SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.1 RELATED WORK

A. Special Conditions for Storm Water Pollution Prevention

B. Section 01 56 39 – Tree and Plant Protection

C. Section 31 10 00 – Site Preparation

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. D1556: Density of Soil in Place by Sand Cone Method.


3. D2922: Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depths)

4. D3017: Water Content of Soil and Rock in Place by Nuclear Method (Shallow Depth)

B. Current Caltrans Standard Specifications:

1. Section 17 – Watering

2. Section 19 – Earthwork

1.3 SUBMITTALS

A. Samples: Samples of all proposed imported materials, minimum 50 pounds, tagged with source location and supplier shall be submitted to the Geotechnical Engineer at least 15 days prior to import. Materials shall not be imported to jobsite without written approval by the Project Manager.
B. Trench Excavation and Shoring: The Contractor shall provide the Project Manager with a letter identifying the company's "Competent Person" overseeing excavation activities, and a copy of the company's current OSHA permit.

1.4 SITE CONDITIONS

A. The Contractor shall conduct operations and schedule cleanup to cause the least possible obstruction and inconvenience to public traffic, pedestrians, and adjacent landowners.

B. The Contractor shall protect open excavations, trenches, and the like with fences, covers, and railings as required, to maintain safe pedestrian and vehicular traffic passage.

C. The Contractor shall prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

D. The Contractor shall protect existing trees not designated for removal from injury or damage during grading operations by use of fences or other protective measures as required.

E. Fill material shall be temporarily stockpiled in an orderly and safe manner in a location approved by the Project Manager.

F. Provisions shall be made whereby all storm water can flow uninterrupted in gutters or drainage channels.

G. All bench marks, monuments, signs, and other reference points shall be maintained; if disturbed or destroyed, they shall be replaced by the Contractor as directed by the Project Manager.

H. Earthwork operations shall be conducted so as to prevent windblown dust and dirt from interfering with the surrounding normal operations. Contractor shall assume liability for all claims related to windblown dust and dirt. Water shall be applied in conformance with applicable provisions of Section 17 of the Caltrans Standard Specifications.

I. If existing underground utilities are damaged, the Project Manager, and if the Project Manager cannot be reached, Maintenance Customer Service (650-723-2281) shall be notified immediately.

J. Existing irrigation lines to be abandoned shall be capped as directed by the Project Manager. All hose bibs, valves and sprinkler heads removed from the project area prior to commencement of construction shall be salvaged in accordance with these Specifications or as directed by the Project Manager.

K. In the event irrigation lines are discovered passing through the project area to other areas of the campus, lines shall be rerouted and maintained in operation during construction as directed by the Project Manager.
L. When unfavorable weather conditions necessitate interrupting earthwork operations, areas shall be prepared by compaction of surface and grading to avoid collection of water. Adequate temporary drainage shall be provided to prevent erosion. After interruption, compaction specified in last layer shall be verified or reestablished before resuming work. (Refer to the Special Conditions for Storm Water Pollution Prevention.)

**PART 2 PRODUCTS**

2.1 FILL MATERIALS

All proposed fill material to be used for the project shall be submitted to and approved by the Geotechnical Engineer. Excavated materials from the site may be used if approved by the Geotechnical Engineer. Imported fill, where required, shall be a clean, non-expansive and predominantly granular soil or soil-rock mixture which is free from organic matter, deleterious substances, and contamination and which does not contain materials over 6 inches in greatest dimension. Materials having dimension greater than 4 inches shall not be used in the upper 6 inches of fill. Fill material shall have a minimum "R" value of 25, a Plasticity Index less than 15, and at least 20% and no more than 60% passing the No. 200 sieve.

2.2 SOIL STERILANT

Soil Sterilant shall be Treflan E.C. or equal as approved by the Stanford Grounds Maintenance Department.

**PART 3 EXECUTION**

3.1 PREPARATION (NOT USED)

3.2 EXCAVATION

A. General

1. All supports, shoring, and sheet piling required for the sides of excavations or for protection of adjacent existing improvements shall be provided and maintained by the Contractor. The adequacy of such systems shall be the complete responsibility of the Contractor. Shoring systems required to support adjacent buildings and structural foundations shall be designed by a registered Structural Engineer.

2. Earth and rock, regardless of character and subsurface conditions, shall be excavated to depths shown on drawings and to the neat dimensions of the footings wherever practicable, to permit pouring of footings and grade beams without use of sideforms, except at slab perimeters.
3. Large rocks, pieces of concrete or other obstructions, if encountered during the excavation/scarifying operations, shall be removed and disposed of at no cost to Stanford.

4. Should the Contractor excavate beyond the designated lines, the Contractor will be required to replace the material with suitably compacted import material as determined by the Project Manager, without cost to Stanford.

5. Where forming is required, only that excavation necessary to permit placing and removal of forms shall be done.

6. Bottoms of all footings and foundations trenches shall be subject to testing by the Geotechnical Engineer.

7. Corrective measures as directed by the Project Manager shall be executed promptly.

B. The Contractor shall be responsible for removal of all excess excavated material to an off-campus site in a legal manner. The Contractor shall submit to the Project Manager the location of the off-campus site for approval. The Contractor shall be responsible for all costs associated with removal of the excavated material from the site, including all required testing which may be required by the off-campus disposal site.

C. Dewatering

1. Dewatering equipment necessary to drain and keep excavations free of water under all circumstances shall be provided, operated, and removed by the Contractor.

2. Contractor shall obtain the Project Manager’s approval of the proposed method of dewatering.

3. Surface water shall be prevented from flowing into excavations. Accumulated water shall be promptly removed.

4. Dewatering systems shall be maintained in place until construction work below groundwater level is completed.

3.3 GRADING

A. All areas covered by the project, including excavated and filled areas and adjacent transition areas, shall be uniformly graded so those finished surfaces are at the elevations established by the Plans. Planter areas to receive topsoil shall be graded to 6 inches below finished grade to allow for such material. Finish grades shall not vary more than 0.10 feet from the established grade and the top 6 inches shall be compacted to 90% relative compaction. Topsoil shall be compacted to 85% relative compaction.
B. Surfaces to receive paving and aggregate base shall be smooth, compacted, and free from irregular surface drainage and shall not vary more than 0.10 feet from the established grade.

C. Ditches, gutters, and swales shall be finished to provide proper surface drainage, per approved plans.

3.4 SOIL STERILIZATION

Soil sterilant shall be applied to prepared subgrade or after installation of rock or aggregate base as recommended by the manufacturer. Sterilant shall be applied uniformly at the rate recommended by the manufacturer to all areas beneath asphalt concrete pavement, brick pavement, concrete pavement, or on-grade concrete slabs including sidewalks, curbs, and gutters. In addition to ground areas treated, sterilant shall be applied below expansion or control joints, and at all areas where pipe, ducts, or other features penetrate slabs.

3.5 SUBGRADE PREPARATION

A. Subgrade preparation is required under all paved areas, curbs, gutters, walks or structures.

B. The surface shall be scarified to a depth of at least 6 inches below the final subgrade elevation. The soil material shall be brought to a finely divided condition by harrowing, dry rolling and breaking clods. All boulders or solid rock encountered shall be removed. The soil material shall be uniform for a full depth and width of subgrade. The top 6 inches of subgrade shall be moisture conditioned and then compacted to 95% relative compaction.

3.6 FILLING

A. The placement of fills shall be done under the observation of the Project Manager or designated Geotechnical Engineer.

B. Jetting of native material shall not be permitted. Jetting of select material (sand) backfill shall be subject to acceptance by the Project Manager or designated Geotechnical Engineer.

C. All areas to receive fills shall be scarified to a depth of 6 inches and uniformly moisture conditioned as required to obtain the required compaction. Where slopes exceed 4 horizontal to 1 vertical, initial fill shall be keyed into slope.

D. Fill material shall be spread in uniform lifts of not more than 8 inches in uncompacted thickness. Prior to commencing compaction, fills shall be brought to a uniform water content that will permit proper compaction by either aerating the material if it is too wet, or spraying the material with water if it is too dry. Each lift shall be thoroughly mixed before compaction to assure uniform distribution of water content. All fills shall be
brought to suitable elevations above grade to provide for anticipated settlement (approximately 1% of the fill thickness), slope trimming or shrinkage.

E. Fill shall not be dropped on any structure. Backfill shall not be placed around, against, or upon any concrete or masonry structure until structure has attained sufficient strength to withstand the loads imposed and the horizontal structural system has been installed.

F. Within the exterior walls of buildings, utility trenches shall be backfilled using gravel fill or clean sand installed in 6 inch lifts and mechanically tamped to achieve 95% relative compaction.

3.7 COMPACTION AND TESTING

A. Each layer of fill shall be compacted to the minimum compaction requirements listed below:

<table>
<thead>
<tr>
<th>Minimum Compaction</th>
<th>Fill Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>95%</td>
<td>Upper 2 feet below pavement</td>
</tr>
<tr>
<td>90%</td>
<td>Building pads, wall backfill, below the upper 2 feet in pavement areas,</td>
</tr>
<tr>
<td></td>
<td>subgrade below topsoil</td>
</tr>
<tr>
<td>85%</td>
<td>Landscape areas, topsoil, where no immediate or future construction is</td>
</tr>
<tr>
<td></td>
<td>planned</td>
</tr>
</tbody>
</table>

Compaction shall extend not less than 5 feet beyond building lines and pavement edges (including shoulders). The Contractor shall be responsible for the cost of any re-testing required when initial compaction is not achieved.

B. Relative Compaction: In-place compaction testing shall be in accordance with one or more of the following methods (at the discretion of the Project Manager or Geotechnical Engineer): California Test Method No. 216, California Test Method No. 231, ASTM D1556, or ASTM D2922. Laboratory testing shall be in accordance with one or more of the following methods (at the option of the Project Manager or Geotechnical Engineer): California Test Method No. 216 or ASTM D1557.

C. Resistance Value (R Value): The R Value of soil materials shall be as determined by California Test Method No. 301.

D. All compaction shall be performed using compacting rollers, pneumatic or vibrator compactors, or other equipment and mechanical methods approved by the Project Manager or Geotechnical Engineer.
E. Where fill is required and no immediate or future construction is planned (such as planting areas), each layer of fill and scarified subgrade shall be compacted to not less than 85% maximum density.

F. Soils testing services for which the Contractor must pay: for retesting and inspection of rejected work, and in cases where Contractor does not expedite soils work in accordance with the specifications, the Project Manager shall prepare a credit change order to the Contract to reimburse Stanford for extra services rendered by the Geotechnical Engineer. Stanford will require the Geotechnical Engineer to invoice separately for this work, which will establish the amount of the change order. Stanford will, upon execution of the credit change order, pay the Geotechnical Engineer for its extra work.

3.8 FIELD QUALITY CONTROL

A. All excavation, filling, and compaction shall be performed under the direct observation of the Geotechnical Engineer. The Contractor shall cooperate with the Project Manager and Geotechnical Engineer in all aspects of the work. Any materials placed or improvements constructed in the absence of the Geotechnical Engineer’s approval to proceed shall be presumed to be defective. At the discretion of the Project Manager, the areas in question shall be removed and replaced at no cost to the Owner. The Project Manager or Geotechnical Engineer shall be notified at least 48 hours prior to required observation or testing.

B. Embankments shall be maintained to the grades shown on the plans until completion and acceptance of the Contract. Suitable allowance for shrinkage shall be provided for by the Contractor. The Contractor shall be responsible for the stability of all constructed embankments, and shall replace any portion which, in the Stanford representative's opinion, has been displaced due to the Contractor's negligence.

C. The finish soil grade tolerance at the completion of grading is:

   Building and paved areas: 0.00 to – 0.10 feet
   Other areas: ± 0.10 feet.

END OF SECTION