SOIL-MAT ENGINEERS & CONSULTANTS LTD.

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PROJECT NO.: SM 135134-G

January 14, 2014

Penta Properties Inc.
4480 Paletta Court
Burlington, Ontario
L7L 5R2

Attention: Mr. Dave Pitblado

SLOPE STUDY
FALCON CREEK, INDIAN CREEK AND GRINDSTONE CREEK
1200 KING ROAD
BURLINGTON, ONTARIO

Dear Mr. Pitblado,

As requested, SOIL-MAT ENGINEERS conducted a slope stability study of the creek valleys on the above noted site to determine the location of the Top of Stable Slope of the valleys. The slope assessment, determination of the Top of Stable Slope and stability analyses were conducted in accordance with the applicable guideline policies of MNR and Conservation Halton [CH].The results of our stability analyses are presented in the following paragraphs.

PROCEDURE:

Survey data was provided to our office by Metropolitan Consultants, and used to prepare representative cross sections of the slopes adjacent to Falcon, Indian and Grindstone Creeks. The subsurface soil conditions across the subject property were previously investigated and reported in our Geotechnical Investigation entitled, "**Geotechnical Investigation, Proposed Business/Commercial and Mixed-Use Development, 1200 King Road, Burlington, Ontario**", SM 135134-G, dated November 22, 2013. The subject site was also visited by a representative of our office to conduct a general visual evaluation of the subject slopes.

Stability analyses of the subject slopes were performed with a computerized modelling program [SLOPE/W 2007] utilising multiple methods of analysis [Ordinary, Bishop and Janbu] and considering different slip planes and centres of rotation, to determine the minimum factor of safety for a series of potential trial slip surfaces.

SLOPE AND SUBSURFACE SOIL CONDITIONS:

Soil properties for the subsurface soils were assigned based on the findings of our referenced geotechnical investigation report. The subsurface soils typically consist of shallow Sandy fill deposits and/or disturbed/weathered native soils in the upper about 1 to 1.5 metres underlain by stiff to very stiff native Silty Clay. The following material properties were considered in the stability assessment:

Fill and/or near surface disturbed soils:

Friction Angle, $\phi = 28^{\circ}$ Cohesion, c = 0 kPa
Unit Weight, $\gamma = 19.0$ kN/m^3

Native Silty Clay:

Friction Angle, $\phi = 30^{\circ}$ Cohesion, c = 2 kPa
Unit Weight, $\gamma = 19.0$ kN/m^3

The face of the subject slopes were lightly vegetated with grass and scrub vegetation, with occasional small to mature trees. As mentioned above, the upper layers of the subsurface soils consist of a weathered sandy fill and native soils. The survey information indicated the slopes adjacent to the banks of Indian Creek and Grindstone Creek had overall inclinations as flat as, or flatter than, 3 horizontal to 1 vertical, indicating an inherently stable slope condition. As such the physical crest of the slopes of the banks of Indian and Grindstone Creek would be considered the Top of Stable Slope. Drawing Nos. 1 and 2, appended to the end of this report, provide sample cross-sections of the two creeks to demonstrate the relatively flat bank slopes.

TOP OF STABLE SLOPE AND STABILITY ANALYSIS:

For the slopes adjacent to the banks of Falcon Creek, representative cross sections were selected at six stations along the creek alignment and subjected to detailed stability analyses. The profile sections are illustrated in the attached Drawings Nos. 3 to 9, inclusive.

The Top of Stable Slope locations were calculated in general accordance with the guideline policies of the CH, including the Natural Hazards Technical Guide by the Ministry of Natural Resources [MNR] and the supporting document "Geotechnical Principles for Stable Slopes". These Top of Stable Slope locations were calculated by applying a stable slope inclination to a pre-determined setback from the toe of the slope, referred to as the erosion allowance. A conservative 2.3 horizontal to 1 vertical stable slope allowance has been applied to a 1 metre erosion allowance.

Based on our analyses, the minimum factor of safety of the existing slopes with respect to slope failure through the established Top of Stable Slope is presented in the following table:

SUMMARY OF FACTORS OF SAFETY – FALCON CREEK

Falcon Creek Station	Left Bank		Right Bank	
	Minimum Factor of Safety	Top of Stable Slope Setback from Crest (m)	Minimum Factor of Safety	Top of Stable Slope Setback from Crest (m)
0+080.00	1.408	3.5	1.459	4.1
0+160.00	1.993	3.8	1.996	3.0
0+260.00	2.085	3.6	1.514	-
0+340.00	1.552	1.9	1.873	0
0+380.00	1.518	3.5	2.094	-
0+420.00	1.884	1.8	2.293	3.9

Note: "Left" and "Right" refers to the view of the slopes from the centreline of the creek, facing in the direction of increasing chainage.

The Ministry of Natural Resources "Geotechnical Principles for Stable Slopes" publication, Table 7.2 lists a minimum Factor of Safety of between 1.3 to 1.5 for Active Land Use application [habitable or occupied structures]. With factors of safety well above this range the banks of Falcon Creek are considered to be stable in both the short and long-term. It is noted that theoretical shallow failure planes would exist with appreciably lower calculated factors of safety, however these models do not account for the stabilizing effect of surface vegetation. Furthermore, any such shallow movements would not impact the global stability of the slope.

CONCLUSION AND RECOMMENDATIONS:

The results of this study confirm that the banks of both Indian and Grindstone Creeks are inherently stable across the subject site, at inclinations of 3 horizontal to 1 vertical or flatter. As such the Top of Stable slope would coincide with physical crest of slope. The stability analyses of Falcon Creek confirm the Top of Stable Slope, as summarized above and illustrated on the attached slope profiles, to have factors of safety in excess of 1.5. Any development 'uphill' of the physical crest/Top of Stable Slope would have no impact on the subject slopes, from a geotechnical point of view.

It should be noted that any development slopes outside of the established Top of Stable Slope should have a maximum inclination of 2.3 horizontal to 1.0 vertical.

The following recommendations should be incorporated into the design and construction of the proposed development.

1. Heavy construction equipment, such as excavators, bulldozers, etc., should not come any closer to the slope than the Top of Stable Slope/physical crest of slope. A temporary silt fence should be erected along, or just downhill of the Top of Stable Slope to delineate the work area and prevent sediment runoff during construction.
2. Excavated soil or other fill should not be placed over the crest of the slopes.
3. Any drainage, and/or surface runoff should be directed away from the slopes. Or towards the slope in a controlled fashion, such as sheet flow through well-established grass or vegetation, so as to not alter the natural drainage over the slopes or create concentrated flows onto the slopes.
4. Vegetation should be maintained on the subject slopes and/or reinstated/improved post construction to further improve/maintain the stability of the slope. Conservation Halton should be contacted to discuss appropriate species for such vegetation.

We trust that this information is satisfactory for your purposes. Should you have any questions please do not hesitate to contact the undersigned.

Yours very truly,
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Kyle Richardson, B.Eng., EIT

Stephen R. Sears, B. Eng. Mgmt., P. Eng.
Project Engineer

LICENSED PROFESSIONAL ENGINEER
JAN 14/14
S. R. SEARS
PROVINCE OF ONTARIO

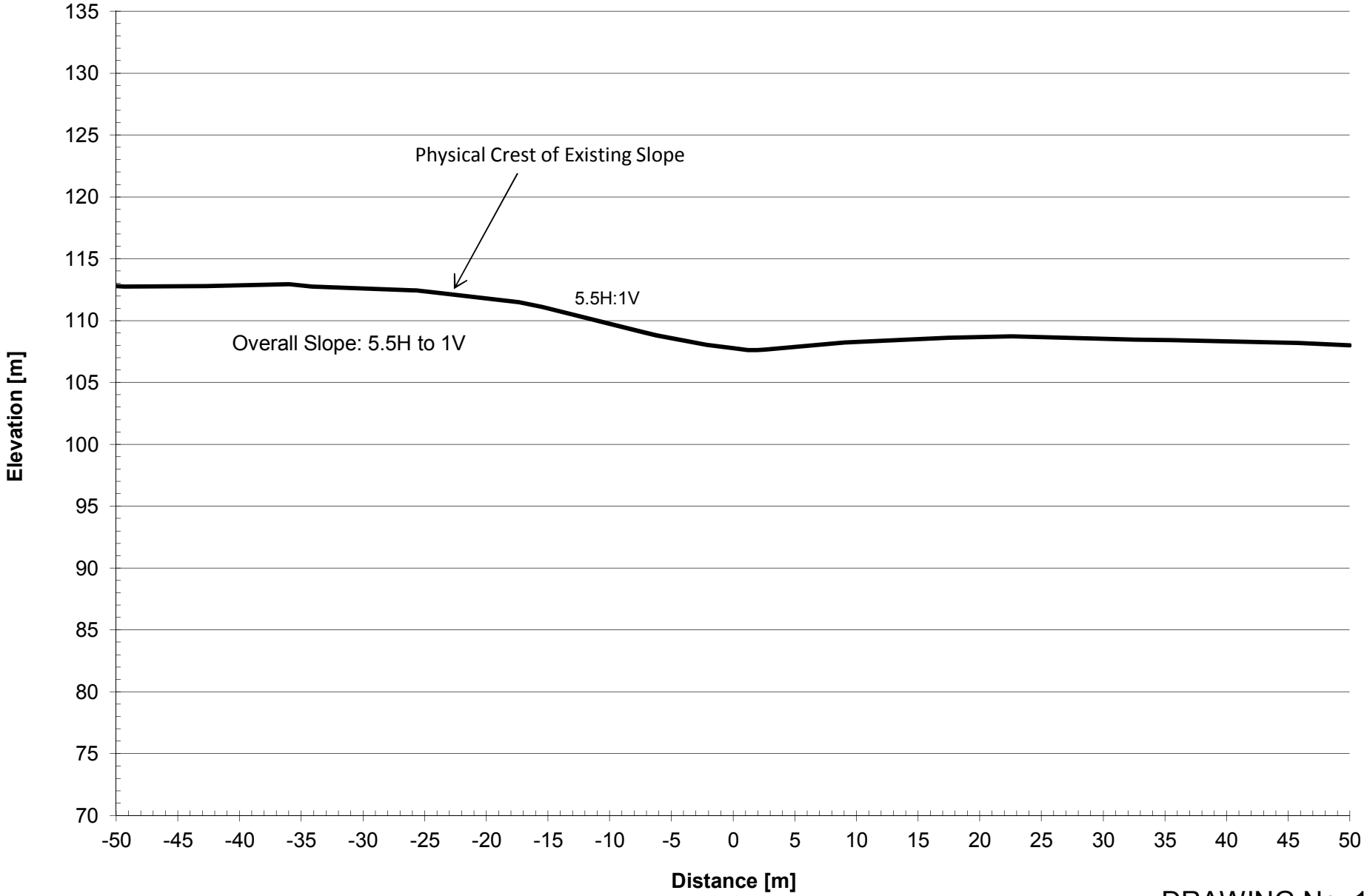
Ian Shaw, P. Eng.
Review Engineer

Attachments: Drawing Nos. 1 and 2, Sample Slope Profiles, Indian Creek and Grindstone Creek, respectively
Drawing Nos. 3 through 8, Falcon Creek Slope Profiles

Distribution: Penta Properties Inc. [2, plus pdf]

Soil-Mat

Slope Study
1200 King Road
Indian Creek
Station 0+080



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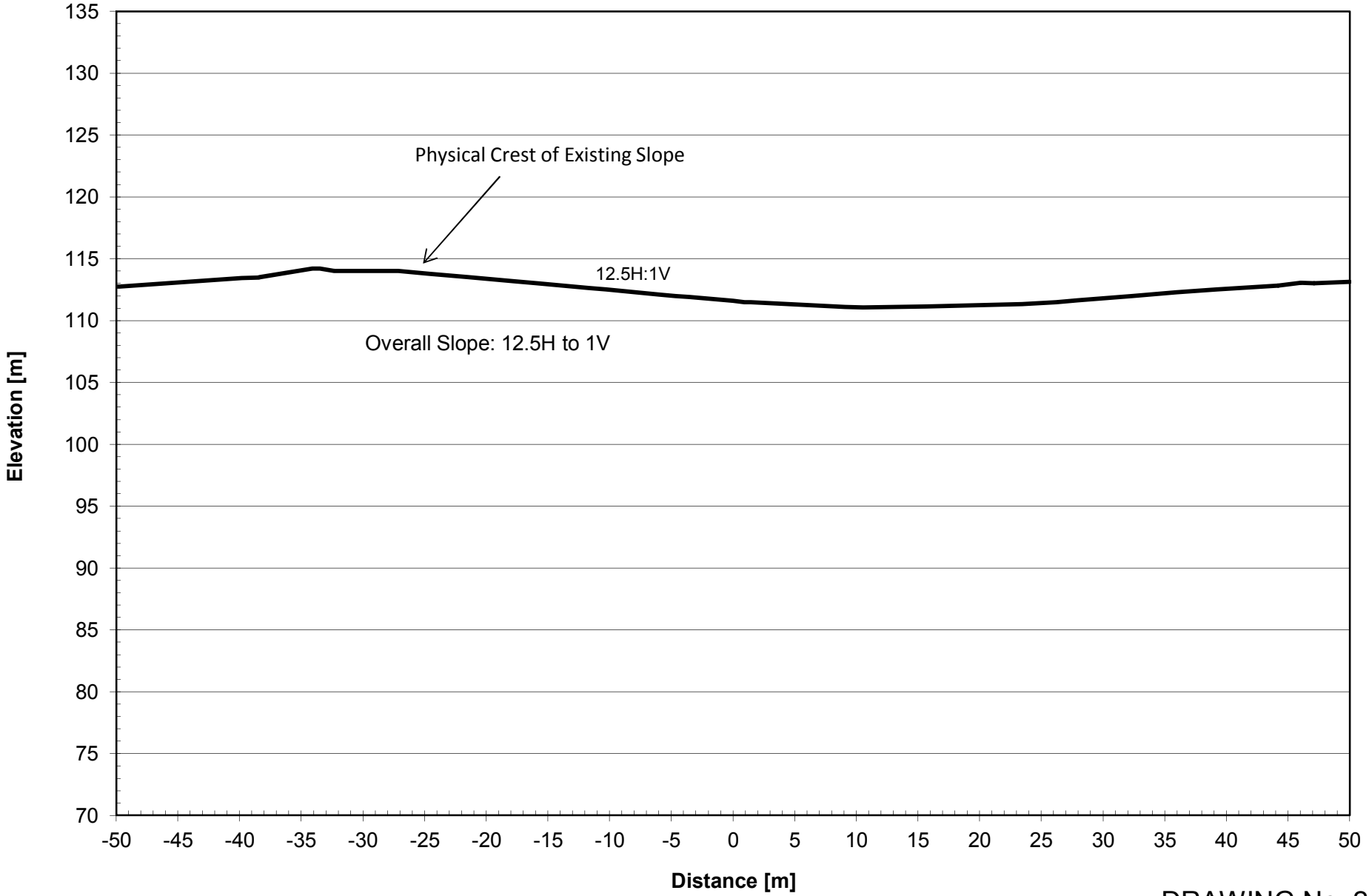
DRAWING No. 1

Soil-Mat

Slope Study
1200 King Road
Grindstone Creek
Station 0+030

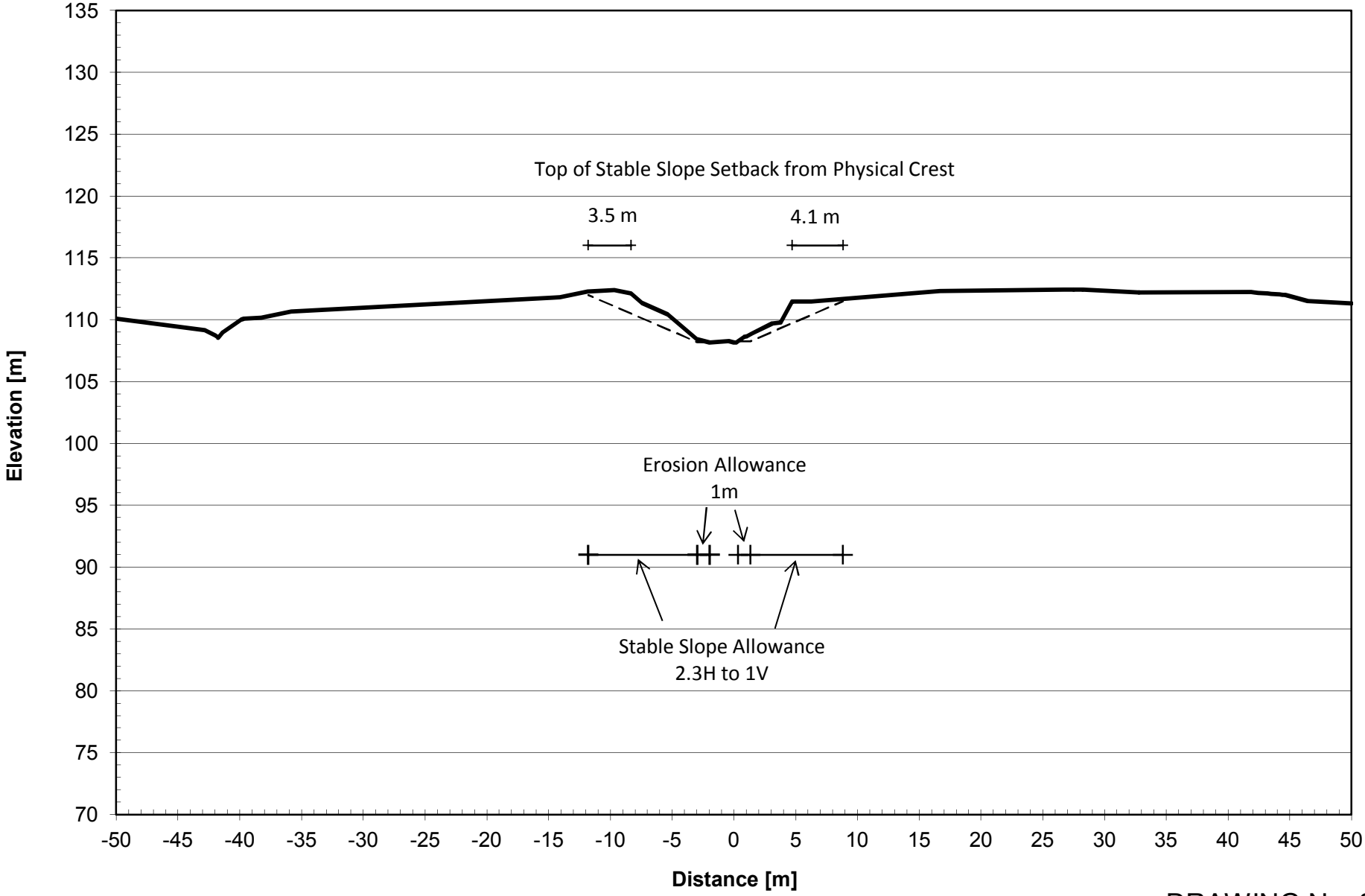


Project No.: SM 135134-G

DRAWING No. 2

Slope Study
1200 King Road
Falcon Creek
Station 0+080

Soil-Mat

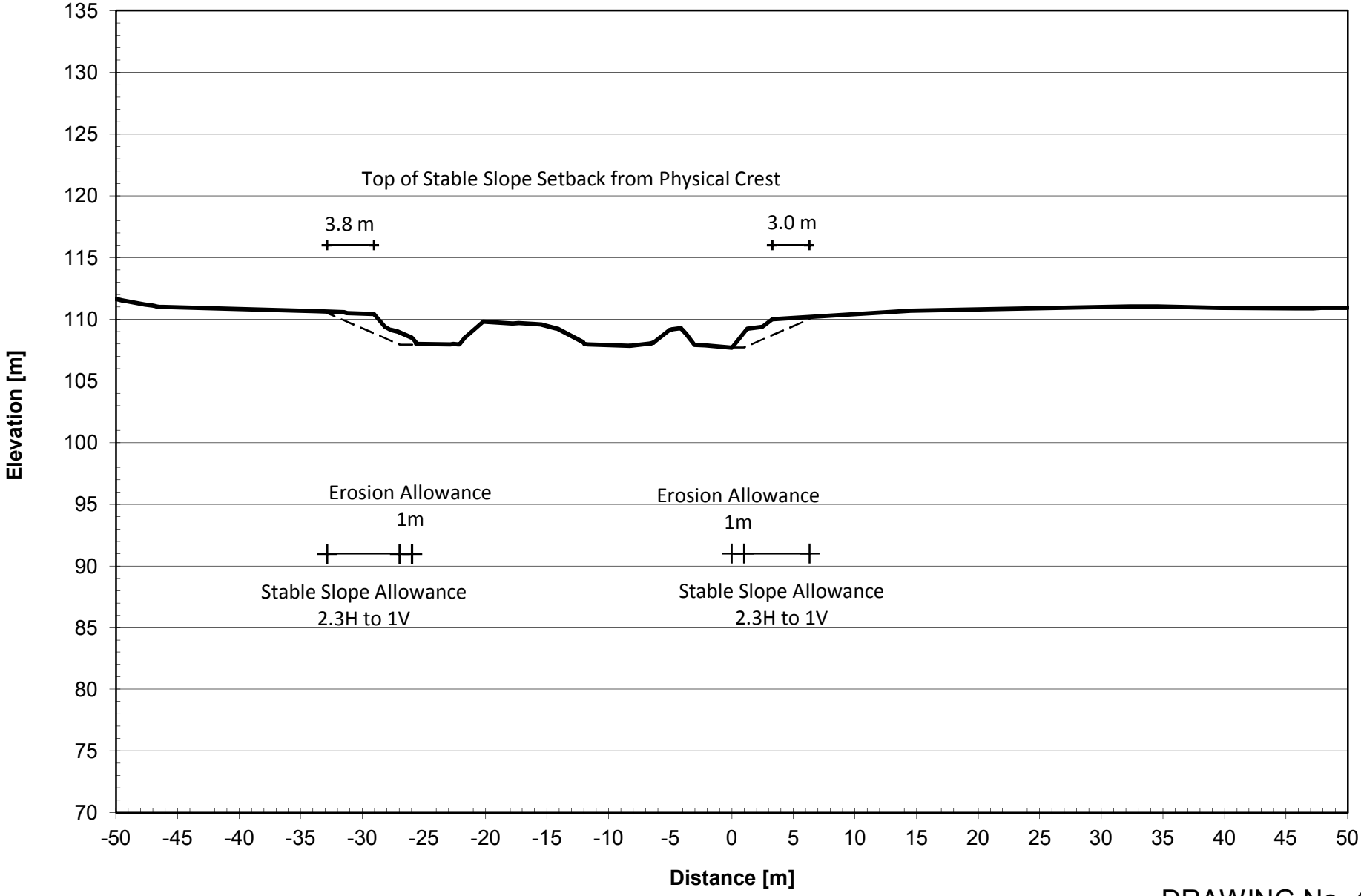


Project No.: SM 135134-G

DRAWING No. 3

Slope Study
1200 King Road
Falcon Creek
Station 0+160

Soil-Mat

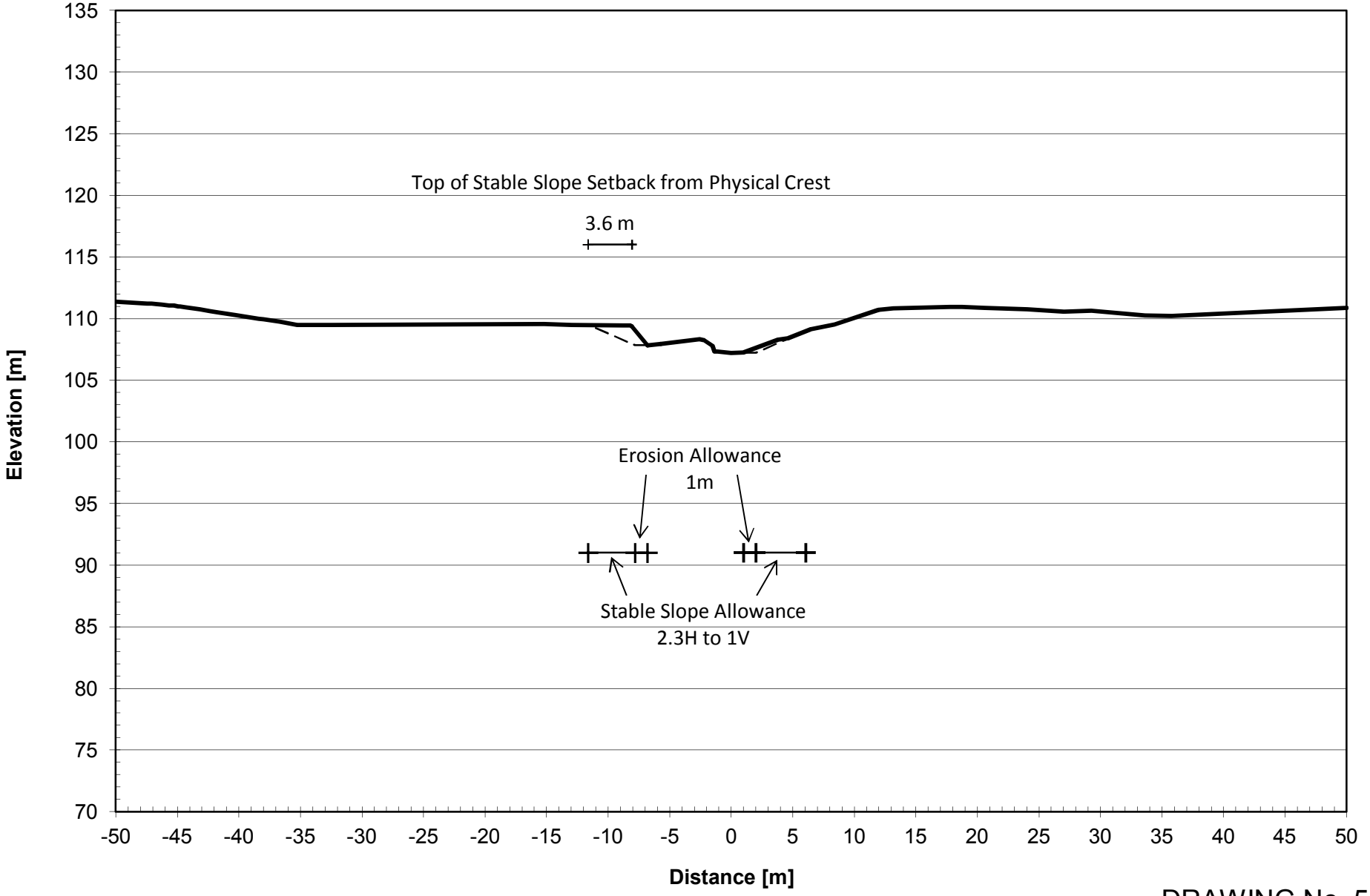


Project No.: SM 135134-G

DRAWING No. 4

Slope Study
1200 King Road
Falcon Creek
Station 0+260

Soil-Mat

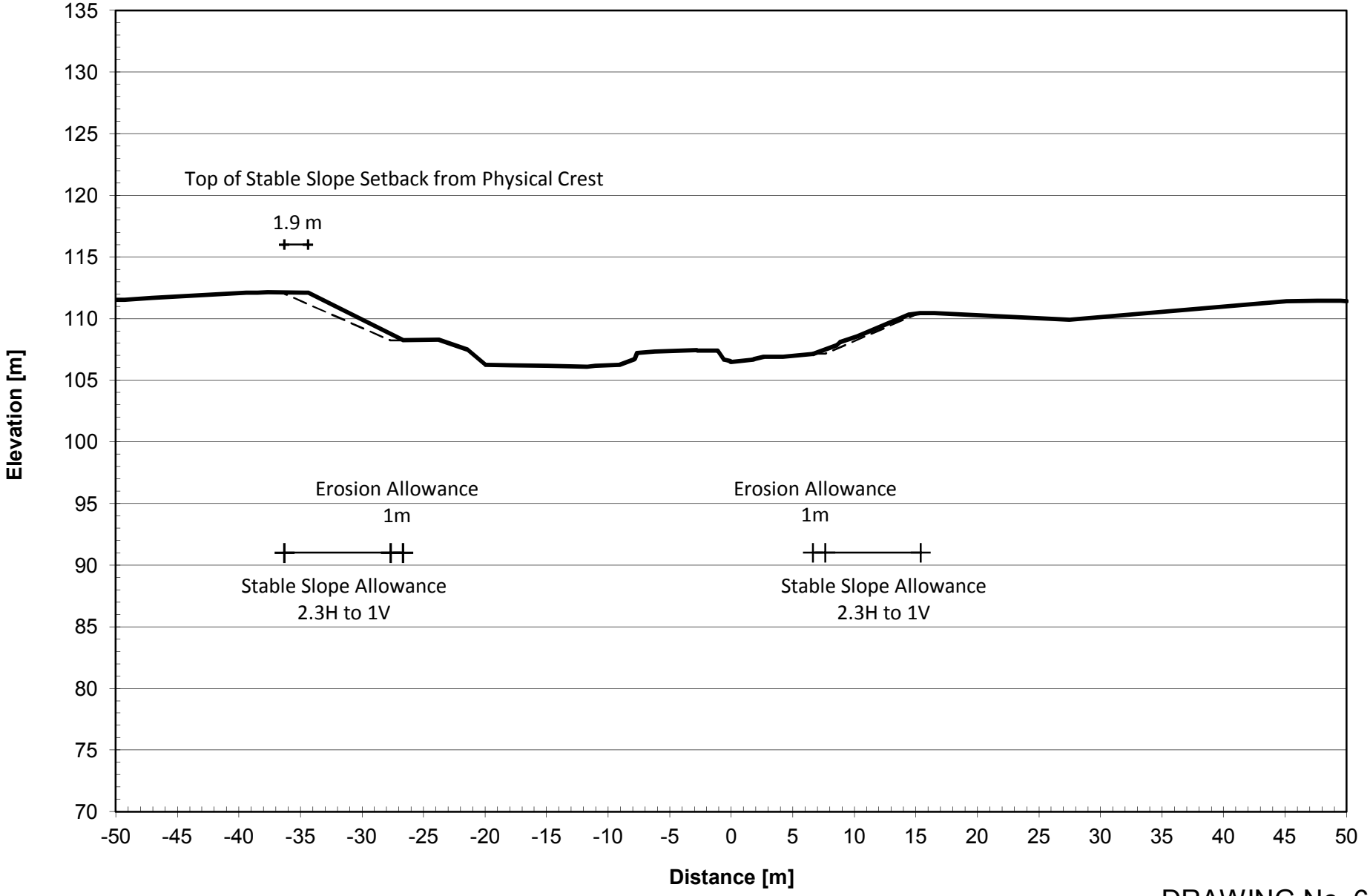


Project No.: SM 135134-G

DRAWING No. 5

Slope Study
1200 King Road
Falcon Creek
Station 0+340

Soil-Mat

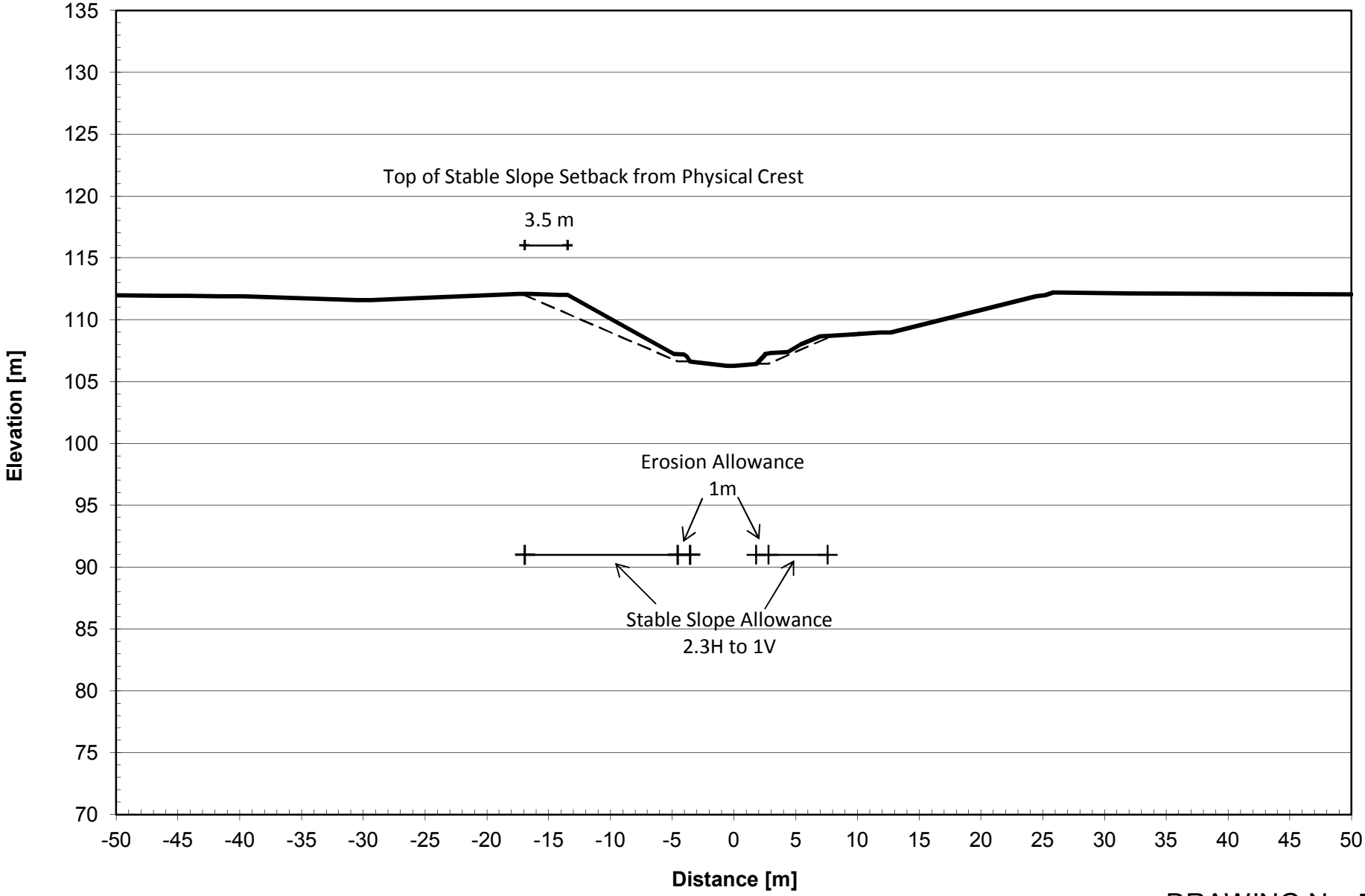


Project No.: SM 135134-G

DRAWING No. 6

Slope Study
1200 King Road
Falcon Creek
Station 0+380

Soil-Mat

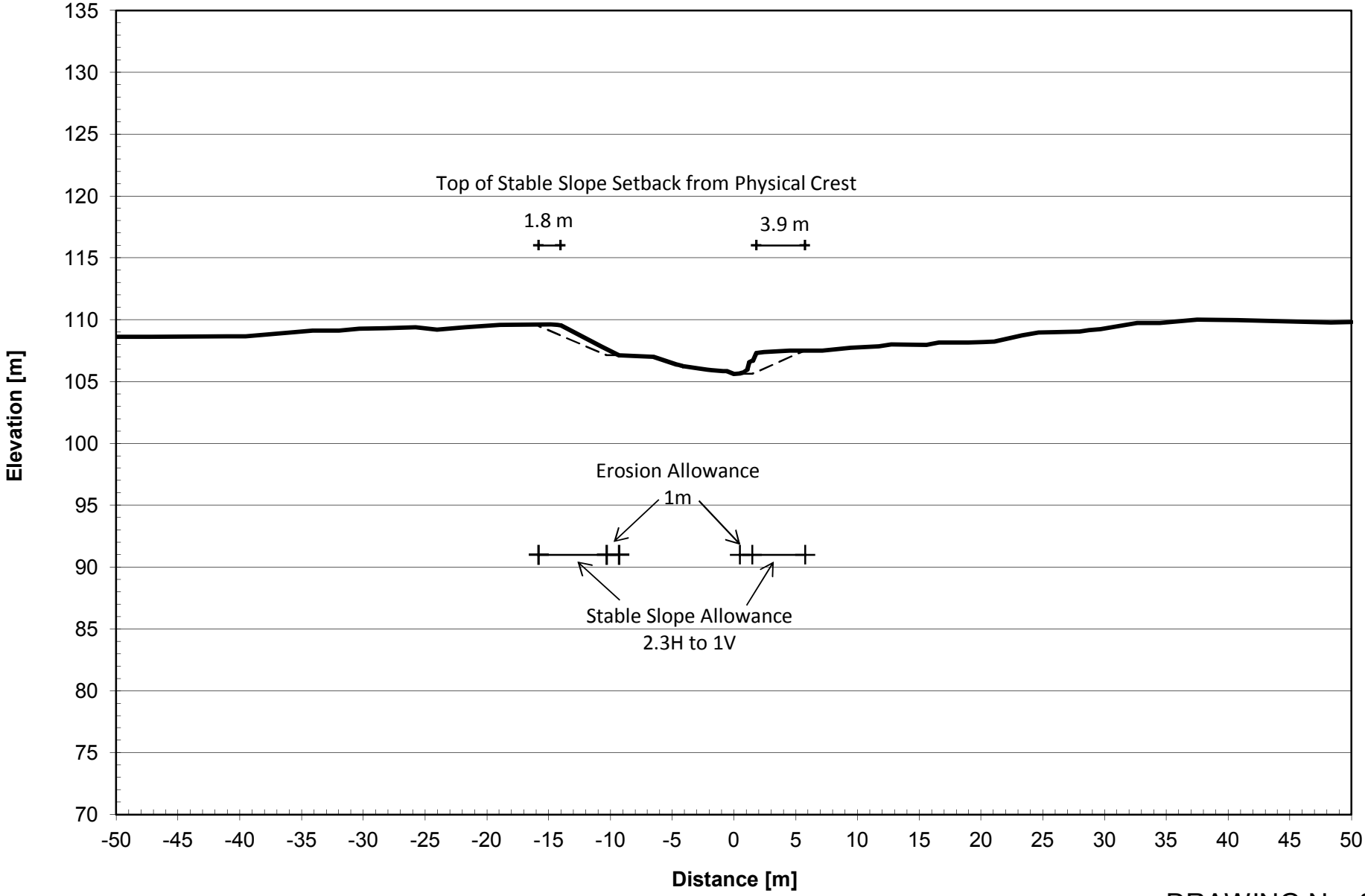


Project No.: SM 135134-G

DRAWING No. 7

Slope Study
1200 King Road
Falcon Creek
Station 0+420

Soil-Mat



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DRAWING No. 8