
Construction Specification 6 — Seeding, Sprigging, and Mulching

Title 210 - Engineering

Part 642 – Specifications for Construction Contracts

Subpart B – National Construction Specifications

June 2024

A. Scope

1. The work consists of preparing the area for treatment; furnishing and placing seed, sprigs, mulch, fertilizer, inoculant, lime, and other soil amendments; and anchoring mulch in designated areas as specified.
2. The following BioPreferred® product categories are applicable to this specification:
 - a. Mulch and compost materials
 - b. Erosion control materials
 - c. Fertilizers
 - d. Agricultural spray adjuvants

B. Material

1. Seed.
 - a. All seed must conform to the current rules and regulations of the state where it is being used and must be from the latest crop available. It must meet or exceed the standard for purity and germination listed in Section G.
 - b. Seed must be labeled in accordance with the state laws and the U.S. Department of Agriculture rules and regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures are evidence of purity and germination. No seed will be accepted with a test date of more than 9 months before the delivery date to the site.
 - c. Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. The percent of noxious weed seed allowable must be as defined in the current state laws relating to agricultural seeds. Each type of seed must be delivered in separate sealed containers and fully tagged unless an exception is granted in writing by the contracting officer.
2. Fertilizer. Unless otherwise specified, the fertilizer must be a commercial-grade fertilizer. It must meet the standard for grade and quality specified by state law. Where fertilizer is furnished from bulk storage, the contractor must furnish a supplier's certification of analysis and weight. When required by the contract, a representative sample of the fertilizer must be furnished to the contracting officer for chemical analysis.

3. Inoculants. The inoculant for treating legume seeds must be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and must not be used later than the date indicated on the container or as otherwise specified. A mixing medium, as recommended by the manufacturer, must be used to bond the inoculant to the seed. Two times the amount of the inoculant recommended by the manufacturer must be used (unless seed is applied using a hydraulic seeder; then four times the amount must be used). Seed must be sown within 24 hours of treatment and must not remain in the hydraulic seeder longer than 4 hours.
4. Lime and Other Soil Amendments. Lime must consist of standard ground agriculture limestone or approved equivalent. Standard ground agriculture limestone is defined as ground limestone meeting current requirements of the state's Department of Agriculture. Other soil amendments must meet quality criteria and application requirements specified in Section G.
5. Mulch Tackifiers. Asphalt emulsion tackifiers must conform to the requirements of ASTM D977, Specification for Emulsified Asphalt. The emulsified asphalt may be rapid setting, medium setting, or slow setting. Non-asphaltic tackifiers required because of environmental considerations must be as specified in Section G.
6. Straw Mulch Material. Straw mulch must consist of wheat, barley, oat or rye straw, hay, grass cut from native grasses, or other plants as specified in Section G. The mulch material must be air-dried reasonably light in color and must not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds is not permitted. The contractor must provide a method satisfactory to the contracting officer for determining weight of mulch furnished.
7. Other Mulch Materials. Mulching materials, such as wood cellulose fiber mulch, mulch tackifiers, synthetic fiber mulch, netting, and mesh may be required for specialized locations and conditions. These materials, when specified, must be accompanied by the manufacturer's recommendations for methods of application.

C. Seeding Mixtures, Sod, Sprigs, and Dates of Planting

1. The application rate per acre for seed mixtures, sprigs, or sod and the date of seeding or planting must be as shown on the plans or as specified in Section G.

D. Seedbed Preparation and Treatment

1. Dress areas to be treated to a smooth, firm surface. On sites where equipment can operate on slopes safely, adequately loosen and smooth the seedbed (4 to 6 inches deep). Depending on soil and moisture conditions, disking, cultipacking, or both, may be necessary to properly prepare a seedbed. Where equipment cannot operate safely, prepare the seedbed by methods like scarifying, providing a roughened soil surface by hand so that broadcast seed will remain in place.
2. If seeding is to be accomplished immediately following construction operations, seedbed preparation may not be required except on a compacted, polished, or freshly cut soil surface.

3. Rocks larger than 6 inches in diameter, trash, weeds, and other debris that will interfere with seeding or maintenance operations must be removed or disposed of as specified in Section G.
4. Discontinue seedbed preparation when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the responsible engineer.

E. Seeding, Sprigging, Fertilizing, Mulching, and Stabilizing

1. Perform all seeding or sprigging operations in such a manner that the seed or sprigs are applied in the specified quantities uniformly in the designated areas. The method and rate of seed application must be as specified in Section G. Unless otherwise specified, seeding or sprigging must be accomplished within 2 days after final grading is completed and approved.
2. Apply fertilizer, lime, and other soil amendments as specified in Section G. When specified, the fertilizer and soil amendments must be thoroughly incorporated into the soil immediately following surface application.
3. The rate, amount, and kind of mulching or mesh must be as specified in Section G. Apply mulches uniformly to the designated areas. They must be applied to areas seeded not later than 2 working days after seeding has been performed. Stabilize straw mulch material within 24 hours of application using a mulch crimper or equivalent anchoring tool or by a suitable tackifier. When the mulch crimper or equivalent anchoring tool is used, it must have straight blades and be the type manufactured expressly for and capable of firmly punching the mulch into the soil. Where the equipment can be safely operated, it must be operated on the contour. Use hand methods where equipment cannot safely operate to perform the work required.
4. Apply the tackifier uniformly over the mulch material at the specified rate or inject it into the mulch material as it is being applied. Stabilizing materials like mesh or netting must be applied smoothly but loosely on the designated areas. The edges of these materials must be buried or securely anchored using spikes or staples as specified in Section G.
5. The contractor must maintain the mesh or netting areas until all work under the contract has been completed and accepted. Maintenance must consist of the repair of areas damaged by water erosion, wind, fire, or other causes. Such areas must be repaired to reestablish the intended condition and to the design lines and grades required by the contract. The areas must be re-fertilized, reseeded, and re-mulched before the new application of the mesh or netting.

F. Measurement and Payment

1. For items of work for which specific unit prices are established in the contract, each area treated is measured as specified in Section G and area is calculated to the nearest 0.1 acre. Payment for treatment is made at the contract unit price for the designated treatment, which will constitute full compensation for completion of the work.

- a. When specified as an item of work, mesh or netting is measured to the nearest square yard of surface area covered and accepted. Payment is made at the contract unit price and will constitute full compensation for completion of the work.
2. The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section G.

G. Items of Work and Construction Details

Items of work to be performed in conformance with this specification and construction details are:

Bid Item #6 Critical Area Planting – Seeding and Mulching:

1. This item shall consist of preparing the seedbed and placing seed and mulch to approximate limits shown on the Drawings or as staked in the field.
2. All areas where fill has been placed on the embankment and other fill areas outside of the wetland as well as channel excavation 1B shall be broadcast seeded. Broadcast areas shall be lightly harrowed or raked the same day the seed is spread.
3. Mulch materials shall consist of native prairie grass hay or clean straw. If mulch is applied on or after July 15, current year hay cutting shall be used. If mulch is applied before July 15, hay shall be no older than the previous year's cutting. The mulch shall be applied at the rate specified on the Drawings or 2 tons per acre. The mulch shall be anchored using one of the methods specified in the Drawings. No area shall be mulched that cannot be anchored in the same day's operation. All areas seeded shall be mulched.
4. The seed mixture shall be as specified in the Drawings.

Items of work subsidiary to this bid item are:

1. Mobilization and Demobilization – Construction Specification 8
2. Contractor Quality Control – Construction Specification 94

Construction Specification 7 — Construction Surveys

Title 210 – Engineering

Part 642 – Specifications for Construction Contracts

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June 2024

A. Scope

1. The work consists of performing all surveys, measurements, and computations required by this specification.

B. Equipment and Material

1. Equipment for construction surveys must be of a quality and condition to provide the required accuracy. The equipment must be maintained in good working order and in proper adjustment at all times. Records of repairs, calibration tests, accuracy checks, and adjustments must be maintained and be available for inspection by the engineer. Equipment must be checked, tested, and adjusted as necessary in conformance with manufacturer's recommendations.
2. Necessary materials include field notebooks, stakes, templates, platforms, equipment, spikes, steel pins, tools, and all other items necessary to perform the work specified.

C. Quality of Work

1. All work must follow recognized professional practice and the standards of the industry unless otherwise specified in Section I of this specification. Perform the work to the accuracy and detail appropriate for the type of job. Notes, sketches, and other data must be complete, neatly recorded, legible, reproducible, and organized to facilitate ease in review for job documentation. Survey equipment that requires little or no manual recording of field data must have survey information documented as outlined in Section I of this specification.
2. All computations must be mathematically correct and include information to identify the bid item, date, and the person who performed, checked, and approved the computations. Computations must be legible, complete, and clearly document the source of all information used, including assumptions and measurements collected.
3. If a computer program is used to perform the computations, the contractor must provide the engineer with the software identification, vendor's name, version number, and other pertinent data before beginning survey activities. Computer-generated computations must show all input data, including values assigned and assumptions made.

4. Determine and record the elevations of permanent and temporary benchmarks to the nearest 0.01 foot. Differential leveling and transit traverses must be of such precision that the error of vertical closure in feet must not exceed plus or minus 0.1 times the square root of the traverse distance in miles. Linear measurements must be accurate to within 1 foot in 5,000 feet unless otherwise specified in Section I of this specification. The angular error of closure for transit traverses must not exceed 1 minute times the square root of the number of angles turned.
5. The minimum requirements for placing slope stakes must be at 100-foot stations for tangents and as little as 25 feet for sharp curves, breaks in the original ground surface, and at any other intermediate stations necessary to ensure accurate location for construction layout and measurement. Slope stakes and cross-sections must be perpendicular to the centerline. Significant breaks in grade must be determined for cross-sections. Distances must be measured horizontally and recorded to the nearest 0.1 foot. Side shots for interim construction stakes may be taken with a hand level.
6. Unless otherwise specified in Section I of this specification, measurements for stationing and establishing the location of structures must be made to the nearest 0.1 foot.
7. Elevations for concrete work, pipes, and mechanical equipment must be determined and recorded to the nearest 0.01 foot. Elevations for earthwork must be determined and recorded to the nearest 0.1 foot.

D. Primary Control

1. The baselines and benchmarks for primary control necessary to establish lines and grades needed for construction are shown on the drawings and have been located on the jobsite.
2. These baselines and benchmarks must be used as the origin of all surveys, layouts, and measurements to establish construction lines and grades. The contractor must take all necessary precautions to prevent the loss or damage of primary control points. Any stakes or control points lost or damaged by construction activity will be reestablished by the contractor or at contractor expense.

E. Construction Surveys

1. Before starting work that requires contractor-performed surveys, the contractor must submit in writing for the engineer's review the names, qualifications, and experiences of the individuals to be assigned to the survey tasks.
2. Contractor-performed surveys must include:
 - a. Checking and any supplemental or interim staking
 - b. Performing quantity surveys, measurements, and computations for progress payment
 - c. Other surveys as described in Section I of this specification

F. Staking

1. Complete the construction staking required for the item before work on any item starts. Complete construction staking as follows or as otherwise specified in Section I of this specification:
 - a. Clearing and Grubbing. The boundary of the areas to be cleared and grubbed must be staked or flagged at a maximum interval of 200 feet, closer if needed, to clearly mark the limits of work. When contractor staking is the basis for determining the area for final payment, all boundary stakes will be reviewed by the engineer before start of this work item.
 - b. Excavation and Fill. Place slope stakes at the intersection of the specified slopes and ground line. Slope stakes and the reference stakes for slopes must be marked with the stationing, required cut or fill, slope ratio, and horizontal distance from the centerline or other control line. The minimum requirements for placing slope stakes are outlined in Section C, Quality of Work.
 - c. Structures. Place centerline and offset reference line stakes for location, alignment, and elevation for all structures.

G. Records

1. Record all survey data in properly labeled, standard, hardbound engineering survey field notebooks with consecutively numbered pages. All field notes and printed data must include the purpose or description of the work, the date the work was performed, weather data, sketches, and the personnel who performed and checked the work. Electronically generated survey data and computations must be bound with numbered pages and cross-referenced in a bound field notebook containing the index for all survey activities. All work must follow recognized professional practices.
2. The construction survey records must be available at all times during the progress of the work for examination and use by the engineer. When requested, copies must be made available. The original field notebooks and other records must be provided to and become the property of the owner before final payment and acceptance of all work.
3. Complete documentation of computations and supporting data for progress payments must be submitted to the engineer with each invoice for payment as specified in Section I of the specification. When the contractor is required to conduct initial and final surveys as outlined in Section E, Construction Surveys, notes must be provided as soon as possible after completion to the engineer for the purpose of determining final payment quantities.

H. Payment

1. For items of work for which lump-sum prices are established in the contract, payment is made as the work proceeds with progress payment amounts determined as a percentage of the total work planned as projected from the contractor's approved construction schedule. Payment of the lump-sum contract price will constitute full compensation for completion of all work under this bid item.

2. Payment will not be provided under this item for the purchase price of materials or equipment having a residual value. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the item to which they are made subsidiary are identified in Section I of this specification.

I. Items of Work and Construction Details

The Engineer will perform basic layout and staking as detailed below prior to commencement of construction. Most staking will occur after mowing and/or clearing and grubbing operations have been completed. Construction staking in those areas will be completed within 5 working days after notification by the Contractor. All reasonable efforts shall be made to preserve staking throughout the construction period. Reestablishing any staking that is disturbed by construction activity will be the Contractor's responsibility.

All staking shall be done in accordance with Section F except that slope ratios are not required to be marked on stakes.

Benchmarks:

The benchmark locations will be referenced to geodetic coordinates. Elevations will be provided to the nearest 0.01 foot. The location and elevations of additional benchmark locations for construction staking and final checking will be supplied to the Contractor.

Earthfill Stakeout:

The earthfill will be staked at all 100-foot stations, grade breaks, and changes in cross section. Stakes will be marked with station number and fill depths. Offsets at all stations are optional and the Engineer will determine when they will be utilized.

Structure and Piping Stakeout:

Structure and pipe locations will be staked and marked. The Engineer will determine if an offset stake will be utilized.

Excavated Channels and Pipe Trench Stakeout:

Channel centerlines will be staked and marked with station number and cut depth to the designed bottom of the channel.

Items of work to be performed in conformance with this specification and construction details are:

Subsidiary Item - Construction Surveys:

1. This item shall consist of furnishing personnel required by the Contractor to perform the construction surveys.

2. Construction surveys will be as specified in Section E and include the reestablishment of any basic staking disturbed by construction activity.
3. Survey control point locations shall be verified prior to starting work, and the Engineer shall be promptly notified of any discrepancies discovered.
4. Bid items essential to this item that payment will be incidental to are:
 - a. Bid Item #1a Earthfill – Embankment Fill at WCS, Construction Specification 23
 - b. Bid Item #1b Earthfill – Embankment Fill Low Areas, Construction Specification 23
 - c. Bid Item #1c Earthfill – Fill Existing Channel, Construction Specification 23
 - d. Bid Item #2a Excavation – Channel 1A, Construction Specification 21
 - e. Bid Item #2b Excavation – Channel 1B, Construction Specification 21
 - f. Bid Item #3 Water Control Structure (3' Tall), Construction Specification 45
 - g. Bid Item #4 12" SDR 35 PVC Pipe, Construction Specification 45

Construction Specification 8 — Mobilization and Demobilization

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June 2024

A. Scope

1. The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

B. Equipment and Material

1. Mobilization includes all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and other items specified in Section D of this specification.
2. Demobilization includes all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site, including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this contract.
3. This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

C. Payment

1. Payment will be made as the work proceeds after presentation of paid invoices or documentation of direct costs by the contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump-sum contract price, the balance remaining will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for completion of the work.

2. Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

D. Items of Work and Construction Details

Items of work to be performed in conformance with this specification and construction details are:

Subsidiary Item – Mobilization and Demobilization:

1. This item shall consist of mobilization and demobilization of the Contractor's forces and equipment necessary for the completion of the work.
2. Transportation of any materials incorporated into the permanent works shall not be considered a mobilization item.
3. All roads, culverts, bridges, sidewalks, parking lots, fences, structures, etc., shall be protected from damage during the contract period. Road surfaces shall be protected from damages by equipment.
4. Access shall be from Prairie Road and must be approved by the Engineer. All access routes shall be restored by the contractor to a condition equal to or better than the condition prior to the commencement of work under this contract.
5. Bid items essential to this item that payment will be incidental to are:
 - a. Bid Item #1a Earthfill – Embankment Fill at WCS, Construction Specification 23
 - b. Bid Item #1b Earthfill – Embankment Fill Low Areas, Construction Specification 23
 - c. Bid Item #1c Earthfill – Fill Existing Channel, Construction Specification 23
 - d. Bid Item #2a Excavation – Channel 1A, Construction Specification 21
 - e. Bid Item #2b Excavation – Channel 1B, Construction Specification 21
 - f. Bid Item #3 Water Control Structure (3' Tall), Construction Specification 45
 - g. Bid Item #4 12" SDR 35 PVC Pipe, Construction Specification 45
 - h. Bid Item #5 Riprap, Construction Specification 61
 - i. Bid Item #6 Seeding & Mulching, Construction Specification 6

Construction Specification 11 — Removal of Water

Tile 210 – Engineering

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June 2024

A. Scope

1. The work consists of the removal of surface water and ground water as necessary to perform the construction required by the contract in accordance with the specifications. It must include: (1) constructing, installing, building, and maintaining all necessary temporary water containment facilities, channels, and diversions; (2) furnishing, installing, and operating all necessary pumps, piping, and other facilities and equipment; and (3) removing all such temporary works and equipment after their intended function is no longer required.

B. Diverting Surface Water

1. The contractor must install, maintain, and operate all cofferdams, channels, flumes, sumps, and all other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site. Control of surface water must be continuous during the period that damage to construction work could occur. Unless otherwise specified or approved, the diversion outlet must be into the same drainageway that the water would have reached before being diverted.
2. The contractor must furnish the contracting officer, in writing, a proposed plan for diverting surface water before beginning any construction activities for which a diversion is required, unless waived in Section H of this specification. Acceptance of this plan or the waiving of the plan requirement will not relieve the contractor of the responsibilities related to this activity during the process of completing the work as specified.

C. Dewatering the Construction Site

1. Foundations, cutoff trenches, and all other parts of the construction site must be dewatered and kept free of standing water and muddy conditions as necessary for the proper execution of the work. The contractor must furnish, install, operate, and maintain all drains, sumps, pumps, casings, well points, and all other equipment required to properly dewater the site as specified. Dewatering systems that cause a loss of soil fines from the foundation areas will not be permitted.
2. The contractor must furnish the contracting officer, in writing, a proposed plan for dewatering before commencing with any construction activity for which dewatering may be required unless waived in Section H of this specification.

Acceptance of this plan or the waiving of the plan requirement will not relieve the contractor of the responsibilities for completing the specified work.

D. Dewatering Borrow Areas

1. The contractor must maintain all borrow areas free of surface water or otherwise provide for timely and effective removal of surface and subsurface water that accumulates within the borrow area unless waived in Section H of this specification. Process borrow material as necessary to achieve proper and uniform moisture content at the time of placement.
2. If pumping to dewater borrow areas is included as a bid item of work in the bid schedule, equip each pump discharge pipe with a water meter. The meter must be such that the measured quantity of water is accurate within 3 percent of the true quantity. The contractor must provide necessary support to perform accuracy tests of the water meter when requested by the contracting officer.

E. Erosion and Pollution Control

1. Removal of water from the construction site, including the borrow areas, must be accomplished so that erosion and the transporting of sediment and other pollutants are minimized. Dewatering activities must be accomplished in a manner that the water table water quality is not altered. Pollution control activities must not conflict with the requirements of Construction Specification 5, Pollution Control, if it is a part of this contract.

F. Removal of Temporary Works

1. When temporary works are no longer needed, the contractor must remove and return the area to a condition similar to that which existed before construction. Areas where temporary works were located must be graded for slightly appearance and proper functioning and access to the installed works of improvement and may not obstruct natural surface waterflows. The contractor must exercise extreme care during the removal stages to minimize the loss of soil sediment and debris that was trapped during construction.
2. Pipes, casings, and any other material used to dewater the site must be removed from temporary wells. Fill the wells to ground level with clean gravel or other suitable material approved by the contracting officer. The contractor must exercise extreme care to prevent pollution of the ground water by these actions.

G. Measurement and Payment

1. Method 1.
 - a. Items of work listed in the bid schedule for removal of water, diverting surface water, and dewatering construction sites and borrow areas are paid for at the contract lump-sum prices. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.
2. The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the

bid schedule is included in the payment for the contract line item to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section H of this specification.

H. Items of Work and Construction Details

Items of work to be performed in conformance with this specification and construction details are:

Subsidiary Item – Dewatering:

1. This item shall consist of dewatering the site and/or low areas in order to perform the work. Submit a dewatering plan prior to commencement of work.
2. Bid items essential to this item that payment will be incidental to are:
 - a. Bid Item #1a Earthfill – Embankment Fill at WCS, Construction Specification 23
 - b. Bid Item #1b Earthfill – Embankment Fill Low Areas, Construction Specification 23
 - c. Bid Item #1c Earthfill – Fill Existing Channel, Construction Specification 23
 - d. Bid Item #2a Excavation – Channel 1A, Construction Specification 21
 - e. Bid Item #2b Excavation – Channel 1B, Construction Specification 21
 - f. Bid Item #3 Water Control Structure (3’ Tall), Construction Specification 45

Construction Specification 21 — Excavation

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June 2024

A. Scope

1. The work consists of the excavation required by the drawings and specifications, as well as the disposal of the excavated materials.

B. Classification

1. Excavation is classified as common excavation, rock excavation, or unclassified excavation in accordance with the following definitions.
2. Common excavation is defined as the excavation of all materials that (1) can be excavated, transported, and unloaded using heavy ripping equipment and wheel tractor-scrappers with pusher tractors or (2) can be excavated and dumped into place or loaded onto hauling equipment by excavators having a rated capacity of 1 cubic yard or larger and equipped with attachments (shovel, bucket, backhoe, dragline, or clam shell) appropriate to the material type, character, and nature of the materials.
3. Rock excavation is defined as the excavation of all hard, compacted, or cemented materials that require blasting or the use of ripping and excavating equipment larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than 1 cubic yard encountered in materials otherwise conforming to the definition of common excavation must be classified as rock excavation. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.
 - a. For the purpose of these classifications, the following definitions apply:
 - (1) Heavy ripping equipment is a rear-mounted, heavy-duty, single-tooth, ripping attachment mounted on a track-type tractor having a power rating of at least 250-flywheel horsepower, unless otherwise specified in Section J.
 - (2) A wheel tractor-scraper is a self-loading (not elevating) and unloading scraper having a struck-bowl capacity of at least 12 cubic yards.
 - (3) A pusher tractor is a track-type tractor having a power rating of at least 250-flywheel horsepower equipped with appropriate attachments.

4. Unclassified excavation is defined as the excavation of all materials encountered, including rock materials, regardless of their nature or the manner in which they are removed.

C. Blasting

1. The transportation, handling, storage, and use of dynamite and other explosives must be directed and supervised by someone of proven experience and ability who is authorized and qualified to conduct blasting operations.
2. Blasting must be done in a manner that prevents damage to the work or unnecessary fracturing of the underlying rock materials. It must conform to any special requirements in Section J of this specification. When specified in Section J, the contractor must furnish the engineer, in writing, a blasting plan before blasting operations begin.

D. Use of Excavated Material

1. To the extent they are needed, all suitable material from the specified excavations must be used in the construction of required permanent earthfill or rockfill. The suitability of material for specific purposes is determined by the engineer. The contractor must not waste or otherwise dispose of suitable excavated material.

E. Disposal of Waste Materials

1. All surplus or unsuitable excavated materials are designated as waste and must be disposed of at the locations shown on the drawings.

F. Excavation Limits

2. Excavations must comply with the Occupational Safety and Health Administration Construction Industry Standards Subpart P, Excavations, Trenching, and Shoring (29 CFR pt. 1926). All excavations must be completed and maintained in a safe and stable condition throughout the total construction phase. Structure and trench excavations must be completed to the specified elevations and to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work. Excavations outside the lines and limits shown on the drawings or specified herein are required to meet safety requirements and must be the responsibility of the contractor in constructing and maintaining a safe, stable excavation.

G. Borrow Excavation

1. When the quantities of suitable material obtained from specified excavations are insufficient to construct the specified earthfills and earth backfills, obtain additional material from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas are as specified in Section J or as approved by the engineer.
2. Borrow pits must be excavated and finally dressed to blend with the existing topography. They are sloped to prevent ponding and to provide drainage.

H. Over Excavation

1. Correct excavation in rock beyond the specified lines and grades by filling the resulting voids with Portland Cement concrete. Materials and mix proportions must be approved by the engineer. Concrete that will be exposed to the atmosphere when construction is completed must meet the requirements of concrete selected for use under Construction Specification 31, Concrete for Major Structures, or 32, Structure Concrete, as appropriate.
2. Concrete that will be permanently covered must contain not less than five bags of cement per cubic yard. The concrete must be placed and cured as specified by the engineer.
3. Correct excavation in earth beyond the specified lines and grades by filling the resulting voids with approved compacted earthfill. The exception to this is that if the earth will become the subgrade for riprap, rockfill, sand or gravel bedding, or drainfill, the voids may be filled with material conforming to the specifications for the riprap, rockfill, bedding, or drainfill. Before correcting an over excavation condition, the contractor must review the planned corrective action with the engineer and obtain approval of the corrective measures.

I. Measurement and Payment

1. Unit Price Methods. For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas or by methods outlined in Section J of this specification. Regardless of quantities excavated, the measurement for payment is made to the specified pay limits except when excavation outside the specified lines and grades directed by the engineer to remove unsuitable material is included. Excavation required because unsuitable conditions result from the contractor's improper construction operations, as determined by the engineer, is not included for measurement and payment.
2. The pay limits are defined as follows:
 - a. The upper limit is the original ground surface as it existed before the start of construction operations, unless excavation is performed within areas designated for previous excavation or earthfill; then the upper limit is the modified ground surface resulting from the specified previous excavation or earthfill.
 - b. The lower and lateral limits is the true surface of the completed excavation as directed by the engineer.
3. The following provisions apply to all methods of measurement and payment.
 - a. Payment for each type and class of excavation is made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and other items necessary and incidental to the performance of the work with the exception that extra payment for backfilling over excavation will be made in accordance with the following provisions.

- b. Payment for backfilling over excavation, as specified in Section H of this specification, is made only if the excavation outside specified lines and grades is directed by the engineer to remove unsuitable material and the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.
- c. Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section J of this specification.

J. Items of Work and Construction Details

All excavations shall be constructed to the lines and grades shown on the Drawings or as directed by the Engineer.

Items of work to be performed in conformance with this specification and construction details are:

Bid Item #2a Excavation – Channel 1A & Bid Item #2b Excavation – Channel 1B:

- 1. This item shall consist of the excavation of the channels as shown on the Drawings. The completed work shall conform to the lines, grades, and elevations shown on the Drawings.
- 2. Excavated materials that are suitable for earthfill shall be used according to Section D.
- 3. Surplus or unsuitable excavated materials must be disposed of according to Section E or as approved by the Engineer.
- 4. Items of work subsidiary to this item are:
 - a. Construction Surveys – Construction Specification 7
 - b. Mobilization and Demobilization – Construction Specification 8
 - c. Dewatering - Construction Specification 11
 - d. Topsoil – Construction Specification 26
 - e. Contractor Quality Control – Construction Specification 94

Subsidiary Items – Bid Item #3 Water Control Structure (3' Tall) and Bid Item #4 12" SDR 35 PVC Pipe

- 1. Work shall consist of the excavation required for the installation of the plastic pipe and structure for water control as shown on the Drawings. The completed work shall conform to the lines, grades, and elevations shown on the Drawings or as staked in the field.
- 2. Excavations for the installation of the plastic pipe and water control structure shall be at least 8" or wider on both sides. The bottom of the excavation shall be graded and compacted to provide the elevations shown on the Drawings.
- 3. Excavated materials that are suitable for earthfill shall be used in the dike around the structure according to Section D.

4. Bid items essential to this item are:
 - a. Bid Item #3 Water Control Structure (3' Tall), Construction Specification 45
 - b. Bid Item #4 12" SDR 35 PVC Pipe, Construction Specification 45

Construction Specification 23 — Earthfill

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Part 642 – Specifications for Construction Contracts

Subpart B – National Construction Specifications

June 2024

A. Scope

1. The work consists of the construction of earth embankments, other earthfills, and earth backfills required by the drawings and specifications.
2. Earthfill is composed of natural earth materials that can be placed and compacted by construction equipment operated conventionally.
3. Earth backfill is composed of natural earth material placed and compacted in confined spaces or adjacent to structures (including pipes) by hand tamping, manually directed power tampers or vibrating plates, or their equivalent.

B. Material

1. All fill material must be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of material in the various fills must be subject to approval by the engineer.
2. Fill materials must contain no frozen soil, sod, brush, roots, or other perishable material. Rock particles larger than the maximum size specified for each type of fill must be removed prior to compaction of the fill.
3. The types of material used in the various fills must be as listed and described in the specifications and drawings.

C. Foundation preparation

1. Foundations for earthfill must be stripped to remove vegetation and other unsuitable material or must be excavated as specified.
2. Except as otherwise specified, earth foundation surfaces must be graded to remove surface irregularities and must be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material must be controlled as specified for the earthfill and the surface material of the foundation must be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.
3. Earth abutment surfaces must be free of loose, uncompacted earth in excess of 2 inches in depth normal to the slope and must be at such a moisture content that the earthfill can be compacted against them to produce a good bond between the fill and the abutments.
4. Rock foundation and abutment surfaces must be cleared of all loose material by hand or other effective means and must be free of standing water when fill is

placed upon them. Occasional rock outcrops in earth foundations for earthfill, except in dams and other structures designed to restrain the movement of water, must not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

5. Foundation and abutment surfaces must be no steeper than one horizontal to one vertical unless otherwise specified. Test pits or other cavities must be filled with compacted earthfill conforming to the specifications for the earthfill to be placed upon the foundation.

D. Placement

1. Earthfill must not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the engineer. Earthfill must not be placed upon a frozen surface nor have snow, ice, or frozen material incorporated in the earthfill matrix.
2. Earthfill must be placed in approximately horizontal layers. The thickness of each layer before compaction must not exceed the maximum thickness specified in section J or shown on the drawings. Materials placed by dumping in piles or windrows must be spread uniformly without exceeding the specified thickness before being compacted.
3. Hand-compacted earth backfill must be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of earth backfill compacted by manually directed power tampers.
4. Place earth backfill in a manner that prevents damage to the structures and allows the structures to assume the loads from the earth backfill gradually and uniformly. The height of the earth backfill adjacent to a structure must be increased at approximately the same rate on all sides of the structure.
5. Meet the following additional requirements for earthfill and earth backfill in dams, levees, and other structures designed to restrain the movement of water.
 - a. The distribution of materials throughout each zone must be essentially uniform and the earthfill free from lenses, pockets, streaks, or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material. Zone earthfills must be constructed concurrently unless otherwise specified.
 - b. Scarified the surface of each layer parallel to the axis of the fill to at minimum a depth of 2 inches before the next layer is placed.
 - c. The top surface of embankments must be maintained approximately level during construction with two exceptions: a crown or cross-slope of about 2 percent must be maintained to ensure effective drainage, or as otherwise specified for drainfill or sectional zones.
 - d. Construct dam embankments in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of streamflow during construction are specifically authorized in the contract.

- e. Embankments built at different levels as described under paragraphs c or d above must be constructed so that the slope of the bonding surfaces between embankments in place and embankments to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place must be stripped of all material not meeting the requirements of this specification and must be scarified, moistened, and recompacted when the new earthfill is placed against it. This ensures a good bond with the new earthfill and obtains the specified moisture content and density at the contact of the in-place and new earthfills.

E. Control of moisture content

1. During placement and compaction of earthfill and earth backfill, the moisture content of the material being placed must be maintained within the specified range.
2. The application of water to the earthfill material must be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the material after placement on the earthfill, if necessary. Obtain a uniform moisture distribution by disking.
3. Material that is too wet when deposited on the earthfill must either be removed or dried to the specified moisture content prior to compaction.
4. If the top surface of the preceding layer of compacted earthfill or a foundation or abutment surface in the contact zone with the earthfill becomes too dry to permit suitable bond, it must either be removed or scarified and moistened by sprinkling to an acceptable moisture content before placement of the next layer of earthfill.

F. Compaction

1. Earthfill. Earthfill must be compacted according to the following requirements for the class of compaction specified:
 - a. Class A compaction. Compact each layer of earthfill as necessary to provide the density of the earthfill matrix not less than the minimum density specified in Section J or identified on the drawings. The earthfill matrix is defined as the portion of the earthfill material finer than the maximum particle size allowed in the reference compaction test method specified (ASTM D698 or ASTM D1557).
 - b. Class B compaction. Compact each layer of earthfill to a mass density not less than the minimum density specified.
 - c. Class C compaction. Compact each layer of earthfill by the specified number of passes of the type and weight of roller or other equipment specified or by an equivalent approved method. Each pass must consist of at least one passage of the roller wheel or drum over the entire surface of the layer.
2. Earth backfill. Compact earth backfill adjacent to structures to a density equivalent to that of the surrounding in-place earth material or adjacent required earthfill or earth backfill. Compaction must be accomplished by hand tamping or manually directed power tampers, plate vibrators, walk-behind, miniature, or self-

propelled rollers. Unless otherwise specified, heavy equipment, including backhoe-mounted power tampers or vibrating compactors, and manually directed vibrating rollers must not be operated within 3 feet of any structure. Towed or self-propelled vibrating rollers must not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist is not permitted.

3. Heavy Equipment. The passage of heavy equipment will not be allowed:
 - a. Over cast-in-place conduits within 14 days after placement of the concrete
 - b. Over cradled or bedded precast conduits within 7 days after placement of the concrete cradle or bedding
 - c. Over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 3 feet, whichever is greater, except as may be specified in Section J.
4. Compacting adjacent to structures. Compacting of earth backfill adjacent to structures must not be started until the concrete has attained the strength specified in Section J for this purpose. The strength is determined by compression testing of test cylinders cast by the contractor's quality control personnel for this purpose and cured at the worksite in the manner specified in ASTM C31 for determining when a structure may be put into service.
5. Placement Interval Against Concrete. When the required strength of the concrete is not specified as described above, compaction of earth backfill adjacent to structures must not be started until the following time intervals shown in figure 23-1 have elapsed after placement of the concrete.

Figure 23-1 Time interval before placing backfill

| Structure | Time interval (days) |
|--------------------------------------------------------------------------|-----------------------------|
| Vertical or near-vertical walls with earth loading on one side only | 14 |
| Walls backfilled on both sides simultaneously | 7 |
| Conduits and spillway risers, cast-in-place (with inside forms in place) | 7 |
| Conduits and spillway risers, cast-in-place (inside forms removed) | 14 |
| Conduits, pre-cast, cradled | 2 |
| Conduits, pre-cast, bedded | 1 |
| Cantilever outlet bents (backfilled both sides simultaneously) | 3 |

G. Reworking or removal and replacement of defective earthfill

1. Earthfill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content, or otherwise not conforming to the requirements of the specifications must be reworked to meet the requirements or removed and replaced by acceptable earthfill. The replacement earthfill and the foundation, abutment, and earthfill surfaces upon which it is placed must conform to all requirements of this

specification for foundation preparation, approval, placement, moisture control, and compaction.

H. Testing

1. During the course of the work, the contractor must perform quality control tests, as applicable, to identify earthfill and earth backfill materials; determine the reference maximum density and optimum moisture content; and document that the moisture content of material at the time of compaction and the density of earthfill and earth backfill in place conform to the requirements of this specification.
2. Determining Reference Maximum Density and Optimum Moisture Content. For Class A compaction, the reference maximum density and optimum moisture content must be determined in accordance with the compaction test and method specified on the drawings or in section J.
3. Documenting Specification Conformance. In-place densities of earthfill and earth backfill requiring Class A compaction must be measured in accordance with ASTM D1556, D2167, D2937, D6938, or D8167. Moisture contents of earthfill and earth backfill at the time of compaction must be measured in accordance with ASTM D2216, D4643, or D6938. Values of moisture content determined by ASTM D2216 are considered the true value of the soil moisture. Values of moisture content determined by ASTM D4643 or D6938 must be verified by comparison to values obtained by ASTM D2216. Values of in-place density and moisture content determined by these tests must be compared to the minimum density and moisture content range specified on the drawings or in Section J.
4. Correction for Oversize Particles. If the materials to be used for earthfill or earth backfill contain more than 5 percent by dry weight of oversize rock particles (particles larger than those allowed in the specified compaction test and method), corrections for oversize particles must be made using the appropriate procedures explained in ASTM D4718.

I. Measurement and payment

1. Unit Price Methods. For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earthfill and earth backfill within the specified zone boundaries and pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified in Section J, no deduction in volume is made for embedded items such as, but not limited to, conduits, inlet structures, outlet structures, embankment drains, sand diaphragm and outlet, and their appurtenances.
2. Pay Limits. The pay limits must be as defined below, with the further provision that earthfill required to fill voids resulting from over excavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only under the following conditions:

- a. Where such over excavation to remove unsuitable material is directed by the engineer
 - b. Where the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.
3. Beyond Specified Lines and Grades. Earthfill beyond the specified lines and grades to backfill excavation required for compliance with OSHA requirements will be considered subsidiary to the earthfill bid items.
 4. The pay limits must be as designated on the Drawings.
 5. The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section J of this specification.

J. Items of work and construction details

All fills shall be placed in loose lifts of not more than 6 inches thickness. The volume of earthfill will not be measured.

Compaction shall be in accordance with Class C as specified in Section F. Machine compaction shall be accomplished by the controlled movement of hauling and spreading equipment over the fill area. Every point on the surface of each lift shall be traversed by not less than one tread track of the equipment. Hand compaction shall be required in areas inaccessible to heavy equipment. The hand-compacted fill shall be compacted by hand tamping or manually directed power tampers or plate vibrators.

Items of work to be performed in conformance with this specification and construction details are:

Bid Item #1a Earthfill – Embankment Fill at WCS:

1. Placing and compacting earth backfill around the water control structure and piping including placing hand compacted earth backfill required for installation of the pipes and structure for water control as shown on the Drawings.
2. The completed work shall conform to the lines, grades, and elevations shown on the Drawings or as staked in the field.

Bid Item #1b Earthfill – Embankment Fill Low Areas:

1. Placing and compacting earth backfill on the low areas of the embankment where shown on the Drawings.
2. The completed work shall conform to the lines, grades, and elevations shown on the Drawings or as staked in the field.

Bid Item #1c Earthfill – Fill Existing Channel:

1. Placing and compacting fill in the existing channel where shown on the Drawings.

2. The completed work shall conform to the lines, grades, and elevations shown on the Drawings or as staked in the field.

Items of work subsidiary to these items are:

1. Construction Surveys – Construction Specification 7
2. Mobilization and Demobilization – Construction Specification 8
3. Dewatering - Construction Specification 11
4. Topsoil – Construction Specification 26
5. Contractor Quality Control – Construction Specification 94

Construction Specification 26 — Topsoiling

Title 210 - Engineering

Part 642 — Specifications for Construction Contracts

Subpart B — National Construction Specifications

June 2024

A. Scope

1. The work consists of furnishing and spreading topsoil to specified depths at locations shown on the drawings.

B. Quality of Topsoil

1. Topsoil must consist of friable surface soil reasonably free of grass, roots, weeds, sticks, rocks, or other unsuitable material. Additional quality requirements, if any, are in Section G of this specification.

C. Furnishing

1. Method 1. Salvage topsoil from designated earth surfaces that will be disturbed by construction activities. After designated sites have been cleared and grubbed, remove the topsoil from the designated areas and stockpile it at locations shown on the drawings or that are acceptable to the engineer. Dispose of unsuitable material encountered during removal of topsoil at locations shown on the drawings or that are approved by the engineer. Otherwise, it will be hauled and disposed of at locations removed from the construction site. The contractor is responsible for complying with all local rules and regulations and the payment of any and all fees that may result from the disposal at locations outside the construction work limits.
2. Method 2. Topsoil is furnished from an offsite source designated by the contractor. The engineer must be granted access to the source for inspection and acceptance before delivery to the site. Test results and samples must be provided when specified in Section G of this specification.

D. Stockpiling

1. Stockpiles of topsoil must not conflict with the requirements of Construction Specification 5, Pollution Control, when made a part of this contract.

E. Spreading

1. Spreading must not be conducted when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to uniform spreading operations. Surfaces designated to receive a topsoil application must be lightly scarified just before the spreading operation.

2. Following the spreading operation, the topsoil surface must be left reasonably smooth and without ruts or surface irregularities that could contribute to concentrated waterflow downslope.

F. Measurement and Payment

1. The total surface covered by topsoil is measured except for the surface area of embankments, levees, dikes, and other earthfills not included for payment, and the areas are computed to the nearest square yard.
2. Payment for topsoil spread on the surface of embankments, levees, dikes, and other earthfills is included in the measurement and payment for that item of earthfill where topsoil application occurred.
3. The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section G of this specification.
4. Payment will constitute full compensation for all labor, equipment, material, and other items necessary and incidental to the completion of the work. This includes excavating, stockpiling, hauling, spreading, and the wasting of unsuitable excavated material.

G. Items of Work and Construction Details

Items of work to be performed in conformance with this specification and construction details are:

Subsidiary Item – Topsoil

1. This item must consist of furnishing all equipment, labor, and materials necessary for stripping the topsoil to a depth of six inches from areas to be excavated or covered with earthfill, salvaging it, and spreading it over the completed earthfill areas.
2. Bid items essential to this item are:
 - a. Bid Item #1a Earthfill – Embankment Breach, Construction Specification 23
 - b. Bid Item #1b Earthfill – Embankment Fill Low Areas, Construction Specification 23
 - c. Bid Item #1c Earthfill – Fill Existing Channel, Construction Specification 23
 - d. Bid Item #2a Excavation – Channel 1A, Construction Specification 21
 - e. Bid Item #2b Excavation – Channel 1B, Construction Specification 21
 - f. Bid Item #3 Water Control Structure (3' Tall), Construction Specification 45
3. Payment for topsoiling shall be incidental to Earthfill payment items.

Construction Specification 45 — Plastic Pipe

Title 210 – Engineering

Part 642 – Specifications for Construction Contracts

Subpart B – National Construction Specifications

June 2024

A. Scope

1. The work consists of furnishing and installing plastic pipe (except corrugated polyethylene pipe) and the necessary fittings and appurtenances as shown on the drawings or as specified herein.

B. Material

1. Pipe, fittings, and gaskets must conform to the requirements of Material Specification 547, Plastic Pipe, and as specified in Section N of this specification or as shown on the drawings.
2. Perforated pipe must conform to the requirements of Material Specification 547, Plastic Pipe, and as specified in Section N of this specification or as shown on the drawings.
3. Unless otherwise specified, concrete must conform to the requirements of Construction Specification 32, Structure Concrete, and Section H of this specification.
4. Unless otherwise specified, earth backfill must conform to the requirements of Construction Specification 23, Earthfill.
5. Unless otherwise specified, drainfill must conform to the requirements of Construction Specification 24, Drainfill.

C. Handling and Storage

1. Deliver pipe to the job site and handled by means that provide adequate support to the pipe and do not subject it to undue stresses or damage. When handling and placing plastic pipe, take care to prevent impact blows, abrasion damage, and gouging or cutting by metal edges, surfaces or rocks. The manufacturer's special handling requirements must be strictly observed. Special care must be taken to avoid impact when the pipe must be handled at a temperature of 40 degrees Fahrenheit or less.
2. Store pipe on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specifically manufactured to withstand exposure to ultraviolet radiation, cover it with an opaque material when stored outdoors for 15 days or longer.

D. Excavation

1. Excavate in accordance with Construction Specification 21, Excavation, and Section N of this specification or as shown on the drawings.
2. Excavate the pipe foundation a minimum of 4 inches lower than the pipe grade shown on the drawings or staked in the field whenever bedrock, boulders, cobbles, or other material that may cause pipe damage is encountered at planned pipe grade.

E. Laying the Pipe

1. Install plastic pipe conduits complete with fittings and other related appurtenances to the lines and grades shown on the drawings or specified in Section N of this specification. Install the pipe so that there is no reversal of grade between joints unless otherwise shown on the drawings. The pipe must not be dropped or dumped on the bedding or into the pipe trench. The ground surface near the pipe trench must be free of loose rocks and stones greater than 1 inch in diameter. This ensures that rock will not be displaced and impact the pipe.
2. Just before placement, inspect each pipe section to ensure that all foreign material is removed from inside the pipe. The pipe ends and the couplings must be free of foreign material when assembled. At the completion of a work shift, all open ends of the pipeline must be temporarily closed off using a suitable cover or plug.
3. Take care to prevent distortion and damage during hot or cold weather. During unusually hot weather (daytime high temperature of more than 90 °F), lightly backfill the pipe assembled in the trench or shade to keep it as near to ground temperature as possible until final backfill is placed. Backfill operations must be performed during daily construction periods when the ground temperature and the temperature of the pipe do not vary more than 40 degrees Fahrenheit.
4. Install perforated pipe with the perforations down and oriented symmetrically about the vertical centerline. Perforations must be clear of any obstructions on the inside and outside of the pipe when the pipe is approved by the engineer for backfill.
5. During installation, firmly and uniformly bed the pipe throughout its entire length to the depth and in the manner specified in Section N of this specification or as shown on the drawings. Place bell-holes in bedding material under bells, couplings, and other fittings to ensure the pipe is uniformly supported throughout its entire length. Blocking or mounding beneath the pipe to bring the pipe to final grade is not permitted.

F. Pipe Embedment

1. Earth bedding.
 - a. Firmly and uniformly place the pipe on compacted earthfill bedding or an in-place earth material bedding of ample bearing strength to support the pipe without noticeable settlement. The earth material on which the pipe is placed must have uniform density to prevent differential settlement.

- b. Unless otherwise specified, form a groove that closely conforms to the outside surface of the pipe in the bedding. The depth of the groove must be equal to or greater than 0.3 of the pipe diameter.
 - c. Compact earth bedding to a density not less than adjacent, undisturbed, in-place earth material or be compacted earth backfill. Earthfill material used for compacted earth bedding must be free of rocks or stones greater than 1 inch in diameter and earth clods greater than 2 inches in diameter. The pipe must be loaded sufficiently during the compaction of bedding under the haunches and around the sides of the pipe to prevent displacement from its final approved placement.
2. Sand, gravel, or crushed rock bedding. When sand, gravel, or crushed rock bedding is specified, firmly and uniformly place the pipe on the bedding material. Material for bedding must not exceed 1 inch in diameter. Unless otherwise specified in Section N of this specification or shown on the drawings, the coarse-grained bedding material must be carefully placed and compacted to a depth equal to or greater than 0.3 of the diameter of the pipe above the bottom of the pipe. The pipe must be loaded sufficiently during backfilling and compaction around the sides to prevent displacement of the pipe from its final approved placement.
 3. Pipe encased in drainfill. Firmly and uniformly place the pipe on bedding of specified drainfill, which must be placed and compacted as specified in Section N of this specification or as shown on the drawings to form a continuous, uniform support around the entire circumference of the pipe. The pipe must be loaded sufficiently during backfilling around the sides and during compaction to prevent displacement of the pipe.

G. Backfill

1. Initial backfill.
 - a. Unless otherwise specified, initial backfill to 6 inches above the top of the conduit is required. Earth haunching and initial backfill material must consist of soil material free of rocks, stones, or hard clods more than 1 inch in diameter. Coarse backfill material must be the specified sand, gravel, crushed rock, or drainfill material.
 - b. Initial backfill must be placed in two stages. In the first stage (haunching), backfill is placed to the pipe spring line (center of pipe). In the second stage, it is placed to 6 inches above the top of the pipe.
 - c. The first stage material must be worked carefully under the haunches of the pipe to provide continuous support throughout the entire pipe length. The haunching backfill material must be placed in layers that have a maximum thickness of about 6 inches and are compacted as specified in Section N of this specification or as shown on the drawings. During compaction operations, care must be taken to ensure that the tamping or vibratory equipment does not come in contact with the pipe, and the pipe is not deformed or displaced.
 - d. When pressure testing is not specified, cover the pipe with a minimum of 6 inches of backfill material as soon as possible following assembly of the pipe in the trench but not later than within the same day that placement has

occurred. When pressure testing is specified, place sufficient backfill material over the pipe to anchor the conduit against movement during pressure testing activities.

2. Final backfill.

- a. Final backfill consists of placing the remaining material required to complete the backfill from the top of the initial backfill to the ground surface, including mounding at the top of the trench. Final backfill material within 2 feet of the top of the pipe must be free of debris or rocks larger than 3 inches nominal diameter. Coarse backfill material must be the specified sand, gravel, crushed rock, or drainfill. Final backfill must be placed in approximately uniform, compacted layers. Final backfill compaction requirements must be as specified in Section N of this specification or as shown on the drawings.
- b. Vehicles or construction equipment must not be allowed to cross the pipe until the minimum earth cover and required density as specified in Section 14 of this specification have been obtained.

H. Pipe Encasement in Concrete

1. Concrete encasement must be carefully placed to form a continuous, uniform support around the entire circumference of the pipe as specified in Section N of this specification or as shown on the drawings. Pipes encased in concrete must be securely anchored to prevent movement of the pipe during concrete placement. A clear distance of 1.5 inch must be maintained between the pipe and the reinforcing steel.
2. The concrete for the encasement must conform to the requirements of Construction Specification 32, Structure Concrete, for Class 3000M concrete unless otherwise specified.

I. Joints

1. Unless otherwise specified in Section N of this specification or shown on the drawings, joints must be either bell-and-spigot types with elastomeric gaskets, coupling types, solvent cement bell and spigot, or jointed by butt heat fusion. When a lubricant is required to facilitate joint assembly, it must be a type having no deleterious effect on the gasket or pipe material.
2. Pipe joints must be watertight at the pressures specified except where unsealed joints are indicated.
3. Install pipe and join in accordance with the manufacturer's recommendations. Laying deflections and joint fitting or stab depths must be within the manufacturer's recommended tolerances.
4. When solvent cement joints are specified for PVC or ABS pipe and fittings, they must be made in accordance with the following ASTMs and the related appendix of each ASTM: D2855 for PVC pipe and fittings and D2235 for ABS pipe and fittings.

5. Flanged, banded, heat-fusion, or elastomeric-sealed mechanical joints must be used when joining polyethylene (PE) and high-density polyethylene (HDPE) pipe and fittings unless otherwise specified in Section N of this specification or as shown on the drawings.
6. Cut pipe ends square and debur to provide a uniform, smooth surface for the jointing process. Place reference marks on the spigot ends to assist in determining when proper seating depth has been achieved within the joint.

J. Fittings

1. Unless otherwise specified, steel fittings, valves, and bolted connections must be painted or coated as recommended by the manufacturer.
2. Fittings for non-pressure pipe must be of the same or similar material as the pipe and must provide the same durability, watertightness, and strength as the pipe unless otherwise specified.

K. Thrust Blocks and Anchors

1. When specified, install concrete thrust blocks and anchors as shown on the drawings or as specified in Section N of this specification.
2. The concrete for thrust blocks and anchors must conform to the requirements of Construction Specification 32, Structure Concrete, for Class 3000M concrete unless otherwise specified in Section N of this specification.
3. The thrust block cavity must be hand-dug into undisturbed soil or previously placed, compacted backfill. The cavity must be formed with soil or wood to hold the freshly placed concrete without displacement until an initial set has occurred.
4. When excavation beyond the designated trench widths and depths as shown on the drawings or specified in Section N of this specification occurs at locations where installation of concrete thrust blocks is required, the contractor must install an alternative thrust block provision. The concrete thrust block must have a thickness of one pipe diameter and a contact face area that must be formed against the pipe as shown on the drawings or as specified in Section N of this specification. Place backfill on all sides of the thrust block and to the sides of the excavation. It must be compacted as specified for initial backfill.

L. Pressure Testing

1. Pressure testing of the completed conduit is not required.

M. Measurement and Payment

1. For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe is determined to the nearest foot by measurement of the laid length along the crown centerline of the conduit. Payment for each kind, size, and class of pipe is made at the contract unit price for that kind, size, and class. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe including excavation, shoring, backfill, bedding, thrust blocks, and all fittings, appurtenances, and other items

necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule is made at the contract prices for those items.

2. Compensation for any items of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in Section N of this specification.

N. Items of Work and Construction Details

Bid Item #3 Water Control Structure (3' Tall):

1. This item shall consist of furnishing and installing the inline water level control structure including all fittings and other items necessary and incidental to the installation as shown on the Drawings.
2. The height of the inline water control structure shall be as shown on the Drawings.
3. The walls and floor of the inline water control structure shall be constructed of polyvinyl chloride (PVC) having a minimum wall thickness of ½ inch with lockable plastic lid. All corners shall be reinforced with anodized aluminum extrusions with stainless steel screws. All joints shall be sealed.
4. The inline water control structure shall be equipped with flexible connectors for connecting the inlet and outlet pipes sized for the pipe specified on the Drawings.
5. Stoplogs shall be constructed of PVC having heights of 5 and 7 inches. Seals shall be provided between individual stoplogs and between the stoplogs and the stoplog tracks. The stoplogs shall have stainless steel lifting hooks to allow for easy removal. A handle shall be provided for use when installing or removing the stoplogs. Provide enough stoplogs to allow setting the water level at the designed water elevation noted on the Drawings.
6. The earth backfill adjacent to the inline water control structure shall meet the requirements for Earth Backfill (Construction Specification 23) and shall be hand compacted.
7. Prior to placing and compacting earth backfill adjacent to the water control structure, sufficient support shall be provided inside the structure to protect from warping the sides of the structure affecting installation or removal of the stoplogs.
8. The following shall be incidental to the installation of the water control structure:
 - a. Pipe Tie Downs: This item shall consist of furnishing and installing the pipe anchor assemblies complete with 36" long earth augers and ¼" stainless steel cable. It shall include all other items necessary and incidental to the installation.

- b. 12" Bar Guard: This item shall consist of furnishing and installing the 12" bar guard on the pipe inlet. It shall include all other items necessary and incidental to the installation. Bar guard shall be constructed of ¼ inch steel rod with a black powder coat finish. Bar guard shall be designed to slide inside the pipe.
 - c. 12" Rat Guard Band Type: This item shall consist of furnishing and installing the 12" band type rat guard on the pipe outlet. It shall include all other items necessary and incidental to the installation. Bar guard shall be zinc dichromate plating to resist corrosion. All bars shall be MIG welded on both sides. Bar guard shall be designed to fit PVC, CMP, and other similar types of pipe.
9. Payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Bid #4 12" SDR 35 PVC Pipe:

- 1. This item shall consist of furnishing and installing the 12 inch diameter pipe for the water control structure inlet and outlet. It shall include all fittings and other items necessary and incidental to the installation.
- 2. PVC pipe shall conform to ASTM D3034 SDR 35.
- 3. The pipe and joints shall be bell and spigot with an elastomeric gasket. They shall be considered watertight for pressures less than 10 psi.

Bid items subsidiary to these bid items are:

- 1. Bid Item #2a Excavation – Channel 1A.
- 2. Bid Item #2b Excavation – Channel 1B.

Items of work subsidiary to these bid items are:

- 1. Construction Surveys – Construction Specification 7
- 2. Mobilization and Demobilization – Construction Specification 8
- 3. Removal of Water - Construction Specification 11
- 4. Topsoil – Construction Specification 26
- 5. Contractor Quality Control – Construction Specification 94

Construction Specification 61 — Rock Riprap

Title 210 – Engineering

Part 642 – Specifications for Construction Contracts

Subpart B – National Construction Specifications

June 2024

A. Scope

1. The work consists of the construction of rock riprap revetments and blankets, including filter or bedding where specified.

B. Material

1. Rock riprap must conform to the requirements of Material Specification 523, Rock for Riprap, or, if so specified, must be obtained from designated sources. It must be free from dirt, clay, sand, rock fines, and other material not meeting the required gradation limits.
2. At least 30 days before rock is delivered from other than designated sources, the contractor must designate in writing the source from which rock material will be obtained and provide information satisfactory to the contracting officer that the material meets contract requirements. The contractor must provide the responsible engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock must be as specified in section H.
3. Rock from approved sources must be excavated, selected, and processed to meet the specified quality and grading requirements at the time the rock is installed.
4. Based on a specific gravity of 2.65 (typical of limestone and dolomite) and assuming the individual rock is shaped midway between a sphere and a cube, typical size/weight relationships are given in figure 61-1:

Figure 61-1 Typical riprap size/weight relationship

| Sieve Size of Rock | Approx. Weight of Rock | Weight of Test Pile |
|--------------------|------------------------|---------------------|
| 16 inches | 300 pounds | 6,000 pounds |
| 11 inches | 100 pounds | 2,000 pounds |
| 6 inches | 15 pounds | 300 pounds |

5. When specified in section H or when it is necessary to verify the gradation of the rock riprap, a particle size analysis must be performed in accordance with ASTM D5519, Test Method A or B. The analysis must be performed at the worksite on a test pile of representative rock. The mass of the test pile must be at least 20 times the mass of the largest rock in the pile. The results of the test are compared to the gradation required for the project. Test pile results that do not meet the construction specifications must be cause for the rock to be rejected. The test pile that meets contract requirements must be left on the jobsite as a sample for visual comparison. The test pile must be used as part of the last rock riprap to be placed.

6. Filter or bedding aggregates, when required, must conform to Material Specification 521, Aggregates for Drainfill and Filters, unless otherwise specified. Geotextiles must conform to Material Specification 592, Geotextile.

C. Subgrade preparation

1. The subgrade surface on which the rock riprap, filter, bedding, or geotextile is to be placed must be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it must consist of approved material and conform to the requirements of the specified class of earthfill.
2. Rock riprap, filter, bedding, or geotextile must not be placed until the foundation preparation is completed and the subgrade surface has been inspected and approved.

D. Equipment-placed rock riprap

1. The rock riprap must be placed by equipment on the surface and to the depth specified. It must be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The rock for riprap must be delivered and placed in a manner that ensures the riprap in place is reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface.
2. Rock riprap must be placed in a manner to prevent damage to structures. Hand placing is required as necessary to prevent damage to any new and existing structures.

E. Hand-placed rock riprap

1. The rock riprap must be placed by hand on the surface and to the depth specified. It must be securely bedded with the larger rocks firmly in contact one to another without bridging. Spaces between the larger rocks must be filled with smaller rocks and spalls. Smaller rocks must not be grouped as a substitute for larger rock. Flat slab rock must be laid on its vertical edge except where it is laid like paving stone and the thickness of the rock equals the specified depth of the riprap course.

F. Filter or bedding

1. When the contract specifies filter, bedding, or geotextile beneath the rock riprap, the designated material must be placed on the prepared subgrade surface as specified. Compaction of filter or bedding aggregate is not required, but the surface of such material must be finished reasonably smooth and free of mounds, dips, or windrows.

G. Measurement and payment

1. For items of work for which specific unit prices are established by the contract, the volume of each type of rock riprap, including filter and bedding aggregate, is

measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

2. Payment is made at the contract unit price for each type of rock riprap, including filter and bedding. Such payment is considered full compensation for completion of the work
3. The following provision applies to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section H.
4. No separate payment is made for testing the gradation of the test pile. Compensation for testing is included in the appropriate bid item for riprap.

H. Items of work and construction details

Items of work to be performed in conformance with this specification and the construction details are:

Bid Item #5 Riprap:

1. This item shall consist of furnishing and installing riprap and filter fabric at the inlet and outlet pipes. It shall include all items necessary and incidental to the installation.
2. Riprap shall be rock consisting of fieldstone or rough, unhewn quarry rock. Stone containing shale, sandstone, or other material that will disintegrate readily shall not be used.
3. Riprap shall have the percentage of weight smaller than the following:

| | |
|-----|-----------|
| 12" | 50 to 75% |
| 9" | 10 to 50% |
| 6" | 0 to 10% |
4. Riprap shall be placed by equipment capable of controlling drop of the rock riprap. The maximum drop of the rock shall be three (3) feet. Pushing or rolling rocks over the geotextile will not be allowed.
5. Filter fabric is considered incidental to the installation of riprap. The filter fabric shall be nonwoven polyester or polypropylene geotextile. The geotextile shall have a minimum grab tensile strength of 150 pounds as determined by ASTM D4632. The geotextile shall have a maximum opening size equivalent to a #70 U.S. standard sieve. Supply all pins and other items necessary to fasten the filter fabric to the ground so it will not slide or form gaps when placing rock riprap.
6. Payment will be based on the square foot having a 12-inch thickness. Payment shall include installation of filter fabric and all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Items of work subsidiary to this bid item are:

1. Construction Surveys – Construction Specification 7
2. Mobilization and Demobilization – Construction Specification 8
3. Contractor Quality Control – Construction Specification 94

Construction Specification 94 — Contractor Quality Control

Title 210 – Engineering

Part 642 – Specifications for Construction Contracts

Subpart B – National Construction Specifications

June 2024

A. Scope

1. The work consists of developing, implementing, and maintaining a quality control system to ensure that the specified quality is achieved for all materials and work performed.

B. Equipment and Materials

1. Equipment and material used for quality control must be of the quality and condition required to meet the test specifications cited in the contract. Testing equipment must be properly adjusted and calibrated at the start of operations with the calibration maintained at the frequency specified. Records of equipment calibration tests must be available to the engineer at all times. Equipment must be operated and maintained by qualified operators as prescribed in the manufacturer's operating instructions, the references specified, and as specified in Section J of this specification. All equipment and materials used in performing quality control testing must be as prescribed by the test standards referenced in the contract or in Section J.
2. Handle and operate all equipment and materials in a safe and proper manner and comply with all applicable regulations pertaining to their use, operation, handling, storage, and transportation.

C. Quality Control System

1. The contractor must develop, implement, and maintain a system of quality control to provide the specified material testing and verification of material quality before use. The system activities must include procedures to verify adequacy of completed work, initiate corrective action to be taken, and document the final results. The identification of the quality control personnel and their duties and authorities must be submitted to the contracting officer in writing within 15 calendar days after notice of award.
2. The quality control system must include, but not be limited to, a rigorous examination of construction material, processes, and operation, including testing of material and examination of manufacturer's certifications as required, to verify that work meets contract requirements and is performed competently.

D. Quality Control Personnel

1. Quality control activities must be accomplished by competent personnel. A competent person is one who is experienced and capable of identifying, evaluating, and documenting that materials and processes being used will result in work that complies with the contract. This person also has authority to take prompt action to remove, replace, or correct such work or products not in compliance. Off-site testing laboratories must be certified or inspected by a nationally recognized entity. The contractor must submit to the contracting officer for approval laboratory certification or inspection information. The contractor must submit to the contracting officer for approval the names, qualifications, authorities, certifications, and availability of the competent personnel who will perform the quality control activities.

E. Post-award Conference

1. The contractor must meet with the contracting officer before any work begins and discuss the contractor's quality control system. The contracting officer and the contractor must develop a mutual understanding regarding the quality control system including procedures for correcting quality control issues.

F. Records

1. The contractor's quality control records must document both acceptable and deficient features of the work and corrective actions taken. All records must be on forms approved by the contracting officer, be legible, and be dated and signed by the competent person creating the record.
2. Unless otherwise specified in Section J of this specification, records must include:
 - a. Documentation of shop drawings including date submitted to and date approved by the contracting officer, results of examinations, need for changes or modifications (if any), manufacturer's recommendations and certifications (if any), and signature of the authorized examiner.
 - b. Documentation of material delivered including quantity, storage location, and results of quality control examinations and tests.
 - c. Type, number, date, time, and name of individual performing quality control activities.
 - d. The material or item inspected and tested, the location and extent of such material or item, and a description of conditions observed and test results obtained during the quality control activity.
 - e. The determination that the material or item met the contract provisions and documentation that the engineer was notified.
 - f. For deficient work, the nature of the defects, specifications not met, corrective action taken, and results of quality control activities on the corrected material or item.

G. Reporting Results

1. The results of contractor's quality control inspections and tests must be communicated to the engineer immediately upon completion of the inspection or test. Unless otherwise specified in Section J, the original plus one copy of all records, inspections, tests performed, and material testing reports must be

submitted to the engineer within 1 working day of completion. The original plus one copy of documentation of material delivered must be submitted to the engineer before the material is used.

H. Access

1. The contracting officer and the engineer must be given free access to all testing equipment, facilities, sites, and related records for the duration of the contract.

I. Payment

1. For items of work for which lump sum prices are established in the contract, payment is prorated and paid in equal amounts on each monthly estimate. The number of months used for prorating must be the number estimated to complete the work. The final month's prorate amount is made with the final payment. Payment as described above constitutes full compensation for completion of the work.
2. Payment is not made under this item for the purchase cost of material and equipment having a residual value.
3. Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section J.

J. Items of Work and Construction Details

Subsidiary Item - Contractor Quality Control

1. This item must consist of furnishing personnel required by the Contractor to perform the testing and inspection necessary to implement a quality control system and ensure quality construction work.
2. The Contractor shall identify a quality control manager who shall be on-site or be available for immediate consultation during all periods of production work.
3. Finished top of dike earthfills shall be constructed to within +0.2 foot of the designed elevation. Fill over the water control structure and surrounding area should be the highest point of the embankment but blend into the finished grade of the embankment. There is no tolerance below the design height. Shrinkage shall be 20% of the fill height regardless of equipment used.
4. Top width must be ± 1 foot near the water control structure. Any overbuild should blend into the shape and form of the embankment. In no case shall the top width be less than 1 foot of the design top width.
5. Finished dike earthfill slopes shall be constructed to within ± 0.3 foot of the designed elevation as calculated for any horizontal distance on the slope. The elevation difference shall not exceed 0.2 foot at successive staked stations along the slope line. The slope shall be nearly uniform (within 0.2 foot of true slope) from top to bottom.

6. Finished channel and fill elevations shall be constructed to within +0.1 foot of the designed elevation.
7. Contractor must furnish material certifications for the following specific items:
 - a. Structure for Water Control
 - b. PVC Plastic Pipe
 - c. Seed for Critical Area Planting
 - d. Mulch for Critical Area Planting
 - e. Riprap and Filter Fabric
8. Bid items essential to this item that payment will be incidental to are:
 - a. Bid Item #1a Earthfill – Embankment Fill at WCS, Construction Specification 23
 - b. Bid Item #1b Earthfill – Embankment Fill Low Areas, Construction Specification 23
 - c. Bid Item #1c Earthfill – Fill Existing Channel, Construction Specification 23
 - d. Bid Item #2a Excavation – Channel 1A, Construction Specification 21
 - e. Bid Item #2b Excavation – Channel 1B, Construction Specification 21
 - f. Bid Item #3 Water Control Structure (3' Tall), Construction Specification 45
 - g. Bid Item #4 12" SDR 35 PVC Pipe, Construction Specification 45
 - h. Bid Item #5 Riprap, Construction Specification 61
 - i. Bid Item #6 Seeding & Mulching, Construction Specification 6