

## 31 23 00 – EXCAVATION AND FILL PLACEMENT

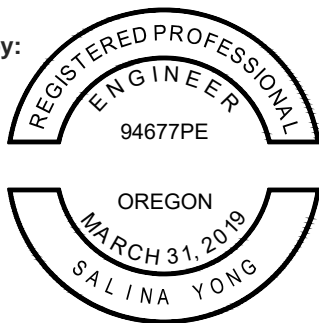
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### REVISION INDEX

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### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This specification describes the construction and quality management requirements for excavation and fill placement activities, including:
  - 1. General site grading work.
  - 2. All excavations necessary for the construction of the Works.
  - 3. Maintaining excavations and trenches free of water.
  - 4. Backfilling of excavations and trenches.
  - 5. Placing fill to final grade.
  - 6. Construction of embankments.

#### 1.2 RELATED SECTIONS

- A. Section 02 41 00 – Demolition and Facility Removal.
- B. Section 03 30 00 – Cast-in-Place Concrete.
- C. Section 03 60 00 – Grouting.
- D. Section 31 05 00 – Materials for Earthwork.
- E. Section 31 10 00 – Clearing, Grubbing and Stripping.
- F. Section 31 25 00 – Erosion and Sedimentation Controls.
- G. Section 31 60 00 – Foundation Preparation.
- H. Section 31 71 00 – Tunnel Construction.
- I. Section 31 80 00 – Care of Water.

#### 1.3 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials (AASHTO).
- B. American Society for Testing and Materials (ASTM):

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1. ASTM D854 – Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer.
  2. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
  3. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  4. ASTM D2216 – Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
  5. ASTM D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
  6. ASTM D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
  7. ASTM D5030 – Standard Test Methods for Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
  8. ASTM D6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
  9. ASTM D6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- C. United States Department of Labor Occupational Safety and Health Administration (OSHA) Regulations.
1. Part 1926.
- D. California Department of Transportation (Caltrans) – Standard Specifications:
1. Section 19 – Earthwork.
- E. California Stormwater BMP Handbook – Construction.
- F. Construction Stormwater Best Management Practiced Manual, 1200-C NPDES General Permit, State of Oregon Department of Environmental Quality.
- G. Oregon Department of Transportation (ODOT) Standard Specifications:
1. Section 00330 – Earthworks.
- 1.4 DEFINITIONS
- A. **Backfill** – Materials used for fill placement.
  - B. **Borrow** – Approved area where appropriate material is sourced for use at another location.

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- C. **Fill Placement** – Placement of backfill to lines and dimensions shown on the Drawings.
- D. **Excavation** – Removal of material encountered above subgrade elevations and to lines and dimensions excavated.
- E. **Subgrade** – Uppermost surface of an excavation and the top surface of a fill or backfill immediately below subbase, structures, or geosynthetic layers.
- F. **Confined Openings** – Tunnel portals, waterway openings in intakes, tunnel portals, forebay cavities, powerhouse embedded penstocks, turbine pits and embedded draft tubes where material cannot be placed by conventional methods.
- G. **Water Management** – Collection and diverting of water by gravity.
- H. **Dewatering** – Removal of water from work area by mechanical methods.

### 1.5 SUBMITTALS

- A. Items listed in this section are to be submitted to the Engineer for information prior to the start of any Works, unless noted otherwise.
- B. Project Record Documents: Record actual locations of abandoned utilities and services, foundations, and other appurtenances.
- C. As-built surveys: Record as-constructed excavations and fills to reconcile Drawings and for review and approval by the Engineer.
- D. Dewatering Work Plan: Details of proposed temporary stormwater control measures in accordance with this specification and Section 31 25 00 – Erosion and Sedimentation Controls.
- E. Quality Control Plan.
- F. Quality Control Test Results: submit test results from QC record tests from materials sourced onsite for review and approval by the Engineer.
- G. Blasting plans in accordance with the applicable Federal, State, and local codes and regulations, indicating the following:
  - 1. Name, qualification, and references of the proposed blaster-in-charge and personnel responsible for blast design.
  - 2. Method and mitigation to control noise, air blast, ground vibration, fly rock, and dust control.
  - 3. Explosives transportation plan including handling, storage, and security.

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4. Procedures for conducting blasting operations including Safety plan and fire prevention plan.

### 1.6 QUALITY ASSURANCE

- A. Work shall be in conformance with the Drawings, submittals, and other project documents.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT

- A. Equipment shall be the responsibility of the Contractor.

#### 2.2 FILL MATERIALS

- A. Requirements for production and supply of fill materials detailed in Section 31 05 00 – Materials for Earthworks.

#### 2.3 GEOTEXTILES

- A. Geotextile shall be implemented as detailed in the Drawings.
- B. Requirements for specifications and supply of geotextiles detailed in Section 31 05 00 – Materials for Earthworks.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. All preparation of work areas to be performed prior to excavation or fill placement and conform to Section 31 60 00 – Foundation Preparation.
- B. Site Inspection and existing conditions:
  1. Obtain the Engineer's acceptance of prepared surfaces before backfilling or placing fill.

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2. Provide access to the work areas for quality testing.
  3. Provide at least 24 hours notice to the Engineer for required inspections.
  4. The Contractor shall read the project geotechnical reports and all other project documents and reference information, form their own opinion regarding subsurface conditions based on the facts contained therein, and choose equipment and methods of execution to suit.
- C. Use excavation methods that will not cause damage to nearby structures.
- D. Protect structures near the work areas from damage.
- E. The Contractor is to identify required lines, levels, contours, datum locations and lay out the excavation and fill limits.
- F. Provide surface runoff and sediment control facilities as required for excavations, fills, stockpiles, borrow areas and roads as detailed in Section 31 25 00 – Erosion and Sedimentation Controls. Comply with environmental regulations.
- G. The Contractor shall notify underground service alert (USA NORTH) to identify the location of existing utilities at least 72 hours prior to any excavation work, per state requirements.

### 3.2 EXCAVATING IN SOIL

- A. Use excavation techniques and take necessary precautions to preserve in an undisturbed state all materials outside the lines and grades shown on the Drawings.
- B. Underpin adjacent structures that may be damaged by excavating work.
- C. Use benching excavating techniques where applicable. Benching shall be completed in accordance with the applicable Federal or State OSHA Regulations.
- D. The Contractor shall immediately notify the Engineer if active utility lines which are not indicated on the Project Drawings are encountered during excavation. Abandoned sewers, piping, and other inactive utilities encountered in the progress of excavation shall be removed and plugged.
- E. Provide, maintain, and operate any temporary drainage, dewatering and/or pumping facilities required to control groundwater and keep the excavations dry and stable. Discharge water such that erosion and sedimentation are prevented.
- F. Excavate subsoil to inverts required to accommodate the structures shown on the Drawings.



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- G. Install bracing and shoring as required to ensure the safety of workers and adjacent facilities.
- H. Maintain excavation slopes equal to or flatter than those shown on the Drawings. The slopes of all excavations shall be neatly and evenly trimmed to the lines and slopes indicated on the Drawings or as directed by the Engineer.
- I. Slope banks with machine to angle of repose or flatter until shored.
- J. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- K. Hand trim excavations where required to remove loose matter. All excavation slopes should be free of loose material.
- L. Notify the Engineer of unexpected subsurface conditions.
- M. Protect excavation surfaces from deterioration and maintain in a stable condition.
- N. Backfill over compacted foundation surfaces using specified fill materials.
- O. Remove waste materials from work area. Stockpile materials that are suitable for fill or use these materials directly in fills.
- P. Excavation for Trenches:
  - 1. Excavate trenches to indicated grades, lines, depths, and elevations as shown on the Drawings.
  - 2. Excavate trenches to uniform widths as indicated on the Drawings.
  - 3. Excavate below bottom of pipe and conduit elevations to allow for bedding materials. Excavate deeper for bells of pipe.
  - 4. Maximum unbraced/un-shored trench excavation height is not to exceed 5 ft per OSHA Regulation Part 1926.
  - 5. Shielding/shoring is required for any excavations exceeding 20 ft in depth, as per OSHA Regulations.

### 3.3 EXCAVATING IN ROCK

- A. Remove rock to the lines, grades and dimensions shown on the Drawings or required by the Engineer.
- B. Use methods, techniques, and procedures for control of all factors affecting operations in order to produce smooth and sound peripheral surfaces of all completed excavations, to minimize over-break, and to avoid damage to adjacent structures.

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### C. Drilling and Blasting

1. Carry out blasting operations in accordance with blasting plan, manufacturers data, and blasting schedule.
2. Drilling and blasting shall be completed as described in Section 02 41 00 – Demolition and Facility Removal.
3. Drill blasting holes as required to complete desired construction results. Review the blasting performance and adjust the blast design to achieve the requirements as per the Drawings.
4. Design the blast to comply with safe peak particle velocity (PPV) for all structures within and in the vicinity of the blast area and other locations.
5. Take necessary precautions to protect the structures, buildings and equipment not intended to be removed from blast induced damage, including protection from fly rock, protection from vibrations and air blasts.
6. Remove loose material and scale to sound unshattered base surface to the lines and grades shown on the Drawings as required to provide a stable surface.
7. Do not blast within 300 ft of fresh concrete, grout or shotcrete until the concrete has cured for a minimum of 28 days, unless achieved concrete strength is reviewed and accepted by the Engineer.

D. Scale all excavation slopes to ensure a stable condition, and pressure wash and broom clean rock surfaces against which concrete will be cast to assist bonding.

E. Excavate trenches to the lines and grades indicated on the Drawings. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.

F. Remove boulders and fragments which may slide or roll into excavated areas.

### 3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections. Do not disturb bottom of excavations intended as bearing surfaces.

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### 3.5 EXCAVATION OF MATERIALS

- A. The existing elevations and contours shown on the plans, cross sections, and profiles were surveyed prior to plan development. Existing elevations and grades may have changed since the original survey was completed due to stream erosion, sediment accretion, or fill. It is the Contractor's responsibility to confirm existing grades and adjust earthwork, as necessary.
- B. All earthwork activities shall be performed in accordance with the Contract Documents and permit requirements.
- C. All required erosion and sediment control measures shall be in place prior to onset of earthwork activities.
- D. Erosion and sediment control devices and measures shall be utilized and maintained as per Section 31 25 00 – Erosion and Sedimentation Control.
- E. Grading operations shall be conducted so that material (soil, trees, and vegetation) outside construction limits will not be disturbed.
- F. Excavation and cuts shall be shaped and graded in accordance with the lines, grades, and cross sections or elevations shown on the drawings.
- G. Excavate foundation soil to the lines and grades shown on the Drawings. Stockpile material for backfilling in a neat and orderly manner at a sufficient distance from the banks of the excavation to avoid overloading and to prevent slides or caving. Perform excavation and fill in a manner and sequence that will provide proper drainage at all times. The Contractor is responsible for disposal of surplus material, waste material, and material that does not meet specifications, including any soil which is disturbed by the work operations or softened due to exposure to the elements and water.
- H. Material shown on the plans as suitable material but found at time of construction to be unsuitable shall be disposed of as unsuitable material.
- I. Protruding or unstable rocks 5 inches or larger shall be removed from the surface of soil cut slopes.
- J. The Contractor shall be responsible for stabilizing all stream banks after the completion of grading. The Contractor shall perform all care and remediation work required to maintain stable stream banks during construction as per Section 31 25 00 – Erosion and Sedimentation Controls.
- K. All tree roots exposed along excavated stream banks shall be trimmed to produce a flush surface as shown on the Drawings.

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### 3.6 FILL PLACEMENT

- A. Provide fill materials from the required excavations and from borrow areas. Make all reasonable efforts to use material from the required excavations in fills.
- B. Fill removal from borrow areas:
  - 1. Excavate fill from accepted borrow areas.
  - 2. Selectively excavate, crush, sort, screen, wash and/or blend materials as required to provide the specified fill materials as per Section 31 05 00 – Materials for Earthwork.
  - 3. Control drainage and dewater borrow areas as required. Provide sediment control facilities as required as per Section 31 25 00 – Erosion and Sedimentation Controls and Section 31 60 00 – Foundation Preparation.
- C. Stockpiling:
  - 1. Stockpile in sufficient quantities to meet Project schedule and requirements.
  - 2. Separate differing materials with dividers or stockpile apart to prevent mixing.
  - 3. Prevent intermixing of soil types or contamination of stockpile fills.
  - 4. Prevent excessive segregation of materials.
  - 5. Direct surface water away from stockpile site to prevent erosion or deterioration of materials. Provide sediment control facilities where required.
  - 6. Protect all stockpiled granular fill materials from damage by water.
  - 7. Satisfactory soil in excess of that required for use as engineered fill shall be disposed of in designated disposal areas.
- D. Prior to placement, prepare subgrade and foundation as per Section 31 60 00 – Foundation Preparation.
- E. Placing Fill:
  - 1. Provide fill materials that satisfy the specifications outlined above, in Section 31 05 00 - Materials for Earthwork, and/or as shown on the Drawings. Selectively excavate, crush, sort, screen, wash and/or blend materials as required to provide the specified fill materials.
  - 2. Employ a placement method that does not disturb or damage other work and does not result in excessive segregation.
  - 3. The sequence of filling shall commence at the lowest section (in elevation) of the subject footprint and proceed upward in specified lifts in a manner to maintain positive drainage at all times, where possible.
  - 4. Avoid uncompacted or segregated construction joints.
  - 5. Maintain moisture content of fill materials to attain required compaction density and ensure uniform distribution of moisture throughout the soil.

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6. Place and compact fill material in equal continuous lifts not exceeding the lift thicknesses specified in Section 31 05 00 – Materials for Earthwork.
7. Dumped fill and rubble should be evenly spread into specified lift thickness and with compaction effort specified in Section 31 05 00 – Materials for Earthwork.
8. Backfill against concrete in accordance with the curing and protection requirements of Section 03 30 00 – Cast-In Place Concrete.
9. Backfill against supported foundations and walls. Do not backfill against unsupported foundation walls unless backfilling simultaneously to the same grade on each side of the wall.
10. Upon completion of pipe laying and inspection by the Engineer of the work in place, surround and cover pipe with specified surround material as shown on the Drawings. Ensure good material placement and compaction under pipe haunches.
11. The slopes of all embankments shall be neatly and evenly trimmed to the line and slope indicated on the Drawings or as directed by the Engineer to leave a compacted surface.
12. Consolidate cement treated fill by tamping into place continuously as it is placed. Do not place more than a 6 in. thickness of cement treated backfill without consolidating.
13. Make gradual grade changes. Blend slope into level areas.
14. Re-level and re-compact fills subjected to vehicular traffic.
15. Protect fill surfaces and slopes from damage by water.
16. Place wearing course material as required on the Drawings.
17. Working surfaces left inactive for more than one week shall be sealed with a smooth drum roller and graded to promote positive drainage to reduce the potential for surface water infiltration.

### F. Fill Placement During Freezing Conditions:

1. Place fill materials in freezing conditions only if the materials can be placed and compacted to the specified densities that apply to non-freezing conditions.
2. Remove all ice, snow and loose frozen fill material from compacted fill surfaces or prepared foundations prior to placing new fill materials.
3. Place fill materials on previously placed and compacted fill frozen after compaction or accepted frozen foundations provided that surfaces are cleaned as per (2) above.
4. Place only non-frozen fill. Remove frozen soils from borrow areas prior to excavation of non-frozen materials for use as fill.
5. Fill materials must meet the specified moisture content criteria before acceptance and subsequent material placement.
6. Immediately spread and compact fill materials after placement to achieve specified density before freezing.

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7. Place and compact fill rapidly and in relatively small areas. Keep exposed surfaces to a minimum to minimize the potential for fill materials to freeze before compaction to the specified densities.
8. Remove from the fill, all fill materials that freeze prior to compaction to specified densities.
9. Do not place fill when there is any accumulation of snow or ice on surfaces to be covered by the succeeding layers of fill.
10. Methods proposed by the Contractor for construction during freezing conditions shall be reviewed by the Engineer prior to commencing fill placement.

### G. Fill Placement in Confined Openings

1. Confined openings include, but are not limited to, waterway openings in intakes, tunnel portals, forebay cavities, powerhouse embedded penstocks, turbine pits and embedded draft tubes.
2. Confined openings are to be filled as part of the site-wide burial of partially demolished structures with concrete rubble, boulders and soils as shown on the Drawings.
3. In all confined openings, where possible, the contractor shall strive to meet the placement and compaction requirements defined for each material type in Section 31 05 00 – Materials for Earthwork.
4. Methods proposed by the Contractor for fill placement in confined openings shall be reviewed by the Engineer prior to commencing fill placement.
5. Fill Placement in Tunnel Portals:
  - a. Material to be placed by pushing material horizontally into the openings.
  - b. Material placed inside tunnels shall be placed and compacted following the relevant criteria in the technical specifications for each material type until height restrictions limit the ability of the smallest available equipment to maneuver within the tunnel.
  - c. After conventional placement becomes limited by the height restriction of the cavity, enough material shall be pushed into the tunnel that will satisfy the remaining volume of material required to meet the minimum backfill limit as shown on the drawing.
  - d. Final stabilization and cover to be placed as shown on the Drawings and in accordance with Section 31 25 00 – Erosion and Sediment Control.
6. Fill Placement in all other Confined Openings including, but not limited to, waterway openings in intakes, forebay cavities, powerhouse embedded penstocks, turbine pits and embedded draft tubes:
  - a. Material to be placed by dumping or pushing material into the openings.
  - b. Tamping, pushing, or hammering by excavator bucket to be employed where possible.
  - c. Infill and compaction to occur to the maximum extent possible.
  - d. In locations requiring in-water placement, refer to Section 3.6 H.3 (below).

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### H. FILL PLACEMENT IN WATER

1. If the Contractor elects not to dewater the area, fill placement below water shall comply with the requirements of this document.
2. The foundation surfaces shall comply with the requirements of Section 31 60 00 – Foundation Preparation.
3. Where material is placed in water, material shall have a maximum fines content passing the No. #200 standard sieve of 10% (percent by weight).
4. Limit material placement in or below water, to the maximum extent practical, to periods with low water levels.
5. Material shall be placed using a method that minimizes segregation and consist of material capable of self-compaction (e.g., open-graded gravels).
6. Survey fill placement to accurately demonstrate compliance with the required layer thickness.
7. Once the material surface is above the water level, nominally compact until the surface is smooth and free of rutting or ridges. Proof-rolling may be required, under the direction of the Engineer.

### 3.7 FILL PLACEMENT IN J.C. BOYLE SCOUR HOLE

- A. For placement of the infill materials (not including cover) at the scour hole, certain variances from Section 3.6 are acceptable. These variances are as follows:
1. Fill placed in the bottom half of the hole, approximately El. 3660 ft and below, to be end dumped and shall not be placed in lifts due to logistical constraints.
  2. Fill placed in the upper half of the hole to be mechanically spread in lifts and compacted following the requirements of Section 31 05 00 – Materials for Earthwork based on the dominant fill type in the specific load or haul being placed.
  3. All E9, E9a, CR1 and CR2 materials placed in the scour hole, regardless of placement method, are to be mixed thoroughly to the satisfaction of the Engineer, to minimize voids and avoid the creating of continuous weak fill layers. Dam core material should be deposited of in the upland disposal area, and should not be placed in the scour hole, unless approved by the Engineer.
- B. The Contractor is to employ earthmoving equipment that is suitable for steep-slope operation to maximize the quantity of material that is able to be placed in lifts.
- C. Exposed concrete shall not be visible on the surface of the fill.

### 3.8 FILL PLACEMENT FOR ROADS, BRIDGES AND CULVERTS

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- A. Excavation and Fill placement for roads, bridges and culvert sites (5000 and 6000 series Project Drawings) shall comply with the requirements of this document in addition to Section 32 50 00 – Roads, Bridges and Culverts and the site-specific requirements noted on the Drawings.

### 3.9 CONCRETED EROSION PROTECTION

- A. For concreted erosion protection placement, infill with 2,500 psi mass concrete or as specified on the Drawings. Erosion protection material shall be clean, free of mud and dust. Wet the clean stones and place the 2,500 psi concrete concurrent with placement of the large stones and vibrate the concrete into place to completely infill the voids by vibration wherever practicable or by rodding. Cure the concreted erosion protection material as per Section 03 30 00 – Cast-in-Place Concrete.

### 3.10 SOIL MOISTURE CONTROL

- B. Moisture Adjustment: Moisture content shall be adjusted as necessary to facilitate compaction. Moisture control shall be achieved by either windrowing, scarifying or adding water to achieve workable moisture content.
- C. If additional moisture content is required, water may be added to the material at the source or after the material has been brought into its final position, whichever is more practical. The Contractor shall obtain uniform moisture distribution in the lift by disking, blading, or other approved methods. The amount of water applied shall be controlled so that the moisture content remains within 2% of optimum and free water will not appear on the surface during or subsequent to compaction operations.
- D. Material deposited on fill that is too wet shall be removed or spread and permitted to dry, assisted by disking or blading, if necessary, until the moisture content is reduced to the specified limits.
- E. When the top surface of a layer becomes too dry or too smooth to permit suitable bonding with the subsequent layer, the Contractor shall loosen the material by scarifying or disking. The Contractor shall then moisten the loosened material to acceptable moisture content and re-compact the material to the specified density.

### 3.11 VEGETATIVE COVER

- A. Vegetative cover type material shall be placed as per Section 31 25 00 – Erosion and Sedimentation Controls.



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### 3.12 DEWATERING AND WATER MANAGEMENT (OUTSIDE OF RIVER)

- A. Care of Water and river diversions specific to in-River work, shall be completed in accordance with Section 31 80 00 - Care of Water.
- B. Where Excavation and Fill Placement could result in erosion, measures shall be taken to mitigate such as per Section 31 25 00 – Erosion and Sedimentation Controls.
- C. All excavations completed outside of the Klamath River will require the control of water via water management and/or dewatering systems to maintain dry conditions.
- D. All fills placed outside of the Klamath River will require the control of water via water management and/or dewatering systems to maintain optimum moisture in the fill materials.
- E. Water Management:
  - 1. Diversion ditches/swales, check dams, berms, pumps, sumps, channels, drains, wells, and other temporary measures and equipment shall be provided to control and direct runoff and groundwater away from foundations and excavations in order to prevent ponding and infiltration.
  - 2. Excavation and Fill Placement shall be conducted in a manner that maintains proper drainage at all times in and around the work area.
  - 3. Protect excavations and fills from damage by water. Accumulations of water in and around foundations and excavations shall be promptly removed.
  - 4. Sides and slopes of foundations of fills and excavations shall be protected from erosion and sloughing caused by water.
  - 5. Surface water management and groundwater control measures shall be compatible with the Drawings.
  - 6. Best Management Practices and other means to control water shall be provided and maintained as shown on the Drawings and other project documents.
  - 7. Water management should result in stable foundations of fills.
- F. Dewatering:
  - 1. Dewatering activities to occur when water builds up in construction areas such as excavations, fills and foundations.
  - 2. Protect existing adjacent buildings, structures, and improvements from damage caused by dewatering operations.
  - 3. Divert/collect water and seepage within construction areas into sumps and pump water away from the work site.

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4. Locate system components to allow continuous dewatering operations without interfering with other activities.
5. Dewatering equipment and systems shall be installed and operated in accordance with manufacturer's instructions.
6. Conduct regular inspections of dewatering system. Make required repairs and perform scheduled maintenance.
7. When dewatering system cannot control water, notify Owner and Engineer and stop the work activity.
  - a. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
  - b. Demonstrate that the dewatering system operation complies with performance requirements before resuming work activities.
8. All water to be released as per the contract documents. All applicable Federal, State, and local permits to be followed.
9. Remove dewatering equipment and systems after dewatering operations are no longer required.

### 3.13 QUALITY

- A. The Contractor shall provide the Owner and Engineer access to the site at all times.
- B. The Contractor is required to place fill materials that comply with the requirements of Section 31 05 00 – Materials for Earthworks.
- C. If in the judgement of the Engineer, the volume of material represented by a failed record test is significant or results in work that deviates from design intent, repair or replace the non-complying material. Repair may take the form of moisture conditioning, re-mixing, blending, or re-compacting the material. In the event that repairing the material is not possible or not desired, remove the non-complying material from the work and replace with material that meets the specifications. Any such re-work shall be performed at the Contractor's expense.
- D. The Contractor is responsible for performing work in accordance with the Drawings and performing quality control.
- E. The Contractor is responsible for field quality testing (record tests) for all engineered fill materials incorporated in the permanent work at the frequencies detailed in the following table. Minimum testing requirements: frequency is "1 per" the number of cubic yards of material as required for the work.
- F. Additional excavation, fill placement, and material testing requirements for road and bridge sites are outlined in Section 32 50 00 – Roads, Bridges and Culverts, Part 2, 2.2.

## 31 23 00 – EXCAVATION AND FILL PLACEMENT

Table 1 – Record Testing Schedule

Material and Location	Moisture Content (ASTM D2216)	Particle Size Distribution (ASTM D6913)	Laboratory Compaction (ASTM D1557 or D4253 & D4254 as applicable)	Specific Gravity (ASTM D854)	In Situ Density (ASTM D1556, D6938, D5030 as applicable) Moisture Content (ASTM D2216 or D6938 as applicable)
	1 per	1 per	1 per	1 per	1 per
E2 – Pipe Zone	1,300	1,300	1,300	3,250	350
E3 – Structural Fill	1,300	1,300	1,300	3,250	350
E4 – Select Fill	1,300	1,300	1,300	-	650
E5 – Road Embankment Fill	1,300	1,300	1,300	-	650
E6 / E8 – Bedding	-	650	-	-	-
E7a/E7b/E7c – Erosion Protection	-	Visual	-	-	-
E9/E9a/E9b – General Fill	-	20,000	-	-	-
E11 – Aggregate Base	500	500	2,000	-	500
E12 – Engineered Streambed Material	-	Visual	-	-	-
E13 – Drain Rock	-	Work Area	-	-	-
CR1 – Concrete Rubble	-	Visual	-	-	-
CR2 – Concrete Rubble	-	Visual	-	-	-

**NOTES:**

1. DENSITY AND MOISTURE CONTENT BY NUCLEAR METHODS WILL BE CONDUCTED ON EACH LIFT DURING FILL PLACEMENT.
2. RECORD TESTING TO BE UNDERTAKEN ONCE MATERIALS ARE PLACED TO CONFIRM COMPLIANCE OF IN SITU MATERIALS. CONTROL TESTING TO BE PERFORMED PRIOR TO USE OF MATERIALS IN THE WORK AREA AND INCLUDES A GREATER TESTING FREQUENCY (SECTION 31 05 00 MATERIALS FOR EATHWORK).
3. DUE TO THE SMALL VOLUME OF DRAIN ROCK (E13) SPECIFIED, ONLY 1 RECORD GRADATION TEST PER WORK AREA IS REQUIRED.

END OF SECTION 31 23 00