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23 March 2006

Mr. Lam Chan
Field Construction Manager, LCLS Division
Stanford Linear Accelerator Center (SLAC)
2575 Sand Hill Road, M/S 103
Menlo Park, CA 94025

2003-060G5

Subject: **GEOTECHNICAL ENGINEERING RECOMMENDATIONS**
LCLS EXCAVATION SPOILS DISPOSAL
STANFORD LINEAR ACCELERATOR CENTER
MENLO PARK, CALIFORNIA

Dear Mr. Chan:

This letter report provides geotechnical engineering recommendations for disposal of excavation spoils that will be produced from the LCLS project. The spoils will be placed in fills located nearby on the SLAC campus. We understand that some 180,000 cubic yards of spoil materials are expected from the project. SLAC has identified several areas for disposal of this large quantity, as shown on the attached site plan, Figure 1.

BACKGROUND

Existing Conditions – Proposed Disposal Areas

The proposed disposal fill areas are open land not presently occupied by improvements. Most areas are undisturbed natural ground, but some are occupied by, or adjacent to, previously placed earth fills that are undocumented. The existing fill slopes are generally at gradients of 2:1 and have performed well; there is no visible evidence of slope instability or erosion.

In general, four potential fill areas have been identified (see Figure 1), as follows:

1. North Fill Area: This area is north of the planned LCLS beam alignment and generally occupies the northeast-facing slope of the hill east of the Experimental Yard. The North Fill Area is bounded on the north and east sides by the existing PEP Ring Road, where the lowest grade exists at approximately elevation 240'. Much of the area is natural grade with slopes in the range of 4.5:1 to 7:1, or flatter. Along the south side, an existing fill slope rises at about 2:1, to the unpaved roadway that accesses the summit of the hill. The existing hill rises to approximately elevation 320' along the south side.

2. South Fill Area: This area is south of the planned LCLS beam alignment, and generally occupies the south- and southeast-facing slope of the hill east of the Experimental Yard. The South Fill Area is bounded on the south and southeast by the existing PEP Ring Road, where the lowest grade exists at approximately elevation 242'. The highest portion of the area is at approximately elevation 322', similar to the North Fill Area. Nearly all of

the South Fill Area is sloping natural grade, with slopes ranging from about 5:1 to 7:1, with no flat areas. The steepest portions are along the PEP Ring Road, where the slopes are 4:1, or locally steeper. A small fill is located along the west boundary.

3. West Depression: This area is a depression located south of the Alpine Access Road, between the PEP Ring Road and the PEP ring embankment. The top of the depression ranges from elevation 240' over the PEP ring, to elevation 250' at the roadway intersection. The bottom of the depression is at about elevation 212'.

4. East Depression: This area is located north of the Alpine Access Road, which crosses the PEP ring embankment along the south side of the depression. The top of the depression ranges from elevation 240' along the south side to elevation 260' on the north side. The bottom of the depression is at about elevation 234' where an existing storm drain inlet is located.

Purpose of Spoils Disposal Fills

We understand that the sole purpose of the fills placed in the proposed areas is disposal of the LCLS project spoils, and that no future improvements are planned over the fills. Therefore, the intent of the geotechnical recommendations contained in this report is to create fills that are stable over the long term, but are not intended for future support of structures or improvements. The reason for this approach is twofold: 1) to minimize cost; and 2) because requirements or criteria for future structural support have not been established at this time. We should be notified if this intent is incorrect or is modified in the future, so that appropriate recommendations can be developed to suit a different proposed future use of the fill areas.

GEOTECHNICAL DESIGN RECOMMENDATIONS – SPOILS DISPOSAL

Site Clearing and Stripping

The spoils disposal areas should be cleared and stripped of existing organic materials and topsoil. Stripping depths are unknown at this time and are likely to vary in different areas. Stripped materials could be stockpiled for final spreading as topsoil over the completed disposal fill.

Subgrade Preparation

After clearing and stripping, the subgrade surface that will receive fill should be prepared by grading to a surface with a slope not greater than 5:1 (horizontal: vertical) and rolling to a stable surface that does not exhibit pumping or soft spots. The exposed subgrade should be scarified to a depth of six inches, brought to a moisture content suitable for compaction, and re-compacted to minimum 90% relative compaction (based on ASTM D1557).

Any unstable, pumping, or soft subgrade areas should be stabilized by additional excavation, scarification, and moisture conditioning, as required.

Where fill will be placed on existing slopes steeper than 5:1, the subgrade should be benched to flat areas at least six feet wide, or the width of equipment being used, whichever is wider.

Benching can be performed as the fill is placed, with the materials cut from the benched areas being incorporated into the fill as it is placed. At the toe of any fills on slopes, a keyway bench at least ten feet wide should be excavated to a depth of at least two feet below existing grade at the toe of the new slope.

Subdrains beneath the fills are generally not required unless localized zones of groundwater seepage are encountered. The exposed subgrade surface in all areas to receive fill should be observed by the Geotechnical Engineer. Based on the Geotechnical Engineer's field observations, the locations and extent of any required subdrains can be determined.

Existing Fills

Where new fill will be placed over existing fills, we recommend removing the old fill soils down to undisturbed native material. The native subgrade should be prepared as described above, and the old fill should be replaced as compacted engineered fill, to the same standards as required for the new fill.

Where new fill will be placed adjacent to or against an existing fill slope, the existing fill material may either be removed and recompacted as part of the new fill, or left in place, at SLAC's option. If the existing fill is left in place, the new fill should be benched into the existing slope as described in the preceding section. The location and extent of any old fills left in place should be documented for the benefit of any future use of the land, which would require evaluation of the suitability of the old fills.

Spoils Fill Compaction

After preparation of the subgrade, place spoils fill material in lifts not exceeding twelve inches in uncompacted thickness. Each lift should be compacted to a minimum relative compaction of 90% (based on ASTM D1557), at a moisture content suitable to achieve the required compaction.

Permanent Fill Slopes

Permanent fill slopes should not exceed a gradient of 2:1 (horizontal: vertical) in order to ensure stability, encourage plant growth, and minimize erosion. Terraces should be constructed on fill slopes more than 20 feet high in order to intercept runoff flowing down the slope and minimize erosion. Terraces should be located at the mid-height of the slope, be at least six feet wide, and be graded with a drainage swale sloped at a minimum gradient of 5% along the slope, to discharge drainage in a suitable manner determined by the Civil Engineer.

For fill slopes higher than 30 feet and up to a maximum of 60 feet, terraces should be provided at maximum 15-foot vertical spacing.

Fill Surface Grading

In order to provide positive drainage on all fill surfaces and prevent depressions that would cause ponding, a minimum slope of 5% should be provided on the surface of all fills.

QUALITY CONTROL

The placement of spoils disposal fills should be performed with observation and testing by a qualified Geotechnical Engineer. The Geotechnical Engineer should observe and provide engineering control of all aspects of subgrade preparation; removal and re-compaction of existing fills; and placement and compaction of new fill. Engineering control should consist of all tests and inspections deemed necessary to ensure compliance with the recommendations of this report.

Compaction tests (field density tests) should be performed in accordance with ASTM D1556 or ASTM D2922, as directed by the Geotechnical Engineer. The location and frequency of testing should be at the discretion of the Geotechnical Engineer, or a qualified testing agency in conformance with testing program established by Geotechnical Engineer.

DESIGN DOCUMENT REVIEW

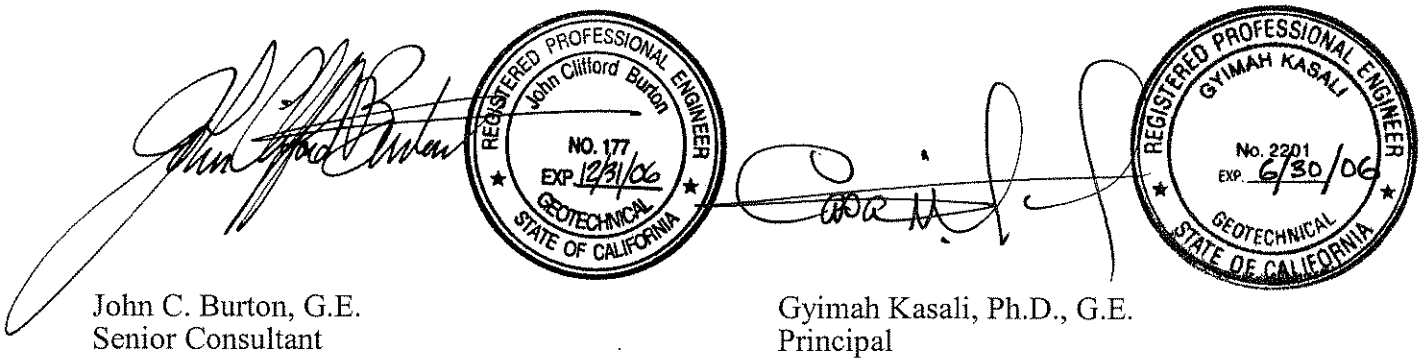
We request the opportunity to review any design drawings and specifications prepared by others for this project, to assist in the appropriate application of our geotechnical design recommendations. Our review will be limited to the aspects involving our recommendations and will not include performing calculations or checking the calculations of others.

CLOSING

Please contact us if you have any questions regarding the recommendations contained herein. We look forward to reviewing the grading drawings and specifications. If there are any questions regarding the application of our recommendation during the design process, please do not hesitate to contact us.

Sincerely,

RUTHERFORD & CHEKENE



John C. Burton, G.E.
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Principal

JCB-GK/hb

cc: John Lamon, BKF Engineers

SLAC SPOILS-JCB.DOC

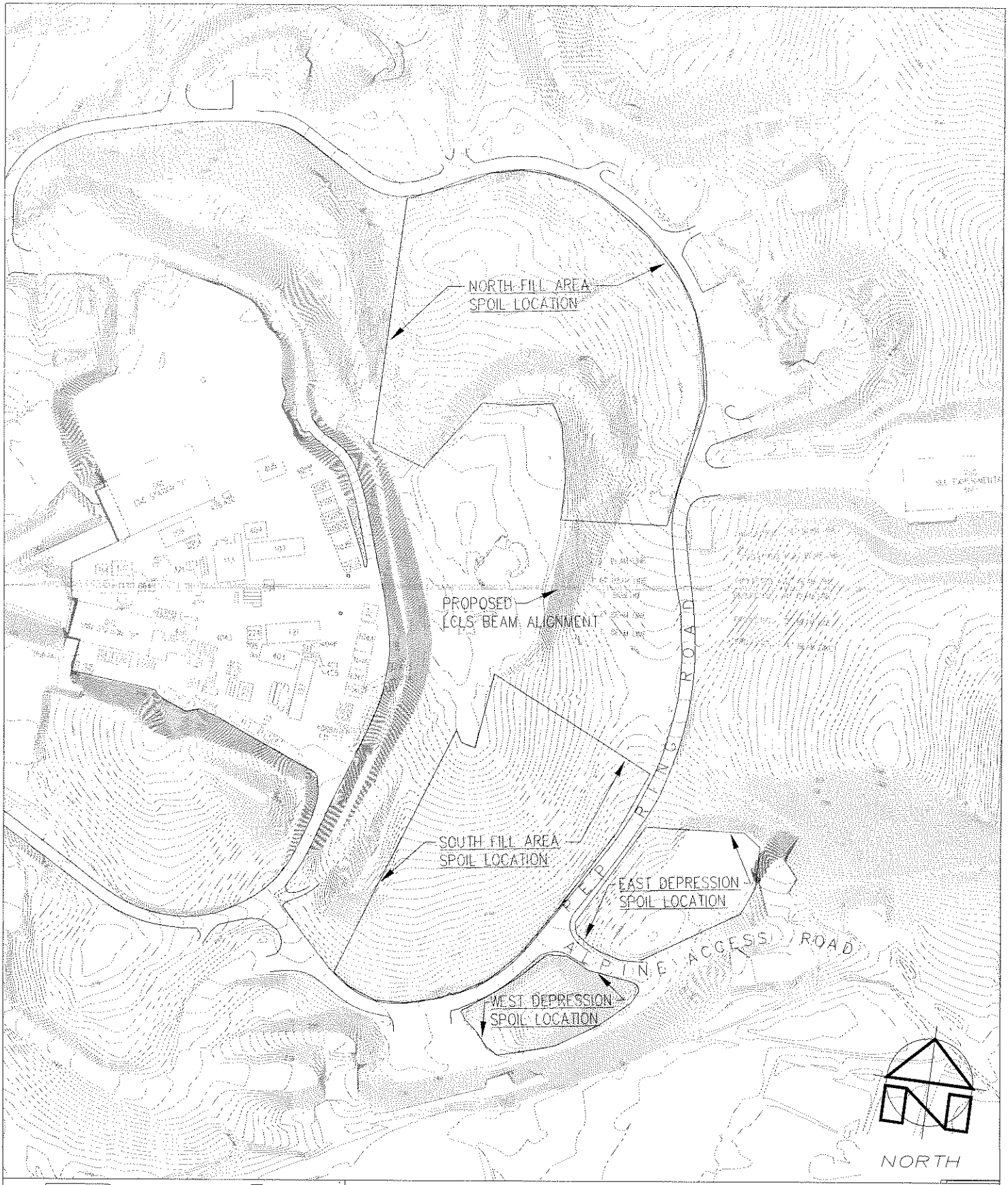

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FIG. 1 - SITE PLAN
GEOTECHNICAL ENGINEERING RECOMMENDATIONS
LCLS EXCAVATION SPOILS DISPOSAL
STANFORD LINEAR ACCELERATOR CENTER, MENLO PARK, CA.

JOB No.: 2003-060G5	BY: JB	SCALE: 1"=300' (+/-)	DATE: 03/23/06