 metres respectively. The sand was underlain by bedrock at TP2 and TP3 and by silty Clay at TP4.

Silty Clay

Silty clay was encountered beneath the topsoil in test pits TP1, TP6 and TP7 and beneath the fine silty sand in TP4. The silt clay was damp to dry to the touch and stiff to very stiff in consistency. The silt clay was fully penetrated in test pits TP1, TP4 and TP6 at depths of 0.4, 3.6 and 1.2 metres respectively. TP7 was terminated in the silty clay at 3.7 metres below grade. The silt clay was underlain by bedrock at TP1 and TP4 and by glacial till at TP6.

It is noted that OMAFRA mapping indicates marine deposited clays along the east side of the Mississippi River. As indicated by the factual information obtained from the test pits, the silty clay at the site is limited in thickness (depth) and extent. Further the silty clay encountered at the site is weathered and consolidated into a stiff to very stiff consistency. As such, the marine deposited silty clays encountered at the site do not detrimentally effect the stability of the slope and do not require any special construction technique or mitigation with respect to the proposed development.

Glacial Till

Glacial till was encountered below the topsoil in TP5 and below the sand in TP6 at depths of 0.5 and 1.2 metres respectively. The glacial till was compact to very dense and was underlain by bedrock.

Bedrock

Bedrock was encountered at all of the test pits put down on the table land with the exception of TP7. The depth to bedrock ranged from 0.4 to greater than 3.7 metres. The overburden thickness was in general shallower near the top of the slope and increased with distance from the slope. The bedrock where observed consisted of near horizontally bedded dolostone.

Slope

In general the subsurface conditions on the slope consisted of a thin layer of topsoil underlain by clayey silt followed by clayey silt or silty clay. The clayey silt and silty clay were dense / very stiff in consistency and damp to dry to the touch. The hand auger holes were advanced to refusal on stones or bedrock. The hand auger holes ranged in depth from about 0.3 to 2.2 in depth. Bedrock was exposed on the slope face at several locations.

Groundwater

Groundwater was not encountered in the test pits put down on the table land or within the hand auger holes put down on the upper and middle sections of the slope. Groundwater was observed seeping from the toe of the slope at several locations and was encountered near the ground surface in the auger holes put down near the toe of the slope. The slope stability sections modelled include a ground water level which varies from just above the bedrock at the top of the slope to just below the ground surface at the toe of the slope.

Slope Conditions

The majority of the site is currently vacant and has a relatively level area between the front of the site and the top of the river bank slope. Mapping obtained from the Mississippi Valley Conservation Authority website indicates that the regulation limit at the site is located approximately 25 metres west of the east property line at the north end of the site and approximately 100 metres west of the east property line at the south end of the site. It is understood that the regulation limit is imposed because of the valley land slope. It is further understood that the extent of the limit of hazard lands is not defined by a site specific geotechnical assessment.

At the time of the site visits by the undersigned, the height and inclination of the slope extending downward from the table land was measured using a hand clinometre at a number of locations. Additional slope sections were obtained during the topographic survey. The locations at which the sections were obtained are indicated on Kollaard Associates drawing 190712-EX. The cross sections were also overlain for comparative purposes.

In general the slope measurements obtained indicate that the ground surface naturally slopes downward from the relatively level table land above the top of the valley slope to the Mississippi River. The upper about 4 to 7 metre portion of the slope is inclined downward from horizontal at between 10 and 20 degrees. The middle about 15 to 20 metre section of the slope is inclined downward from horizontal at about 26 to 31 degrees. The lower portion of the slope is inclined downward at between 5 and 15 degrees from horizontal. The shoreline consists of a mixture of silty clay with some sand and gravel on the surface to exposed rock and bedrock. The river bed beyond the shoreline is relatively shallow and is comprised of bedrock. The following was also observed at the time of the site visit:

- The bedrock where exposed has near horizontal bedding plains;
- There was significant tree growth along the slope between the normal water's edge and top of the slope;
- There are no indications of historical instability of the slope;

Slope Assessment

The details of the required investigation have been defined based on Table 4.2 (slope stability rating chart) of the MNR's "Technical Guide River & Stream Systems: Erosion Harard Limit"

From Table 4-2

Category	Criteria	Rating
1. Slope Inclination	more than 26	16
2. Soil Stratigraphy	Thin Overburden (Silt, sand Clay)	12
3. Seepage from Slope Face	near bottom only	0
4. Slope Height	more than 10 m	8
5. Vegetation	Well Vegetated	0
6. Table Land Drainage	Minor Drainage over slope no active erosion	2
7. Proximity to Watercourse	Less than 15 m	6
8. Previous Landslide Activity	No	0
Total		44
44 – Moderate Potential = Boreholes, piezometers, lab tests, detailed report		

The river bank slope at the site consists of a thin layer of overburden underlain by bedrock which is stable at the height and angles present at the site. The bedrock forming the slopes consists of near horizontally bedded dolostone not prone to instability or erosion which could decrease the stability of the slope.

Piezometers were not installed at the site due to the thin layer of overburden overlying the bedrock. Ground water was either not encountered in the test holes or was near the ground surface.

Soil Strength Parameters

The soil conditions used in the stability analyses were based, in part, on the results of the test holes advanced across the site. The stability analyses were carried out using clayey silt or silty clay and bedrock strength parameters based on the results of the geotechnical investigation as well as our experience in the vicinity of the subject site and geology maps of the area.

The following table summarizes the parameters used in the analysis

Soil Parameters

Soil Type	Effective Angle of Internal Friction (degrees)	Effective Cohesion (kPa)	Unit Weight kN/m^3
Clayey Silt	38	1	19
Silty Clay	35	4	19
Bedrock	n/a	n/a	n/a

The results of the stability analysis are dependent on the assumed groundwater conditions. As previously indicated, the depth at which groundwater was encountered varied significantly from above the slope to the toe of the slope. As a conservative approach, the slope stability analysis were completed using a ground water level which ranged from about 1.0 metre below the ground surface on the table land near the top of slope to above the bedrock surface at the top of the slope and near the ground surface on the bottom section of the slope.

Existing Conditions

The slope stability analyses were completed using soils parameters, groundwater conditions and a slope profile that attempt to model the slopes in question. The cross sections selected are considered to be representative of the various conditions across the site. The models, however, do not exactly represent the actual conditions at the site.

For the purposes of this slope stability assessment:

Under Static conditions:

Slopes with a factor of safety of 1.1 to 1.3 are considered marginally stable, slopes with a factor of safety of greater than 1.3 are considered stable, and slopes with a factor of safety of 1.4 to 1.5 and greater are considered to be adequately stable for dwellings or structures located close to or on the slope crests

Under seismic conditions:

Slopes with a minimum factor of safety of 1.1 are considered to be stable.

The sopes at the site were modelled using the sections considered to be representative of the site in GeoStudio 2019 (Slope/W).

Seismic Stability was also modelled using GeoStudio 2019 (Slope/W) and a seismic coefficient of k = 0.111 where k is equal to one half of the Peak (horizontal) Ground Acceleration at 2% probability of exceedance in 50 years. A PGA of 0.222 was obtained for the site from the 2015 National Building Code Seismic Hazard Calculation.

The results of the slope stability assessment for each section under both static and seismic conditions are provided in Appendix B. The following table also summarizes the minimum factor of safety for each section.

Minimum Factor of Safety

Section	Minimum Factor of Safety		Minimum Safe Slope Setback Distance (m)
	Static	Seismic	
Section 1	1.19	1.18	below top of slope
Section 2	1.16	1.18	below top of slope
Section 3	2.13	1.67	below top of slope
Section 4	1.18	1.15	below top of slope
Section 5	1.22	1.10	below top of slope

Where the minimum safe slope setback distance is below the top of slope, all slipe 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.

Proposed Conditions

The proposed conditions will include constructing residential buildings along the crest of the slope with minimum setback from the crest of the slope. Since the overburden thickness is shallow at the crest of the slope, it is expected that the residential buildings will be founded directly on the bedrock. Provided that the proposed buildings adjacent the crest of the slope are founded on the bedrock underlying the table land, the loading from the buildings will be transferred to the bedrock with no impact on the stability of the slope. The proposed development will not impact the slope stability. As such the slope stability under proposed development conditions remains the same as that under the existing conditions.

Setback Requirements

For unstable slopes, the distance from the unstable slope to the safe setback line is called the 'Erosion Hazard Limit' In accordance with the Ontario Ministry of Natural Resources Technical Guide - River & Stream Systems: Erosion Hazard Limit 2002 [MNR Technical Guide], the Erosion Hazard Limit consists of three components: (1) Stable Slope Allowance, (2) Toe Erosion Allowance, and (3) Erosion Access Allowance.

Component 1) Stable Slope Allowance

The stable slope allowance, corresponds to the minimum set back distance from the top of the slope such that the minimum factor of safety originating for any slip surface originating at or beyond the setback distance is greater than 1.5.

The slope stability analysis completed on each of the sections indicated that the stability of portions of the slope represented by each section, with the exception of section 3, are marginally stable having factors of safety of less than 1.3. The modelling however indicates that the instability in each section occurs along the steeper section of the slope represented by the section. The minimum distance between the top of slope and the location at which all of the slip surfaces have a factor of safety of greater than 1.5 is 2.7 metres below the top of slope. The minimum factors of safety for any surface originating near the top of slope and on the table land above the top of slope are all above 1.5. Therefore, the stable slope allowance, resulting in a setback from the top of slope, as described in the MNR Technical Guide is not required.

Component 2) Toe Erosion Allowance

The minimum toe erosion allowance for a slope adjacent a river is defined by Table 3: Determination of Toe Erosion Allowance in the MNR Technical Guide copied below.

Table 3: Determination of Toe Erosion Allowance

MINIMUM TOE EROSION ALLOWANCE - River Within 15 m of Slope Toe*

Type of Material Native Soil Structure	**Evidence** of Active Erosion** **OR** Bankfull Flow Velocity > Competent Flow Velocity***	**No evidence** of Active Erosion** **OR** Bankfull Flow Velocity <Competent Flow Velocity***		
	RANGE OF SUGGESTED TOE **EROSION ALLOWANCES**	Bankfull Width < 5m	5-30m	> 30m
1.Hard Rock (granite) *	0 - 2 m	0 m	0 m	1 m
2.Soft Rock (shale, limestone) Cobbles, Boulders *	2 - 5 m	0 m	1 m	2 m
3.Stiff/Hard Cohesive Soil (clays, clay silt), Coarse Granular (gravels) Tills *	5 - 8 m	1 m	2 m	4 m
4.Soft/Firm Cohesive Soil, loose granular, (sand, silt) Fill *	8 - 15 m	1-2 m	5 m	7 m

As previously indicated, the subsurface conditions along the shoreline at the site consisted of a mixture of silty clay / clayey silt with cobbles and boulders to exposed bedrock (condition 3). 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. The bank full width is greater than 30 metres. Based on the shore line conditions, the range of suggested toe erosion allowance is 5 to 8 metres. It is considered that an erosion allowance of 6 metres be used due to the presence of the cobbles and boulders along the shoreline and because active erosion only occurs during periods of high flow.

As shown in Figure 115b copied below from the MNR Technical Guide the toe erosion allowance is applied at the bottom of the slope beginning at the edge of the river bank. The stable slope is then measured from the extent of the toe erosion allowance. From component 1, stable slope allowance calculated above, the stable slope line shown in the figure below would exist out of the face of the slope between the top of the slope and the watercourse.

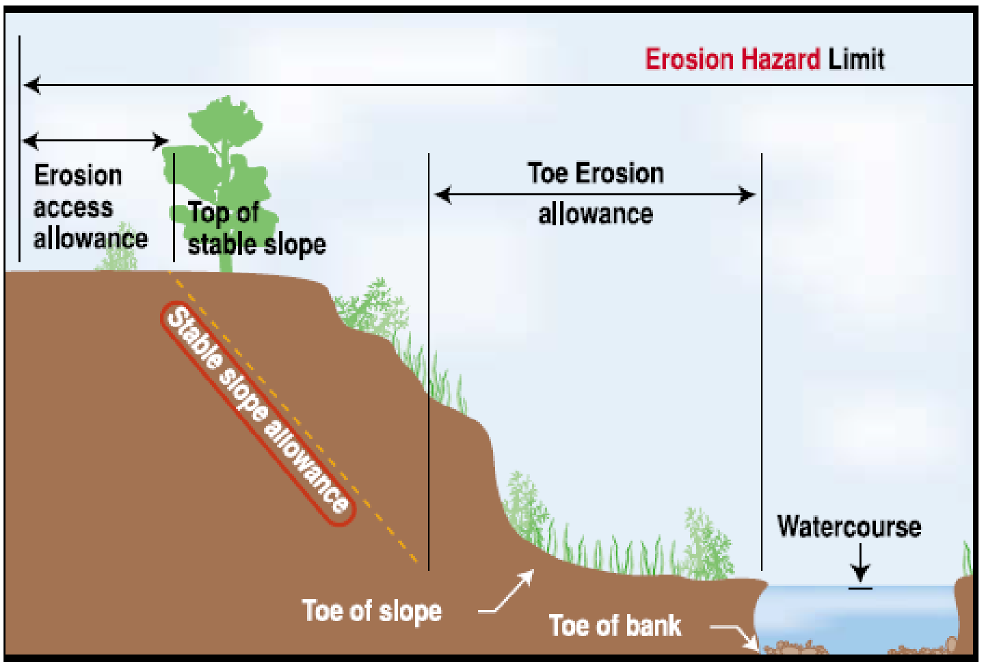


Figure 115 b - Stable Slope Allowance
(toe of valley slope ≤15m from watercourse)

Because the slope at the side is comprised of a thin layer of overburden underlain by bedrock, there is no potential for the full extent of this erosion to be realized. The erosion will also not affect the overall stability of the slope because the overall stability of the slope is governed by the underlying bedrock. Since erosion of at the toe of the slope will not affect the overall stability of the slope, the erosion toe allowance will not affect the safe slope allowance or result in the requirement for a safe slope setback. Since potential erosion has no impact of the stability of the slope or on the stable slope allowance, the toe erosion allowance should be included at the toe of the slope. Referencing Figure 115b above, including a toe erosion allowance of 6 metres at the toe of the slope will not cause the stable slope allowance line shown in the figure to immerge past the top of slope. As such, the toe erosion allowance will not contribute to an Erosion Hazard Limit beyond the top of the slope.

Component 3) Erosion Access Allowance

The MNR technical Guide suggests that the erosion access allowance for river and stream systems be 6 metres. 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.

It is considered that the erosion access allowance measured from the top of slope (top of stable slope) at the site is not appropriate for the site for the following reasons:

- The slope at the site has a height of between 24 and 28 metres. The horizontal length of the slope is between 65 and 90 metres. Due to the significant height and length of the slope, a six metre wide access allowance will not provide access to the slope where erosion will occur.
- The slope is well vegetated with large trees. These trees will prevent access by equipment to the slope from the top of the slope.
- The length and height of the slope will prevent construction access to the majority of the slope for maintenance.
- There are no areas of provincial interest adjacent the site.
- Due to the site specific conditions, an erosion access allowance cannot meet any of the principles that support the inclusion of the erosion access allowance.

It is considered that it would be more appropriate to upgrade the existing vehicle access trail to form a construction access roadway that could be used for maintenance or erosion repair along the toe of the slope.

Erosion Hazard Limit

Based on the results of the slope stability assessment and the considerations above with respect to the toe erosion allowance and the erosion access allowance at the site, the Erosion Hazard Limit for the site is as follows:

Erosion Hazard Limit = Toe Erosion Allowance + Stable Slope Allowance + Erosion Access Allowance

Erosion Hazard Limit = (measure from toe of slope) + 0 + 0 = 0 metres.

Notwithstanding the above calculation for the erosion hazard limit, it is considered prudent to provide a setback from the top of slope to ensure that any proposed structure be founded on sound bedrock in a manner that will ensure the structure and associated development does not impact the stability of the slope. It is considered that this setback be calculated as follows: 6 metres for erosion allowance + (-)2.7 metres for stable slope allowance = 3.3 metres. The stable slope allowance is negative as the minimum stable slope distance is measured to a point below the top of slope.

It is considered that the proposed Erosion Hazard Limit setback distance of 3.3 metres will ensure a long term stable slope for the proposed development. All proposed buildings will be founded on sound bedrock set back from the top of slope at a distance where any surficial failure along the steeper section of the slope or erosion at the toe of the slope will have no impact.

Conclusions

Based on the results of this assessment of the slope stability and limit of Hazard Lands Setback at the site, it is considered that a Hazard Lands Setback of 3.3 metres is appropriate for the site.

In view of the subsurface conditions comprised of a thin layer of overburden overlying bedrock comprising the slope in question, it is the professional opinion of the undersigned geotechnical engineer that the construction of a residential development with buildings set back from the top of slope by 3.3 metres and bearing on sound bedrock will have no adverse affects on the stability of the slope. The slope at the site is considered to be adequately stable to allow the construction of the proposed residential buildings at a setback distance from the top of slope of 3.3 metres.

The top of slope should be verified in the field by the geotechnical engineer taking into account the change in slope inclination and topographic conditions.

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

Sincerely,
KOLLAARD ASSOCIATES INC.

LICENSED PROFESSIONAL ENGINEER
30.NOV.2021
S.E. deWit
100079612
PROVINCE OF ONTARIO

Steven deWit, P.Eng.

APPENDIX A – RECORD OF TEST HOLES

RECORD OF TEST PITS, BOREHOLES AND PROBE HOLES
SLOPE STABILITY ASSESSMENT
38 CARSS STREET
ALMONTE, ONTARIO

TABLE I
TEST PITS ADVANCED USING TIRE MOUNTED BACKHOE SEPTEMBER 11, 2019

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP1 (Line 1) Sept 11, 2019	0.00 – 0.20	TOPSOIL
	0.20 – 0.40	brown SILTY CLAY, trace fine sands
	0.40	End of test pit on BEDROCK
TP2 (under hydro line) Sept 11, 2019	0.00 – 0.25	TOPSOIL
	0.25 - 1.05	Till, red brown FINE SAND with cobbles and boulders trace clay
	1.05	End of test pit on BEDROCK
TP3 (line 2) Sept 11, 2019	0.00 – 0.30	TOPSOIL
	0.30 – 0.40	Red brown FINE SAND trace silt
	0.40	End of test pit on BEDROCK
TP4 Sept 11, 2019	0.00 – 0.25	TOPSOIL
	0.25 – 0.90	Yellow brown, fine SILTY SAND trace clay and cobbles
	0.90 – 3.60	Grey brown STIFF CLAY
	3.60 -	End of test pit on BEDROCK

TABLE I(continued)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP5 (near line 3 by garden) Sept 11, 2019	0.00 – 0.40	Fill Clay
	0.40 – 0.50	TOPSOIL
	0.50 – 1.30	Yellow brown to grey brown GLACIAL TILL (fine sand mixed with boulders and cobbles with clay pockets)
	1.30	End of test pit on BEDROCK
TP6 Sept 11, 2019	0.0 - 0.30	TOPSOIL
	0.30 – 1.20	Grey brown stiff SILTY CLAY (Sample taken)
	1.20 – 2.10	GLACIAL TILL – Grey brown clay with sand pockets boulders and cobbles
	2.10	End of test pit on large boulder or BEDROCK
TP7 Sept 11, 2019	0.0 – 0.25	TOPSOIL
	0.25 – 3.70	Grey brown STIFF CLAY
	3.70 –	End of test pit

TABLE II
AUGER HOLES ADVANCED USING HAND AUGER AUGUST 22, 2019

AUGER HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
AH1 Aug 22, 2019	0.00 – 0.15	TOPSOIL
	0.15 – 0.76	grey brown CLAYEY SILT, dense some sand and gravel sizes beginning at 0.6 m.
	0.76 – 1.42	grey brown SILTY CLAY, very stiff to hard
	1.42 -	ended auger hole with refusal to further advancement by hand.
AH2 Aug 22, 2019	0.00 – 0.20	TOPSOIL
	0.20 – 0.71	grey brown CLAYEY SILT, dense some sand and gravel sizes beginning at 0.4 m.
	0.71 – 1.60	grey brown SILTY CLAY, very stiff to hard
	1.60 -	ended auger hole in silty clay.
AH3 Aug 22, 2019	0.00 – 0.20	TOPSOIL
	0.20 – 1.22	grey brown SILTY CLAY, very stiff to hard
	1.22 – 1.32	grey brown CLAYEY SILT, dense
	1.32 – 1.35	red brown, SAND
	1.35 -	ended auger hole refusal to advance on bedrock.

TABLE II Continued

AUGER HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
AH4 Aug 22, 2019	0.00 – 0.36	TOPSOIL
	0.36 – 0.61	yellow brown SILTY SAND, fine, dense to very dense,
	0.61 – 1.93	grey brown SILTY CLAY, very stiff to hard
	1.93 – 2.18	yellow brown to grey brown GLACIAL TILL (fine sand, silt, gravel and clay)
	2.18 -	ended auger hole with refusal to further advancement by hand
AH5 Aug 22, 2019	0.00 – 0.10	TOPSOIL
	0.10 – 0.25	grey brown SILTY CLAY, very stiff to hard
	0.25 -	ended auger hole refusal to advance on bedrock.
AH6 Aug 22, 2019	0.00 – 0.10	TOPSOIL
	0.10 – 0.46	grey brown CLAYEY SILT, dense
	0.46 – 1.24	grey brown SILTY CLAY, very stiff to hard
	1.24 -	ended auger hole refusal to advance on bedrock.

TABLE II Continued

AUGER HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
AH7 Aug 22, 2019	0.00 – 0.20	TOPSOIL
	0.20 – 0.45	grey brown CLAYEY SILT, dense
	0.45 – 0.50	yellow brown SILTY SAND, some clay fine, dense to very dense,
	0.50 – 157	grey brown SILTY CLAY, very stiff to hard some sand below 0.94 metres
	1.57 – 2.13	yellow brown to red brown SILTY SAND, some gravel
	2.13 -	ended auger hole with refusal to further advancement by hand

TABLE III
PROBE HOLES ADVANCED USING 1.22 METRE HAND PROBE AUGUST 21, 2019

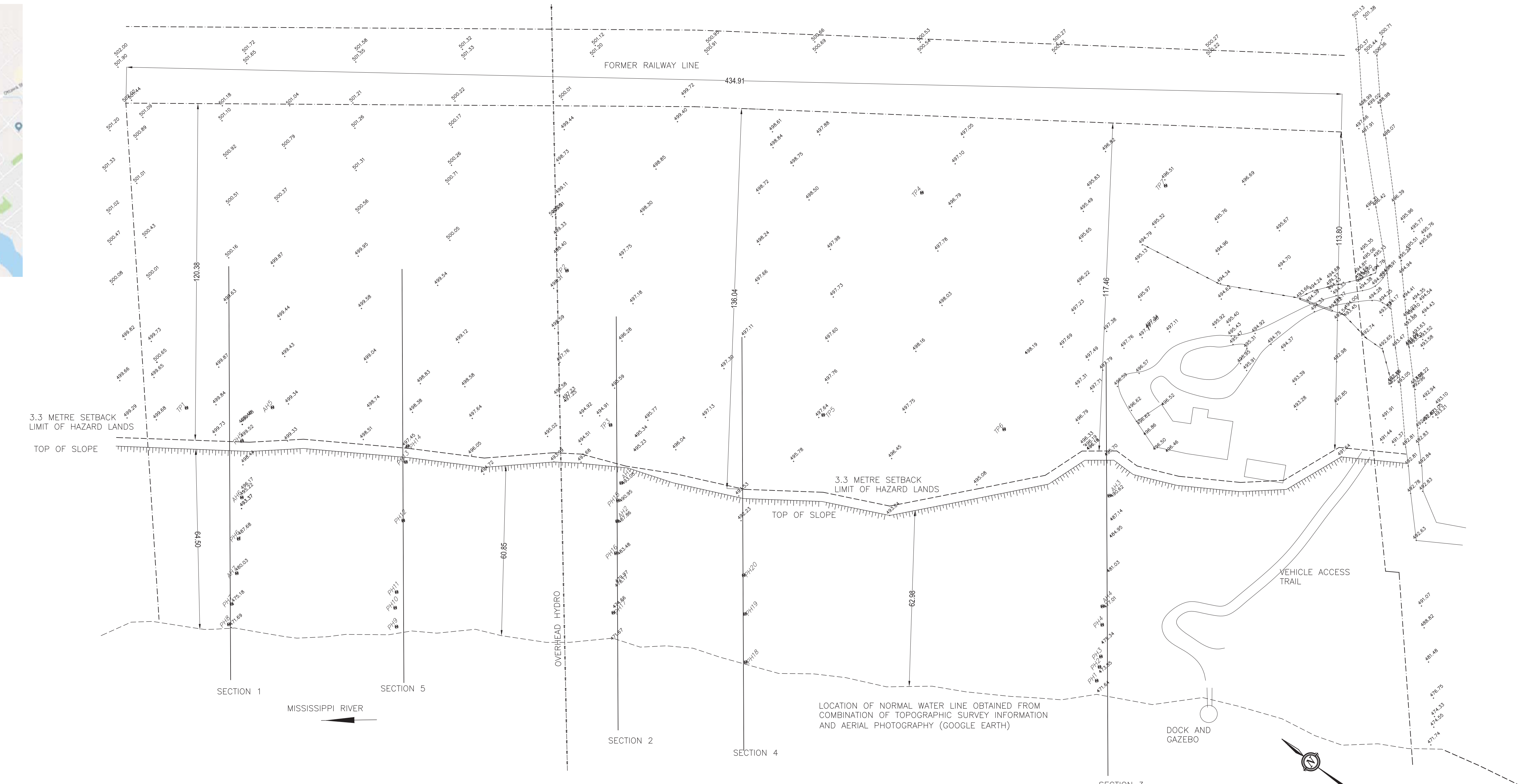
PROBE HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
PH1 Aug 21, 2019	0.00 –	OVERBURDEN
	1.17 –	refusal to further advancement on rock
PH2 Aug 21, 2019	0.00 –	OVERBURDEN
	1.17 –	refusal to further advancement on rock
PH3 Aug 21, 2019	0.00 –	OVERBURDEN
	1.22 –	refusal to further advancement on rock
PH4 Aug 21, 2019	0.00 –	OVERBURDEN
	1.22 –	Overburden thickness greater than length of probe.
PH4 Aug 21, 2019	0.00 –	OVERBURDEN
	1.22 –	Overburden thickness greater than length of probe.
PH5 Aug 21, 2019	0.00 –	OVERBURDEN
	0.30 –	refusal to further advancement on rock
PH6 Aug 21, 2019	0.00 –	OVERBURDEN
	0.91 –	refusal to further advancement on rock
PH6 Aug 21, 2019	0.00 –	OVERBURDEN
	0.91 –	refusal to further advancement on rock

TABLE III Continued

PROBE HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
PH7 Aug 21, 2019	0.00 –	OVERBURDEN cobbles / boulders encountered below 0.6 metres
	1.22 –	Overburden thickness greater than length of probe.
PH8 Aug 21, 2019	0.00 –	OVERBURDEN cobbles / boulders encountered below 0.6 metres
	1.22 –	Overburden thickness greater than length of probe.
PH9 Aug 21, 2019	0.00 –	OVERBURDEN cobbles / boulders encountered below 0.3 metres
	1.37 –	refusal to further advancement on rock
PH10 Aug 21, 2019	0.00 –	OVERBURDEN
	1.07 –	refusal to further advancement on rock
PH11 Aug 21, 2019	0.00 –	OVERBURDEN
	0.91 –	refusal to further advancement on rock
PH12 Aug 21, 2019	0.00 –	OVERBURDEN
	1.22 –	Overburden thickness greater than length of probe.
PH13 Aug 21, 2019	0.00 –	OVERBURDEN
	0.91 –	refusal to further advancement on rock

TABLE III Continued

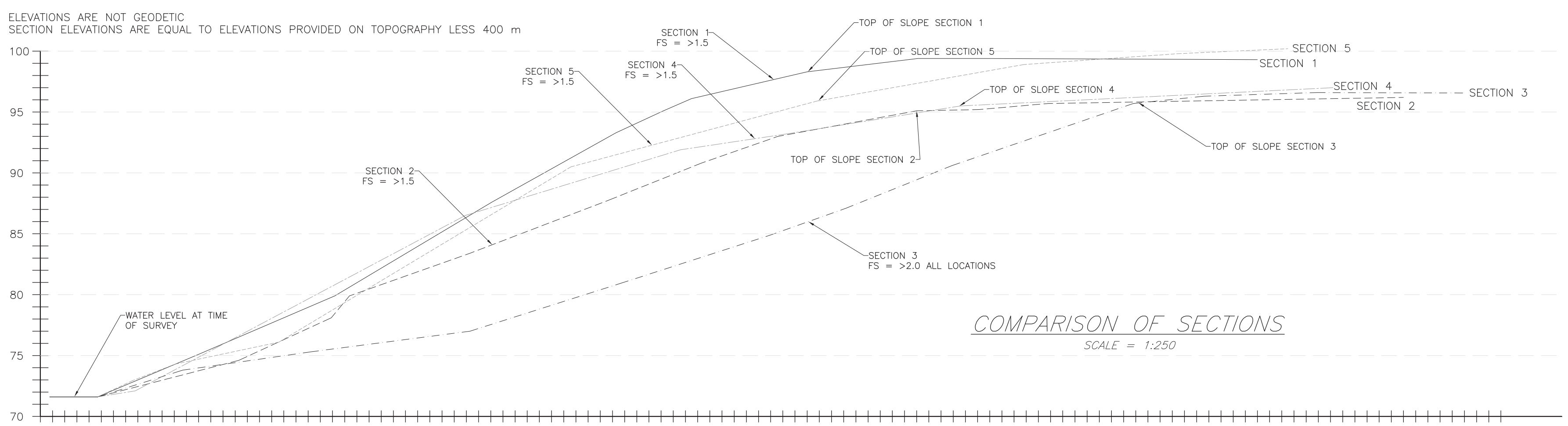
PROBE HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
PH14 Aug 21, 2019	0.00 –	Exposed bedrock at surface
PH15 Aug 21, 2019	0.00 –	OVERBURDEN
	0.91 –	refusal to further advancement on rock
PH16 Aug 21, 2019	0.00 –	OVERBURDEN
	1.07 –	refusal to further advancement on rock
PH17 Aug 21, 2019	0.00 –	OVERBURDEN
	0.91–	refusal to further advancement on rock
PH18 Aug 21, 2019	0.00 –	OVERBURDEN
	0.76 –	refusal to further advancement on rock
PH19 Aug 21, 2019	0.00 –	Exposed bedrock at surface
PH20 Aug 21, 2019	0.00 –	OVERBURDEN
	1.22 –	Overburden thickness greater than length of probe.



EXISTING SITE TOPOGRAPHY

SCALE = 1:750

ELEVATIONS ARE NOT GEODETIC
SECTION ELEVATIONS ARE EQUAL TO ELEVATIONS PROVIDED ON TOPOGRAPHY LESS 400 m



COMPARISON OF SECTIONS

SCALE = 1:250

NOTE:
SECTIONS 1, 2 AND 3 WERE OBTAINED FROM THE TOPOGRAPHIC SURVEY
SECTIONS 4 AND 5 WERE OBTAINED USING A HAND HELD SLOPE CLINOMETER

KEY PLAN

NOT TO SCALE

NOTES:

No.	REVISION	DATE	BY
1	ISSUED IN SUPPORT OF SLOPE STABILITY ASSESMENT	18.NOV.2019	SD
0	ISSUED FOR CLIENT REVIEW	18.SEP.2019	SD

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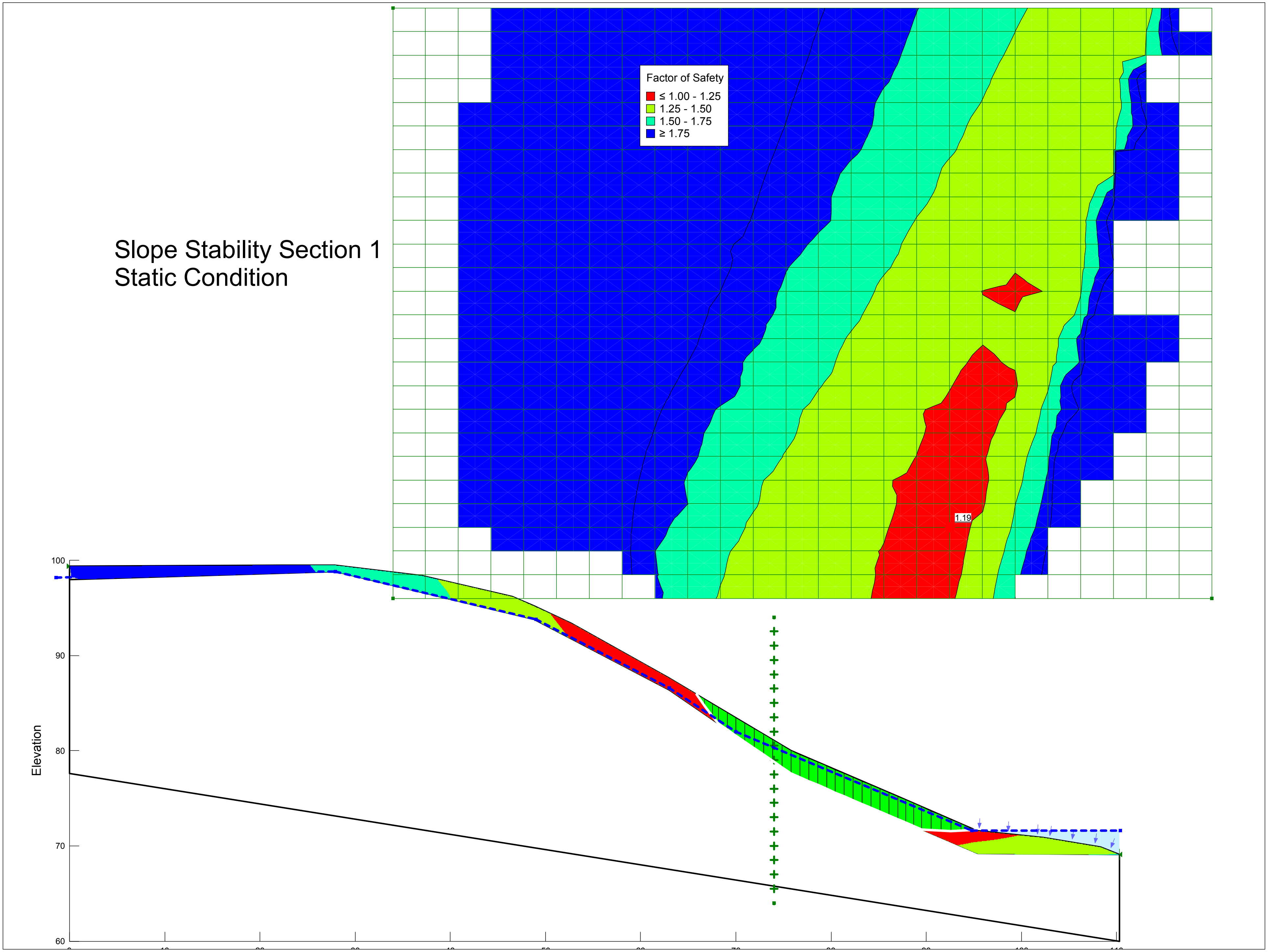
DESIGN	SD
CHECKED	SD
DRAWN	SD
CHECKED	SD
APPROVED	SD

STAMP

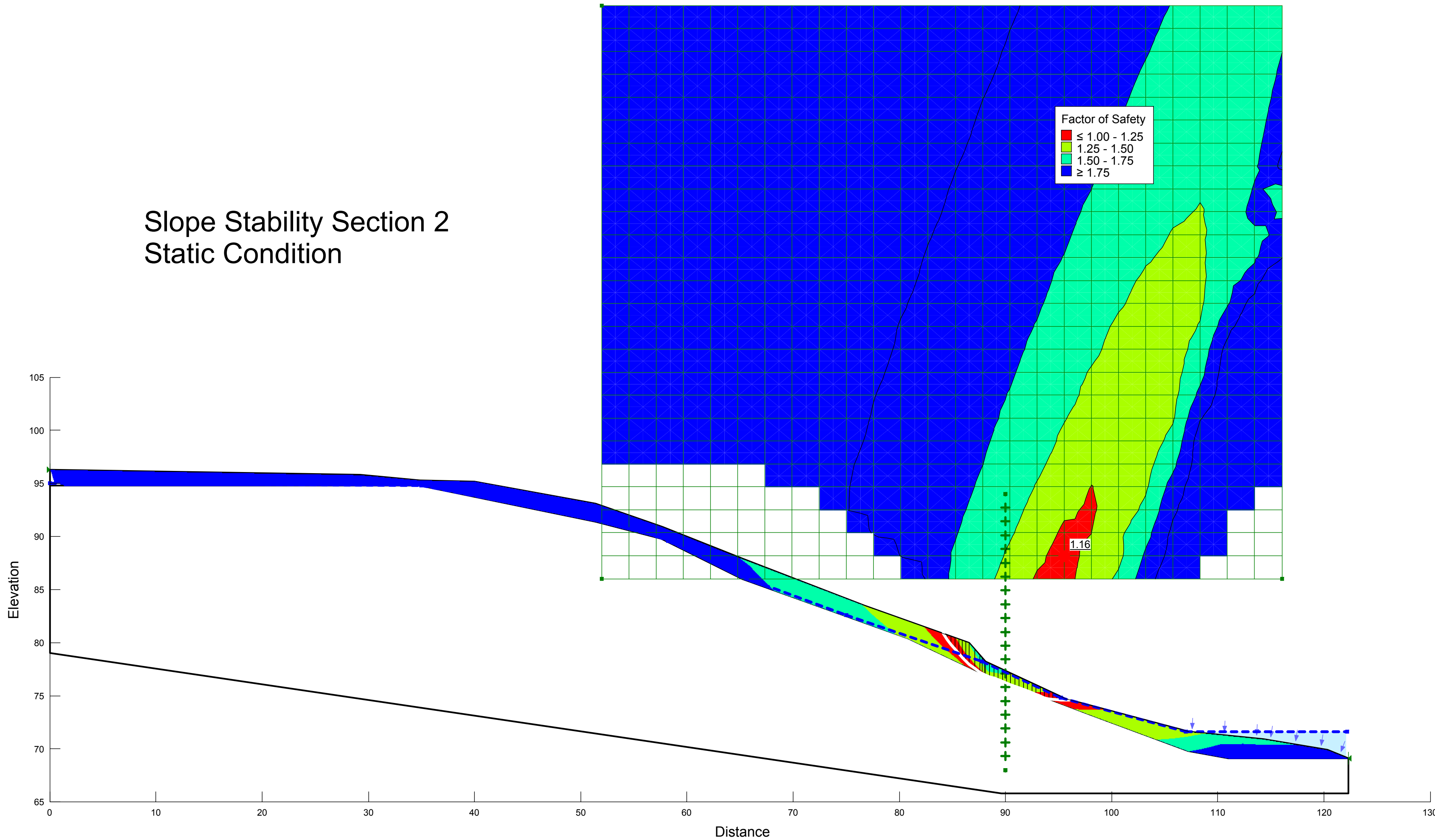
CLIENT NAME: ALFRED POTVIN	PROJECT No.: 190712
PROJECT NAME: PROPOSED RESIDENTIAL DEVELOPMENT	DATE: 18.SEP.2019
PROJECT LOCATION: CARSS STREET, ALMONTE, ONTARIO	SCALE: AS SHOWN
DRAWING: EXISTING SITE CONDITIONS	DRAWING No.: 190712-EX

APPENDIX B – SLOPE STABILITY ANALYSIS RESULTS

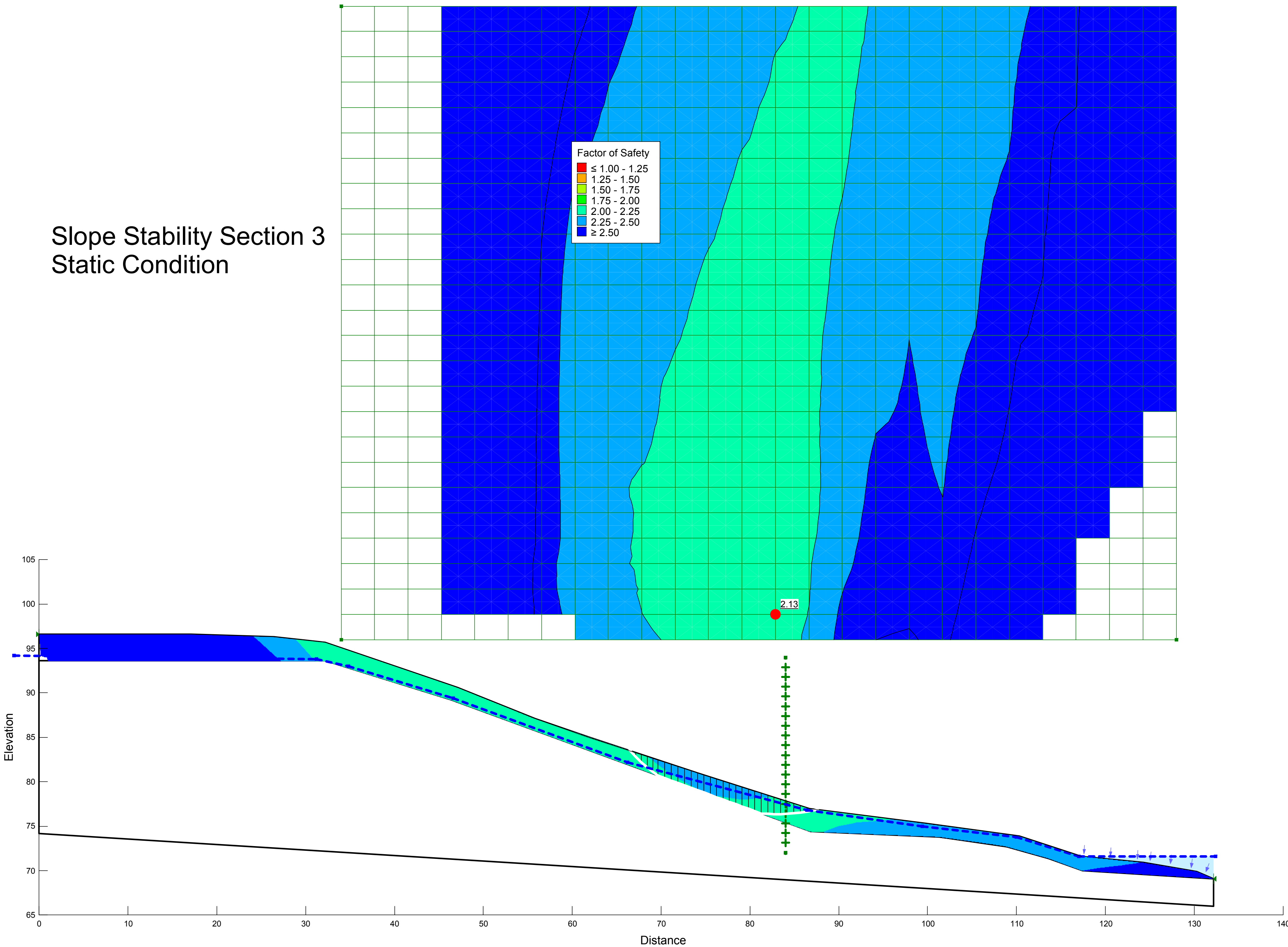


Slope Stability Section 1
Static Condition
Factor of Safety
≤ 1.00 - 1.25
1.25 - 1.50
1.50 - 1.75
≥ 1.75
1.19
Elevation
100
90
80
70
60

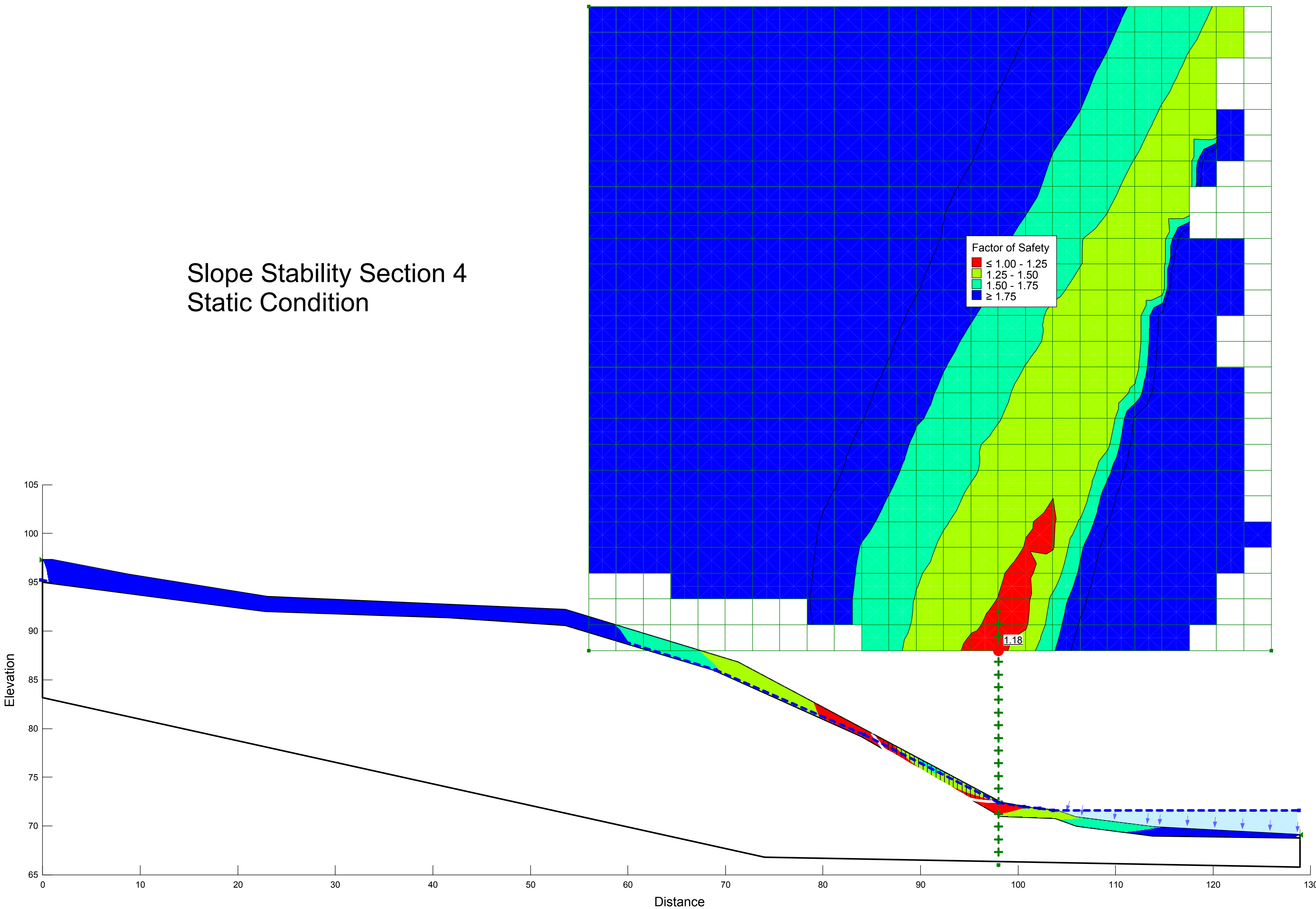
Slope Stability Section 2
Static Condition



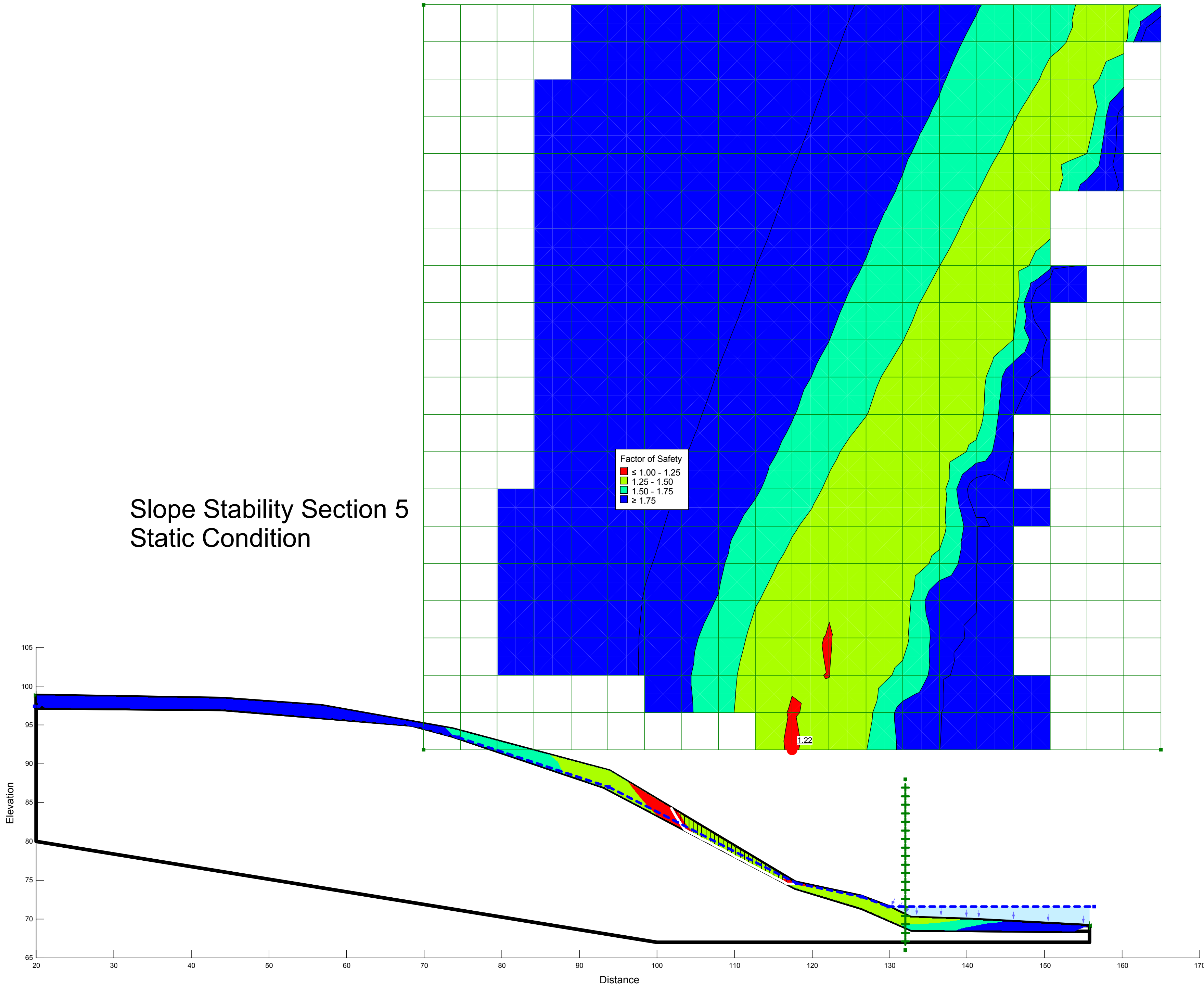
Slope Stability Section 3
Static Condition



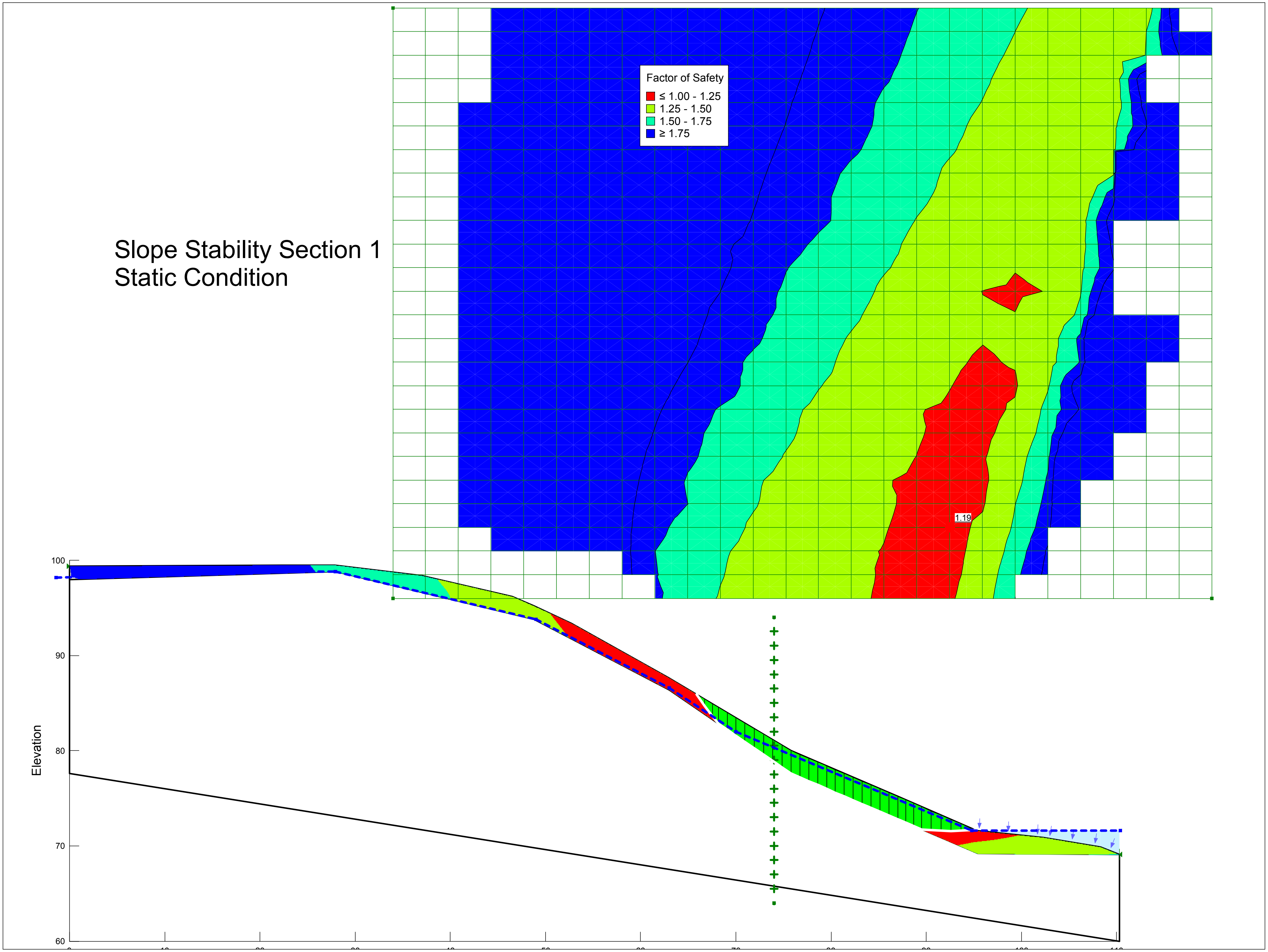
Slope Stability Section 4
Static Condition



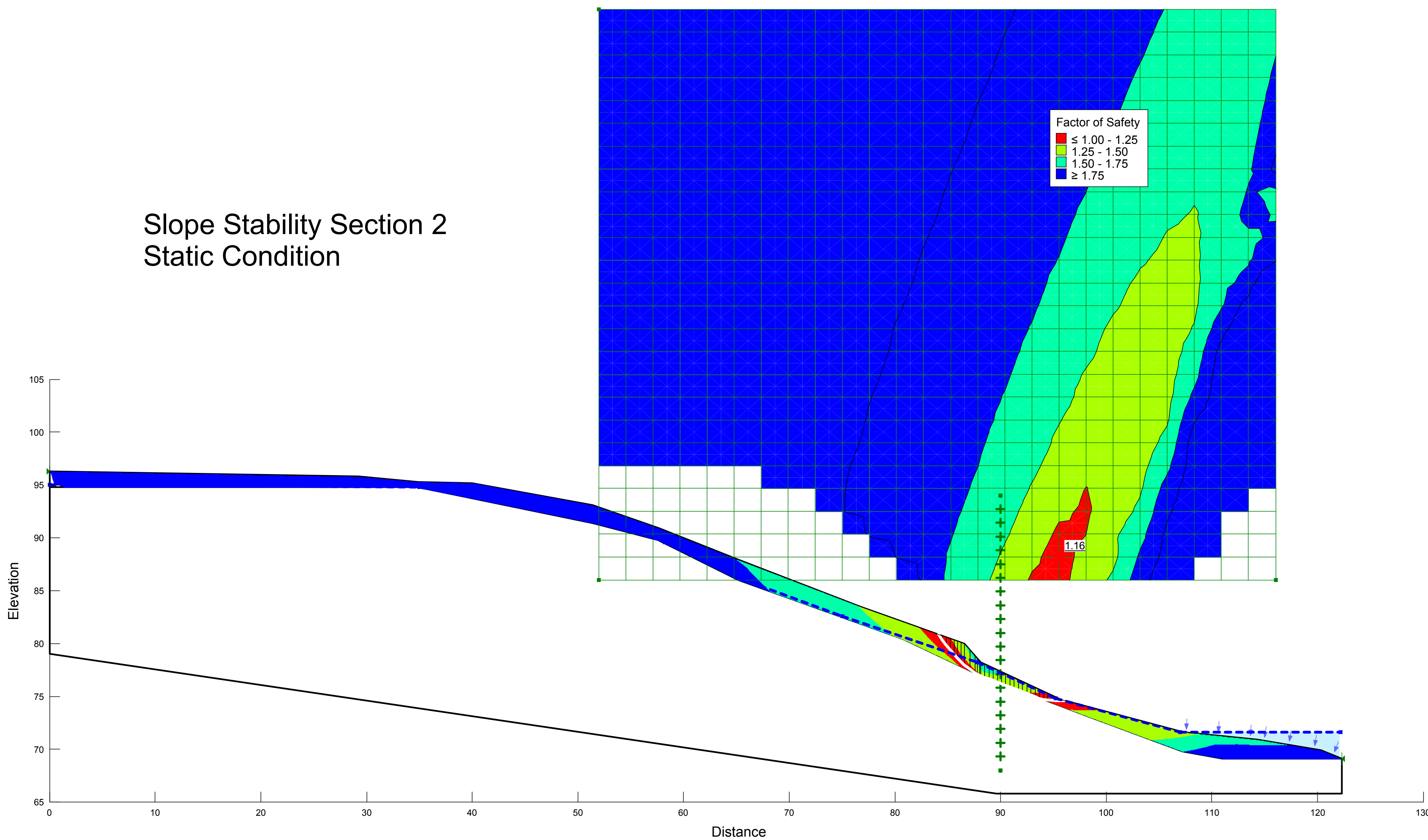
Slope Stability Section 5
Static Condition



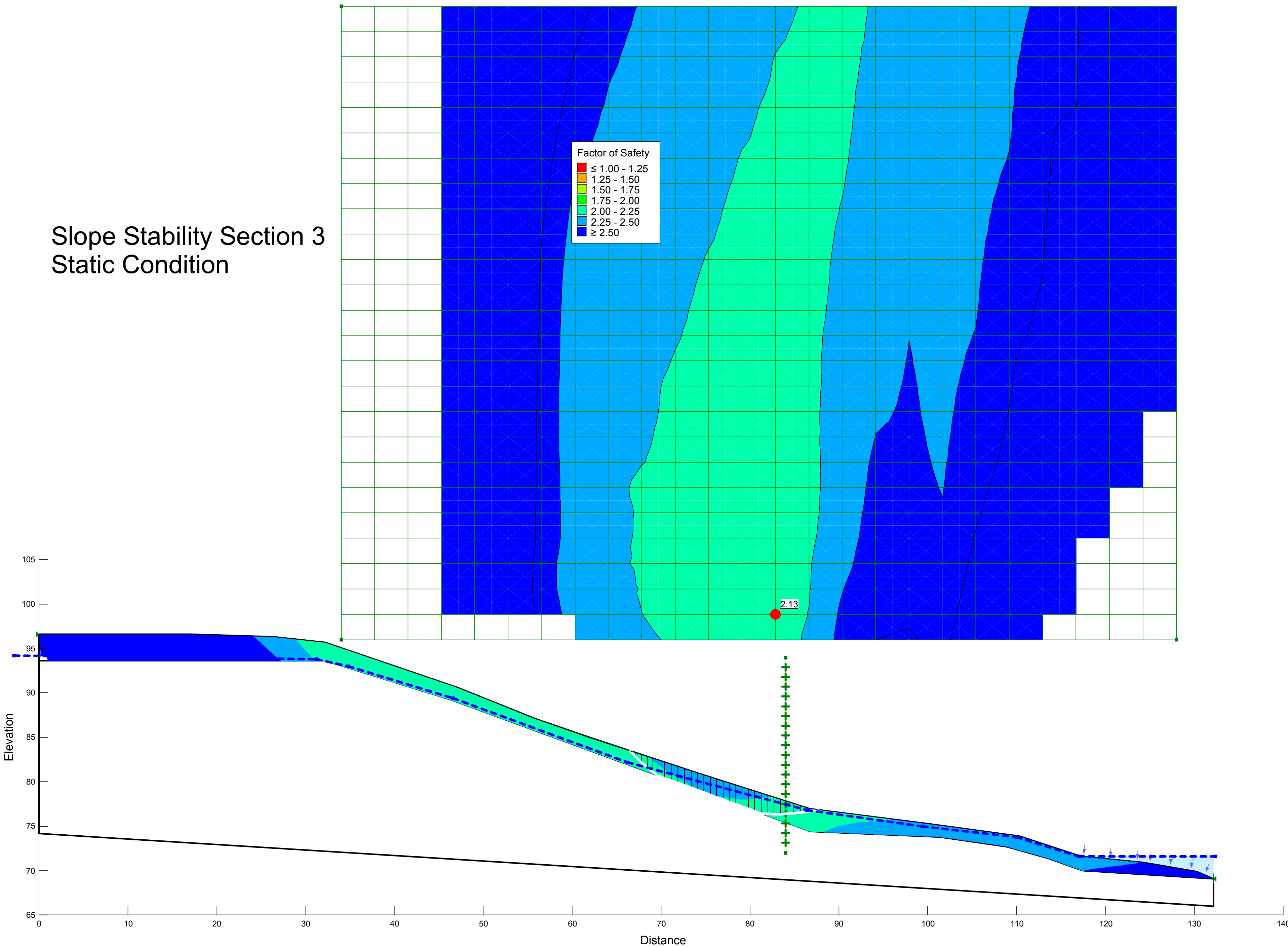
Slope Stability Section 1
Static Condition



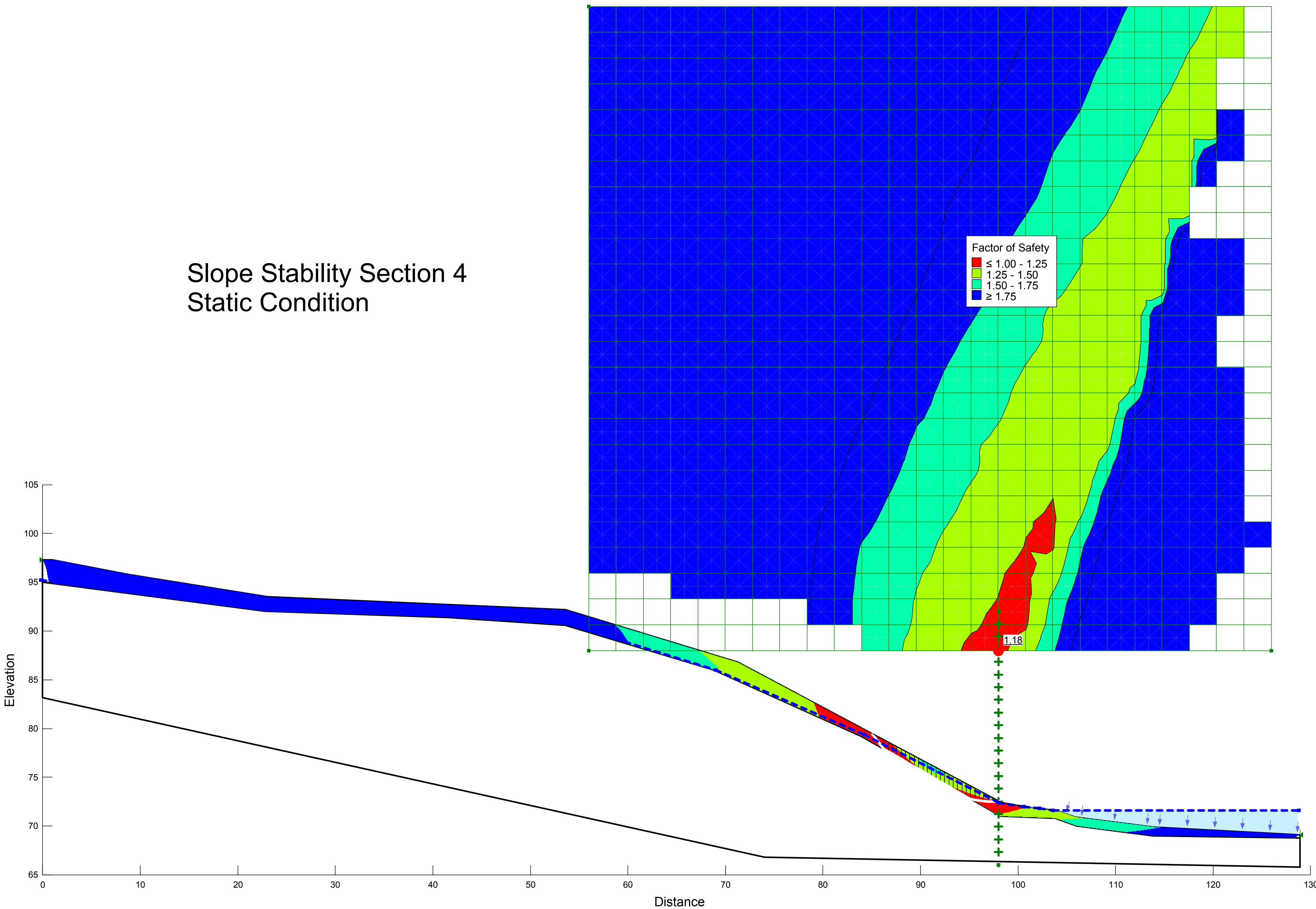
Slope Stability Section 2
Static Condition



Slope Stability Section 3
Static Condition



Slope Stability Section 4
Static Condition



Slope Stability Section 5
Static Condition