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**CITY OF SANTA FE
ARROYO CHAMISO DRAINAGE IMPROVEMENTS,
EROSION CONTROL AND BANK REPAIR
C.I.P. 413-D**

CONSTRUCTION SPECIFICATIONS

This project will use the following Construction Specifications and Special Provisions. 2014 NMDOT Standard Specifications for Highway and Bridge Construction in which references to the department shall imply the "City of Santa Fe".

SPECIAL PROVISIONS

- SP 1 - Boulder Material
- SP 2 - Cobble Material
- SP 3 - Boulder Toe Protection
- SP 4 - Boulder Cascade
- SP 5 - Post Vane



Neil Williams
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SPECIAL PROVISIONS
SP - 1

BOULDER MATERIAL

DESCRIPTION. Furnish, transport, stockpile, maintain, and place boulders to be used in boulder toe protection and boulder cascade.

MATERIALS.

- (a) Boulder Material consists of boulders placed in the channel. The boulder material shall comply with the following:
 - (1) The dimensions of the boulders shall be 3 to 6 feet along the A-axis, 2.5 to 3.5 feet along the B intermediate axis, and 2 to 2.5 feet along the C-axis as shown on the Contract Documents.
 - (2) Boulders shall consist of angular flat boulders obtained from an approved source.
 - (3) Boulder material shall be limestone.
 - (4) Boulder shall have a specific gravity of 2.4 or greater.
- (b) The Contractor shall locate potential sources for boulder material. The Contractor and Engineer will jointly visit the sites to determine whether the boulder material meets the specified requirements. Source of boulder material shall be from an approved mining operation with up-to-date regulatory permits. Boulder material shall not be harvested from streams or rivers outside a commercial quarry operation.
- (c) Boulder material may come from the limits of grading of this Contract, provided that it meets the specified requirements and lies within the limits of grading. If the Contractor chooses to use onsite material (if available), the contractor must provide adequate material testing to show that on-site material meets these specifications.
- (d) The Contractor shall obtain from the quarry and submit to the Engineer a certificate verifying the following:
 - (1) Boulder material Classification.
 - (2) Unit Weight (lbs. per cubic foot).
 - (3) Weight of boulder being supplied.
- (e) Samples shall be submitted to the Engineer for approval, prior to its use in the project.

SPECIAL PROVISIONS
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- (f) The Contractor shall not be granted an extension of time or extra compensation due to delay caused by sampling, testing, approval, or disapproval of material under the requirements of these Specifications.
- (g) Due to the anticipated quarry preparatory time, and/or demand for the boulder material (limestone) as specified in the Contract, the Contractor shall make all necessary arrangements with the source of supply in a timely fashion, so that the an adequate supply of boulder material shall be maintained and the work shall not be unnecessarily delayed due to insufficient supply.
- (h) Any unsuitable material shall be removed at the Contractor's sole expense.

SPECIAL PROVISIONS
SP - 2

COBBLE MATERIAL

DESCRIPTION. Furnish, transport, stockpile, maintain and place cobble material for cobble weir structures, as specified in the Contract or as directed by the Engineer.

MATERIALS.

- (a) Cobble material shall consist of natural field rock or natural river rock. Cobble material shall be sound, tough, dense, resistant to the action of air and water, and suitable in all respects for the purpose intended. Cobble material may contain small amounts of fine aggregate but shall contain no amounts of soil material.
 - (1) The dimensions of the cobble shall be 6 to 8 inches along the A-axis, 6 to 8 inches along the B intermediate axis, and 6 to 8 inches feet along the C-axis as shown on the Contract Documents.
 - (2) Cobble material shall have a specific gravity of 2.4 or greater.
- (b) Cobble material shall not be mined from active streams and rivers.
- (c) Cobble material shall consist of appropriate color (e.g., green/gray, brown/gray, dark gray, and/or dark brown in color) obtained from an approved source. Concrete shall not be considered as an alternative for cobble material.
- (d) Cobble material shall have a grading size relative to a specified median grain size, referred to as D₅₀. Cobble material shall be composed of well-graded mixture of stone size so that 50% of the pieces, by weight, shall be larger than the D₅₀ size. A well graded mixture as used herein is defined as a mixture composed primarily of larger stone sizes but with a sufficient mixture of other sizes to fill the small voids between the cobbles. The D₅₀ size range for this project is between 6 and 8 inches. The diameter of the largest stone size in each mixture shall be no larger than 2.5 times the D₅₀ size (6 inches x 2.5 = 15 inches, 8 inches x 2.5 = 20 inches). The total weight of cobble material shall contain no more than 10% of the pieces smaller than half the diameter of the D₅₀ size (3 to 4 inches).
- (e) Cobble material shall be premixed at the potential source location.
- (f) The Contractor shall locate potential sources for cobble material. The Contractor and Engineer will jointly visit the sites to determine whether the cobble material meets the specified requirements.
- (g) The Contractor shall obtain from the quarry and submit to Project Manager a certificate verifying the following:

SPECIAL PROVISIONS
2- COBBLE MATERIAL

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- (1)** Cobble Classification.
 - (2)** Unit Weight (lbs. per cubic foot).
 - (3)** Weight of cobble material being supplied.
- (h)** Samples shall be submitted to the Engineer for approval, prior to its use in the project. Any unsuitable material shall be removed at the Contractor's sole expense.
- (i)** The Contractor shall not be granted an extension of time or extra compensation due to delay caused by sampling, testing, approval, or disapproval of cobble protection material under the requirements of these Specifications.
- (j)** Due to the anticipated quarry preparatory time, and/or demand for the cobble material as specified in the Contract, the Contractor shall make all necessary arrangements with the source of supply in a timely fashion, so that the Contractor shall maintain an adequate supply of cobble material, and also so that work shall not be unnecessarily delayed due to insufficient supply.

SPECIAL PROVISIONS
SP – 3

BOULDER TOE PROTECTION

DESCRIPTION. Furnish, transport, install, and maintain boulder toe protection within the stream channel, as specified in the Contract Documents or as directed by the Engineer.

REFERENCES.

Boulder Material	Refer to special provision for SP – 1 for material and dimensions.
Cobble Material	Refer to special provision for SP - 2 for material and dimensions.
Geotextile Filter Fabric	Refer to 2014 NMDOT Standard Specifications for Highway and Bridge Construction, Section 604.

CONSTRUCTION. Boulder toe protection installation shall follow:

- (a) If bedrock is present in the area of installation, boulders shall still be required unless approval for elimination is obtained from the Engineer. For example, where bedrock is friable and can be trenched, the boulders will be required. In areas where bedrock is resistant, the Engineer shall determine whether or not to eliminate a boulder course.
- (b) Excavation shall be minimized where installation of the boulder toe protection may damage tree roots at the direction of the Engineer. Reducing the length of the boulder toe protection or eliminating trenching for footer rock shall be considered. This decision shall be field determined and authorized by the Engineer.
- (c) Excavate a trench to accommodate the installation. Place geotextile as per section 604 “Soil and Drainage Geotextile” at the bottom of the trench and parallel to the trench. Exercise care in the placement of material to prevent puncture of the geotextile.
- (d) Place the boulders rocks on top of the geotextile at the bottom of the trench abutting one another. Embed into the stream bottom substrate. Place boulders so the tops of the rocks are even with the proposed channel thalweg.
- (e) Fill voids between boulders and geotextile with cobble. Arrange cobbles so that smaller rocks cannot be washed through openings between boulders.

SPECIAL PROVISIONS

3 – BOULDER TOE PROTECTION

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- (f) Fold the geotextile forward over the boulders and backfill the trench behind the boulders, cobble, and geotextile with appropriate fill material. Fold the geotextile back over the fill material and place a course of boulder and cobble material. Once backfilled, fold the geotextile back over the fill material. Continue this process until the proper numbers of courses are placed to achieve the proposed elevation specified in the Contract Documents.
- (g) Key in the upstream end of the boulder toe protection a minimum of one boulder.
- (h) Backfill behind top course with the appropriate fill material to the proposed elevation as specified in the Contract Documents. Compact and backfill the fill material in 1 foot layers. Fold geotextile (filter fabric) back over the compacted backfill and key in a minimum of 1 foot.
- (i) Construct the boulder toe protection so the exposed face of the rocks is flush with the proposed grade as shown in the Contract Documents.
- (j) Reshape slopes and stream bottom to specified elevations upon completion of work.
- (k) Remove unsuitable and surplus rocks and excavated materials to fill areas or approved off-site locations.

MEASUREMENT AND PAYMENT. Boulder Toe Protection will be measured and paid for at the Contract unit price per cubic yard of boulder toe protection installed. Materials include boulders, cobbles, and geotextile (filter fabric). The payment will be full compensation for the transport of all materials, excavation, installation, and maintenance, and for all material, labor, equipment, tools, and incidentals necessary to complete the work as specified in the Contract Documents.

SPECIAL PROVISIONS
SP - 4

BOULDER CASCADE

DESCRIPTION. Furnish, transport, install and maintain boulder cascade within the stream channel, as specified in the Contract Documents or as directed by the Engineer.

REFERENCES.

Boulder Material	Refer to special provision for SP – 1 for material and dimensions.
Cobble Material	Refer to special provision for SP - 2 for material and dimensions.
Geotextile Filter Fabric	Refer to NMDOT Standard Specifications for Highway and Bridge Construction, Section 604.

CONSTRUCTION. Boulder cascade installation shall follow.

- (a) Begin construction at the downstream most extent of the structure. Construct the boulder cascade so that boulders perpendicular to the channel taper downstream in an arc formation with the center of the arc set in the thalweg of the stream channel furthest upstream. Construct the rock cascade according to the locations and elevations as indicated in the Contract Documents.
- (b) If bedrock is present in the area of installation, boulder material shall still be required unless approval for elimination of boulders is obtained from the Engineer. For example, where bedrock is friable and can be trenched, footer boulders will be required. In areas where bedrock is resistant, the Engineer shall determine whether or not to eliminate footer boulders.
- (c) Excavate a trench or raise the invert of the channel by backfilling and compacting fill material in 1 foot lifts to prior to placing boulders. At the direction of the Engineer, excavation shall be minimized where installation of the boulder cascade may damage tree roots.
- (d) Place geotextile at the bottom of the excavated trench and parallel to the trench or place geotextile along compacted fill material where the footer boulders are proposed to be placed. Exercise care in the placement of boulders to prevent puncture of the geotextile.
- (e) Place footer boulders on top of geotextile. Embed footer boulders firmly into the stream bottom substrate. Backfill behind the footer boulders with native material before the top boulders are set. Take care to fill all voids between the footer boulders with cobble material. Small voids shall be chinked by hand. Fold the geotextile back over the substrate material prior to placing top boulders.

- (f) Place top boulders on footer boulders. Place top boulders to fit snugly against each other. Take care when placing top boulders so that the seams between top boulders do not line up with the seams between the footer boulders. Place the top elevation of the top boulders at the centerline of the stream so the boulders are flush with the proposed stream grade as shown on the Contract Documents. Taper adjacent boulders up to the top of bank starting at the thalweg.
- (g) Fold the geotextile back over the top boulder and backfill behind with cobble material to the proposed elevation as specified in the Contract Documents. Fold geotextile back over the fill material. Trim any excess geotextile to be 6 inches below boulder. Geotextile to extend downstream beyond footer boulder approximately 3 feet at an elevation of approximately 6 inches below downstream toe.
- (h) Embed the outermost boulders into the existing bank as shown on the Contract Documents.
- (i) Backfill behind the keyed-in top boulder to the proposed elevation as specified in the Contract Documents. Backfill above the keyed-in top boulder within a minimum of 6 inches and to the proposed elevation as specified in the Contract Documents. Backfill and compact the fill material in 1 foot layers.
- (j) Boulder Cascade A-axis will be oriented in direction of channel flow. Footer boulders A-Axis will be oriented perpendicular to channel flow.
- (k) Place cobble material to the proposed invert elevation as shown in the Contract Documents. Fill all voids chinked with cobble material.
- (l) Remove unsuitable and surplus boulders and excavated materials to fill areas or approved off-site locations.

MEASUREMENT AND PAYMENT. Boulder Cascade materials include boulder materials, cobble material, and geotextile (filter fabric), and will be measured and paid for at the Contract unit price per linear foot from bank to bank of the channel width, measured along the “neat line” as shown in the Contract Documents. Boulder Cascades require approximately 2.0 cubic yards of boulder material and 1.0 cubic yards of cobble material per linear foot as measured along the “neat line”. Payment will be full compensation for the transport of all materials, excavation, installation, and maintenance, and for all material, labor, equipment, tools, and incidentals necessary to complete the work as specified in the Contract.

SPECIAL PROVISIONS
5 – POST VANE

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SPECIAL PROVISION
SP - 5

POST VANE

DESCRIPTION. Furnish, transport, and install post vane structures within the stream channel and key lines across the overbank as shown on the plans and as specified in the Contract Documents or as directed by the Engineer.

REFERENCES.

Posts	Wood posts shall be sound, de-barked juniper with minimum 6 to 8 inch diameter tips.
Cobble Material	Refer to special provision for SP - 2 for material and dimensions.
Riprap Class C	Refer to NMDOT Standard Specifications for Highway and Bridge Construction, Section 602.

CONSTRUCTION. Post Vane installation shall follow:

- (a) Locate the position for the apex of the vane at bankfull elevation per the Contract Documents. Mark the location of the lines of posts in the locations shown on the plans for the in-channel portion of the vane and the key in line on the overbank, if applicable.
- (b) Measure and mark the locations of each post according to the spacing shown on the plans. Stockpile the posts near the vane location.
- (c) Ensure that posts are long enough to install to the lines and grades shown on the plans. Posts may be installed by trenching to design depth and placing posts at the bottom of the trench. The contractor shall take care to use safe practices as outlined in OSHA Standard #1926 Subpart P for Trench Safety. Secure posts so they are not disclosed during backfill operations.
- (d) Install bottom layer of Class C riprap to the dimensions as stated in the Contract Documents. Ensure posts have not been dislodged by riprap installation. Minimize riprap voids between posts.
- (e) Backfill and compact in 12" lifts to the depth shown in the Contract Documents. The first lift above the riprap may require additional material and vibratory plate compactive effort to fill the voids in the riprap below.
- (f) Install middle layer of Class C Riprap to the dimensions stated in the Contract Documents. Minimize riprap voids between posts.

SPECIAL PROVISIONS

5 – POST VANE

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- (g) Backfill and compact in 12” lifts to the depth shown in the Contract Documents. The first lift above the riprap may require additional material and vibratory plate compactive effort to fill the voids in the riprap below.
- (h) After all the posts have been placed to the correct depth, mark and cut the tops of posts. The apex or bank end is marked at bankfull elevation and the tip end is marked at design channel bottom elevation plus 2 inches. Stretch a string between these marks and cut the posts to the line. It may be beneficial to postpone the final backfill lift to allow for easier cutting.
- (i) Install surface cobbles at the apex on the upstream side of the post vane as shown in the Contract Documents.
- (j) Place backfill material between the vanes, shape the finished channel bank from the bankfull elevation down to the channel bottom.
- (k) Remove cutoff post ends from the job site. Relocated any unsuitable or surplus cobbles and excavated materials to fill areas or approved off-site locations.

MEASUREMENT AND PAYMENT. Post vanes including cobbles and riprap, will be measured and paid for at the Contract unit price per linear foot of post vane installed, as measured from center to center of posts. Payment will be full compensation for the transport of all materials, excavation, installation, and maintenance, and for all material, labor, equipment, tools, and incidentals necessary to complete the work as specified in the Contract.