



SECTION 31 23 16 STRUCTURE EXCAVATION AND BACKFILL

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The work covered by this section consists of furnishing all labor, equipment, and materials, and performing all operations necessary in connection with the excavations, shoring, and the subsequent backfill for structures and foundations, as shown on the Drawings, as specified herein or as otherwise directed by the County.
- B. The work covered by this section consists of furnishing all labor, equipment, and materials, and performing all operations necessary in connection with dewatering and pumping efforts as required to perform project work.

1.02 REFERENCES

- A. American Society for Testing of Materials (ASTM) Standards:
 - D1556 Test Method for Density of Soil in Place by the Sand Cone Method
 - D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort
 - D2794 Test Method for the Organic Content of Soils
 - D6938 In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
 - D3017 Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - D4318 Test Method for the Liquid Limit and Plastic Limit of Soils
 - D6913 Particle-Size Distribution Analysis of Soils Using Sieve Analysis

1.03 GENERAL REQUIREMENTS

- A. With reference to the terms and conditions of the construction standards for excavations set forth in OSHA "Safety and Health Regulations for Construction", Chapter XVII of Title 29, CFR, Part 1926, Cal OSHA "Construction Safety Orders" Title 8, California State Labor Code 6705, and requirements listed in the General Conditions; Contractor shall employ a competent person and, when necessary based on the regulations, a licensed professional engineer, to act upon all pertinent matters of the work of this section.
- B. Dewatering and pumping efforts will be provided, designed, and operated by the contractor in accordance with this specification section. The design, construction, and maintenance of all required dewatering systems, including nuisance water management and temporary pumping systems, shall be the responsibility of the Contractor. Proposed facilities shall be designed and operated in accordance with the County's requirements. Facilities shall be removed following completion of all work relying on their temporary service.



1. The Contractor shall design, furnish, install, maintain, and operate all necessary pumping, bypassing, and other dewatering equipment required for dewatering the various work areas and for maintaining the foundation and other work areas free from water. Dewatering shall be accomplished by methods that will ensure an excavation work area free from standing water and preserve the final lines and grades of the excavation bottoms. Said methods may include deep wells, well points, or other methods suitable for accomplishing the Work.
2. The County, at its discretion, will consider the functional viability and cost of any Contractor-proposed system and determine its value and acceptability prior to executing a Contract and issuing a Notice to Proceed. The Contract Price will be set according to the County's acceptance or rejection of the Contractor's proposed price for designing, constructing, and maintaining a temporary dewatering system.
3. The Contractor's discharge and routing of water from dewatering operations is governed by the National Pollutant Discharge Elimination System (NPDES), the project Stormwater Pollution Prevention Plan (SWPPP), and related project permits and regulatory requirements pertinent to completing the project work.
4. Dewatering shall be accomplished in a manner that will prevent excessive loss of fines from the foundation, or "sanding", and will maintain stability of all excavated slopes and bottoms of excavations, and will permit all construction operations to be performed in dry, stable conditions. Any sump found to be sanding at a rate exceeding one (1) pint per 55,000 gallons of pumped water or otherwise considered sanding at an excessive rate as determined by the County's representative, shall be deemed unsatisfactory and shall be replaced.
5. Dewatering of excavations shall be performed to the extent required to permit placement of compacted fill materials in the dry and to prevent sloughing of the excavation side slopes. The Contractor shall lower the groundwater level a minimum of three (3) feet below foundation grade or subgrade prior to foundation preparation and placement of structural foundations. During the placement and compaction of fill or bedding materials, the water level at every point within the limits of fills being placed shall be maintained a minimum of three (3) feet below fill placement level.
6. The infiltration of groundwater into excavations will be affected by the soil type and depth of the excavation below the static water level. Particular attention will be required when excavating trenches and structural excavations through wet or saturated soil deposits and rock. Prevent groundwater inflows into trench excavations. Field conditions shall be carefully assessed before trenches and excavations are made so that appropriate measures can be taken to prevent sloughing and caving, running ground, and excessive ground movement during construction.



- C. Detailed Excavation and Shoring Plan. The Contractor's attention is directed to the 2025 (Revision 2) CalTrans Trenching and Shoring Manual and the provisions for "Shoring and Bracing Drawings," in Section 6705 of the California Labor Code. Prior to beginning any structure excavation five (5) feet deep or greater, submit the Contractor's detailed excavation plan showing design of all shoring, bracing, sloping of sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation. Pre-manufactured support systems shall be used only as the vendor intended. Vendor shall supply technical data for the chosen shoring system. Include the name(s) of competent person(s) who will be on-site to determine if bracing, shoring, and sloping of sides is appropriate for the conditions encountered.
1. If the Contractor's detailed excavation plan(s) vary from the excavation or shoring system standards set forth in Paragraph 1.03A and 1.04 A.3 above, or in the case where excavations exceed 20 feet in depth, the plan(s) shall be prepared and signed by a licensed geotechnical engineer, civil, or structural engineer in the state of California. This licensed engineer should have adequate experience in performing slope stability analysis and evaluation using state-of-the-art techniques and using site specific information. Shoring, bracing, sloping, or other protective systems shall not be less effective than the standards listed in Paragraph 1.03A and 1.04 A.3. The Contractor's excavation plan(s) shall also indicate location and overall limits of excavation and/or sheeting and shoring being provided.
- D. Dewatering Plan. A detailed Dewatering Plan, including, but not limited to, the following:
1. Anticipated dewatering flow rates and a means for monitoring flow rates during construction.
 2. Description of Contractor's equipment, materials, and systems proposed for use in nuisance water management, dewatering excavations and areas of work, pumping, measuring, monitoring, and treating discharge water collected from open excavations, dewatering well fields, and or water management systems. Include a description of operations and power source(s) for operating proposed equipment and systems.
 3. Description of methods for the disposal or discharge of water from construction dewatering into nearby drainages, conveyances, water courses, or off-site.
 4. Schedule for implementation, duration of use, and decommissioning of dewatering, water management, and treatment systems.
 5. The dewatering plan shall be coordinated with and conform to the permit requirements and other requirements specified by the County and county Representative.



6. The dewatering plan shall be prepared by a professional with experience coincident with the risks associated with the plan and submitted for the County's review and acceptance prior to dewatering. The Contractor may be required to demonstrate that the proposed system(s) will satisfy the requirements specified herein and to verify that adequate equipment, personnel, and materials are provided to dewater the excavations at all locations and times.
 7. If necessary, include attenuating, treating, stabilizing, and disposing of chemically affected groundwater, if encountered.
- E. Refer to Section 31 00 00, "Embankment Construction" for product data submittal requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Structure Backfill. Structure backfill shall comply with the suitable embankment material requirements as specified in Section 31 00 00, "Embankment Construction," except liquid limit shall be 35 or less for each individual test.
- B. Unless otherwise specified on the Drawings, structure backfill shall be all fill to be placed within three (3) feet of a structure. Structure backfill shall also be placed to provide for the support of footings, foundations, or slabs-on-grade. Structure Backfill shall begin at the limit of excavation and extend to the lines and grades, as required on the Drawings.
- C. Unsuitable Materials. Unsuitable materials are specified in Section 31 00 00, "Embankment Construction."

PART 3 – EXECUTION

3.01 STRUCTURE EXCAVATION

- A. General. Excavation shall include the removal and disposal of all materials of whatever nature encountered as required to complete the work. Remove unsuitable materials and reprocess or spoil in accordance with Section 31 23 00, "Stripping and Excavation." Stockpile suitable materials for backfill for reuse, re-handle as necessary, and place in the work.
- B. Excavation
 1. General – The original material at foundation surfaces shall be undisturbed and carefully graded. Where unsuitable material is found at the planned foundation grade, it shall be removed to a depth as directed by the County and replaced with structure backfill placed and compacted as specified herein.



2. Foundations – Surfaces upon or against which concrete is to be placed shall be free of standing water, mud, debris, and loose material. The surfaces shall be inspected and approved by the County before any concrete is placed.

3.02 STRUCTURE BACKFILL

A. General.

1. Place backfill at near optimum moisture content, in uniform layers of not more than four (4) inches in thickness prior to compaction. The backfill shall be brought up evenly on all sides of the structure.
2. Compaction equipment or methods that may cause displacement or damage to structures shall not be used. Compact backfill within three (3) feet of the structure with hand-operated power tampers. The remaining backfill shall not be compacted with equipment that exerts a total force greater than 25,000 pounds or a uniform load greater than 5,000 pounds per square foot.
3. Backfill shall not be placed until cast-in-place concrete has been in place for at least seven days and has obtained its specified 28-day compressive strength, except as otherwise approved by the County.
4. Compaction of backfill by ponding or jetting will not be permitted.

- B. Structure Backfill. Compact structure backfill to a relative compaction of not less than 97% maximum dry density, based on laboratory test procedure ASTM D698.

3.03 FOUNDATION PREPARATION FOR STRUCTURES

- A. After stripping and excavation operations, scarify the foundation soils beneath new concrete structures to a depth of eight (8) inches; moisture condition to at least 1% above optimum moisture, and compact to 100% maximum dry density, based on laboratory test procedure ASTM D698.

3.04 DEWATERING

- A. Dewatering for structures shall commence when groundwater is first encountered and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.
- B. Dewatering operations shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils and rock at the proposed bottom of excavation. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.



- C. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with the appropriate fill material as specified in this Section and Section 31 00 00 or as directed by the County Representative at no additional cost.
- D. Surface water should be directed away from open excavations, and water should not be allowed to accumulate in the bottoms of excavations.
- E. Excavations that will be left open for an extended period (more than 48 hours) likely will require more elaborate dewatering measures.
- F. Maintain the water level three (3) feet below the bottom of the excavation in all work areas where groundwater occurs during construction, backfilling, and until acceptance of the Work.
- G. Control water within areas of concrete placements to lower surrounding water levels below the lowest point of placement and prevent erosion of fresh concrete due to flowing water.
- H. Flotation of structures shall be prevented by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.
- I. Except for shutdowns for maintenance of dewatering equipment, no interruption in the authorized dewatering procedures will be permitted during excavation and construction operations. Full-time surveillance (24 hours a day) and maintenance of the equipment shall be provided by the Contractor to avoid breakdowns.

3.05 SITE DRAINAGE.

- A. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

3.06 WELL AND WELL POINTS

- A. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering. They shall be packed with sand and/or other porous medium to prevent pumping of fine sands or silts from the subsurface. A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.
- B. Contractor shall remove/destroy all wells and groundwater monitoring wells when no longer needed, or at the completion of construction work, unless otherwise directed by the County.



- C. Contractor shall comply with all applicable laws and regulations of the State of California pertaining to well construction, destruction, repair or modification. Contractor shall obtain all required permits, coordinate all inspections, submit all documentation, and pay all fees relating to the destruction of the installed piezometers.

3.07 DISPOSAL AND DISCHARGE OF WATER

- A. Contractor shall dispose of water in a suitable manner without damage to adjacent property and in conformance with permit conditions. No water shall be drained into work built or under construction without prior consent of the County. Water shall be filtered using an authorized method to remove sand, cementitious materials, and fine-sized soil particles before disposal into any drainage system. The dewatering system shall not allow migration and pumping of soil fines with the discharge water. Discharge water shall comply with the permit conditions for water quality requirements before being released into natural watercourses or County facilities.
- B. Water extracted by dewatering from the work areas shall be discharged into an area designated or as approved by the County or as allowed by permit conditions. No sediment, cementitious materials, etc., shall for any reason be allowed to discharge into bodies of water. Any regulatory violation which may result from such action by the Contractor is the sole responsibility of the Contractor.
- C. The Contractor's plan for discharge of water from the work area shall be prepared consistent with the requirements of the permits and SWPPP and shall be submitted to the County for review and approval.

3.08 TERMINATION OF DEWATERING.

- A. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, and pipelines. All equipment and appurtenances used for dewatering and water management systems shall be removed once dewatering efforts are no longer required and construction work has been completed.

3.09 FIELD QUALITY CONTROL

- A. Testing Methods and Frequency. The County will perform the following tests. The Contractor shall perform testing as required to control the work.



<u>Test</u>	<u>ASTM Designation</u>
Field Density	D1556; D6913; D3017
Moisture-Density	D698
Gradation	D6913
Atterberg Limits	D4318
Organic Content	D2794

- B. Backfill: Material gradation tests will be performed when the materials are first incorporated into the work and each time the source of the materials is changed.
- C. Compaction
 - 1. Foundations, Subgrades: At least one compaction test on cast-in-place concrete structure foundations.
 - 2. Backfill: Compaction tests on each different backfill material at least once each day that material is placed, and for each 50 cubic yards of material placed.

3.10 DEWATERING QUALITY CONTROL

- A. All dewatering operations shall be the responsibility of the Contractor and shall be adequate to assure the integrity of the finished project and controlled in such a manner as to avoid all objectionable settlement and subsidence and avoid damage to existing structures and infrastructure.
- B. Contractor shall establish reference points where critical structures or facilities exist immediately adjacent to areas of proposed dewatering. Reference points shall be observed at frequent intervals to detect any settlement that may develop. Additional monitoring of existing facilities for movement may be required where dewatering will create significant unbalanced loading, uplift, increased seepage gradients, etc. and shall be implemented when directed by the County or County's Representative.
- C. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.
- D. The Contractor shall monitor and record all dewatering pump rates and volumes. Dewatering equipment shall be equipped with meters and totalizers or similar equipment, acceptable to the County, to adequately measure the instantaneous flow and totalized volume of pumped discharges. Initial dewatering volumes and averaged rates shall be recorded at least once every 6 hours until the pumping has reached a uniform flow. Subsequent pumping volumes and averaged rates shall be recorded at least twice a day, once at the beginning of the work shift and once at the end of the work shift. A record of all pumping rates and volumes shall be provided to the County's Representative on a weekly basis.



E. EQUIPMENT

1. Dewatering, where required, may include the use of well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, ditches, drainage trenches, and other means.
2. Standby pumping equipment shall be maintained on the job site. A minimum of one standby unit (a minimum of one for each ten in the event well points are used) shall be available for immediate installation should any well unit fail. The design and installation of well points or deep wells shall be suitable for the accomplishment of the Work. Drawings indicating the proposed dewatering system shall be submitted to the County for review.

F. NOISE MITIGATION. Dewatering equipment shall not cause noise nuisance. Noise levels shall, at a minimum, comply with the requirements of the permits.

G. DISPOSAL OF CONTAMINATED GROUNDWATER. Contractor shall refer to permit requirements and the SWPPP for treatment and disposal of groundwater not meeting water quality requirements of the permits and the SWPPP.

END OF SECTION