APPENDIX H

ILWD GEOTECHNICAL STABILITY EVALUATION

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STABILITY EVALUATION OF REMEDIATION AREA D ONONDAGA LAKE BOTTOM SUBSITE

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1. INTRODUCTION

This appendix provides the methods and results of a stability evaluation for Remediation Area D, which was performed as part of the *Capping, Dredging, and Habitat Design*. Remediation Area D, which is also referred to as the In Lake Waste Deposit (ILWD), is shown in Figure 1 and consists predominantly of Sediment Management Unit (SMU) 1 with limited portions of SMUs 2 and 7. Consistent with the Statement of Work (SOW) in the Consent Decree for Onondaga Lake [United States District Court, Northern District of New York, 2007] [89-CV-815], this evaluation includes a stability analysis under both static and seismic conditions.

Guidelines for the stability evaluations are provided below, along with a summary of the following analyses: (i) subsurface geotechnical conditions (Appendix H.1); (ii) liquefaction potential (Appendix H.2); (iii) static slope stability after dredging, during capping, and after capping (Appendix H.3); and (iv) seismic slope stability after capping (Appendix H.4). Lastly, conclusions based on the results of the evaluations are provided.

2. GUIDELINES FOR STABILITY EVALUATION

The SOW provided guidelines for evaluating the stability of the ILWD as follows:

"The determination of geotechnical stability shall consider both static and seismic stability of the ILWD. The determination of seismic stability shall be based on an analysis of cap stability during an operating level event (i.e., a seismic event with a 50 percent chance of exceedance in 50 years) and a contingency level event (i.e., a seismic event with a 10 percent chance of exceedance in 50 years). If analysis of geotechnical stability demonstrates that the remediated slope would have an operating and/or contingency seismic slope stability factor of less than 1.1, Honeywell shall evaluate deformation of the cap and the ILWD under the seismic event. If the analysis of the geotechnical stability demonstrates that the remediated slope would have a static slope stability factor of less than 1.5 or if the predicted operating and/or contingency seismic deformation would compromise the performance of the isolation cap, Honeywell shall dredge sufficient material from the ILWD to ensure the geotechnical stability of the Isolation Cap, provided, however, that Honeywell may propose alternative engineering measures to ensure the ILWD is not exposed."

An evaluation approach, consistent with the SOW, was developed and is presented as a flowchart in Figure 2. Since a contingency level event is more severe than an operating level event, the analysis was only performed for the contingency level event. If the calculated factor of safety (FS) for the contingency level event is greater than 1.1, the calculated FS for an operating level event would also be greater than 1.1. In addition, as part of this evaluation, the potential for sensitivity and flow-type behavior in the ILWD was analyzed and is presented herein.

3. SUBSURFACE GEOTECHNICAL CONDITIONS

A detailed description of the development of the subsurface model and geotechnical parameters used in the analyses is presented in Appendix H.1 titled “Summary of Subsurface Stratigraphy and Material Properties”. As indicated in this appendix, it has been established that the subsurface soils in Remediation Area D consist primarily of seven strata (from top to bottom): (i) Solvay waste (SOLW); (ii) Marl; (iii) Silt and Clay; (iv) Silt and Sand; (v) Sand and Gravel; (vi) Till; and (vii) Shale. In addition, thin silt layers (up to 10-ft thick) are present on top of the SOLW in isolated areas. Geotechnical parameters of these subsurface soils were selected based on laboratory performance test data or empirical correlations using in situ and/or index test data.

4. LIQUEFACTION POTENTIAL ANALYSES

Liquefaction potential analyses are presented in Appendix H.2 in a calculation package titled “Liquefaction Potential Analyses”. These analyses include an evaluation of the potential for flow (or true) liquefaction, cyclic mobility (or cyclic liquefaction), and flow-type behavior due to sensitivity. As shown on Figure 2, the result of this evaluation is the basis for whether or not strength parameters need to be reduced for the seismic stability analyses.

The liquefaction analyses indicate that the SOLW and underlying soil layers in Remediation Area D are not considered susceptible to potential liquefaction or cyclic softening during a contingency level seismic event. In addition, the materials are not considered susceptible to sensitive behavior or loss of shear strength. Therefore, the original strength parameters developed in Appendix H.1 can be used for the seismic slope stability analyses. Liquefaction potential of the cap material and the impact of the cap on the liquefaction potential of underlying materials are addressed in an addendum to Appendix H.2. Since the site is not in a seismic impact zone, monitoring and maintenance will be performed, as necessary, to address the potential for cap liquefaction during a seismic event.

5. STATIC SLOPE STABILITY ANALYSES

Static slope stability analyses are presented in Appendix H.3 in a calculation package titled “Static Slope Stability Analyses”. The purpose of these analyses is to establish stability of Remediation Area D after dredging, during capping, and after capping. Static stability was evaluated for five overall general slopes (i.e., Cross Sections 1 through 5) and three localized steep slopes (i.e., Cross Sections A through C), as shown on Figure 3. These analyses were performed using Spencer’s [1973] method, which is a generally accepted slope stability analysis method in engineering practice. The results indicate that the selected cross sections have acceptable calculated FSs for static slope stability after dredging, during capping, and after capping.

6. SEISMIC SLOPE STABILITY ANALYSES

Seismic slope stability analyses are presented in Appendix H.4 in a calculation package titled "Seismic Slope Stability Analyses". As indicated in Figure 2, the results of the liquefaction potential evaluation may impact the seismic stability evaluation. Specifically, because it was established that the SOLW, Marl, Silt and Clay, Silt and Sand, and Sand and Gravel are not susceptible to liquefaction, the original material strengths (as opposed to reduced strengths) can be used in the seismic stability evaluation.

The seismic slope stability of Remediation Area D after capping was evaluated for five overall general slope cross sections (i.e., Cross Sections 1 through 5) and three localized steep slope cross sections (i.e., Cross Sections A through C), as shown on Figure 3. As with the static stability analyses, Spencer's [1973] method was used. The results indicate that the selected cross sections have acceptable calculated FSs after capping for the case of a contingency level seismic event.

The seismic slope stability analysis results are based on representative shear strength parameters selected by the geotechnical engineers for this project. A sensitivity analysis with lower shear strength parameters is included as Attachment 1 to this appendix; however, this sensitivity analysis does not change the main conclusions described herein, which are based on the representative parameters selected for this project.

7. CONCLUSIONS

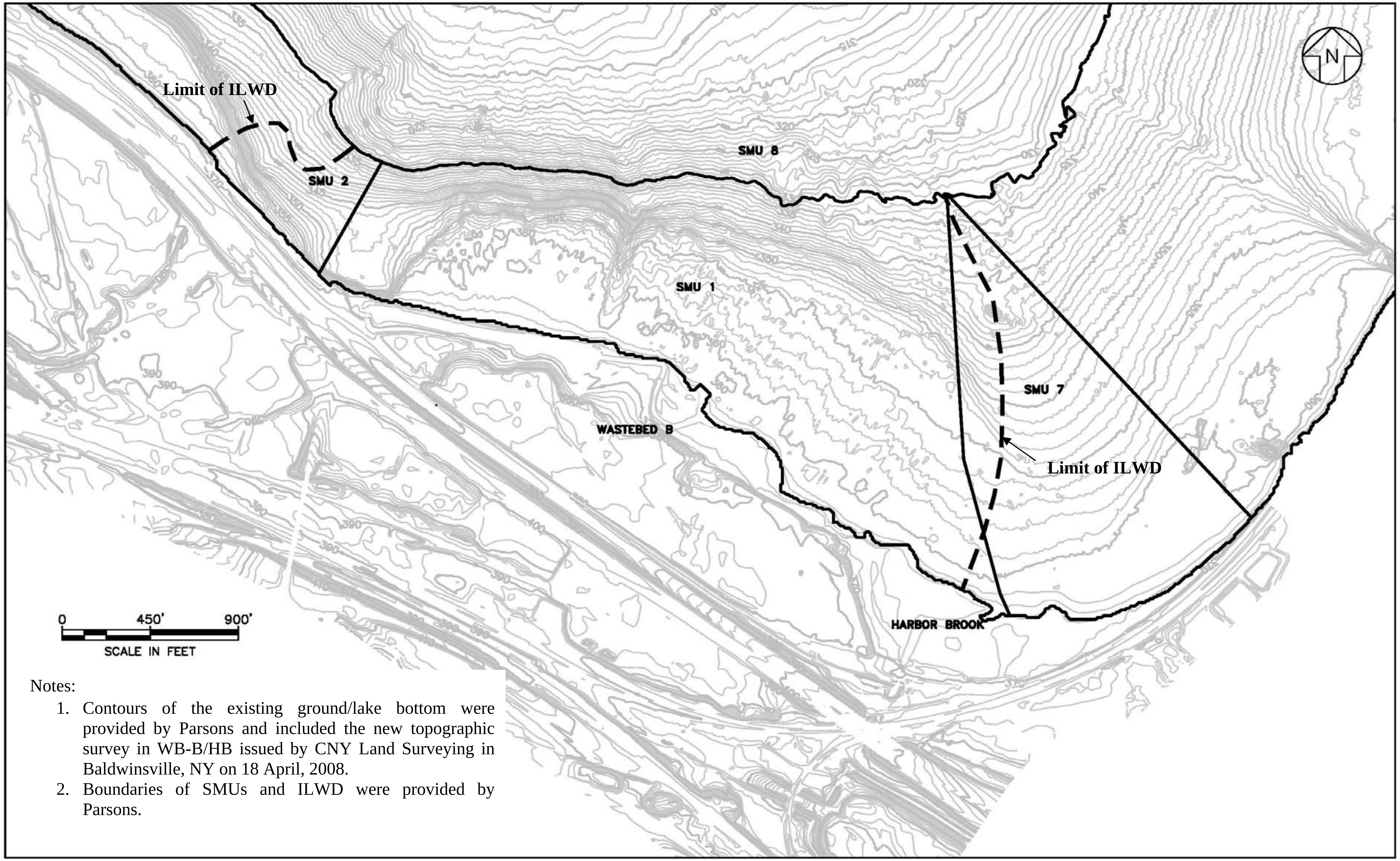
Geotechnical stability of Remediation Area D under static conditions (after dredging, during capping, and after capping) and during a contingency level earthquake (after capping) was evaluated. Based on the analyses, the SOLW and underlying soils do not have the potential for liquefaction or cyclic softening during an operating or contingency level seismic event. The materials in Remediation Area D also do not appear to have the potential for sensitive behavior or loss of shear strength. Since the site is not in a seismic impact zone, the potential for cap liquefaction during a seismic event will be addressed through a monitoring and maintenance program, as needed. In addition, calculated static and seismic FSs for the five overall general slope cross sections (i.e., Cross Sections 1 through 5) and three localized steep slope cross sections (i.e., Cross Sections A through C) in Remediation Area D have adequate FSs.

REFERENCES

Spencer, E., "The Thrust Line Criterion in Embankment Stability Analysis," Géotechnique, Vol. 23, No. 1, pp. 85-100, March 1973.

United States District Court, Northern District of New York. 2006. State of New York and Denise M. Sheehan against Honeywell International, Inc. Consent Decree Between the State of New York and Honeywell International, Inc. Senior Judge Scullin. Dated October 11, 2006. Filed January 4, 2007.

FIGURES



Notes:

1. Contours of the existing ground/lake bottom were provided by Parsons and included the new topographic survey in WB-B/HB issued by CNY Land Surveying in Baldwinsville, NY on 18 April, 2008.
2. Boundaries of SMUs and ILWD were provided by Parsons.

Figure 1. ILWD layout.

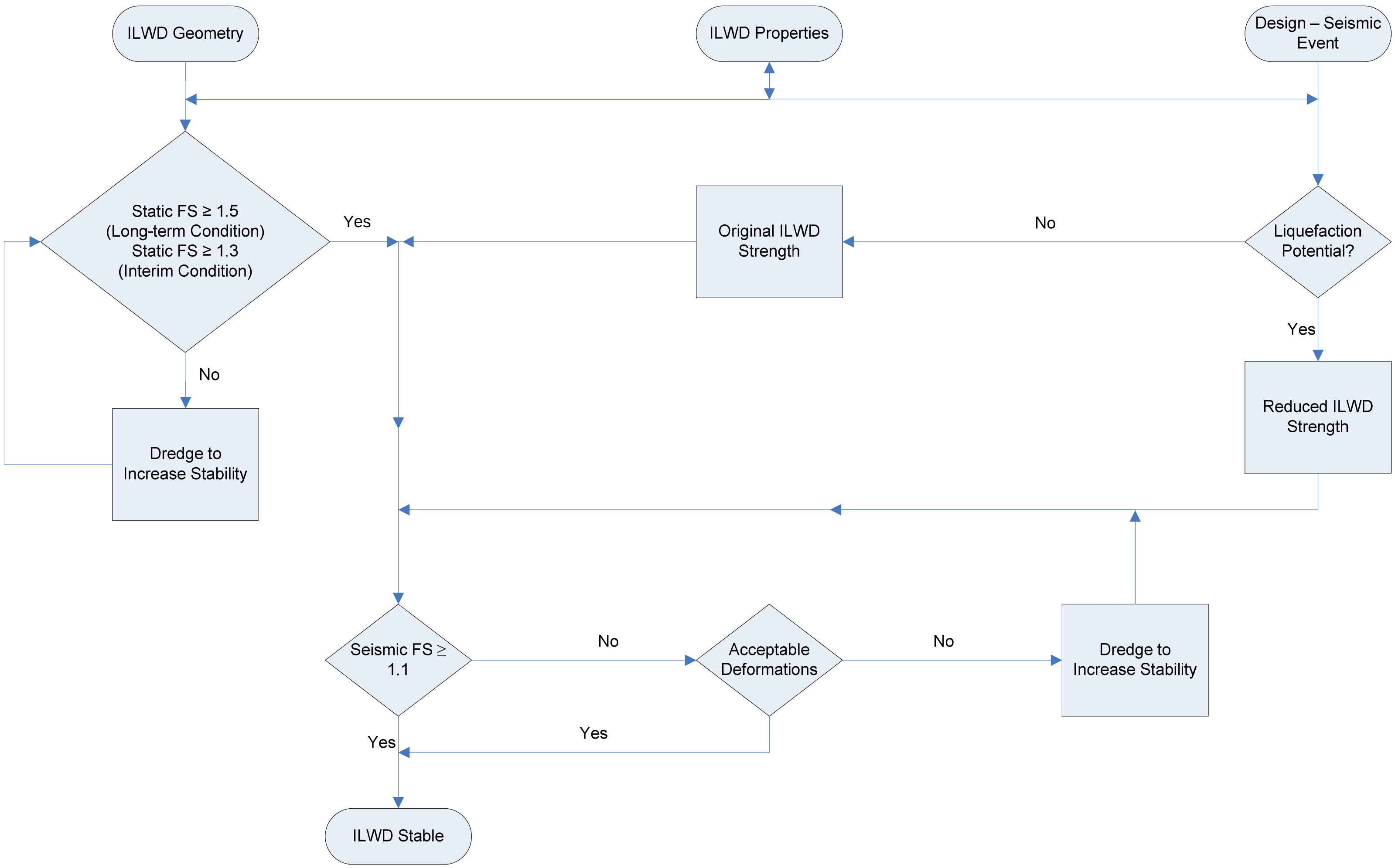
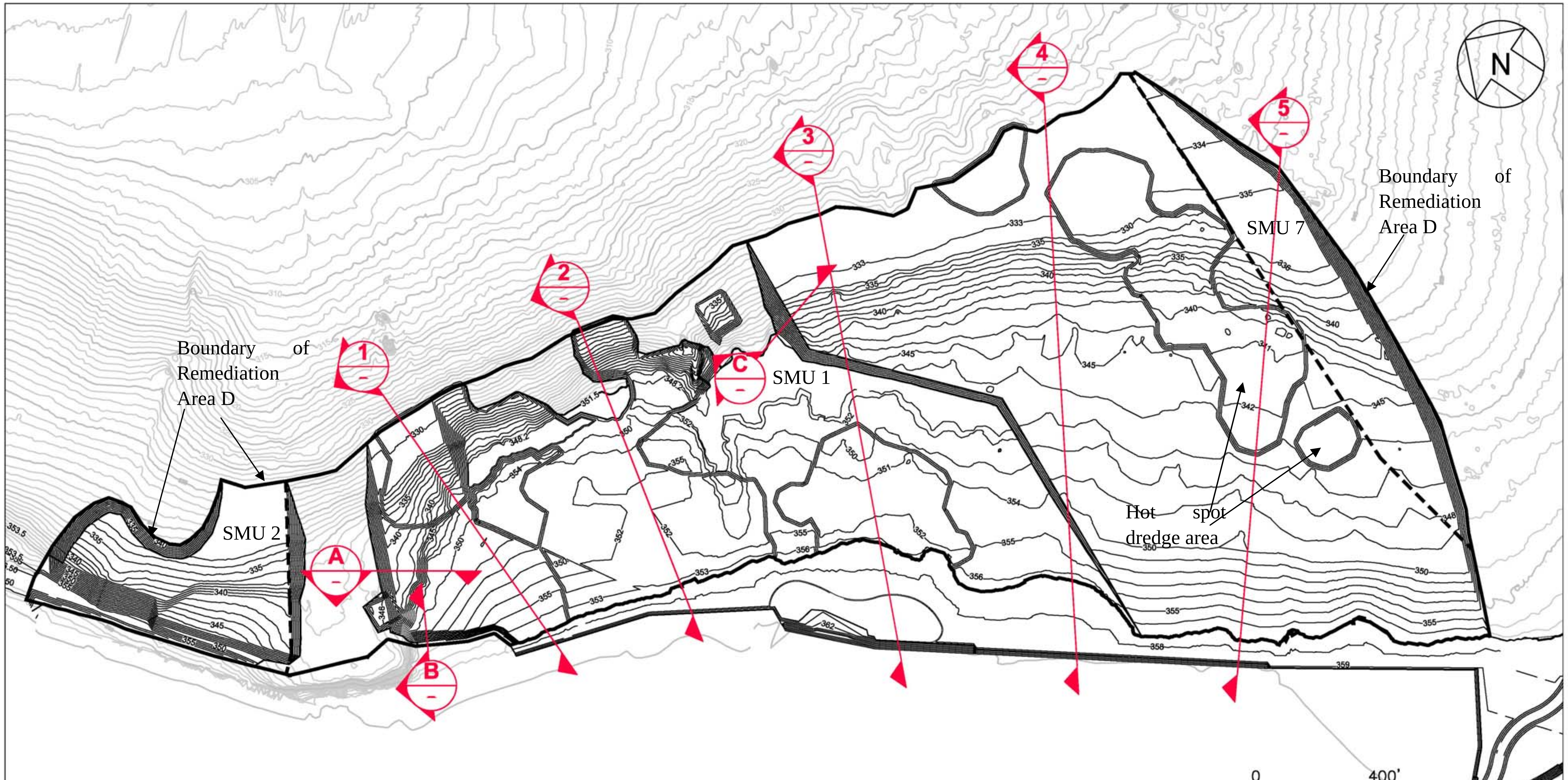


Figure 2. Flow chart of geotechnical stability evaluation strategy (note that this approach is applicable for soils underlying the Solvay waste as well).



Notes:

1. Contours of the existing ground/lake bottom were provided by Parsons.
2. Dredging plan was prepared by Anchor Environmental and provided to Geosyntec

Figure 3. Locations of borings and selected cross sections.

Appendices H.1 through H.4