Geo-Logic ASSOCIATES

December 14, 2023

Mr. Steve Cassulo
Chiquita Canyon Landfill
29201 Henry Mayo Drive
Castaic, California 91384

STABILITY ANALYSIS WORK PLAN
CHIQUITA CANYON LANDFILL
CASTAIC, CALIFORNIA

Dear Mr. Cassulo:

This Work Plan was prepared by Geo-Logic Associates, Inc. (GLA) to address the slope stability work plan requirement in the November 21, 2023 letter to Chiquita Canyon Landfill (CCL) from Los Angeles County Department of Public Health in its role as the Local Enforcement Agency (LEA). The letter references a November 2, 2023 site visit by the LEA, CalRecycle, South Coast Air Quality Management District (SCAQMD), Los Angeles Regional Water Quality Control Board (LARWQCB), Department of Toxic Substances Control (DTSC), and the United States Environmental Protection Agency (USEPA). The letter appends a November 14, 2023 CalRecycle letter that includes a series of recommendations, one of which states:

> "Given the prior slope instability on the western slope near the leachate outbreak, CCL should perform a slope stability analysis in this area, as saturated waste has very low shear strength."

Requirement 3 of the LEA letter incorporates this recommendation and requires submittal of a slope stability work plan with a timeline for LEA review and approval by December 14, 2023.

PURPOSE OF WORK PLAN

The purpose of this Work Plan is to meet Requirement 3 of the LEA letter. More specifically, the objectives of the analyses are to:

- Assess whether sliding has occurred or could occur along the western slope of the area affected by the reaction.
- Assess the significance and potential consequences associated with sliding that has occurred or could occur.

- Assess the effects of mitigation measures that have been implemented to date at the landfill.
- Provide recommendations for additional short-term measures that could be implemented, if necessary, based on the analyses.
- Provide recommendations for long-term measures to improve stability, if necessary, based on the analyses.
- Identify the uncertainties, if any, associated with the analyses and provide recommendations for additional subsurface data collection, if necessary, based on the analyses.

The scope of work summarized below is based primarily on our understanding of previous and current site conditions, site observations, available site data, previous stability analyses performed for different phases of construction at CCL, available and relevant information regarding municipal solid waste (MSW) shear strength, and stability models that incorporate sensitivity analyses to assess the significance of material property and fluid level variability on the analysis results. Pursuant to the LEA letter, the stability analyses will focus on the western slope of area affected by the reaction and will incorporate the tasks summarized below.

SCOPE OF WORK

Task 1 Data Collection and Review

The objective of this task will be to collect and review available site information relevant to the site and the stability analyses. Data sources will include (but not be limited to):

- Site topography including the most recent (2023) aerial survey of the site and the focused western slope area Propeller surveys that have been flown in 2023. Earlier site topography will also be reviewed and incorporated if judged to be relevant to the analyses.
- Surface crack and fissure mapping performed during the second and third quarters of 2023.
- Western slope and plateau area landfill gas (LFG) installation records and post-installation information that may be relevant to the assessment of fluid levels in the landfill and an assessment of MSW shear strength.
- Western slope seepage information.
- Landfill leachate collection information.

- Landfill base grading and development information.
- Landfill containment system information including materials and available material property data for the western slope of the area affected by the reaction.

Task 2 Cross Sections, Material Properties, and Pressures

The information will be reviewed, compiled, and used to identify one or more representative cross sections for analysis. Based on current site understanding, east-to-west cross sections that intersect the western slope of the area affected by the reaction are assumed. However, other orientations may also be developed based on the Task 1 data. The subsurface materials along each cross section will be evaluated based on the available data and fluid levels incorporated in the analyses will be estimated using the data from the LFG wells and zones of surface seepage that have been observed. To the extent practicable, zones of previous instability, if any, will be incorporated into the cross sections and used to inform the analysis results. As part of this task, sequential topographic data, surface fissure and cracking mapping, and site observations regarding leachate seepage will be used to identify zones of previous instability.[1]

Materials incorporated into the analyses will include landfill subgrade and underlying geologic materials, the containment systems soil and geosynthetic layers, MSW, internal and intermediate cover soils, and engineered fill. Material properties (unit weights and shear strengths) will be estimated and assigned based on existing site test data for the bottom of landfill geologic materials and the containment systems soils and geosynthetics. The properties of intermediate cover layers will be estimated based on judgment that considers soil types and available information regarding placement. The unit weights and shear strengths of MSW will be based largely on published information for typical and degraded MSW. The uncertainty and variability of the MSW properties will be evaluated using sensitivity analyses that bookend a range of unit weights and shear strengths that are judged to be potentially applicable to the conditions being analyzed.

An objective of this task will be to assess whether the fluid levels and pressures within area(s) being evaluated occur as continuous zones, as laterally extensive perched zones, and/or as isolated layers and lenses of saturation and pressure. This assessment will be based on data from the LFG wells, site seepage observations, and site leachate removal records. The uncertainty and variability likely associated with this characterization will be addressed by

[1] If reasonably well-characterized, zones of instability or previous sliding, if any, can be used with other site information to assess subsurface stratigraphy and possible zones of degraded MSW, the distribution of subsurface fluids, and to back-calculate shear strengths.

sensitivity analyses that vary the fluid levels and pressures across a range that is judged reasonable based on the available data.

Task 3 Stability Analyses

For this evaluation, the static safety factors and yield accelerations for each section identified in Task 2 will use Spencer's 1967 method of analysis that satisfies both moment and force equilibrium.[2] The calculations will be implemented by an industry standard computer program such as SLIDE2 or SLOPE/W to assess circular and/or non-circular failure surfaces and search routines will be used to characterize the surfaces with the lowest safety factors. As applicable based on the results of Task 1 and Task 2, shear strengths of the underlying MSW will be back calculated for induvial failure surfaces that may be identified using the same methods and the material properties will be adjusted accordingly. As noted above, sensitivity analyses will be performed to assess the significance of uncertainties associated with material properties, fluid levels, and pressures within the waste fill. Seismic stability will be evaluated using the simplified Bray and Travasarou (2007) analysis procedure to calculate potential deformations associated with the design earthquake for the landfill.[3]

Task 4 Documentation and Recommendations

The results of the analyses will be documented in a report that will summarize the data used for the analyses and the analysis results. Relevant data, site information, and analysis output will be appended to the report. The report will also address the effectiveness of leachate and LFG removal actions to date and the probable influence of future and/or ongoing mitigation measures. Principal uncertainties associated with the analyses will be identified, and if warranted, the report will include recommendations for additional investigations to assess subsurface MSW properties, fluid levels, internal pressures, and/or short-term stabilization measures. The report will be signed and stamped by two licensed GLA professionals.

TIMELINE

An approximate timeline for each of the associated tasks is shown in the attached schedule. This schedule assumes a two-week LEA Work Plan review and approval period. Under this timeline, the analysis report would be submitted to the LEA by February 21, 2024. A shorter or longer LEA Work Plan review and approval period will shift the report

[2] Spencer, E., 1967, A Method of Analysis of the Stability of Embankments Assuming Parallel Inter-Slice Forces; Géotechnique. 17: 11–26.

[3] Bray, J.D., and Travasarou, Thalia, 2007, Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements: Journal of Geotechnical and Geoenvironmental Engineering, v. 133, p. 381-392.

submittal date accordingly. From the time of LEA approval to completion, the entirety of the project should take approximately eight weeks. This timeline is approximate and may change based on other factors or unanticipated circumstances.

Please contact the undersigned at (415) 699-8073 if you have questions or need additional information.

Very truly yours,
Geo-Logic Associates, Inc.

Richard A. Mitchell, PG, CEG
Principal Engineering Geologist

CHIQUITA CANYON LANDFILL STABILITY ANALYSIS WORK PLAN TIMELINE (Calendar Days)

ID	Task Name	Start	Finish
1	SUBMIT WORK PLAN TO LEA	12/14/2023	12/14/2023
2	LEA REVIEW	12/14/2023	12/27/2023
3	LEA APPROVAL	12/28/2023	12/28/2023
4	TASK 1 DATA COLLECTION AND REVIEW	12/28/2023	1/10/2024
5	TASK 2 CROSS SECTIONS, MATERIAL PROPERTIES, AND PRESSURES	1/11/2024	1/17/2024
6	TASK 3 STABILITY ANALYSES	1/18/2024	1/24/2024
7	TASK 4 DOCUMENTATION AND RECOMMENDATIONS	1/25/2024	2/21/2024
8	REPORT SUBMITTAL TO LEA	2/22/2024	2/22/2024