

Photovoltaic Panel Structure
and Parking Lot Addition
Shasta Community Health Center
Redding, CA

SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Contractor Shall:

1. Prepare subgrades for slabs-on-grade and pavements.
2. Excavate and backfill for buildings and structures.
3. Provide base course for asphalt paving.
4. Provide subsurface drainage backfill for walls and trenches.
5. Excavate and backfill for utility trenches.

1.02 RELATED SECTIONS

A. Section 02230 – Site Clearing

1.03 DEFINITIONS

A. Backfill: Soil material or lean concrete used to fill an excavation.

1. Trench Backfill: Backfill placed over pipe bedding to fill the trench. Includes Class “A” and Class “C” backfill as shown on the Plans.

B. Aggregate Base: Granular material placed between the subgrade and asphalt paving.

C. Pipe Bedding: Material supporting, surrounding, and extending to 6 inches above the top of the pipe as shown on the Plans.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

F. Engineered Fill: Compacted soil materials used to raise existing grades.

G. Structures: Retaining walls, slabs, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill.

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- I. Utilities: On-site underground pipes, conduits, ducts, and cables.

1.04 SUBMITTALS

- A. Samples:

- 1. 12-by-12-inch Sample of each geotextile.
- 2. 25 to 30-pound Sample in 5-gallon bucket of each of the following:
 - a. Engineered fill (each material if more than one)
 - b. Structural fill (each material if more than one)
 - c. Pipe bedding
 - d. Trench backfill (each material if more than one)

- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for the following with requirements indicated:

Material	Test	Test Method
Engineered Fill:	Compaction Curve Atterberg Limits	ASTM D1557
Structural Fill:	Compaction Curve Atterberg Limits Sieve Analysis	ASTM D1557
Pipe Bedding:	Compaction Curve Sand Equivalent Sieve Analysis	ASTM D1557
Trench Backfill:	Compaction Curve Sand Equivalent Sieve Analysis	ASTM D1557

1.05 QUALITY ASSURANCE

- A. Agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.06 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Project Manager and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Project Manager not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Project Manager's written permission.

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3. Contact USA (1-800-227-2600) for area where Project is located before excavating.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Aggregate Base: Aggregate base shall conform to the requirements of the State Standard Specifications for Class 2 aggregate base, ¾-inch maximum size (Caltrans).
- C. Engineered Fill: Requirements for engineered fill, as well as applicable test procedures to verify material suitability are provided in the table below.

TABLE 1 ENGINEERED FILL REQUIREMENTS

Fill Requirement Test Procedures

ASTM¹ Caltrans²

Gradation

Sieve Size Percent Passing

3 inch	100	C 136	202
-inch	70-100	C 136	202
No. 4	50-100	C 136	202
No. 40	30-100	C 136	---
No. 50	30-100	---	202
No. 200	15-70	C 136	202

Plasticity

Liquid Limit Plasticity Index

<30	<12	D 4318	204
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Organic Content

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Less than 3% D2974 ---

Expansion Potential

Less than 20 --- --- ---

Maximum Dry Density

More than 105 pcf --- D1557 ---

*1*AMERICAN SOCIETY FOR TESTING AND MATERIALS STANDARDS (LATEST EDITION) *2*State of California, Department of Transportation, Standard Test Methods (latest edition)

- D. Pipe Bedding: Imported clean sand or well graded sand gravel mix, maximum size of ¾-inch, free from all organic matter and debris; minimum sand equivalent of 30. In areas with pipe slope greater than 2 percent use a silt-sand-gravel mixture with gradation corresponding to that for Caltrans Class 2 aggregate base – ¾-inch maximum size.
- E. Trench Backfill: Caltrans Class 2 aggregate base ¾-inch maximum size.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface as specified in Division 2 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to

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accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

- C. Excavations which extend more that about 2 to 3 feet below existing site grade (and possibly shallower, depending on location and time of year) may need to be dewatered to facilitate construction. The contractor is solely responsible for the design, installation, maintenance, and performance of all temporary dewatering, shoring, and other similar systems.

3.03 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.05 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.06 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide 6 inches of clearance on each side of pipe or conduit.
- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course.

3.07 SUBGRADE INSPECTION

- A. Notify Project Manager when excavations have reached required subgrade.

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- B. If Project Manager determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a loaded 10-wheel, tandem-axle water truck with a rear axle load of not less than 8 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Project Manager, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Project Manager, without additional compensation.

3.8 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations.

3.9 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact pipe bedding on trench bottoms as shown on the Plans. Shape bedding to

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provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."
- D. Place and compact remainder of pipe bedding material to a height of 6 inches over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. Backfill voids with trench backfill material while removing shoring and bracing.
- F. Place and compact trench backfill material to final subgrade elevation.
- G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
- H. Trench backfill shall be mechanically compacted. Jetting is not permitted.

3.11 SURFACE PREPARATION FOR FILL PLACEMENT

- A. After site stripping and any required grubbing and/or overexcavation, areas to receive fill shall be scarified to a depth of at least 8 inches, uniformly moisture conditioned to between 0 and 3 percent above optimum moisture content, and compacted to at least 95 percent of the material's maximum dry density as determined by ASTM Test Method D1557. Scarification and compaction may not be required within earthwork cut areas consisting of undisturbed bedrock and if approved by the project Geotechnical Engineer during construction.

If soft or yielding soils are encountered during scarification and compaction, they shall be removed by overexcavation to expose firmer soils. The horizontal and vertical extent of the overexcavation shall be determined in the field by the project Geotechnical Engineer. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

3.12 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer to between 0 and 3 percent of optimum moisture content before compaction.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

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2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 8 inches of existing subgrade and each layer of backfill or fill soil material to at least 95 percent.
 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material to at least 92 percent.
 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material to at least 85 percent.
 4. For utility trenches, compact each layer of bedding and backfill material to at least 95 percent.

3.14 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Pavements:
 - 1) Plus or minus 0.04 feet (1/2 inch) for subgrade
 - 2) Plus or minus 0.02 feet (1/4 inch) for AB, AC and concrete surfaces
 - 3) No birdbath deeper than 1/8 inch ponded water.

3.15 AGGREGATE BASE

- A. Place aggregate on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place aggregate base as follows:
 - 1. Shape aggregate base to required crown elevations and cross-slope grades.
 - 2. Place aggregate base 6 inches or less in compacted thickness in a single layer.
 - 3. Place aggregate base that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 4. Compact aggregate base at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 1557, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
 - 2. Trench Backfill: At each compacted initial and final trench backfill layer, at least 1 test for each 500 feet or less of trench length, but no fewer than 2 tests.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required. Recompact and retest until specified compaction is obtained.

3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

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1. Scarify or remove and replace soil material to depth as directed by Project Manager; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300