



ENGINEERING CLARIFICATION

EC TITLE: Specification Section 31 23 23, Fill and Backfill
PROJECT: 3 Kings Water Treatment Plant

EC NO.: 1
DATE: 2/17/2020
STATUS: Acknowledged

SECTION 1: BY CONTRACTOR

QUESTION:

Specification Section 31 23 23, Fill and Backfill, was inadvertently left out of the Issue for Construction table of contents and specification documents.

DRAWING NO.:
SPECIFICATION SECTION: 31 23 23 Fill and Backfill

POTENTIAL COST IMPACT:
POTENTIAL SCHEDULE IMPACT:

PROPOSED SOLUTION:

Please replace the table of contents for the specifications with the document attached, and insert the attached Section 31 23 23, Fill and Backfill, into the set of specifications.

COMMENTS:

INITIATOR: Zalla, Joseph/SLC

PRIORITY: Normal
REQUESTED RESPONSE DATE: 3/2/2020

SECTION 2: BY REVIEWER

RESPONSE:

Alder Construction has added the Specification Section 31 23 23, Fill and Backfill to the Specification Book Issued on 02-10-2020 and has updated the Table of Contents to match.

COMMENTS:

REVIEWED BY: Bailey Henrie

REVIEWED DATE: 2/24/2020

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VOLUME 2

STANDARD DETAILS (BOUND SEPARATELY)

VOLUME 2A

STANDARD DETAILS, PARK CITY WATER STANDARD PLANS (BOUND SEPARATELY)

VOLUME 2B

STANDARD DETAILS, PARK CITY STANDARD DRAWINGS (BOUND SEPARATELY)

VOLUME 2C

STANDARD DETAILS, SNYDERVILLE BASIN WATER RECLAMATION DISTRICT DETAILS (BOUND SEPARATELY)

VOLUME 3

DRAWINGS (BOUND SEPARATELY)

END OF SECTION

**SECTION 31 23 23
FILL AND BACKFILL**

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. ASTM International (ASTM):
 - a. C117, Standard Test Method for Materials Finer Than 75-Micrometers (No. 200) Sieve in Mineral Aggregates by Washing.
 - b. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - c. D75, Standard Practice for Sampling Aggregates.
 - d. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - e. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - f. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - g. D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - h. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.02 DEFINITIONS

- A. Borrow Material: Material from required excavations or from designated borrow areas on or near Site.
- B. Completed Course: A course or layer that is ready for next layer or next phase of Work.
- C. Embankment Material: Fill materials required to raise existing grade in areas other than under structures.
- D. Geosynthetics: Geotextiles, geogrids, or geomembranes.
- E. Imported Material: Materials obtained from sources offsite, suitable for specified use.

- F. Influence Area: Area within planes sloped downward and outward at 60-degree angle from horizontal measured from:
 - 1. 1 foot outside outermost edge at base of foundations or slabs.
 - 2. 1 foot outside outermost edge at surface of roadways or shoulder.
 - 3. 0.5 foot outside exterior at spring line of pipes or culverts.
- G. Lift: Loose (uncompacted) layer of material.
- H. Optimum Moisture Content:
 - 1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.
 - 2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.
- I. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and subgrade preparation.
- J. Relative Compaction:
 - 1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D1557.
 - 2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density, as determined by Engineer.
- K. Relative Density: Calculated in accordance with ASTM D4254 based on maximum index density determined in accordance with ASTM D4253 and minimum index density determined in accordance with ASTM D4254.
- L. Well-Graded: As defined in Section 31 23 23.15, Trench Backfill.
- M. Selected Backfill Material: Materials available onsite that Engineer determines to be suitable for specific use.
- N. Structural Fill: Fill materials as required under structures, pavements, and other facilities.
- O. Standard Specifications: When referenced in this section, shall mean Utah Department of Transportation (UDOT) Standard Specifications.

3KINGS WTP PHASE III DESIGN

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Tank manufacturer's recommendations for backfill around each buried tank.

B. Informational Submittals:

1. Manufacturer's data sheets for compaction equipment.
2. Certified test results from independent testing agency.

1.04 QUALITY ASSURANCE

A. Notify Engineer when:

1. Structure or tank is ready for backfilling, and whenever backfilling operations are resumed after a period of inactivity.
2. Soft or loose subgrade materials are encountered wherever embankment or site fill is to be placed.
3. Fill material appears to be deviating from Specifications.

1.05 SEQUENCING AND SCHEDULING

- A. Complete applicable Work specified in Section 02 41 00, Demolition; Section 31 10 00, Site Clearing; Section 31 23 16, Excavation; and Section 31 23 13, Subgrade Preparation, prior to placing fill or backfill.
- B. Backfill against concrete structures only after concrete has attained 70 percent of design strength. Obtain Engineer's acceptance of concrete work and attained strength prior to placing backfill.
- C. Backfill around water-holding structures only after completion of satisfactory leakage tests as specified in Section 03 30 00, Cast-in-Place Concrete.
- D. Backfill around buried tanks only after tank is set in position, securely anchored, and ready to be backfilled, and Engineer provides authorization to backfill.
- E. Do not place granular base, subbase, or surfacing until after subgrade has been prepared as specified in Section 31 23 13, Subgrade Preparation.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Gradation Tests:

1. As necessary to locate acceptable sources of imported material.
2. During production of imported material, test as follows:
 - a. Granular Fill: 100 cubic yards.
 - b. Sand: 100 cubic yards.
 - c. Backfill Around Buried Tanks: 100 cubic yards.
 - d. Granular Drain Material: 100 cubic yards.
 - e. Granular Filter Material: 100 cubic yards
 - f. Base Course Rock: 100 cubic yards.
 - g. Foundation Stabilization Rock: 100 cubic yards.
 - h. Crushed Rock for Substations:
 - 1) Base Course: 100 cubic yards.
 - 2) Finish Grade Rock: 100 cubic yards.
 - 3) Access Road Surfacing: 100 cubic yards.
 - i. Soil Cover Over Geotextiles: 100 cubic yards.
 - j. Soil Cover Over Geomembranes: 100 cubic yards.

2.02 EARTHFILL

- A. Excavated material from required excavations free from rocks larger than 3 inches, from roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials.
- B. Provide imported material of equivalent quality, if required to accomplish Work.

2.03 GRANULAR FILL

- A. 4-inch minus native or imported granular soil.
- B. Free from dirt, clay balls, and organic material.
- C. Well-graded from coarse to fine with a maximum of 50 percent passing the No. 4 sieve and a maximum 25 percent passing the No. 200 sieve. Clay and silt particles must have a liquid limit less than 35 and a plasticity index less than 15.

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2.04 SAND

- A. Free from clay, organic matter, or other deleterious material.
- B. Gradation as determined in accordance with ASTM C117 and ASTM C136:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
1/4-inch	100
No. 4	95 - 100
No. 200	0 - 8

2.05 BACKFILL AROUND BURIED TANKS

- A. As recommended by tank manufacturer.

2.06 GRANULAR DRAIN MATERIAL

- A. As specified in Section 31 23 23.15, Trench Backfill.

2.07 GRANULAR FILTER MATERIAL

- A. Clean, hard, durable gravel, free from foreign materials and washed.
- B. Meeting the requirements of ASTM C33, fine aggregate.

2.08 WATER FOR MOISTURE CONDITIONING

- A. Free of hazardous or toxic contaminants, or contaminants deleterious to proper compaction.

2.09 BASE COURSE ROCK

- A. As specified in Section 32 11 23, Aggregate Base Courses.

2.10 FOUNDATION STABILIZATION ROCK

- A. Crushed rock or pit run rock.
- B. Uniformly graded from coarse to fine.
- C. Free from excessive dirt and other organic material.
- D. Maximum 2-1/2-inch particle size.

2.11 CRUSHED ROCK FOR SUBSTATIONS

- A. Clean, hard, durable crushed rock, free from foreign materials and washed.
- B. Gradation as determined in accordance with ASTM C117 and ASTM C136.
- C. Base Course:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
2 inches	-100
1-1/2 inches	95 - 100
3/4 inch	55 - 75
1/4 inch	35 - 50
No. 10	4 - 60

- D. Finish Grade Rock:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
2 inches	-100
1-1/2 inches	90 - 100
1 inch	30 - 65
3/4 inch	0 - 15

- E. Access Road Surfacing: Gradation same as for base course.

2.12 SOIL COVER OVER GEOTEXTILES

- A. Particle Size: Maximum 1 inch.
- B. Free of sharp angular pieces that may damage geotextile.

2.13 SOIL COVER OVER GEOMEMBRANES

- A. Granular material.
- B. Particle Size: Maximum 1/4 inch.
- C. Particle Shape: Rounded.

PART 3 EXECUTION

3.01 GENERAL

- A. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.
- B. Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.
- C. During filling and backfilling, keep level of fill and backfill around each structure and buried tank even.
- D. Do not place fill or backfill, if fill or backfill material is frozen, or if surface upon which fill or backfill is to be placed is frozen.
- E. If pipe, conduit, duct bank, or cable is to be laid within fill or backfill:
 - 1. Fill or backfill to an elevation 2 feet above top of item to be laid.
 - 2. Excavate trench for installation of item.
 - 3. Install bedding, if applicable, as specified in Section 31 23 23.15, Trench Backfill.
 - 4. Install item.
 - 5. Backfill envelope zone and remaining trench, as specified in Section 31 23 23.15, Trench Backfill, before resuming filling or backfilling specified in this section.
- F. Tolerances:
 - 1. Final Lines and Grades: Within a tolerance of 0.1 foot unless dimensions or grades are shown or specified otherwise.
 - 2. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.
- G. Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.

3.02 BACKFILL UNDER AND AROUND STRUCTURES

- A. Under Facilities: Within influence area beneath structures, slabs, pavements, curbs, piping, conduits, duct banks, and other facilities, backfill with granular fill, unless otherwise shown. Place granular fill in lifts of 6-inch maximum

thickness and compact each lift to minimum of 95 percent relative compaction as determined in accordance with ASTM D1557.

- B. Under slabs-on-grade, including mat slab foundations: Place slabs-on-grade on 4 inches of compacted gravel overlying either native soils or a zone of granular fill that is at least 12 inches thick. Gravel shall consist of road base or clean drain rock with 3/4-inch maximum particle size and no more than 12 percent fines passing the No. 200 sieve. The gravel layer should be compacted to at least 95 percent of the maximum dry density of the modified proctor or until tight and relatively unyielding if material is non-proctorable.
- C. Subsurface Drainage: Backfill with granular drain material, where shown. Place granular drain material in lifts of 6-inch maximum thickness and compact each lift to minimum of 90 percent relative density.
- D. Other Areas: Backfill with earthfill to lines and grades shown, with proper allowance for topsoil thickness where shown. Place in lifts of 6-inch maximum thickness and compact each lift to minimum 90 percent relative compaction as determined in accordance with ASTM D1557 density.

3.03 BACKFILL AROUND TANKS

- A. Backfill to top of tank, unless otherwise shown, with granular fill and thoroughly water settle by saturating backfill and vibrating saturated backfill with a concrete vibrator inserted through full depth of backfill on 1-foot maximum centers.
- B. Backfill above top of tank with earthfill placed in 8-inch lifts. Compact each lift to minimum 90 percent relative compaction as determined in accordance with ASTM D1557.

3.04 FILL

- A. Outside Influence Areas beneath Structures, Tanks, Pavements, Curbs, Slabs, Piping, and Other Facilities: Unless otherwise shown, place earthfill as follows:
 - 1. Allow for 6-inch thickness of topsoil where required.
 - 2. Maximum 8-inch thick lifts.
 - 3. Place and compact fill across full width of embankment.
 - 4. Compact to minimum 90 percent relative compaction as determined in accordance with ASTM D1557.
 - 5. Dress completed embankment with allowance for topsoil, crest surfacing, and slope protection, where applicable.

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3.05 SITE TESTING

A. Gradation:

1. One sample from each 1,500 tons of finished product or more often as determined by Engineer, if variation in gradation is occurring, or if material appears to depart from Specifications.
2. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.
3. Remove material placed in Work that does not meet Specification requirements.

B. In-Place Density Tests: In accordance with ASTM D1556 or D6938. If ASTM D6938 is used to test in-place density, verify test results by performing at least one test per day using ASTM D1556 at location already tested in accordance with ASTM D6938. Perform at least one additional test using ASTM D1556 for every ten tests performed with a nuclear device, at locations checked in accordance with ASTM D6938. During placement of materials, test as follows:

1. Granular Fill: 75 cubic yards.
2. Sand: 75 cubic yards.
3. Backfill Around Buried Tanks: 75 cubic yards.
4. Granular Drain Material: 75 cubic yards.
5. Granular Filter Material: 75 cubic yards.
6. Base Course Rock: 75 cubic yards.
7. Foundation Stabilization Rock: 75 cubic yards.
8. Crushed Rock for Substations:
 - a. Base Course: 75 cubic yards.
 - b. Finish Grade Rock: 75 cubic yards.
 - c. Access Road Surfacing: 75 cubic yards.
9. Soil Cover Over Geotextiles: 75 cubic yards.
10. Soil Cover Over Geomembranes: 75 cubic yards.

3.06 SAND BLANKET OVER VAPOR RETARDER

- A. Place sand in manner that avoids damage to underlying vapor retarder.
- B. Moisten sand and thoroughly compact it with a vibratory plate compactor.

3.07 GRANULAR BASE, SUBBASE, AND SURFACING

- A. Place and Compact as specified in Section 32 11 23, Aggregate Base Courses.

3.08 REPLACING OVEREXCAVATED MATERIAL

- A. Replace excavation carried below grade lines shown or established by Engineer as follows:
1. Beneath Footings: Concrete of strength equal to that of respective footing, as specified in Section 03 30 00, Cast-in-Place Concrete.
 2. Beneath Fill or Backfill: Same material as specified for overlying fill or backfill.
 3. Beneath Slabs-On-Grade: Granular fill.
 4. Trenches:
 - a. Unauthorized Overexcavation: Either trench stabilization material or granular pipe base material, as specified in Section 31 23 23.15, Trench Backfill.
 - b. Authorized Overexcavation: Trench stabilization material, as specified in Section 31 23 23.15, Trench Backfill.
 5. Permanent Cut Slopes (Where Overlying Area is Not to Receive Fill or Backfill):
 - a. Flat to Moderate Steep Slopes (3:1, Horizontal Run: Vertical Rise or Flatter): Earthfill.
 - b. Steep Slopes (Steeper than 3:1):
 - 1) Correct overexcavation by transitioning between overcut areas and designed slope adjoining areas, provided such cutting does not extend offsite or outside easements and rights-of-way, or adversely impacts existing facilities, adjacent property, or completed Work.
 - 2) Backfilling overexcavated areas is prohibited, unless in Engineer's opinion, backfill will remain stable, and overexcavated material is replaced as compacted earthfill.

3.09 SUBSTATION SITE SURFACING

- A. Base Course:
1. 6-inch layer.
 2. Installed after Site grading and substation construction is complete.
 3. Compact to at least 92 percent of maximum dry density as determined by ASTM D1557.
- B. Finish Grade:
1. 4-inch layer.
 2. Installed over base course.
 3. Finish grade layer shall not be compacted.

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3.10 PLACING FILL OVER GEOSYNTHETICS

A. General:

1. Place fill over geosynthetics with sufficient care so as not to damage them.
2. Place fill only by back dumping and spreading only.
3. Dump fill only on previously placed fill.
4. While operating equipment, avoid sharp turns, sudden starts or stops that could damage geosynthetics.

B. Hauling: Operate hauling equipment on minimum of 3 feet of covering.

C. Spreading:

1. Spreading equipment shall be track mounted, low ground pressure, D-6 or lighter.
2. Operate spreading equipment on minimum of 12 inches of fill over geosynthetics.
3. Spread fill in same direction as unseamed overlaps to avoid separation of seams and joints.
4. Never push fill downslope. Spread fill over sideslopes by pushing up from slope bottom. If access to bottom of slope is unavailable, progressively place fill, beginning at toe of slope and working upslope, with backhoe or dragline operated from top of slope. Limit distance material falls onto the geosynthetics to maximum of 2 feet.
5. Flatten wrinkles of geosynthetics, geotextiles, geomembranes, and geogrids in direction of spreading.
6. Maintain proper overlap of unseamed geosynthetics.
7. Avoid overstressing geosynthetics and seams.

D. Compaction: Compact fill only after uniformly spread to full thickness shown.

E. Geosynthetic Damage:

1. Mark punctures, tears, or other damage to geosynthetics, so repairs may be made.
2. Clear overlying fill as necessary to repair damage.
3. Repairs to geosynthetics shall be made by respective installers as specified in respective specification section for each geosynthetic.

3.11 ACCESS ROAD SURFACING

A. Place and compact as specified in Section 32 11 23, Aggregate Base Courses.

END OF SECTION

