ABPB CONSULTING

GEOTECHNICAL/EARTH SCIENCES

PAUL BONIFACI, P.E.G.
ANIL BUTAIL, P.E.

12525 Willows Road, Suite 80
Kirkland, WA 98034
Phone: 425-820-2544
Fax: 206-418-6448

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Project No. 1379

MEMO

To: Leo Suver
Steve Burnstead Construction Company

From: Anil Butail, P.E.
ABPB Consulting

Subject: Response to Comments by AMEC Foster Wheeler, July 23, 2015
Portofino
Kirkland, Washington

Leo:

As requested, we have reviewed comments related to the geotechnical aspects of the project as made by AMEC Foster Wheeler in their letter dated July 23, 2015. These comments relate primarily to the slope stability on Lots 3, 4 and 5.

To address the comments we performed slope stability analyses using the computer program WINSTABL and recently obtained survey information extending down to the toe of the slopes. Printouts of the slope stability analysis data are attached and are discussed in this memo as well as the specific comments by AMEC.

It should be noted that there we reviewed two possible modes of slope stability failure as follows:

1. – A shallow failure in the medium dense to dense soils that are present immediately below the surface. For this mode of failure, as shown on the attached stability analyses results, the lowest safety factors are on the order of 1.4. These are most likely to occur as shallow failures on the slope itself. They are not impacted by the development conditions on the top of the slope. For

seismic conditions, using a pseudostatic seismic acceleration of 0.47g, the safety factor drops to as low as 0.55. Again, this is confined to the area of the slopes and is not affected by any development on the top of the slope.

2 – A deep seated mode of failure that extends down below the looser surface soils and into the underlying dense glacial till soils. We reviewed possible failures coming all the way up the slope and into the area at the tops of the slopes where the houses will be constructed. The lowest safety factors noted were those that just penetrated the glacial till surface. The minimum calculated safety factor for the deep failure mode was 2.25. For conditions using a pseudostatic seismic co-efficient of 0.47g, the minimum calculated safety factor appeared to be on the order of 1.2, as shown on the attached stope stability data sheets. These critical failure circles are located on the slope and are not affected by development at the top of the slope.

The specific comments from AMEC, our responses and the stability analysis results are discussed below.

1. The slope stability analysis provided in the Geotech Consultants, Inc. report *Slope Setback Reduction, Lots 3 and 4 of Dadvar Short Plat, Northeast 43rd Street, Kirkland, Washington*, dated July 3, 2003 may be out of date. The currently proposed residential structures are not in the same location as proposed for the original lots. Some of the new structures are now closer to the top of the slope and are within the buffer zone of the old study. We recommend performing slope stability analyses for the current development conditions.

Slope stability analyses have been performed using current topographic information and the soil profiles and parameters described above. As indicated earlier, for all of the conditions analyzed, the potential failure surfaces with the lowest safety factors are located on the slope, and in most cases in the lower portions of the slope. Consequently, the critical stability zones are unaffected by the development on the surface or by intrusion into buffer areas.

2. The seismic requirements for the current building codes have changed since the preparation of the Geotech Consultants, Inc., slope stability analysis in 2003. We recommend updating the seismic slope stability analyses by using a seismic acceleration based on a probability of exceedance of 2 percent in 50 years, which is specified by IBC 2012 and ASCE 7-10. (This will result in a higher acceleration than was used previously.)

Slope stability analyses were performed using a pseudostatic seismic horizontal acceleration of 0.47g. As indicated earlier, these analyses indicate that for shallow failure surfaces on the slope, the safety factors drop to as little as 0.55. For deeper circles that extend into the glacial till soils, the minimum safety factor is on the order of 1.2, which is well within the parameters that are considered acceptable. The analyses do indicate that in a major seismic event, shallow failures will most likely occur on the slope but these would occur regardless of whether there was development on the site

or not. Also, these would be shallow circles and would not extend up to the top of the slope in the area of the proposed construction.

3. The slope stability analyses should model the present stability, stability during construction, and stability after all development activities are completed; the analyses should address the site and any affected adjacent properties, as specified in the Kirkland Zoning Code Section 85.15, 4.a.

The slope stability analyses concluded that the potential failure surfaces with the lowest safety factors are located on the slope itself and in most cases in the lower portions of the slope. Therefore, these is no impact on the stability by any proposed development on the site. Slope stability during construction and after construction will remain unchanged.

As indicated above, the most likely mode of slope stability is shallow circles in the lower portions of the slope during an earthquake of large magnitude. These would occur regardless of whether there was development on the site or not. Obviously, properties downslope may be affected, but the effect would not be caused by any proposed development on the site

In summary, the slope stability analysis performed on the recently prepared topographic information show two distinct conditions. Shallow failures are likely to occur in the overburden soils on the slope during an earthquake of large magnitude. Deep seated failures that extend to the top of the slope are not likely to occur.

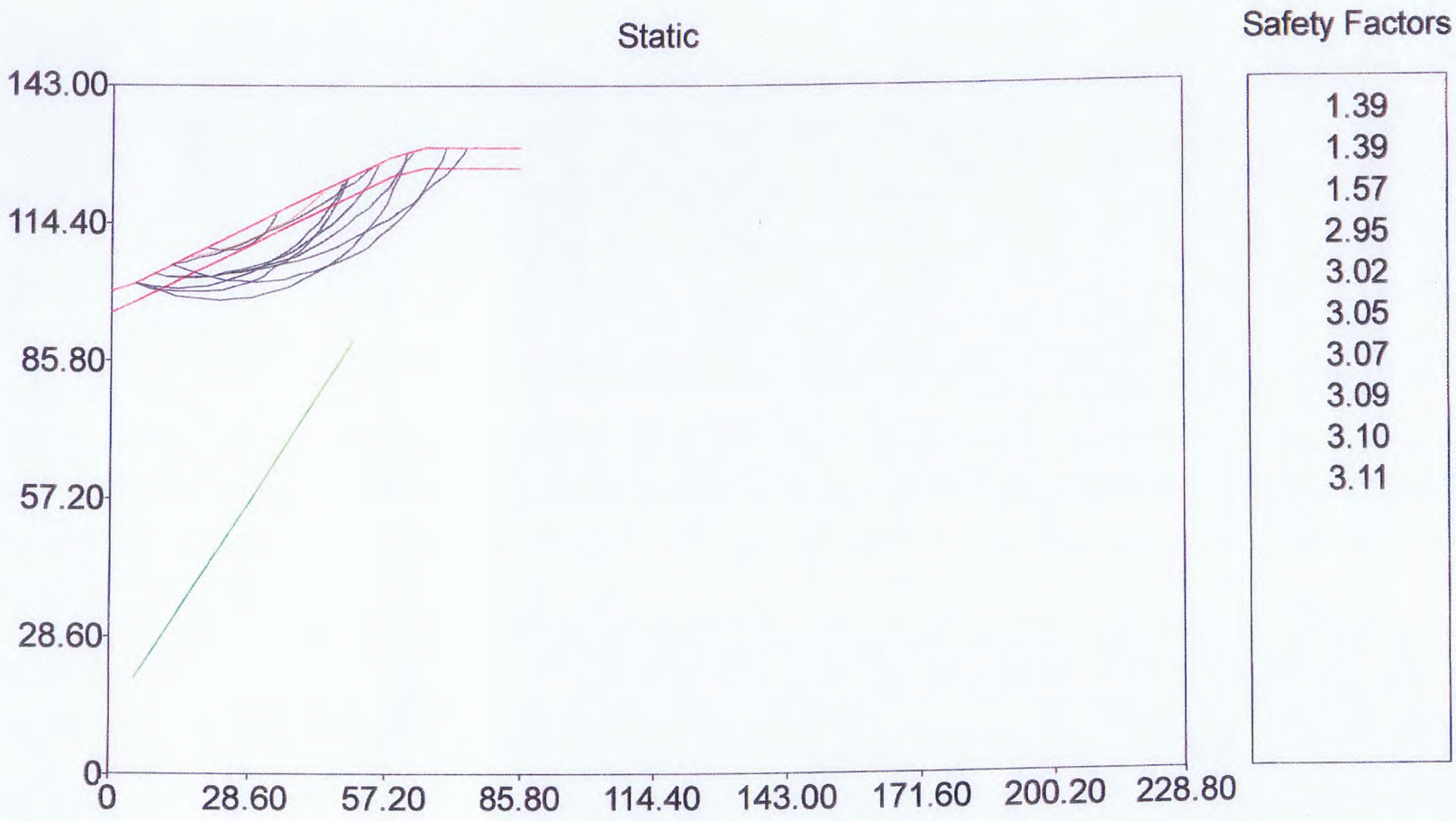
We trust this memo provides sufficient information for your current needs. Please call if you need any additional information.

Anil Butail PHB

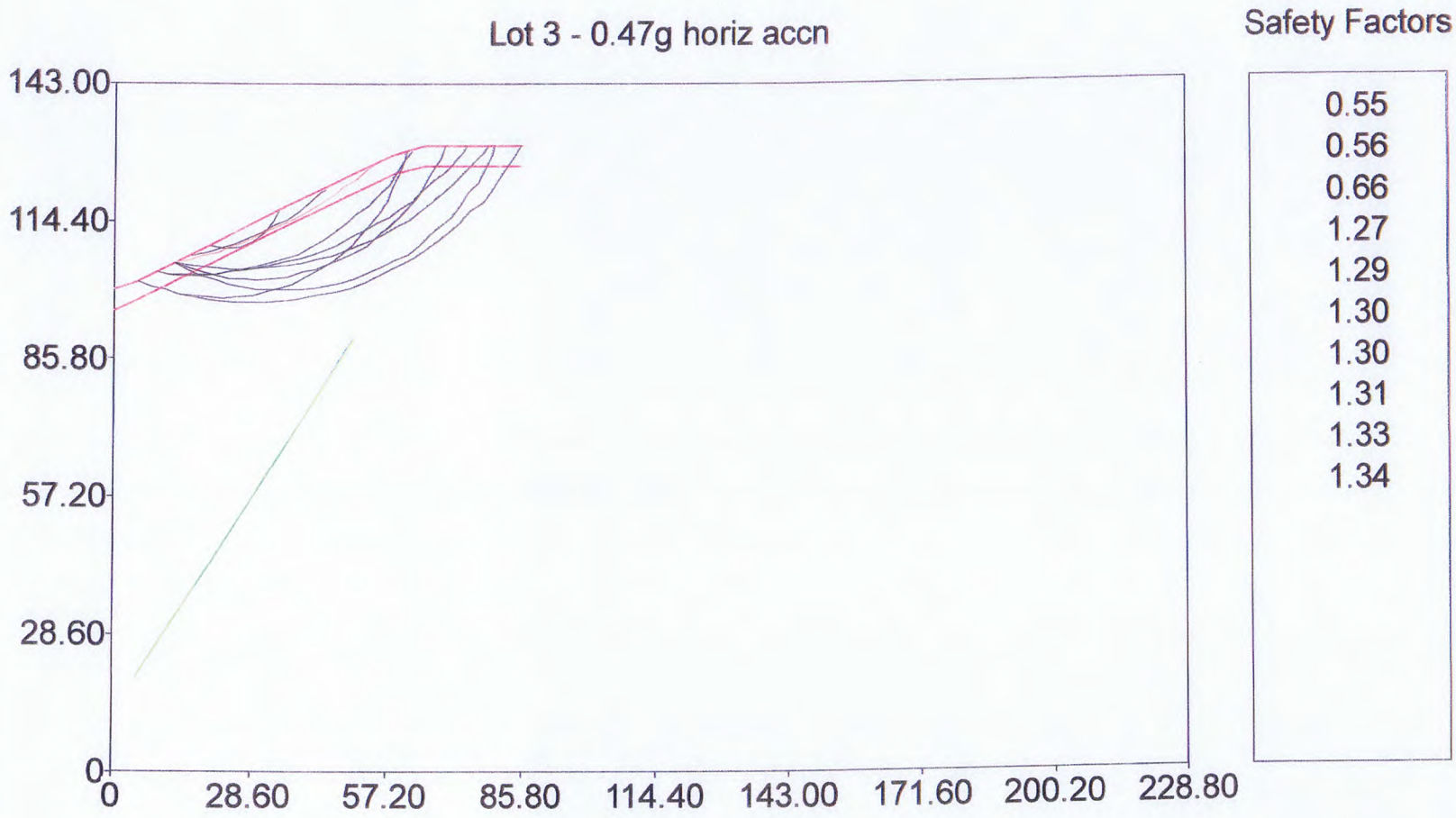
Anil Butail, P.E.

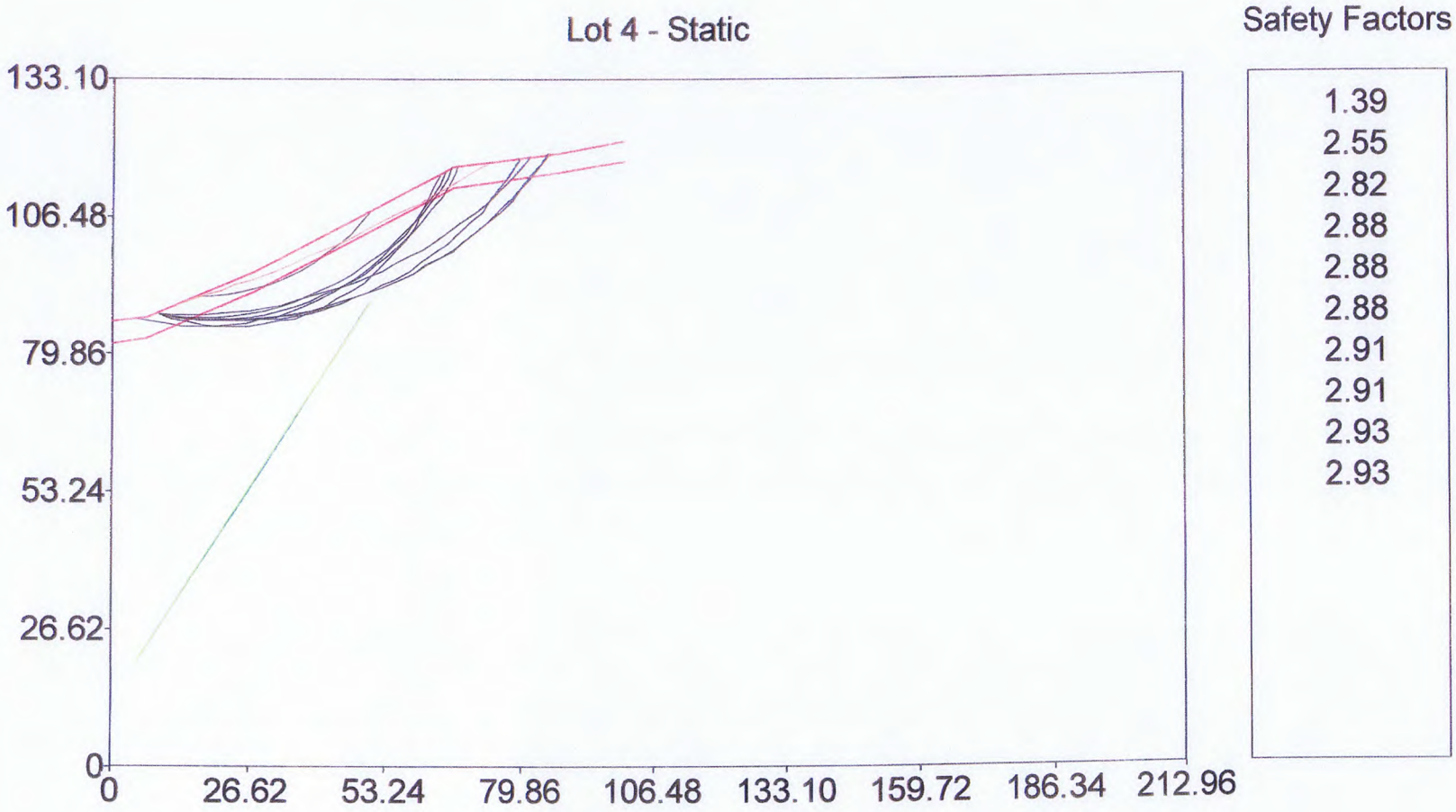
Attachments: Soil Parameters

Slope Stability Analyses


Static
Safety Factors
143.00
114.40
85.80
57.20
28.60
0
0
28.60
57.20
85.80
114.40
143.00
171.60
200.20
228.80
1.39
1.39
1.57
2.95
3.02
3.05
3.07
3.09
3.10
3.11

Lot 3 - static


Lot 3 - 0.47g horiz accn
Safety Factors
0.55
0.56
0.66
1.27
1.29
1.30
1.30
1.31
1.33
1.34
143.00
114.40
85.80
57.20
28.60
0
0
28.60
57.20
85.80
114.40
143.00
171.60
200.20
228.80


Lot 4 - Static
Safety Factors
133.10
106.48
79.86
53.24
26.62
0
0
26.62
53.24
79.86
106.48
133.10
159.72
186.34
212.96
1.39
2.55
2.82
2.88
2.88
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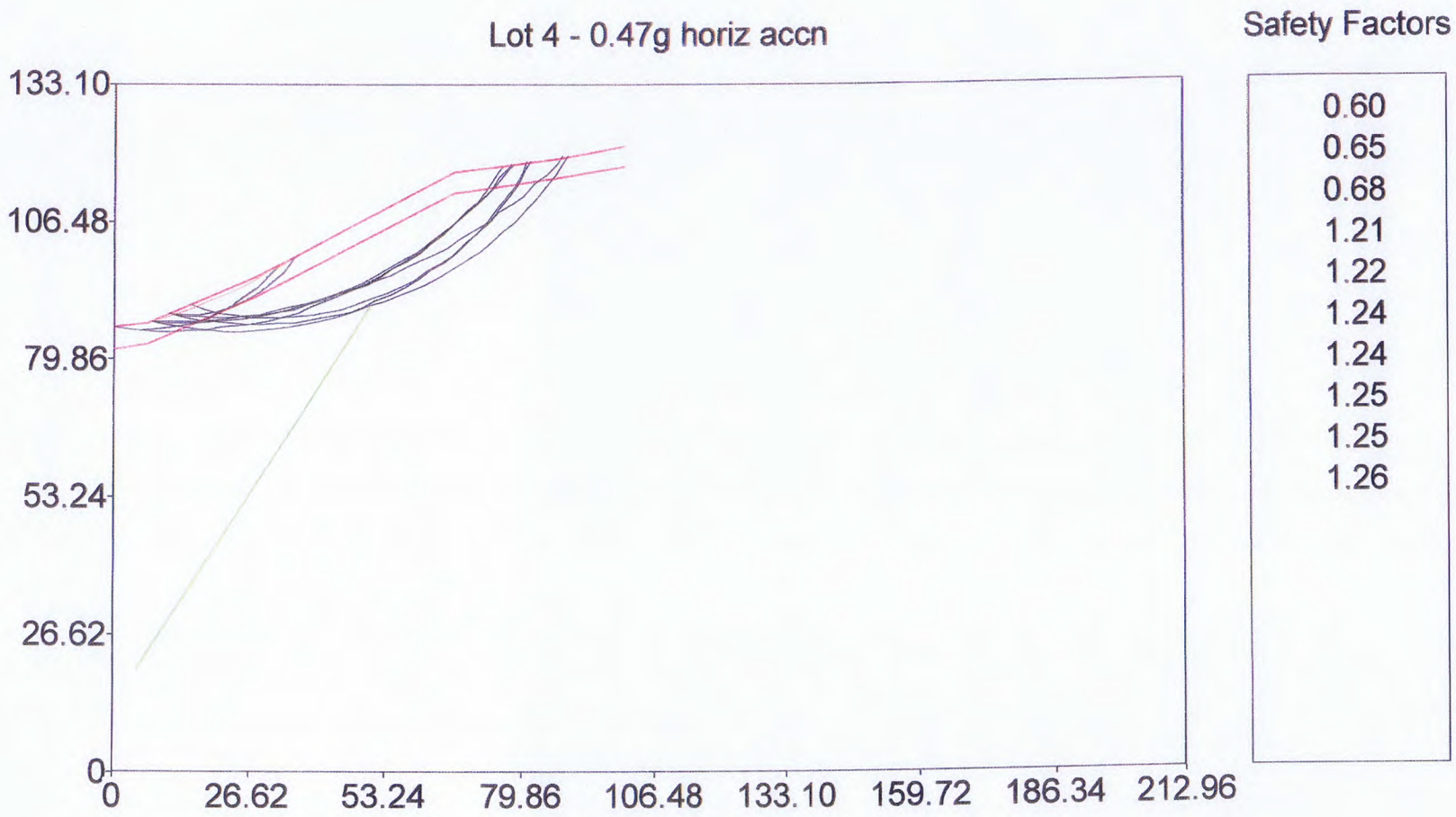
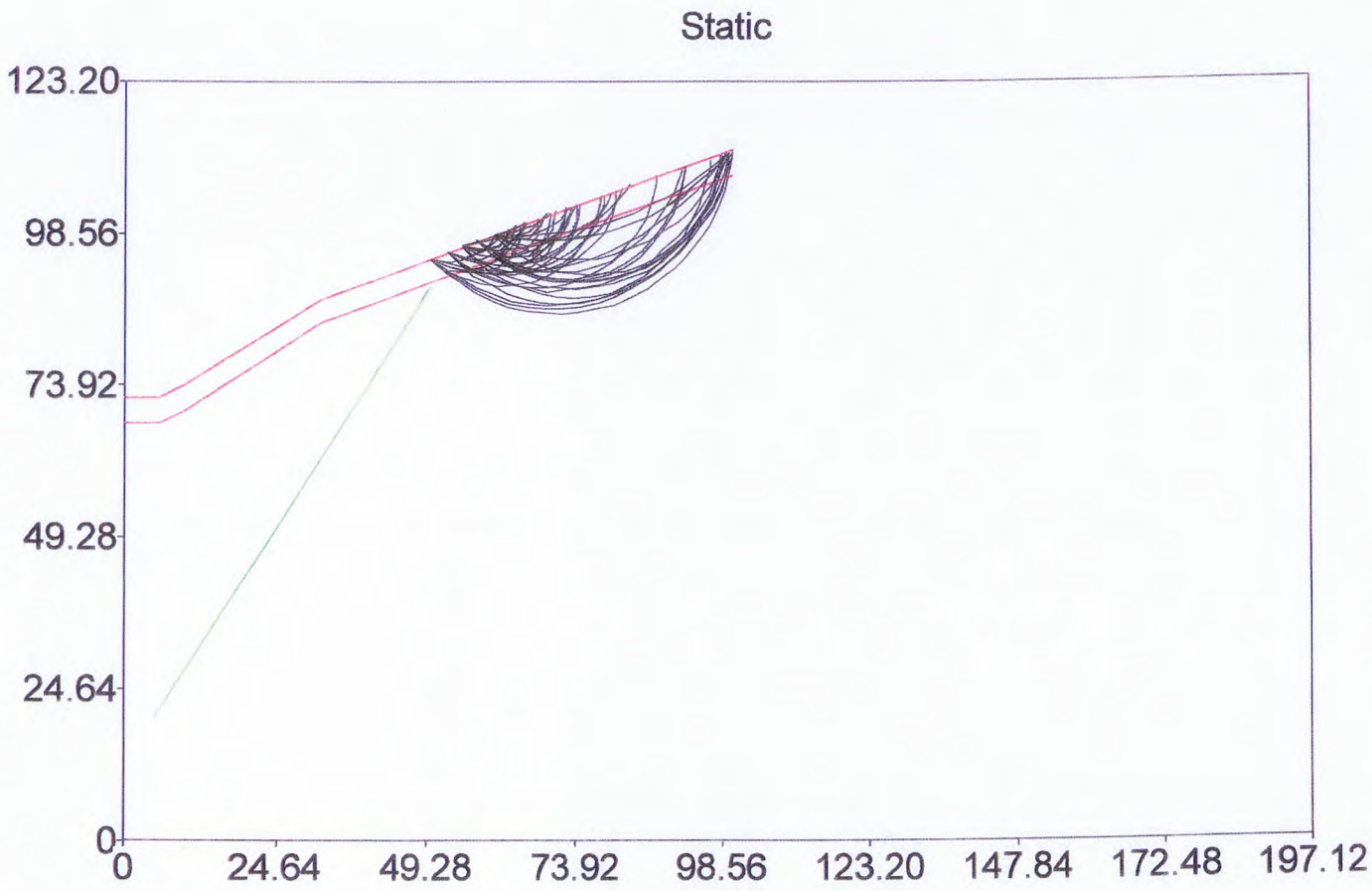
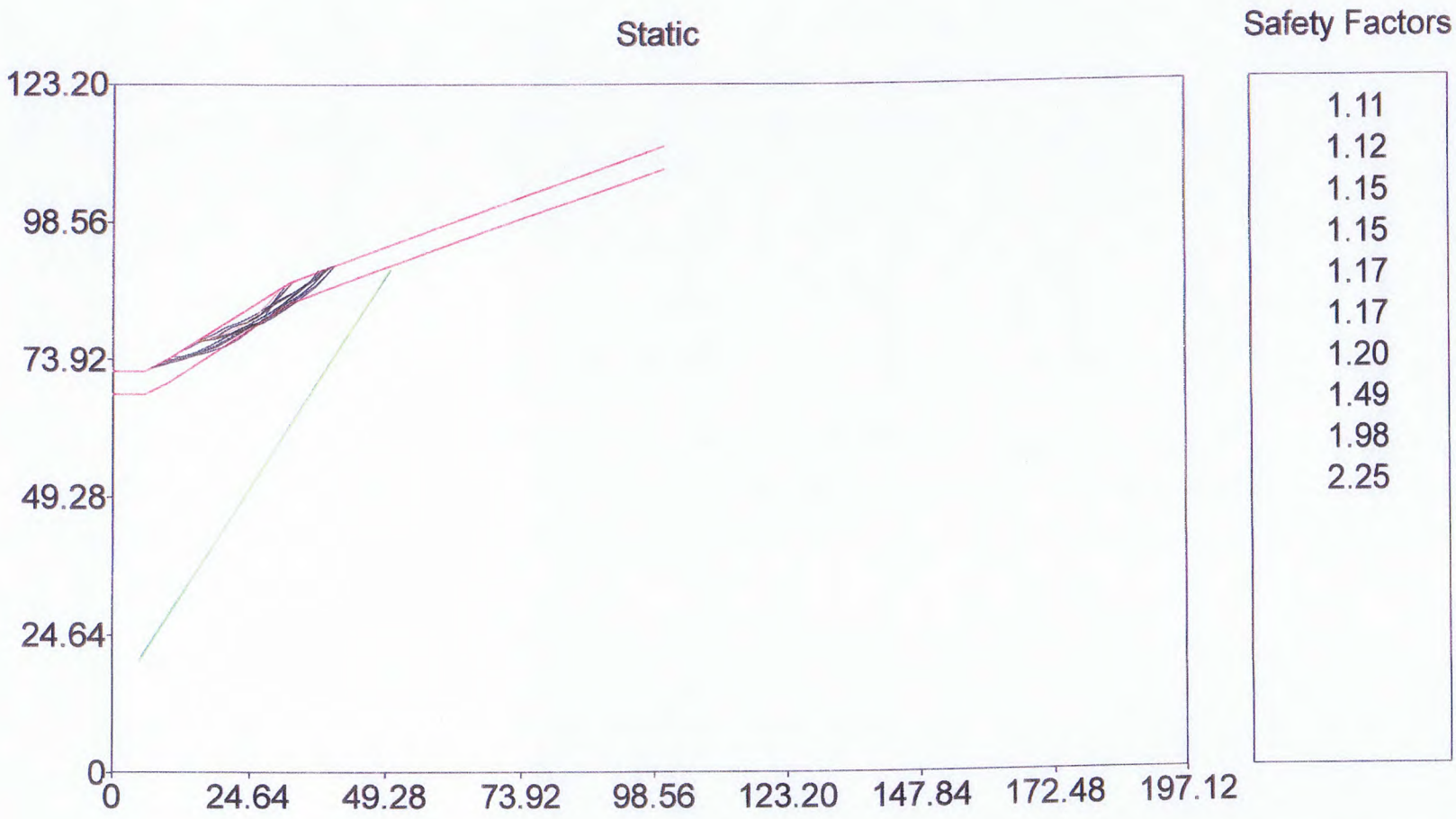
2.91
2.91
2.93
2.93

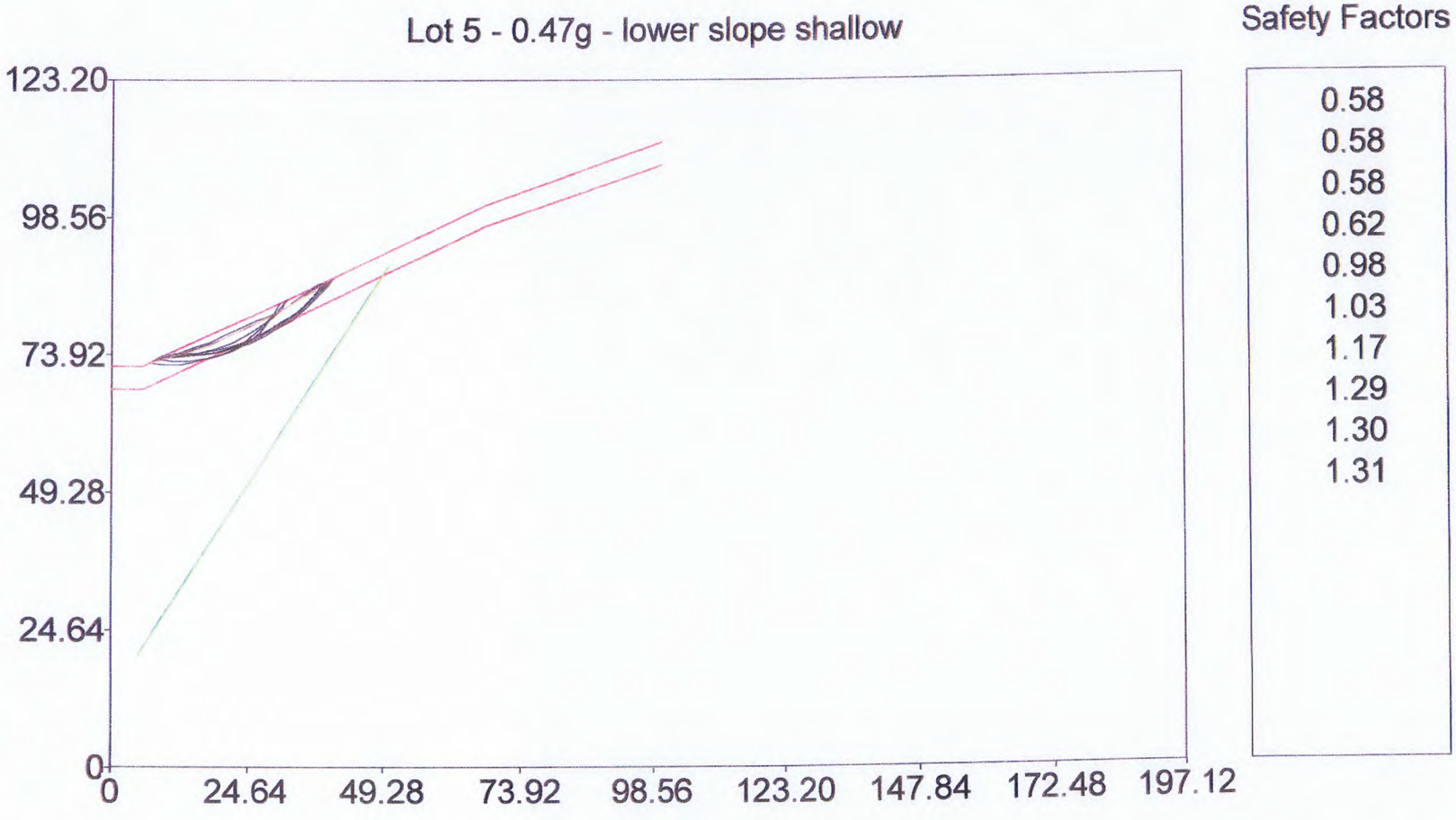

Lot 4 - 0.47g horiz accn
Safety Factors
0.60
0.65
0.68
1.21
1.22
1.24
1.24
1.25
1.25
1.26
133.10
106.48
79.86
53.24
26.62
0
0
26.62
53.24
79.86
106.48
133.10
159.72
186.34
212.96



Lot 5 - Static - Upper Elevations



Lot 5 Static - Shallow Low Elevation


Lot 5 - 0.47g - lower slope shallow
Safety Factors
0.58
0.58
0.58
0.62
0.98
1.03
1.17
1.29
1.30
1.31
123.20
98.56
73.92
49.28
24.64
0
0
24.64
49.28
73.92
98.56
123.20
147.84
172.48
197.12

SOIL PARAMETERS Used in Stability Analysis

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	.
1	120.0	125.0	0.0	34.0	- Upper medium dense to dense overburden soils
2	125.0	130.0	500.0	38.0	- Underlying Glacial till