TORTUGAS ARROYO IMPROVEMENTS

BID & CONTRACT DOCUMENTS

VOLUME 2 of 2: PROJECT SPECIFICATIONS

Southern Sandoval County Arroyo Flood Control Authority

IFB # 2025-01

SSCAFCA PROJECT NUMBER: MO-P0007

STATE FUNDING SOURCE:
SAP 21-F2370-STB

FEDERAL FUNDING SOURCES:
USACE/SSCAFCA Agreement – Section 595

January 2025

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Specifications

Supplemental Data

SECTION 31- Inline Check Valve

DESCRIPTION

31.01.01 General. Install one (1) 24-inch inline check valve. The valve will be manufactured in accordance with the attached specification. Check valves are delivered at the site six weeks after the PO has been issued.

WORKMANSHIP

31.02.01 Workmanship. The manufacturer is responsible for the accurate manufacture and fabrication of the equipment in accordance with the best modern practice and the requirements of these specifications and drawing. All work is performed and completed in a thorough workmanlike manner by mechanics skilled in their various trades. The inline valve shall be slip-in style with an expandable stainless steel retaining ring.

PRODUCT

31.03.01 General. The valve is a one-piece rubber construction with internal fabric reinforcing all vulcanized into a composite material. The amount and configuration of the internal reinforcing is sufficient to maintain structural integrity of the valve under the specified operating conditions and allowable headloss value.

The slip-in style check valve will be furnished with a set of stainless steel expansion clamps. The clamps will secure the valve in place and shall be installed inside the cuff portion of the valve, and shall expand outwards by means of a turnbuckle.

Install per the manufacturer's installation instructions and operations manual and approved submittals.

VALVE CHARACTERISTICS

31.03.01 General. The valve manufacturer will have a minimum of fifteen (15) years of experience in fabrication and installations for valves of the same size as required within these specifications.

Manufacturer will have conducted independent hydraulic testing to determine headloss and jet velocity characteristics on a representative set of valves. The testing must include multiple construction (stiffness) within each size designated by backpressure rating and must have been conducted for free discharge (discharge to atmosphere) and submerged conditions. Refer to submittal documents section for the required submittal documentation.

Manufacturer will have conducted independent hydraulic testing where multiple valves (at least four) of the same size and construction (stiffness) were tested to validate the submitted headloss characteristics and to prove the repeatability of the manufacturing process to produce the same hydraulic characteristics. Refer to the submittal documents section fro required submittal documentation.

Manufacturer will have conducted Finite Element Analysis (FEA) on representative

duckbill valve sizes to determine deflection, stress and strain characteristics under various load conditions. Modeling must have been done for flowing conditions (positive differential pressure) and reverse differential pressure. Refer to submittal documents section for required submittal documentation.

The following valves predetermine characteristics will be met:

Size:	24-inch
Design Max Flow Rate:	2.5 cfs
Inlet Pressure:	10 feet (min)
Back Pressure:	10 feet (min)

MATERIALS

31.03.01 General. Materials used for the valve will conform to the requirements of the following material schedule.

Material	24-inch	ASTM Standard
Cover Elastomer	Neoprene	ASTM D1418
Tube Elastomer	Neoprene	ASTM D2000
Reinforced Fabric	Polyester/ EPDM	ASTM D1418
Retaining Ring	SST 316	ASTM A276

Materials specified by ASTM or other standard specifications are minimum requirements. Better grades of material may be submitted at the Contractor's option.

COORDINATION OF DESIGN

31.03.01 General. The contractor is responsible for a fully coordinated design.

SUBMITTAL DOCUMENTS

31.04.01 Measurement. The following documents must be submitted in their entirety within one complete package; submittal packages not including all of these items will be deemed incomplete and rejected without review. The following is an itemized list of documents to be included within the submittal package.

i. Valve Dimensional Drawing
ii. Valve Installation Orientation Drawing
iii. Verification of Independent Laboratory Testing for Headloss and Velocity tests of check valves
iv. Verification of Independent Laboratory Testing of Backpressure Capacity of check valves.
v. Verification of Independent Laboratory Testing for manufacturing consistency of check valves of the same size and construction.
vi. Verification of Finite Element Analysis (FEA) conducted.
vii. Hydraulic Curve for the 24-inch valve showing headloss versus flow, operating point and backpressure capacity.
viii. Installation, Operation, and Maintenance Manual.

The following defines the specific requirements for each submittal item:

a. Valve Dimensional Drawing – a scaled drawing of the actual valve, generic drawings with listed dimensions will not be accepted. Dimensions required on the drawing include the following;
    i. Overall Length
    ii. Nominal Diameter
    iii. Number of Clamps
    iv. Cuff Depth
    v. Back Pressure Rating
b. Valve Installation Orientation Drawing - a scaled drawing of the actual valve, generic drawings with listed dimensions will not be accepted. The drawing will show the valve installed on the pipe from side view and front view showing the bill opening orientation. Adjacent floor elevations and wall locations showing dimensionally and graphically accurate.

SHIPPING REQUIREMENTS

31.03.01 General. The elastomer check valve will be placed on a pallet with the cuff portion seated flush against the surface of the pallet and the bill portion facing upward; shipping the valve on it's side in any manner will not be accepted. The manufacturer will provide supplemental supports and bracing to the interior and/or exterior to maintain shape and form of the valve through the packaging and shipping process. The valve will be adequately strapped to the pallet to prevent movement while handling and moving the entire pallet assembly; strapping shall not cause deflection or deformation of the valve. The valve shall be externally covered in clear plastic static wrap prior to leaving the manufacturing facility.

The elastomer check valve will be stored in a cool, dry location and remain packaged on the shipping pallets for storage periods prior to installation. Do not remove any bracing or shipping rings until the valve is to be installed. During the storage period, avoid exposure to UV light, corrosive chemicals, and concentrated noxious gases (i.e. Ozone).

Refer to the manufacturer's Installation, Operation and Maintenance Manual for handling procedures of the valve during installation and proper use of lifting clevis and clamp rings.

Purchase order numbers and model numbers shall provide a shipping document to department of water resources identifying the valve. Shipping shall be F.O.B. destination. An inspection will be performed upon delivery to insure that the valve is free of damage.

All deviations from Specification will be clearly identified and submitted to DWR Engineer through the contractor as a Change Order and any other information necessary for DWR Engineer to determine compliance with specification.

WARRANTY

31.03.01 General. Warranty will be for a period of 1 year on labor, material, and workmanship. Warranty will commence after installation but not to exceed six months from purchase.

BASIS OF PAYMENT

31.05.01 Payment. The accepted quantity, measured as provided above, will be paid for at the contract price per unit of measurement for the pay item listed below that is shown in the proposal. Payment will be full compensation for the work, including installation, as prescribed in this Section.

Payment will be made under:

Pay Item	**Pay Unit**
Duckbill Valve	Each

APWA (2006) SECTION 201

CLEARING AND GRUBBING

Revised 07/24/2020

This specification applies to bid item numbers:
2: Clearing and Grubbing

This work shall consist of removing natural and man-made objectionable material from the right-of-way, construction areas, road approaches, material and borrow sites, areas through which ditches and channels are to be excavated, and such other areas as may be shown on the plans. Clearing and grubbing shall be performed in advance of the grading operations. Clearing and grubbing shall be in accordance with the requirements herein specified, such as erosion control requirements. Demolition of structures, other than foundations or slabs, shall be as shown on the plans.

No changes to SSCAFCA Supplemental Specification.

SUPPLEMENTAL TECHNICAL SPECIFICATION

APWA (2006) SECTION 201

CLEARING AND GRUBBING

Revised 07/24/2020

1. In the Subsection 201.1 GENERAL, delete the second sentence and replace with the following: Clearing and grubbing shall be performed in advance of the grading operations.

2. In the Subsection 201.4.1 CONSTRUCTION METHODS, add the following:

   Clearing and grubbing operations shall include stripping of the existing ground surface. Stripping shall be achieved only by cutting, i.e., ground depressions or narrow sections of tributary arroyos should not be inadvertently filled during the foundation preparation. The resulting area shall be cut to provide a uniform, relatively level surface.

3. In Subsection 201.5 LIMIT LINES, add the following:

Unless otherwise approved by the Engineer or otherwise specifically designated on the plans, limits of clearing & grubbing shall not exceed slope limits as shown with finished grade contours on plans.

END OF SECTION

SECTION 201

CLEARING AND GRUBBING

201.1 GENERAL

This work shall consist of removing natural and man-made objectionable material from the right-of-way, construction areas, road approaches, material and borrow sites, areas through which ditches and channels are to be excavated, and such other areas as may be shown on the plans. Clearing and grubbing shall be performed in advance of grading operations except that in cuts over 3 feet in depth, grubbing may be done simultaneously with excavation, provided stumps, roots, embedded wood, foundations and slabs are removed as specified. Clearing and grubbing shall be in accordance with the requirements herein specified, such as erosion control requirements. Demolition of structures, other than foundations or slabs, shall be as shown on the plans.

201.2 REFERENCES

201.3 PRESERVATION OF PROPERTY

Existing improvements, adjacent property, utility and other facilities, and trees and plants not to be removed shall be protected from injury or damage resulting from the CONTRACTOR's operations. Only trees and plants designated or marked for removal by the ENGINEER shall be removed.

201.4 CONSTRUCTION METHODS

201.4.1 The natural ground surface shall be cleared of vegetable growth, such as trees, tree stumps, logs, roots or downed trees, brush, grass, weeds, and surface boulders, as well as fences, walls, rubbish, foundations and slabs.

201.4.2 Unless otherwise shown on the plans, the entire area of the project within the limit lines specified below shall be cleared and grubbed. No payment will be made to the CONTRACTOR for clearing and grubbing outside these limits, unless such work is authorized by the ENGINEER.

201.5 LIMIT LINES: Except when limit lines for clearing and grubbing are shown on the plans or are staked by the ENGINEER, clearing and grubbing shall extend only within reasonable limits of the work area.

201.6 REMOVAL OF TREES AND TREE BRANCHES

201.6.1 Trees shall be removed in such a manner as not to injure standing trees, plants, and improvements which are to remain. Tree branches extending over a roadway and which clear finish grade by 12 feet or less shall be cut off close to the boles in a workmanlike manner.

201.6.2 Trees requiring trimming to facilitate normal construction operations shall be trimmed by a tree surgeon.

201.7 REMOVAL AND DISPOSAL OF DEBRIS

Debris to be removed shall be disposed of outside the right-of-way at a location satisfactory to the ENGINEER, except when burning of combustible debris is permitted. The area to be graded and adjacent areas shall be left with a neat and finished appearance. No accumulation of flammable material shall remain on or adjacent to the property line. In case burning precedes construction operations, the piles may be placed in the center of the area; otherwise, the piles shall be placed in the most convenient location at the side of the area and beyond slope lines where they may be burned without damage to surrounding forest cover or adjacent property. Burning shall be done in conformance with local regulations and at such times and in such manner as to prevent the fire from spreading to areas adjoining the construction site. In areas where burning is prohibited by local regulations, all removed material shall be disposed in an approved solid waste disposal site.

201.8 REMOVAL AND DISPOSAL OF SALVAGEABLE ITEMS

Items and materials of salvage value as shown on the plans or as determined by the ENGINEER, unless incorporated in the new work, shall remain the property of the OWNER and shall be delivered to approved storage areas as directed by the ENGINEER. Such items and materials shall be carefully removed and delivered in such a manner as to permit re-use.

201.9 MEASUREMENT AND PAYMENT

201.9.1 CLEARING AND GRUBBING:

201.9.1.1 When the proposal includes an item for clearing and grubbing, the quantity for measurement shall be as indicated in the Bid Proposal.

201.9.1.2 The unit price per acre paid for clearing and grubbing shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in clearing and grubbing as shown on the plans, as provided in these specifications and as directed by

the ENGINEER, including the removal and disposal of resulting material.

201.9.1.3 When the Bid Proposal does not include a pay item for clearing and grubbing as above specified and unless otherwise specified in the Supplementary Specifications, full compensation for any necessary clearing and grubbing required to perform construction operations specified shall be considered as included in the price paid for other items of work and no additional compensation will be allowed therefore.

201.9.2 REMOVAL AND DISPOSAL OF TREES: If the Bid Proposal includes separate estimates of quantities for the removal of trees, the trees shall be classified by size as follows:

201.9.2.1 Trees less than 12 inches in circumference at 3 feet above the original ground surface shall be considered as included in the price for clearing and grubbing or excavation, and no additional compensation will be allowed therefor.

201.9.2.2 Trees between 12 and 30 inches in circumference shall be measured as a unit price for each tree in the item provided in the Bid Proposal for trees of this dimension.

201.9.2.3 Trees more than 30 inches in circumference shall be measured as a unit price for each tree in the item provided in the Bid Proposal for trees of this dimension.

TECHNICAL SPECIFICATION 203

EXCAVATION, BORROW AND FILL

This specification applies to bid item numbers:
3: Unclassified Excavation
4: Structure Excavation
5: Structure Backfill
12 – 14: Riprap
15: Rock Mulch
29: Rock Core (Filtration Structure)

SSCAFCA Technical Specification 1510 Excavation, Borrow and Fill is modified to read as follows:

203.1 GENERAL

Excavation, borrow, and fill shall consist of all earthwork operations involved in grading and construction in accordance with the Plans and specifications, including excavation and structural fill for structures; excavation and trench backfill for trenching; riprap; rock mulch; and volcanic rock (filtration structure); except for any other earthwork operations separately designated.

203.2 REFERENCES

This section incorporates the following publications by reference:

- ASTM C88
- ASTM C117
- ASTM C131
- ASTM C136
- ASTM D422
- ASTM D1556
- ASTM D1557
- ASTM D2487
- ASTM D4318
- ASTM D4718
- ASTM D6938
- NMDOT Standard Specifications for Highway and Bridge Construction (NMDOT)
- NMDOT Special Provisions Modifying Section 602.2.1 (September 29, 2021)
- OSHA Excavation Standards - 29 CFR Part 1926 Subpart P Excavations
- SSCAFCA Supplemental Technical Specification STS-201 – Clearing And Grubbing
- SSCAFCA Technical Specification 1513 – Construction Staking

203.3 MATERIAL CLASSIFICATIONS

203.3.1 UNSUITABLE MATERIAL

Unsuitable materials shall include all material that contains debris, roots, organic matter, stones, cobbles or boulders too large to be used in the intended construction, frozen material, contaminated material, or other materials that are determined by the Engineer to be unsuitable. Otherwise, suitable material which is unsuitable due to excess moisture content will not be classified as unsuitable material unless it cannot be dried by manipulation, aeration or blending with other materials satisfactorily as determined by the Engineer.

Material that is unsuitable for the intended use shall be excavated and removed from the site or otherwise disposed of as approved by the Engineer. Unsuitable material shall be disposed of in accordance with environmental requirements and as approved by the Engineer.

The removal and disposal of such unsuitable material will be paid for as excavation, removal and disposal for the quantities involved.

203.3.2 FILL & BACKFILL MATERIAL - GENERAL

All fill material shall be free of vegetation and debris. Clods or hard lumps of earth of 6 inches or larger in greatest dimension shall be broken up. Fill materials shall be free of vegetation and debris and contain no rocks larger than 3 inches. All fill and backfill material, including selection and blending of material, shall be subject to approval by the Engineer. All fill material shall conform to the requirements for the class of material as outlined below.

203.3.3 STRUCTURAL FILL AND STRUCTURE BACKFILL

Structural fill and structure backfill shall consist of material excavated from on-site or borrow material that meets the requirements described in this section. The blended excavated site soils from within the area will be generally suitable for use as structural fill. Blending of soils shall be considered incidental to the Work and no separate payment will be made for this effort. Gradation of structural fill and structure backfill material, as determined in accordance with ASTM D422, shall be as follows:

Sieve Size (Square Openings)	Percent Passing (by Weight)
3 inch	100
No. 4	60 – 100
No. 200	5 – 40

All structural fill and structure backfill shall be blended as necessary to produce a homogeneous material. The plasticity index of the structural fill shall be a maximum of 15 when tested in accordance with ASTM D4318.

203.3.4 BORROW MATERIAL

Borrow material is defined as material obtained from an approved borrow source to

be used as structural fill and trench backfill material for construction. If borrow material is required, the Contractor shall identify a borrow source and tests shall be performed to verify compliance of the material with structural fill requirements of this specification. The Contractor shall not import any borrow material prior to verification that the material meets the requirements contained herein and he has received approval to import the material by the Owner.

Select borrow material to meet the requirements and conditions of the specific class of fill or embankment for which it is to be used. Unless otherwise provided in the Contract, the Contractor is responsible for obtaining the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling from the borrow source owners. Unless specifically provided, borrow shall not be obtained from within the limits of the project site without prior written approval.

Borrow material obtained from an approved source for use as structural fill and trench backfill shall conform with the following requirements as determined in accordance with ASTM D422 and ASTM D4318:

Sieve Size (Square Openings)	**Percent Passing (by Weight)**
3 inch	100
No. 4	60 – 100
No. 200	5 – 40

The plasticity index of the borrow material fill shall be a maximum of 15 when tested in accordance with ASTM D4318.

203.3.5 GEOTEXTILE SEPARATION FABRIC

Geotextile separation fabric shall conform to the requirements of the NMDOT Standard Specifications for Highway and Bridge Construction, Section 604 Class 3 Separation Geotextile.

203.3.6 RIPRAP

Riprap rock fragments shall be sufficiently durable to ensure permanence in the structure and the environment in which the riprap is to be used. Riprap rock fragments shall be free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Riprap rock shall meet the requirements for Class and Size of Riprap as specified in the Plans and these specifications. Riprap rock shall have a minimum specific gravity of 2.65 and shall not include more than trace quantities of dirt, sand, clay, and rock fines.

Riprap rock shall comply with the requirements of NMDOT Section 602 and the NMDOT Special Provisions Modifying Section 602.2.1 including Tables 602.2.1:1 and 602.2.1:2 as follows:

Riprap Classification, Minimum Dimension & Nominal D50 Value

Riprap Class	Minimum Dimension (inches)	Nominal D50 (feet)
A (Non-enclosed)	4	0.75
B (Non-enclosed)	6	1.25
USACE Class VIII	See Plans	See Plans

Minimum thickness of 150% of Nominal D50 or as defined in the plans (whichever is larger).

The Contractor shall provide the following information to the Engineer at the Pre-Construction Conference:

1. One copy of applicable test results fulfilling requirements, as specified in the Plans.
2. Written acknowledgement from each riprap rock supplier, on the supplier's letterhead, verifying that the supplier can provide the quantity and gradations of for each Class of riprap rock materials required to complete the project.

The Contractor shall provide a sample of at least five (5) tons of the proposed riprap rock which meets the gradation and durability requirements as specified above. The Contractor must receive approval of the riprap rock sample from the Engineer prior to delivery of the remaining quantities of riprap rock to the project site. All samples provided shall be thoroughly cleaned and washed and shall be spread at the required depth, per plans, with a staked sign identifying the riprap Class and source. All samples shall be maintained and protected on-site for comparison until the full quantity of riprap rock required to complete the project has been delivered and placed. After such time, the sample material may be placed as part of the production riprap material, as approved by the Engineer.

Riprap filter layer material shall be obtained from an approved source and shall comply with the requirements of NMDOT Section 509 with the following gradations, determined in accordance with ASTM D422:

Riprap Filter Layer 1 (Top)
NMDOT Table 509.2.3.2.1:1
Coarse Aggregate Gradation Requirements – 1.5-inch Material
with modifications

Sieve Size (Square Openings)	Percent Passing (by Weight)
3 inch	100
2 inch	85 – 100
¾ inch	35 – 70
3/8 inch	10 – 30
No. 4	0 – 5
No. 200	0.0 – 2.0

Note: gradation for 1.5-inch material is modified from NMDOT Table 509.2.3.2.1:1.

Riprap Filter Layer 2 (Bottom)
NMDOT Table 509.2.3.3.1:1
Fine Aggregate Gradation Requirements

Sieve Size (Square Openings)	Percent Passing (by Weight)
3/8 inch	100
No. 4	90 – 100
No. 8	70 – 95
No. 16	45 – 60
No. 30	25 – 60
No. 50	5 – 30
No. 100	0 - 8
No. 200	0.0 – 3.0

203.3.7 ROCK MULCH

Rock mulch shall be graded material and shall be angular, free of calcareous coating, caliche, organic matter, or other foreign substances.

The percentage wear of the rock mulch shall be a maximum of 40 after 500 revolutions as determined by ASTM C131, Grading B.

The aggregate comprising the rock mulch shall be well graded when tested in accordance with ASTM C136 and ASTM C117. The gradation of the rock mulch shall conform with the following requirements:

Sieve Size (Square Openings)	Percent Passing (by Weight)
3 inch	100
2 inch	40 - 60
1 inch	10 - 15

Rock mulch shall be of an integral color with a tone and overall cast as approved by the Owner and shall be approved by the Engineer prior to processing and placement.

Rock mulch approved for construction shall be acquired from a single source.

The Contractor shall provide the following information to the Engineer at the Pre-Construction Conference:

1. One copy of applicable test results fulfilling requirements, as specified in the Plans.
2. Written acknowledgement from each rock mulch supplier, on the Supplier's letterhead, verifying that the Supplier can provide the quantity and gradations of all rock mulch materials required to complete the project.

Contractor shall provide a sample of at least five (5) tons of the proposed rock mulch which meets the gradation and durability requirements, as specified above. The Contractor must receive approval of the rock mulch sample by the Engineer prior to delivery of the remaining quantities of rock mulch to the project site. All samples provided shall be thoroughly cleaned and washed and shall be spread at the required depth, per plans, with a staked sign identifying the product color, size, and source. All samples shall be maintained and protected on-site for comparison until the full quantity of rock mulch required to complete the project has been delivered and placed. After such time, the sample material may be placed as part of the production rock mulch material, as approved by the Engineer.

203.3.8 VOLCANIC ROCK (FILTRATION STRUCTURE)

Volcanic Rock (filtration structure) Core Rock shall be well-graded when tested in accordance with ASTM C136 and ASTM C117. The gradation of the Core Rock shall conform with the following requirements:

Core Rock Gradation

Sieve Size (Square Openings)	Percent Passing (by Weight)
8 inch	100
6 inch	50 - 70
4 inch	30 - 55
2 inch	< 10

Volcanic rock shall have a minimum specific gravity of 2.30.

The maximum permissible loss of the volcanic rock shall be 20 percent when tested in accordance with ASTM C88.

The maximum percent loss of the volcanic rock shall be 50 percent when tested in accordance with ASTM C131, Grading A.

203.3.9 DISPOSAL OF SURPLUS MATERIAL

The Contractor shall make all arrangements for disposal of surplus material in accordance with environmental requirements and as approved by the Engineer. If the material is disposed of on-site, the Contractor shall place material in locations as designated by the Owner. Do not remove materials from the project limits without the approval of the Owner. The Contractor shall satisfy himself that there is sufficient material available for the completion of all items requiring fill material before disposing of any indicated surplus material inside or outside of the project site. Any shortage of material caused by premature disposal of surplus material by the Contractor shall be replaced by the Contractor and no payment will be made for such replacement.

The Contractor shall not dispose of excavated material such that the flow of any stream is obstructed, a partly finished structure endangered, the efficiency or appearance of any structure impaired, or in a manner that is detrimental to the completed work in any way.

203.4 CONSTRUCTION REQUIREMENTS

203.4.1 GENERAL

Contractor shall perform necessary clearing, grubbing, and stripping of topsoil in accordance with Section 201 of the Specifications and Supplemental Technical Specification STS-201 - Clearing and Grubbing, prior to any excavation, grading, or other earthwork operations. Excavation, fill construction and backfill shall be finished to reasonably smooth and uniform surfaces.

Surface water and subsurface water encountered during construction shall be controlled, collected, and disposed of. Storm drainage features (ponds/basins) shall be constructed at the

earliest stages of site development, and the construction area shall be graded throughout construction to provide positive surface water runoff away from the construction activity, or temporary ditches, swales, and other drainage features and equipment shall be provided as required. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, the unsuitable soil material shall be removed, and new soil material provided. The Contractor shall be responsible for assessing the soil moisture and groundwater conditions and for employing necessary measures to permit construction to proceed.

All slopes and cuts should be made in accordance with the OSHA excavation standards contained in 29 CFR Part 1926 Subpart P Excavations, and all applicable State of New Mexico and local regulations.

203.4.2 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of 4 inches. Spread topsoil on areas already graded and prepared for topsoil, or transport and deposit in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified in the Plans. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Stockpile at locations indicated on the Plans.

203.4.3 EXCAVATION – GENERAL REQUIREMENTS

Excavation shall consist of the removal of earth involved in grading and construction according to the Plans.

Excavation of every type of material encountered within the limits of the project shall be performed to the lines, grades, and elevations indicated on the Plans. Suitable excavated materials which meet the requirements for fill shall be placed within the limits of the Work. Unsuitable materials encountered within the limits of the Work below grade shall be excavated and replaced with suitable materials of the applicable material class as directed. Surplus suitable excavated material not required for fill and unsuitable excavated material shall be disposed of as specified in DISPOSAL OF SURPLUS MATERIAL. During construction, excavation and fill shall be performed in a manner and sequence which maintains positive surface drainage at all times.

Temporary construction excavations shall be made in accordance with OSHA excavation standards contained in 29 CFR Part 1926 Subpart P Excavations, and all applicable State of New Mexico and local regulations.

Surface water shall be routed such that it does not flow down the face of the excavation slopes. Where insufficient space exists for open cut excavations, a shoring system will be required. All required shoring systems shall be considered incidental to the cost of excavation and no additional payment will be made for the shoring system.

203.4.3.1 EXCAVATION OF BASINS, CHANNELS, DITCHES AND EMBANKMENT FOUNDATION AREAS

Excavation of basins, channels, ditches, and embankment foundation areas shall be finished by cutting accurately to the cross sections, grades, and elevations shown on the Plans. Basins, channels, ditches, and embankment foundation areas shall not be over-excavated below grades shown. Over-excavated areas shall be backfilled with suitable thoroughly compacted fill material to the finished grades shown. Excavated material shall be disposed of as shown or as directed. Excavations shall be maintained free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the Work.

203.4.3.2 EXCAVATION OF DRAINAGE STRUCTURES

Excavations shall be made to the lines, grades, and elevations shown on the Plans, or as directed. Trenches and foundation pits of sufficient size shall be provided to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Disintegrated rock and thin strata shall be removed. Excavation bottoms shall not be disturbed when concrete is to be placed in an excavated area. Excavation to the final grade level shall not be performed until just before the overlying concrete is to be placed.

203.4.3.3 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, sand boils, uplift, and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches, or trenches shall not be permitted within 3 feet of the foundation of any structure, except with specific written approval of the Engineer, and after specific Contractual provisions for restoration of the foundation area have been made. Groundwater control measures shall be taken by the time the excavation reaches the groundwater level to maintain the integrity of the in-situ material. While the excavation is open, the groundwater level shall be continuously maintained at least 3 feet below the working level.

203.4.3.4 Trench Excavations

Pipe trenches shall be excavated in accordance with the Plans and as recommended by the manufacturer of the pipe to be installed. Trench walls shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in, as determined by the Contractor's Safety Engineer or other competent person. Special attention shall be given to excavation slopes which may be adversely affected by weather or moisture content. The trench width shall be as specified on the plans. Where the recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be provided by the Contractor. The Contractor shall be responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Owner.

203.4.3.4.1 Trench Bottom Preparation

Trench bottoms shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

203.4.3.4.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, such material shall be removed to a depth of 4 inches below the required grade and replaced with suitable material as provided in FILL CONSTRUCTION and PLACING AND COMPACTING.

203.4.3.4.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in FILL CONSTRUCTION and PLACING AND COMPACTING. When removal of unstable material is required due to the Contractor's fault or neglect in performing the Work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Owner.

203.4.3.5 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. Unstable material, rock and loose debris shall be removed, and the cut made to a firm surface either level, stepped, or serrated, as shown on the Plans or as directed by the Engineer. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be performed until just before the concrete or masonry is to be placed.

203.4.3.6 EXCAVATION SHORING

Shoring, including sheet piling, shall be furnished and installed as necessary to protect workers, banks, adjacent paving, structures, and utilities. The Contractor shall submit a Shoring and Sheeting Plan to the Engineer for approval 15 days prior to starting shoring and sheeting Work. The Plan shall include drawings and calculations, certified by a Registered Professional Engineer in the State of New Mexico, describing the methods for shoring and sheeting of excavations. Shoring and sheeting shall be removed as excavations are backfilled in a manner to prevent caving.

203.4.4 Underground Utilities

The Contractor shall be responsible for movement of construction machinery and equipment over pipes and utilities during construction. For Work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavation shall be by hand. Uncovered lines or other existing Work affected by the excavation shall be supported until

approval for backfill is granted by the Engineer. Damage to utility lines or subsurface construction shall be immediately reported to the Owner and Engineer.

203.4.5 Structure Excavation

The Contractor shall ensure that footing subgrades have been inspected and approved by the Engineer prior to concrete placement. Over-excavated areas and changes in grade shall be backfilled with fill moisture conditioned to within the range of -3 to +3 percent of optimum moisture content and compacted to a minimum of 95 percent of ASTM D1557 laboratory maximum dry density.

203.4.6 FILL CONSTRUCTION

203.4.6.1 GENERAL

Fill construction shall consist of constructing embankments; placing and compacting approved material within areas where unsuitable material has been removed; placing and compacting suitable backfill materials in trenches, holes, pits, and other depressions; and placing rock riprap, rock mulch and volcanic rock (filtration structure) materials.

Ground surfaces on which fill or backfill is to be placed shall be prepared in conformance with the applicable portions of GROUND SURFACE PREPARATION. Compaction shall be finished by sheepsfoot or padfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the material being compacted.

203.4.6.2 GROUND SURFACE PREPARATION

Unsuitable material shall be removed and replaced with suitable material, on surfaces to receive fill or in excavated areas as directed by the Engineer. The surface shall be scarified to a minimum depth of 8 inches before placement of fill is started.

Sloped surfaces steeper than 4 horizontal to 1 vertical (4H:1V) shall be stepped or benched so that the new fill material will bond with the existing material.

Fill and backfill material shall not be placed on surfaces that are muddy, frozen, or contain frost.

When subgrades are less than the specified compacted density, the ground surface shall be scarified to a minimum depth of 8 inches, pulverized as needed, and moisture conditioned to within the range of -3 to +3 percent of optimum moisture content. The ground surface shall be compacted to a minimum of 95 percent of ASTM D1557 laboratory maximum dry density. When the subgrade is partially fill and partially excavation surface or natural ground surface, the excavated or natural ground portion shall be scarified to a minimum depth of 12 inches and compacted as specified for the adjacent fill.

203.4.6.3 UTILIZATION OF EXCAVATED MATERIALS

Suitable material obtained from excavations shall be used in the construction of fills, embankments, subgrades, bedding, trench backfill, and for similar purposes. Surplus suitable excavated material not required for fill and unsuitable excavated material shall be disposed of as specified in DISPOSAL OF SURPLUS MATERIAL.

203.4.7 PLACING AND COMPACTING FILL AND BACKFILL

203.4.7.1 GENERAL

Fill or backfill, consisting of material approved by the Engineer, shall be moisture conditioned to within the range of -3 to +3 percent of optimum moisture content at the time of compaction and placed in controlled compacted layers not exceeding 8 inches loose thickness with approved compaction equipment, or in loose layers not more than 4 inches in thickness when using hand-operated compaction equipment. All fill material shall be blended as necessary to produce a homogeneous fill. The fill shall be raised uniformly and benched into the native soils. All compaction shall be accomplished to a minimum of 95 percent of ASTM D1557 laboratory maximum dry density. Lifts of fill comprised of high permeability material or material differing substantially from the lift below shall not be permitted.

At locations where it would be impractical to use mobile power compacting equipment, fill layers shall be compacted to the specified requirements by any approved method that will obtain the specified compaction.

Compaction of fill and backfill beneath and adjacent to all types of structures shall be performed in such a manner as to prevent wedging action or eccentric loading upon or against the structure.

203.4.7.2 Trench Backfill

Trenches shall be backfilled to the grades indicated on the Plans. Trench backfill material shall be moisture conditioned to within the range of -3 to +3 percent of optimum moisture content at the time of compaction. Trench backfill shall be compacted to at least 90 percent of ASTM D1557 maximum dry density.

203.4.7.3 Trench Bedding and Initial Backfill

Bedding of the type and thickness shown on the Plans shall be provided. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the top of the pipe. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe, and care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Initial backfill to top of pipe shall be compacted to a minimum of 90 percent of ASTM D1557 laboratory maximum dry density. Bedding and initial backfill materials shall be provided as follows:

Class II:
Coarse sand and gravel with maximum particle size of 1.5 inches, including various graded sands and gravels containing small percentages of fines, generally granular and

noncohesive. Soil Classifications of GW, GP, SW-SM, SP and SP-SM as specified by ASTM D2487 are acceptable as Class II bedding and initial backfill.

Class III:
Clean, coarse-grained silty sand classified as SM soil by ASTM D2487 is acceptable as bedding.

203.4.7.4 Final Backfill

Backfill material shall be placed and compacted within the remainder of the trench in accordance with PLACING AND COMPACTING FILL AND BACKFILL.

203.4.8 STRUCTURE BACKFILL

After the structure has been constructed and concrete permitted to cure for 7 days, structure backfill shall be placed in such a manner that the structure is not be damaged by the shock of falling earth. Backfill material shall be placed and compacted as specified for Final Backfill, and the backfill shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

203.4.9 RIPRAP CONSTRUCTION

Riprap shall be constructed on geotextile separation fabric in the areas indicated on the Plans in accordance with NMDOT Section 602. Areas to receive riprap shall be trimmed and dressed to conform to the cross sections, lines and grades shown on the Plans within a tolerance of 0.1 foot.

203.4.9.1 GEOTEXTILE SEPARATION FABRIC PLACEMENT

Geotextile separation fabric shall be constructed in accordance with NMDOT Section 604.3.8 in the areas indicated on the Plans.

203.4.9.2 RIPRAP FILTER LAYER PLACEMENT

Riprap Filter Layer materials shall be moisture conditioned to within the range of -2 to +2 percent of optimum moisture content and compacted to a minimum of 95 percent of ASTM D1557 laboratory maximum dry density.

203.4.9.3 STONE PLACEMENT

Rock for riprap shall be placed on the geotextile separation fabric to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Larger rock fragments shall be distributed, with dimensions extending the full depth of the riprap throughout the entire mass to minimize "pockets" of small rock fragments. Individual rock pieces shall be rearranged by mechanical equipment or by hand as necessary to obtain the distribution of rock fragment sizes specified above.

Riprap corresponding to the required Class shall be installed to the limits and grades shown on the Plans.

All aspects of riprap construction not covered in this specification shall conform to the requirements of NMDOT Section 602.

203.4.10 ROCK MULCH CONSTRUCTION

203.4.10.1 SUBGRADE PREPARATION

Subgrade surfaces shall be to the neat lines and grades shown on the Plans.

Sites where equipment can safely operate (generally slopes 3H:1V or flatter), and which are designated to receive rock mulch, shall be adequately loosened. Subgrade preparation by "track walking" is preferred. Disking or ripping or both may be necessary, as determined by the Engineer. On sites where equipment cannot safely operate, the areas designated to receive rock mulch shall be prepared by scarifying during clearing and grubbing and/or rough grading to provide a roughened surface so that the rock mulch will stay in place.

The finished surface for both equipment-prepped and hand-tilled areas shall be left in a roughened condition as approved by the Engineer. This shall be the normal surface resulting from the tillage operations.

Trash, weeds, and other debris that will interfere with rock mulch placement shall be removed or disposed of as determined by the Engineer. Refer to Section 201 of the Specifications and Supplemental Technical Specification STS-201 - Clearing and Grubbing for further requirements.

Subgrade preparation shall be discontinued when subgrade soil moisture conditions are not suitable for preparation of a satisfactory subgrade, as determined by the Engineer.

Rock mulch shall not be placed until subgrade surfaces have been inspected and approved by the Engineer.

203.4.10.2 PLACEMENT

The rock mulch shall be placed by equipment on the prepared surfaces. The rock mulch shall be constructed to the full course thickness in one operation and in such a manner as to avoid displacement of the underlying materials. The rock mulch shall be delivered and placed in a manner to ensure that the in-place mulch layer shall be reasonably homogeneous, and the fractions uniformly distributed. Hand-placing of rock mulch shall be required to the extent necessary to prevent damage to the permanent Work. Rock mulch shall be placed in an even application, tightly packed, to provide complete coverage of the area shown on the project plans so that soil is not visible between rocks. The thickness of the rock mulch shall be a minimum of six (6) inches, measured from the subgrade surface to the finished grade of the rock mulch surface, as shown on the Plans.

The Contractor shall provide a Work Plan, for approval by the Engineer, illustrating how the rock mulch placement will occur, including equipment travel routes, and shall detail methods for repairing any associated damages.

The rock mulch shall be smoothed prior to water spray settling. The application of a uniform spray of water will be made at a rate not exceeding the infiltration rate of the subgrade to minimize run off. The use of pressure pumps and spray bars on all sprinkling equipment used for the application of water will be required. The use of gravity flow spray bars and splash plates shall not be permitted.

1510.4.11 VOLCANIC ROCK (FILTRATION STRUCTURE) CONSTRUCTION

203.4.11.1 SUBGRADE PREPARATION

The subgrade surfaces shall be to the neat lines and grades shown on the Drawings.

203.4.11.2 PLACEMENT

Volcanic rock shall be placed by equipment on the prepared surfaces.

The Contractor shall provide a Work Plan, for approval by the Engineer, illustrating how the volcanic rock placement will occur, including equipment travel routes, and shall detail methods for repairing any associated damages.

Care shall be taken to avoid damage to the steel gates at the ends of the rock filtration structure.

203.4.12 EMBANKMENTS

203.4.12.1 EARTH EMBANKMENTS

Earth embankments shall be constructed from suitable materials meeting the requirements for STRUCTURAL FILL AND STRUCTURE BACKFILL, free of organic or frozen material and rocks with any dimension greater than 3 inches. Embankment material shall be moisture conditioned to within the range of -3 to +3 percent of optimum moisture content. Embankment material shall be placed in successive horizontal loose layers not more than 8 inches in thickness. Each layer shall be spread uniformly on a soil surface that has been moisture conditioned, and scarified so that the fill will bond with the surface on which it is placed. Embankment material shall be compacted to a minimum of 95 percent of ASTM D1557 laboratory maximum dry density.

Compaction shall be finished by sheepsfoot rollers, padfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

203.5 TESTING

203.5.1 GENERAL

Tests for degree of compaction shall be determined in accordance with ASTM D1556 and ASTM D6938.

Continuous, full-time observation and field tests should be conducted during fill and backfill placement by a representative of the Engineer to assist the Contractor in evaluating the required degree of compaction. If less than the required compaction is required, additional compactive effort should be made with adjustment of the moisture content as necessary until 95 percent compaction is obtained.

Testing shall be performed by the Contractor's approved testing facility. Qualifications of the Contractor's testing facility shall be submitted to the Engineer for approval. If the Contractor elects to establish testing facilities, work requiring testing shall not be permitted until the Contractor's facilities have been inspected, Owner-validated and approved by the Engineer.

Field in-place density shall be determined in accordance with ASTM D1556 and ASTM D6938. When ASTM D6938 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D1556.

The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D6938. The calibration of both the density and moisture gauges shall be checked at the beginning of the project on each different type of material encountered.

When in-place test results indicate that compaction does not meet the requirements of this specification, the material shall be removed, replaced and recompacted to meet specification requirements.

Tests shall be performed on recompacted areas to determine conformance with specification requirements.

A Professional Civil Engineer registered in the State of New Mexico shall certify the inspections and test results. The certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests.

The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type of fill and backfill operation.

203.5.1.1 FILL AND BACKFILL MATERIAL GRADATION

One test per 50 cubic yards of stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C136/C136M.

203.5.1.2 IN-PLACE DENSITIES

a. One test per 100 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 50 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

203.5.1.3 CHECK TESTS ON IN-PLACE DENSITIES

If ASTM D6938 is used, check in-place densities by ASTM D1556 as follows:

a. One check test per 500 square feet, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.

b. One check test per 200 square feet of each lift of fill or backfill areas compacted by hand-operated machines.

203.5.1.4 MOISTURE CONTENTS

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed shall be performed during stable weather conditions. During unstable weather, tests shall be performed as dictated by local conditions and approved by the Engineer.

203.5.1.5 OPTIMUM MOISTURE AND LABORATORY MAXIMUM DENSITY

Tests for each type of material or source of material including borrow material shall be performed to determine the optimum moisture and laboratory maximum density values. One representative test per 50 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density, shall be performed.

203.6 MEASUREMENT AND PAYMENT

203.6.1 EXCAVATION

Excavation shall be measured by the cubic yard after excavation. Field topographic surveys, as described in SSCAFCA Technical Specification 1513 Construction Staking will be used to determine actual excavation quantities.

Payment will be made on the unit price per cubic yard for Unclassified Excavation. Payment will include the cost for all excavation, removal, storage, and disposal of unsuitable material, hauling of surplus material to the designated location(s) and hauling of select material within the construction site. No payment will be made for excavation of stockpiled materials, structural excavation of previously placed materials and over depth cuts. No payment will be made for shrink or swell. Excavation beyond the authorized cross section will not be included in measurement or payment.

203.6.2 FILL CONSTRUCTION

Structural fill and backfill shall be measured by the cubic yard in-place after compaction. Field

topographic surveys, as described in SSCAFCA Technical Specification 1513 Construction Staking will be used to determine in-place quantities.

Payment will be made on the unit price per cubic yard for the class of fill under consideration. Payment will include moisture conditioning, required blending of soils, placement, compaction, and other related work.

203.6.3 BORROW

Borrow material shall be measured by the cubic yard in-place after compaction. Field topographic surveys, as described in SSCAFCA Technical Specification 1513 Construction Staking will be used to determine in-place quantities.

Payment will be made on the unit price per cubic yard for Borrow. Payment will include excavation & haul from Borrow Area, moisture conditioning, required blending of soils, placement, compaction, and other related work.

203.6.4 RIPRAP

Riprap shall be measured by the cubic yard in-place within the limits of dimensions as shown on the Plans. The measurement shall be to the neat line as delineated on the Plans.

Payment for riprap shall be by the cubic yard in place as shown on the Plans. The price shall be considered full compensation for the item complete, including all labor, materials, equipment, surveying, dust control, testing and all other items necessary and incidental to the placement of the riprap. Surface preparation, aggregate filter layers, and separation geotextile fabric shall be considered incidental to riprap construction.

The Contractor shall have the option to re-use existing on-site riprap material if the riprap meets the material properties and durability requirements in this specification, NMDOT Section 602 and the Special Provisions modifying Section 602.2.1. Any riprap material that cannot be re-used shall become the property of the Contractor and must be disposed of or relocated as mutually agreed upon with the Owner and Engineer.

203.6.5 ROCK MULCH

Rock mulch shall be measured by the cubic yard in place within the limits of dimensions as shown on the Plans. The measurement shall be to the neat line as delineated on the Plans.

Payment for rock mulch shall be by the cubic yard in place as shown on the Plans. The price shall be considered full compensation for the item complete, including all labor, materials, equipment, surveying, dust control, testing and all other items necessary and incidental to the placement of the rock mulch. Surface preparation and water to settle rock mulch shall be considered incidental to rock mulch construction.

203.6.6 VOLCANIC ROCK (FILTRATION STRUCTURE)

Volcanic rock (filtration structure) shall be measured by the cubic yard in place within the limits of dimensions as shown on the Plans. The measurement shall be to the neat line as delineated on the Plans.

Payment for volcanic rock (filtration structure) shall be by the cubic yard in place as shown on the Plans. The price shall be considered full compensation for the item complete, including all labor, materials, equipment, surveying, dust control, testing and all other items necessary and incidental to the placement of the volcanic rock.

END OF SECTION

TECHNICAL SPECIFICATION 303

BASE COURSE

This specification applies to bid item numbers:
6: Base Course (Access Road)

NMDOT SECTION 303: Base Course is modified as follows:

303.5 Basis of Payment

SSCAFCA will pay for the accepted quantities of Base Course as determined in Section 303.3.8, "Acceptance".

Pay Item: "Base Course"
Pay Unit: Cubic Yard

SECTION 303: BASE COURSE

303.1 DESCRIPTION

This Work consists of providing, hauling, and placing Base Course.

303.1.1 Stockpiling

This Work consists of providing, hauling, and stockpiling Base Course at specified locations.

303.1.2 Removing, Processing, and Placing Base Course

This Work consists of removing, hauling, processing, placing existing Base Course Material.

303.2 MATERIALS

303.2.1 General

Base Course consists of one (1) or more of the following:

1. Crushed stone;
2. Crushed or screened gravel;
3. Caliche;
4. Sand;
5. Recycled Asphalt Pavement (RAP) not to exceed 50%; recycled concrete pavement (RC) not to exceed 75%; and the combined RAP and RC not to exceed 75% by weight;
6. Processed glass aggregate.

Base Course shall not contain organic matter or other Deleterious Materials, including silt and clay balls.

The Department will allow a maximum of ten percent (10%) (by weight) processed glass aggregate, uniformly distributed, in composite Base Course. Processed glass aggregate shall meet physical properties and deleterious substance requirements in accordance with AASHTO M 318.

303.2.2 Aggregate Acceptance

The Department will accept Base Course based on random samples taken by the Department from the Roadway. Unless the Contract specifies otherwise, the Contractor shall produce Material in compliance with Table 303.2.2:1, “Type I Base Course Gradation Band or Table 303.2.2:2, “Type II Base Course Gradation Band” as specified in the Contract and Table 303.2.2:3, “Base Course Physical Properties.”

Table 303.2.2:1
Type I Base Course Gradation Band

Sieve size	% passing
1.0 inch	100
¾ inch	80--100
No. 4	30-60

Table 303.2.2:1
Type I Base Course Gradation Band

Sieve size	% passing
No. 10	20-45
No. 200	3.0-10.0

Table 303.2.2:2
Type II Base Course Gradation Band

Sieve size	% passing
1.0 inch	100
¾ inch	85-95
No. 4	40-70
No. 10	30-55
No. 200	6.0-15.0

Table 303.2.2:3
Base Course Physical Properties

Property	Specification Limit
Fractured Face[a]	Minimum 50% on Untreated Material
AI[b]	Maximum 35
LL	Maximum 25
PI	Maximum 6

[a]Materials retained on or above the No. 4 sieve shall have at least two (2) Fractured Faces when evaluated in accordance with AASHTO T-335, “Determining the Percentage of Fractured Faces in Coarse Aggregate.”

[b]Maximum AI of 35 for untreated natural aggregate source when calculated in accordance with Section 910, “AGGREGATE INDEX”.

303.3 CONSTRUCTION REQUIREMENTS

303.3.1 Subgrade

The Contractor shall place base course on subgrade prepared in accordance with Section 207, "Subgrade Preparation."

303.3.2 Mixing and Placing

The Contractor shall:

- Place maximum six (6) inch (compacted) lifts, unless specified otherwise.
- Not Place Base Course Material on frozen Subgrade.
- Compact Base Course to at least 96% of maximum density as determined by AASHTO T 180 (Modified Proctor), Method D (TTCP Modified).

The Department will use nuclear testing methods to determine in-place densities in accordance with AASHTO T 310 and TTCP procedures for wet density moisture correction.

303.3.3 Surface Tolerance

The surface tolerance shall not exceed ½ inch within ten (10) feet as verified by the Department. All deviations greater than ½ inch shall be corrected by the Contractor and reverified by the Department.

303.3.4 Plan Base Course and Sub-base Depths

The Department will monitor and record Base Course depth during the placement in accordance with the Department's "Minimum Testing Requirements." If the placed thickness deviates from the requirements by more than minus ½ inch, the Contractor shall add Material and reprocess to correct the deficiency.

303.3.5 Stockpiled Base Course

The Contractor shall stockpile base course material at locations shown on the Plans and prevent segregation of Materials at each stockpile. The Contractor shall maintain each stockpile in accordance with the following requirements:

1. Place stockpiles upon prepared sites;
2. Make stockpiles neat and regular to prevent segregation;
3. Provide enough storage space for each size of aggregate;
4. Prevent contamination (store stockpiles away from vehicular and Equipment traffic);
5. Keep the storage site neat and orderly and keep the stockpiles accessible for sampling; and
6. Acceptance by the Department will be at the final stockpile location.

303.3.6 Removing and Processing Existing Base Course

The Contractor shall:

1. Minimize contamination of Base Course Material when removing it from the Roadway for reuse, and;
2. Meet the requirements as indicated in Section 303.3.2 "Mixing and Placing."

303.3.7 Sampling and Testing

The Contractor and Department shall sample and test the Base Course in accordance with Section 906 "Minimum Testing Requirements" for Base Course. Department personnel may test locations other than the random locations generated for statistical analysis. These tests will not be used for pay factor determination, but may be used to determine Acceptance or rejection of localized Material.

303.3.7.1 Contractor Quality Control

The Contractor shall develop and administer a Quality Control plan that ensures the product meets the requirements of Section 902, "Quality Control." The Contractor shall ensure that the Quality Control plan addresses the following elements:

1. Contractor management and process control personnel,
2. Testing Equipment and lab facilities,
3. Aggregate production,
4. Aggregate quality,
5. Stockpile management,

6. Proportioning,
7. Mixing and processing,
8. Transporting,
9. Placing and spreading,
10. Compaction,
11. Line and grade control, and
12. Criteria for the correction or rejection of unsatisfactory Materials.

The Contractor shall:

1. Provide copies of TTCP wallet cards or certifications for personnel who are responsible for sampling and testing the Base Course.
2. Update the list as required if personnel substitutions are made.
3. Use test results, inspections, and other Quality Control practices to assure the quality of each material source and to control processes for crushing, mixing, proportioning, processing, transporting, placing, spreading, and compacting quality.

303.3.8 Acceptance

The Department will accept Base Course Materials based on samples taken in accordance with the Section 906, “Minimum Testing Requirements” after placement but before compaction. Acceptance will be in accordance with Section 303.2.2, “Aggregate Acceptance” and Section 303.3, “Construction Requirements. If necessary, the Contractor shall re-work the Base Course until all requirements are met at no additional expense to the Department.

303.4 METHOD OF MEASUREMENT

When calculating the square yardage the Department will use the average Base Course width and the station-to-station length along the centerline. The dimensions will show on the typical section of the Plans. When calculating the weight of the material, the Department will deduct the weight of moisture that exceeds the optimum moisture content plus two percent (2%). No additional payment shall be made for the stockpile pad.

303.5 BASIS OF PAYMENT

The Department will pay for the accepted quantities of *Base Course* as determined in Section 303.3.8, "Acceptance."

Pay Item	**Pay Unit**
Base Course	Cubic Yard or Ton
Base Course _____inch Depth	Square Yard
Remove, Process and Place Base Course	Square Yard or Ton
Stockpiled Base Course	Cubic Yard or Ton

303.5.1 Work Included in Payment

The Department will consider as included in the payment for the pay item(s) listed in this section and will not measure or pay separately for the following Work:

1. Providing, hauling, placing, and compacting Base Course Material;
2. Stockpiling, if required by contract;

3. Quality Control in accordance with Section 902, “Quality Control;” and
4. Remove, process, and place Base Course, if required by contract.

TECHNICAL SPECIFICATION 511

CONCRETE STRUCTURES

This specification applies to bid item numbers:
7: Structural Concrete Class A
34: Structural Concrete Class A-4

NMDOT Technical Specification 511 Concrete Structures is modified as follows:

511.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Structural Concrete, Class A	Cubic Yard
Structural Concrete, Class A-4	Square Yard

END OF SECTION

SECTION 511: CONCRETE STRUCTURES

511.1 DESCRIPTION

This Work consists of constructing concrete box Culverts, headwalls, retaining walls, abutments, bents, piers, slabs, girders, and Incidental Structures requiring the use of concrete, except pre-stressed members.

511.2 MATERIALS

When waterproofing is required by the Contract but a type is not specified, either fluid-applied waterproofing or sheet membrane waterproofing shall be used.

511.2.1 Portland Cement Concrete

The Contractor shall use concrete mixes that have been designed in accordance with Section 509, “Portland Cement Concrete Mix Designs” and approved for use on NMDOT Projects by the State Materials Bureau for the freeze/thaw risk zone in which the Project is located. A higher risk zone concrete may be substituted.

511.2.1.1 Concrete Surface Finishing Materials

For Class 2 Surface Finish, the Contractor may use a thin mortar composed of one (1) part cement and four (4) parts sand passing the No. 16 sieve. The cement used in the thin mortar shall be of the same type and source as that used in freshly placed concrete.

Alternatively, the Contractor may use a prepackaged, polymer modified mortar, designed specifically for concrete surface finishing with a minimum 28 day compressive strength of 2,000 psi per ASTM C109.

511.2.2 Steel Reinforcing

The Contractor shall provide steel reinforcement in accordance with Section 540, “Steel Reinforcement.”

511.2.3 Bonding Agent

The Contractor shall use a bonding agent that meets the requirements of ASTM C1059, Type II or C-881 Type V.

511.2.4 Form Release Agent

The Contractor may use form release agents at their discretion. Compatibility must be confirmed in a letter from the Manufacturer of subsequent surface treatments including but not limited to penetrating water repellent treatment, stains, and/or paints. If compatibility cannot be confirmed, form release residue shall be removed per the surface preparation recommendations of the manufacturer of the subsequent product.

When integrally colored concrete is used, the Contractor shall use form release agents that are non-staining and minimize surface imperfections of concrete.

511.2.5 Liquid Applied Evaporation Reducers

Unless otherwise specified in the Contract documents, the Contractor may utilize liquid-applied evaporation reducers to reduce the effects of excessive rate of evaporation at the

surface of plastic concrete. Evaporation reducers shall be commercially available water-based compounds that are specifically designed to form a thin monomolecular film to reduce rapid moisture loss from the concrete surface prior to curing. The product shall be certified to have no adverse effects on the cement hydration process or the concrete and that it reduces surface moisture evaporation from the concrete when performing concrete operations in direct sun, wind, high temperatures, and/or low relative humidity.

511.2.6 Curing Materials

511.2.6.1 Liquid Membrane Forming Compounds

The Contractor shall use Type 1-D or Type 2 liquid membrane-forming concrete curing compounds that comply with ASTM C 309.

When integrally colored concrete is used, the Contractor shall use only curing compounds specifically recommended for use with colored concrete and in accordance with ASTM C309 Type 1.

511.2.6.2 Linseed Oil Emulsion

The Contractor shall not use linseed oil emulsion-curing agent.

511.2.6.3 Sheet Materials for Curing Concrete

The Contractor shall use concrete curing sheet Materials in accordance with AASHTO M 171. The Department will only allow the white reflective type.

511.2.7 Joint Materials

The Contractor shall provide joint filler Material in accordance with AASHTO M213 or AASHTO M153 Type I or IV (no cork).

The Contractor shall provide liquid-applied joint sealant in accordance with Section 452, “Sealing and Resealing Concrete Pavement Joints” at non-Bridge joint locations.

511.2.8 Extruded Polystyrene

The Contractor shall provide extruded polystyrene that complies with ASTM C578 Types X or XII (15 psi), Type IV (25 psi), or Type VII (60 psi). If strength is not shown in the contract, the Contractor shall use Type IV (25 psi). Extruded or expanded polystyrene may be used interchangeably.

511.2.9 Tear–Web Waterstop

Waterstop at the joint between abutment cap and abutment diaphragm shall be tear-web waterstop. The Contractor shall provide a product that meets the requirements of Table 511.2.9:1, “Tear–Web Waterstop Requirements.”

TABLE 511.2.9:1
Tear–Web Waterstop Requirements

Typical Properties	ASTM Method	Minimum Value

TABLE 511.2.9:1
Tear–Web Waterstop Requirements

Typical Properties	ASTM Method	Minimum Value
Water Absorption	D-570	0.10%
Tear Resistance, lb/in	D-624	225
Specific Gravity, (+/-0.05)	D-792	1.38
Hardness, Shore A (+/-5, 10 sec. delay)	D-2240	80
Tensile, psi	D-638, Type IV	2000
Elongation %	D-638, Type IV	350
Low Temperature Brittleness @ -35° F	D-746	No Failure
Stiffness in Flexure, psi	D-747	600
Accelerated Extraction, USACE CRD-C572		
Tensile, psi	D-638, Type IV	1600
Elongation, %	D-638, Type IV	300
Effect of Alkali, USACE CRD-C572		
Weight Change, %	-----	+0.25%, -0.10%
Change in Hardness, Shore A	D-2240	+/-5 points

511.2.10 Sheet Membrane Waterproofing

When specified in the Contract documents, the Contractor shall install waterproof membrane Materials. For this application, the Contractor shall provide flexible, sheet membrane waterproofing Material that is a minimum 50 mil thickness. Compatible surface primers, adhesives and flashings shall be used as recommended by the manufacturer's application instruction. The Material shall meet the requirements of Table 511.2.10:1, "Sheet Membrane Waterproofing Requirements."

TABLE 511.2.10:1
Sheet Membrane Waterproofing Requirements

Typical Properties	ASTM Method	Value
Water Vapor Permeance	ASTM E96	0.05 perms max
Elongation	ASTM D412	300% min
Tensile Strength	ASTM D412	300 psi min
Peel Strength	ASTM D903	8 lbs/in min
Puncture Resistance	ASTM E154	45 lbf min

511.2.11 Fluid-Applied Waterproofing

When specified in the Contract documents, the Contractor shall install cold, fluid-applied waterproof membrane Materials on concrete walls prior to backfill. For this application, the Contractor shall provide seamless rubberized asphalt membrane at a minimum thickness of 30 mils. Compatible surface primers, and joint, crack, and corner treatments shall be used as recommended by the manufacturer's application instruction. The Material shall meet the

requirements of Table 511.2.11:1, “Fluid-Applied Waterproofing Requirements.”

TABLE 511.2.11:1
Fluid-Applied Waterproofing Requirements

Typical Properties	ASTM Method	Value
Solids by Weight	ASTM D1644	60% min
Elongation	ASTM D412	300% min
Water Vapor Permeance	ASTM E96	0.1 perms max
Hardness	ASTM C661	60 max

511.2.12 Swellable Hydrophilic Waterstop

Swellable hydrophilic waterstop shall meet the requirements of ASTM D-71, ASTM D-6, and ASTM D-217. The following properties will apply:

1. Specific gravity — ASTM D71: 1.35;
2. Hydrocarbon content — ASTM D4: 47%;
3. Volatile matter — ASTM D6: one percent (1%);
4. Penetration cone in accordance with ASTM D217 at 77 degrees F (25 degrees C): 40 mm; and
5. Service temperature range: -30 to 180 degrees F (-34 to 82 degrees C).

511.3 CONSTRUCTION REQUIREMENTS

511.3.1 Concrete Placement

Concrete shall be placed and tested for compliance with the Project Specifications in accordance with Section 510, “Portland Cement Concrete.”

511.3.2 Temporary Works and Falsework

511.3.2.1 Temporary Works

The Contractor shall perform temporary Works in accordance with the current edition of the AASHTO Guide Design Specification for Bridge Temporary Works and the AASHTO Construction Handbook for Bridge Temporary Works.

Although the document contains “Guide Design Specifications,” the Contractor shall consider them to have the same importance and standing as a code or a Specification. If the content of the collaboration documents appears permissive with words such as “should,” “could,” “may,” etc., the Contractor shall consider the content to be a requirement unless otherwise approved by the State Bridge Engineer.

In the event of a conflict between a referenced code and this Specification, this Specification will take precedence.

511.3.2.2 Falsework and Falsework Foundations

The Contractor shall construct Structure in accordance with Section 511, “Concrete Structures,” and Section 512, “Superstructure Concrete”, as applicable.

The Contractor shall design, construct, and maintain falsework and falsework foundation to provide the required strength and rigidity, and to support loads without settlement. The Contractor shall have a professional Engineer licensed in the State of New Mexico design the falsework and its foundation. The design of the falsework and foundation will be required if one (1) or more of the following conditions apply:

1. If the height of the Structure is greater than ten (10) ft (excluding concrete Culverts with bottom slabs);
2. Where the supported span is greater than 15 ft; or
3. Where traffic, other than workmen involved in constructing the Structure, will travel under the falsework.

The Contractor shall place the falsework on an adequate foundation. The maximum foundation bearing pressure is 2,000 pounds per square foot unless a Geotechnical investigation indicates a higher value can be used. The Contractor shall provide methods for measuring settlement or movement of falsework and forms under load. If falsework shows settlement greater than 3/8 inch at the vertical supports, the Contractor shall stop the Work and correct the settlement or movement.

If pilings are used for falsework, the Contractor shall pull or cut off falsework pilings. The Contractor shall ensure the cut-off elevations are one (1) ft below the low water level, natural ground, or bottom of proposed channel.

If required, the Contractor shall submit Plans for falsework to the State Bridge Engineer for approval. The Contractor shall submit proposed changes to existing Structures required for maintenance of traffic to the Project Manager for approval. 30 Days shall be allowed for the initial review. 15 additional Days shall be allowed for each resubmittal.

511.3.3 Form Construction

The Contractor shall make forms mortar tight and sufficiently rigid to prevent deformation due to the pressure of the concrete and other loads Incidental to the construction operations, including vibration. The Contractor shall construct and maintain forms to prevent the joints from opening. The Contractor shall construct and maintain forms used on surfaces in public view such that the finished concrete surface will be smooth and of uniform color and texture.

The Contractor shall remove loose dirt, laitance, and miscellaneous debris from the bottom of the forms before placing concrete.

The Contractor shall fillet forms and chamfer them 3/4 inch, unless required otherwise in the Contract, and give them a bevel or draft for easy removal of projections such as girders and copings.

511.3.3.1 Form Lumber

The Contractor shall use lumber that is planed on at least one (1) side and the two (2) edges for exposed concrete surfaces. The Contractor shall place the planed face so that it will be the formed surface for the concrete being placed.

511.3.3.2 Metal Ties

The Contractor shall construct metal ties and anchorages within the forms to permit the removal of a portion of the tie connections without damaging the concrete, and provide at least 1/2 inch depth of cover from the concrete surface.

511.3.3.3 Surface Treatment of Forms

The Contractor shall ensure that forms have been properly wetted before placing concrete.

The Contractor shall use form release agents at their discretion before placing reinforcing steel. The Contractor shall not use form release agents that adhere to or discolor the concrete.

511.3.3.4 Metal Forms

The Contractor shall provide metal forms thick enough to prevent bending and maintain their shape. The Contractor shall use countersunk bolts and rivet heads. The Contractor shall use clamps, pins, and other connecting devices designed to hold forms rigidly together and for removal without damaging the concrete. The Contractor shall use metal forms that have a smooth surface and line up properly.

The Contractor may use metal forms that remain part of the Structure in accordance with the Contract or as approved by the State Bridge Engineer. The Contractor shall use permanent steel Bridge deck forms in accordance with Section 512.3.4.1, "Permanent Steel Deck Forms."

511.3.3.5 Reuse of Forms

The Contractor shall continuously maintain the shape, strength, rigidity, water tightness, and surface smoothness of reused forms. The Contractor shall resize warped or bulged lumber before reusing it.

511.3.4 Temperature and Weather Limitations

The Contractor shall keep the concrete mixture temperature between 50 °F to 90 °F at the time of placement.

511.3.4.1 Cold Weather Concrete

The Contractor shall place cold weather concrete in accordance with ACI 306, "*Cold Weather Concreting*."

If air temperatures are likely to fall below 40 °F during the placement or curing periods, the Contractor shall submit a cold weather concreting and curing plan to the Project Manager for approval by the State Concrete Engineer before concrete placement. The Contractor shall allow 14 Days for review. The Contractor shall ensure that the Plan details the methods and Equipment to maintain the required concrete temperatures over the entire concrete pour area.

Information submitted will include, but not be limited to:

1. Whether or not outside heating sources will be used (and how the exhaust will be vented away from the fresh concrete);
2. Whether or not the rate of surface evaporation is expected to exceed the limitations detailed in Section 511.3.4.3, "Rate of Evaporation Limitations" and measures to be taken;
3. What the target mix temperature will be;
4. How the concrete will be protected from the ambient conditions;
5. Curing methods to be used during and following the protection period;

6. How soon after the placement the protection from the ambient conditions will be implemented;
7. Who will be responsible for insuring that the proper protection from the environment is properly implemented;
8. How the actual temperature of the concrete will be monitored;
    a. How often will this be checked;
    b. Who will do the checking;
9. What actions will be taken if the temperatures fall below the target points;
10. Who will be responsible for taking the necessary actions; and
11. Who the contact will be if Department Personnel need to transmit notices or information about the cold weather conditions.

Review and Acceptance of the Cold Weather Concreting and Curing Plan shall not relieve the Contractor from its obligation to perform the Work and provide Materials in strict conformance with the Contract.

The Contractor shall not place concrete directly onto any surface that is less than 40 °F unless otherwise approved by the Project Manager. The Contractor shall not place concrete on frozen ground.

If placing concrete at or below air temperatures of 35 °F, the Contractor shall provide suitable enclosures and heating devices. The Contractor shall vent exhaust from combustion type heating devices outside the placing area so that the exhaust fumes cannot come in contact with the freshly placed concrete.

The Contractor shall ensure the concrete surface temperatures never fall below 45 °F during placement and the first three (3) Days after placing. The Contractor shall not let the surface temperature fall below 40 °F during the next four (4) Days after the initial three (3) Day curing period, or until the in-place strength determined by the *Maturity Method*, in accordance with Section 510.3.5.2, “In-Place Concrete Strength Measurements” indicates that 75% of the design strength is achieved.

The Contractor shall monitor the minimum concrete temperatures at various locations including edges and corners of slabs or other Structures, and check immediately before placing insulating Material over the concrete.

If heating the aggregates or water, the Contractor shall use heating methods and Equipment that can heat the Material uniformly. The Contractor shall not heat the Materials to more than 110 °F. During the heating or mixing process, the Contractor shall not add cement to water and aggregate combinations that are hotter than 90 °F.

511.3.4.2 Hot Weather Concrete

The Contractor shall place hot weather concrete in accordance with ACI 305, “*Hot Weather Concreting.”*

Hot weather is any combination of the following conditions that tends to impair the quality of freshly mixed or hardened concrete by accelerating the rate of moisture loss and rate of cement hydration or otherwise causing detrimental results: high ambient temperature; high concrete temperature; low relative humidity; wind speed; or solar radiation.

The Contractor shall estimate the rate of evaporation at the surface of the concrete per

Section 511.3.4.3, “Rate of Evaporation Limitations.” If the rate of evaporation is anticipated to be greater than 0.2 lb per sq ft per hour, the Contractor shall submit a hot weather concreting and curing Plan to the Project Manager for approval by the State Concrete Engineer before concrete placement. The Contractor shall allow 14 Days for review.

The Contractor’s Hot Weather Concreting and Curing Plan shall include measures that shall be taken by the Contractor at their expense and maintained to the satisfaction of the Project Manager to reduce the rate of evaporation during initial cure to within the specified rate. The methods can include but not be limited to following:

1. Erect windbreaks to reduce the wind velocity over the concrete surface;
2. Place concrete during nighttime or early morning hours;
3. Use cool aggregate and mixing water to lower the fresh concrete temperature;
4. Increase the relative humidity at the site with a fog spray; and/or
5. Apply a liquid-applied evaporation reducer.

Review and Acceptance of the Hot Weather Concreting and Curing Plan shall not relieve the Contractor from its obligation to perform the Work and provide Materials in strict conformance with the Contract.

511.3.4.3 Rate of Evaporation Limitations

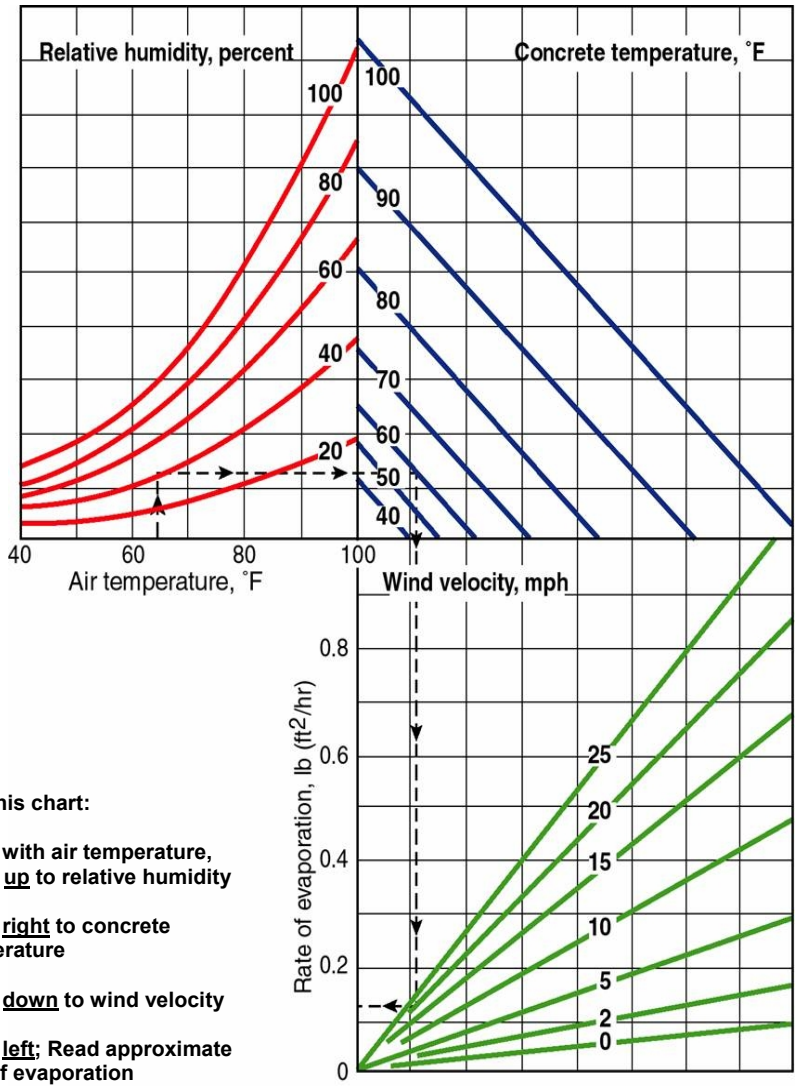
The “Rate of Evaporation Limitations” are detailed in ACI 305 – Hot Weather Concrete. These procedures lessen the potential of plastic-shrinkage cracking in concrete. The “Rate of Evaporation Limitations” apply to Bridge decks, approach slabs, CBC (top and bottom slabs), slipped formed concrete Structures, all PCCP and structural shotcrete. ACI 308 – Guide to Curing Concrete emphasizes that the rate of evaporation limitations can be exceeded in both cold and hot weather and must be addressed in both conditions.

The Contractor shall determine the anticipated rate of evaporation of surface moisture from the concrete by utilizing Figure 511.3.4.3:1, “Surface Evaporation from Concrete.” The Contractor shall not place concrete if the anticipated rate of evaporation exceeds 0.20 lb per square foot per hour at the site over any ten (10) minute period, unless measures are taken to prevent excessive moisture loss from the surface of the concrete during initial curing. See Section 511.3.4.2, “Hot Weather Concrete” for Acceptable measures. These measures must be detailed in the Cold Weather Concrete Plan per Section 511.3.4.1, “Cold Weather Concrete” or the Hot Weather Concrete Plan per Section 511.3.4.2, “Hot Weather Concrete.”

During the concrete placement, the wind speed, relative humidity and ambient air temperature shall be collected via a computerized weather station that shall be provided and retained by the Contractor. The weather station shall be an automated system that does not require any human support or effort after its initial set-up. The Contractor shall record readings at minimum five (5) minute intervals until the final curing system has been physically applied. Copies of these readings shall be submitted to the Project Manager within 24 hours of the placement. Measurements to determine the Surface Evaporation from the Concrete shall be taken at a height of approximately five (5) feet above the deck for relative humidity and ambient air temperature, and between a height of 20 inches and five (5) feet for wind speed.

For concrete placements that are smaller than ten (10) cubic yards, a handheld anemometer may be used in lieu of a weather station. The handheld anemometer shall be capable of measuring wind speed, humidity and air temperature; and shall be supplied and retained by the Contractor.

Figure 511.3.4.3:1
Surface Evaporation from Concrete (reference ACI 305)



To use this chart:

1. **Enter with air temperature, move <u>up</u> to relative humidity**
2. **Move <u>right</u> to concrete temperature**
3. **Move <u>down</u> to wind velocity**
4. **Move <u>left</u>; Read approximate rate of evaporation**

511.3.4.3.1 Wind Break

If a wind break is used, the wind break shall be a minimum height of eight (8) ft - zero (0) inches protecting the Bridge deck, approach slabs, sleeper footings and/or transition slabs (if applicable). All areas of the freshly placed concrete must be protected by the wind break. The nature and type of windbreak to be used shall be approved by the Project Manager prior to placement of any Superstructure concrete.

511.3.4.3.2 Fogging System

If a fogging system is used, a water fog shall be continuously applied over the surface of the freshly placed concrete in such a manner that the entire surface is kept at a relative humidity of 90% or greater and the surface of concrete is kept at an evaporation potential of 0.15 pound/square foot/hour or less, as determined from Figure 511.3.4.3:1, "Surface Evaporation from Concrete." The evaporation potential shall be determined prior to fogging and outside the wind protection, and continuously monitored with evaporation potential measurements taken and recorded at least once every five (5) min throughout the entire placement, and continuing until the concrete curing system has been completely installed. If a wind break and/or fogging are being used, the Contractor shall obtain these readings from the protected area at a height of approximately five (5) feet above the protected concrete.

The area to be fogged shall be the entire area of the freshly placed concrete, which has not had the final finish applied. This fog shall be delivered through a network of nozzles, which are properly spaced to provide a uniform fog at the surface of the concrete. The nozzles used shall be of the type, which atomizes the water so that there are no visually discernible droplets of water. The area of coverage from each nozzle shall overlap all adjacent nozzle coverage by at least one (1) ft. It shall be demonstrated prior to the placement of the concrete that the intended system is capable of delivering the required fogging environment for at least twice the anticipated required time. The Contractor shall not finish or otherwise mix any of the fogging water into the fresh concrete.

The intended system must be properly field tested, and approved by the State Materials Bureau before being used on any Superstructure concrete. Fogging shall continue until the surface is treated with an approved curing method.

511.3.4.3.3 Liquid Applied Evaporation Reducers

If a liquid-applied evaporation reducer is used, it shall be selected from the Departments Approved Products list and must be applied in strict accordance with manufacturer's application instructions.

Liquid applied evaporation reducers are not curing compounds and are not finishing aids. Liquid applied evaporation reducers are to be used to reduce surface evaporation during the initial cure of concrete. Initial cure of concrete typically occurs up to and including bull-floating. Multiple applications of liquid applied evaporation reducer may be required, reference manufacturer's application instructions.

Upon commencing surface finishing (beyond bull-floating), further application of liquid evaporation reducers shall not be allowed (liquid evaporation reducers cannot be used as finishing-aids). The Contractor shall cure concrete after surface finishing in accordance with Section 511.3.9, "Curing."

511.3.5 Concrete Placement

Concrete shall be placed and tested for compliance with the Project Specifications in accordance with Section 510, "Portland Cement Concrete."

The Contractor shall not place concrete until the Project Manager approves the reinforcing steel and forms. The Contractor shall ensure that forms are clean and free of rust, grease, and other Deleterious Material immediately before placing the concrete. The Contractor shall remove wooden form spacers immediately before placing concrete in that area.

The Contractor shall vibrate the concrete during placement to force the coarse aggregate from external surfaces and to bring mortar against the forms to produce a smooth finish significantly free of water, air pockets, and honeycombs.

The Contractor shall place concrete in girders, walls, and other similar Structures in horizontal layers. The Contractor shall ensure that the concrete is not too thick for the vibrator to consolidate and merge it with the previous layer. The Contractor shall not pour concrete layers deeper than two (2) ft.

The Contractor shall not place concrete faster than the rate used for the design of the forms. The Contractor shall adjust the rate for the temperature of the concrete being placed.

511.3.5.1 Chutes and Troughs

The Contractor shall avoid segregation of the Materials and the displacement of the reinforcement when placing the concrete. The Contractor shall use metal or metal-lined open troughs and chutes; the Contractor shall not use aluminum. All tools used for the moving and/or spreading of the concrete shall be square pointed tools. The Contractor shall not use round nose shovels and spreading tools.

Where the Contract requires steep slopes, the Contractor shall equip the chutes with baffle boards or use short lengths that reverse the direction of movement.

The Contractor shall keep chutes, troughs, and pipes clean and free of hardened concrete by thoroughly flushing with water after each pour. The Contractor shall discharge the water used for flushing away from the placed concrete.

The Contractor shall not allow concrete to free fall for more than three (3) ft. For CBC walls and retaining walls that are less than or equal to ten (10) inches thick, maximum free fall heights shall not apply. For CBC walls and retaining walls greater than ten (10) inch thick, concrete may have a free fall of less than nine (9) ft.

The Contractor shall fill each part of the form by placing the concrete as close to the final position as possible. The Contractor shall vibrate the concrete during placement to force the coarse aggregate back from the forms and around the reinforcement without displacing the bars. After the concrete's initial set, the Contractor shall not jar the forms or place strain on the ends of projecting reinforcement.

511.3.5.2 Concrete Pumping

If placing concrete by pumping, the Contractor shall install pumping Equipment so that vibrations resulting from the operation do not damage the concrete being placed. The Contractor shall obtain Project Manager approval before using concrete pumping Equipment.

Before placing the concrete, the Contractor shall clean the Equipment thoroughly. The Contractor shall operate the Equipment so that it pumps a continuous flow of concrete without air pockets and without an appreciable loss of slump or entrained air.

The Contractor shall control the loss of entrained air by one (1) or more of the following methods:

1. Tie the end of the pump hose so that the discharge end is pointing upward, forming a “**J**” at the end of the hose;
2. Install a series of four (4) consecutive elbows to form a 360° loop;

3. Reduce the diameter of the end of the pump line; or
4. Limit the enclosed angle of the boom arms to an angle of 135° or more.

The Contractor shall make sure that the discharge of the concrete from the pump is as close as possible to the bottom of the structure being placed, but in no case shall it be allowed to drop a distance greater than four (4) feet with the exception of CBC walls where the walls equal to or less than ten (10) inch thick, concrete may have a free fall of less than nine (9) ft.

The Contractor shall not use aluminum pipe. The Contractor shall not add water to the concrete during pumping. If water is added at the pump hopper to clear a clogged pump, the Contractor shall dispose of the concrete in the hopper and the line.

511.3.5.3 Conveyers and Belts

The Contractor may use conveyor belts to transport the concrete from the point of delivery to the point of placement. If using multiple belts, the Contractor shall ensure that the drop from one (1) belt to the next is no greater than 18 inches. At the end of the last belt, the Contractor shall not allow the concrete to free-fall more than four (4) ft. The Contractor shall ensure that the concrete coming off the end of any belt is not being segregated. If segregation occurs, the Contractor shall slow down the speed of the belt until segregation no longer occurs.

511.3.5.4 Placing Concrete Under Water

If placing concrete under water, the Contractor shall submit a mix design and procedure plan to the Project Manager. The Project Manager may require up to 30 Days to approve them. The Contractor shall allow time in the schedule to accommodate this approval process.

511.3.5.5 Vibrating/Consolidation

Unless otherwise directed by the Project Manager, and excluding drilled shafts, the Contractor shall consolidate concrete with suitable mechanical vibrators operating within the concrete. During concrete placement, the Contractor shall keep enough personnel, vibrators, and other tools available to assure adequate consolidation. If necessary, the Contractor shall supplement vibrating with hand spading with suitable tools to assure proper consolidation. If using vibrators, the Contractor shall use procedures in accordance with ACI 309 – Consolidation of Concrete.

The Contractor shall not use a “jitterbug” or any other flat tool that could cause concrete segregation.

The Contractor shall use vibrators that have each been certified within the last 90 Days to provide 8,500 to 12,500 Vpm.

The Contractor shall operate vibrators to consolidate the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. The Contractor shall not use vibrators to make concrete flow or run. The Contractor shall vibrate long enough to accomplish consolidation, but do not vibrate so long to cause segregation or air bubbles. The Contractor shall insert the vibrators vertically into the concrete, and immediately withdraw upward along the same line with the opposite motion. The Contractor shall not drag the vibrator horizontally across the placing area.

When operating vibrators, the Contractor shall avoid contact with reinforcing bars, particularly epoxy coated reinforcing bars or bars that extend into concrete that has taken an

initial set. If vibrating concrete in areas reinforced with epoxy-coated bars, the Contractor shall cover the vibrators with nonmetallic sleeves to prevent damage to the epoxy coating.

511.3.5.6 Sequence of Placement and Application of Load

The Contractor shall not place superimposed loads on or against load carrying members, floor slabs, or retaining walls until the concrete reaches 75% of specified design compressive strength but no less than 2,500 psi, determined in accordance with Section 510.3.5.2, "In-Place Concrete Strength Measurements." Concrete Box Culverts and CBC wingwalls shall not be backfilled until specified design compressive strength has been achieved.

The Contractor shall submit a concrete placement schedule to the Project Manager upon request. The Contractor shall plan and schedule concrete placement to prevent damage to previously placed concrete or to the curing or protection systems of previously placed concrete.

The following applies to concrete placement scheduling:

1. The Contractor may erect reinforcement and formwork for walls, columns, and pier caps 24 h after placement of footings or floor slab concrete. Unless otherwise provided, the Contractor may place concrete columns, walls, and pier caps, 48 h after placement of footing or floor slab concrete;
2. The Contractor shall not set beams or girders, or place Superstructure concrete until Substructure forms have been stripped sufficiently to determine the quality of the concrete;
3. The Contractor shall not place the load of the Superstructure on the Substructure until the Substructure concrete has been in place for at least 14 Days or until in-place strength measured by the Maturity Method indicates that the concrete has attained 75% of the design strength;
4. The Contractor shall ensure that the concrete has achieved sufficient strength as determined by the Maturity Method in accordance with the form design before placing concrete for integral horizontal members, such as pier caps or top slabs;
5. The Contractor shall place the vertical members at least seven (7) Days before mounting friction collars or falsework brackets that will support the weight of horizontal members. The Contractor shall ensure that the vertical members have attained the specified strength before applying loads, unless the Department approves otherwise;
6. The Contractor shall limit monolithic casting of walls and deck slabs of concrete box Culverts to Culverts that are six (6) ft high or less. The Contractor shall construct box Culvert walls higher than six (6) ft in accordance with this subsection; and
7. If the concrete is not gaining strength as expected, the Assistant District Engineer of Construction may extend the waiting periods. The Contractor shall conduct construction operations in a manner that does not damage the previously placed concrete.

511.3.5.7 Supplementary Lighting

The Contractor shall not mix, place, or finish concrete when the natural light is insufficient without using an adequate artificial lighting system, approved by the Project Manager. The Contractor shall test the lighting system at least one (1) Day before placing the concrete to assure that the system will provide sufficient light, without shadows or dark areas for placing, testing and finishing concrete. The Contractor shall ensure that the lights do not create a hazard for traffic on adjacent Roadways or Detours.

511.3.6 Removal of Forms

The Contractor shall not remove the forms until the concrete is strong enough to avoid damage by removing the forms.

If in-place strength tests in accordance with Section 510.3.5.2, "In-Place Concrete Strength Measurements," are not used to control field operations, the Contractor shall remove forms in accordance with Table 511.3.6:1, "Timetable for Removal of Forms," not counting those Days when the temperature is below 40 °F.

Table 511.3.6:1
Timetable for Removal of Forms

Structural component	Minimum time for removal
Bottom of beams	14 Days
Bridge decks[a]	seven (7) Days
Floor slabs	seven (7) Days
CBC Floors	seven (7) Days
CBC Top Slab	seven (7) Days
Walls	24 h
Columns	48 h
Sides of beams	24 h
All other parts	24 h

[a]Additional requirements of Section 512, "Superstructure Concrete," shall apply.

If one (1) of the test methods in Section 510.3.5.2, "In-Place Concrete Strength Measurements," is used to control the field operations, the Contractor may remove forms from the bottom of beams and floor slabs when the concrete reaches 75% of the design compressive strength.

511.3.7 Joints

The Contractor shall make construction joints in concrete Structures in accordance with the Plans, unless otherwise directed or approved by the Project Manager.

If the concrete placement is interrupted and additional construction joints are required, the Contractor shall place the additional joints in planes perpendicular to the principal lines of stress, and at points of minimum shear, as approved by the Project Manager.

511.3.7.1 Keyed Joints

The Contractor shall mechanically bond construction joints with keys formed by beveled strips embedded in the surface of the concrete. The Contractor shall make the keys from 1 3/8 inch to 1 1/2 inch deep. The Contractor shall place the keys centrally within the thickness of the joint. The Contractor shall ensure that the keys have a width that is one-third (1/3) of the depth of the smallest dimension of the joint. The keys do not need to exceed the clear distance between reinforcing mats, or be greater than eight (8) inches. The Contractor shall provide raised keys in accordance with the Plans.

511.3.7.2 Bonding New Concrete to Existing

If bonding new and existing concrete, the Contractor shall retighten the forms before

depositing new concrete on or against the hardened concrete. The Contractor shall roughen the surface of the hardened concrete without loosening the aggregate or damaging the concrete on the surface. The Contractor shall thoroughly clean the surface of foreign matter and laitance.

The Contractor shall utilize a bonding method at the interface between the hardened and fresh concrete. It is Acceptable to utilize an enriched mortar or a bonding agent. When using enriched mortar, the Contractor shall saturate the surface of the concrete and scrub the enriched motar onto the entire surface with a nylon bristled brush. The Contractor shall place the new concrete before the enriched mortar reaches an initial set. If using a bonding agent, the Contractor shall follow the manufacturer's application instructions. The Contractor shall place the concrete continuously from joint to joint, and finish the face edges of exposed joints in accordance with the Plans.

511.3.7.3 Water Stops and Flashings

The Contractor shall provide and place water stops, and flashings per the Contract documents. The Contractor shall splice or solder water stops and flashings to form continuous watertight joints.

Swellable hydrophilic waterstop shall be installed with two (2) inch minimum concrete cover. Materials shall be installed per manufacturer's installation instructions.

511.3.7.4 Joint Sealing Materials

The Contractor shall install joint sealers in accordance with the manufacturer's recommendations, including surface preparation and the use of primers and backer-rod as required.

511.3.8 Miscellaneous Construction

511.3.8.1 Setting of Bearings

The Contractor shall ensure the surfaces on which metal masonry plates and elastomeric bearing pads will rest are flat and on level planes. If using elastomeric bearing pads, the Contractor shall finish the Bridge seats slightly high and grind to the correct elevation.

If it is necessary to adjust the elevation of a bearing upward, the Contractor shall make the adjustment by placing full size shim plates. If it is necessary to adjust the elevation of a bearing downward, the Contractor shall make the adjustment by diamond grinding to a level plane-bearing surface. The Contractor shall not use grout to level or adjust elevation.

If placing a bearing surface below the level of adjacent concrete, the Contractor shall ensure water drains away from the masonry plate or elastomeric bearing pad.

The Contractor shall finish sections of Bridge seats on abutments or piers on both sides of bearing assemblies to drain, with a slope of from 1/16 inch to 1/8 inch per foot. The Contractor shall correct depressions that retain water.

511.3.8.2 Waterproofing

If required in the Contract, the Contractor shall protect the backsides of abutment backwalls and wingwalls by waterproofing. The Contract shall define the vertical and horizontal limits of the waterproofing. The Material shall be installed in conformance with the manufacturer's application instructions.

511.3.9 Finishing

The Contractor shall perform finishing after removing forms in accordance with the Contract.

511.3.9.1 Exposed Surfaces

The Department considers “exposed surfaces” as surfaces that are not buried in the ground or permanently covered by the fill, or against which the fill is not permanently placed. However, the Department does not consider the inside surfaces of concrete box drainage Culverts and concrete box girders, and the bottom side of concrete Bridge decks as “exposed surfaces.”

511.3.9.2 Class 1, Ordinary Surface Finish

The Contractor shall apply a Class 1 finish to exposed surfaces as a final finish or before a Class 2, Rubbed Surface Finish, or a Class 4, Special Surface Finish.

A Class 1 finish includes the removal of rods, bolts, or other form ties to at least 1/2 inch deep from the face of the concrete. The Contractor shall fill tie holes and honeycombs with mortar composed of one (1) part cement and two (2) parts sand; the Contractor shall use the same brand and type of cement as used in the concrete.

The Contractor shall remove objectionable fins, bulges, and projections by rubbing with carborundum bricks or by other methods approved by the Project Manager. If necessary, the Contractor shall clean the entire surface. The Contractor shall keep such surfaces in an Acceptable condition until Final Acceptance of the Work.

The Contractor shall apply a Class 1 finish to surfaces buried in the ground or permanently against the fill, except that form ties may be cut off even with the concrete surface, and fins, minor bulges, projections, stains, and discolorations do not need to be removed.

Unless specified otherwise in the Contract, the Contractor shall apply a Class 1 finish to the front faces of backwalls of abutments, the top surfaces of Bridge seats on piers and abutments, and concrete curtain walls between pier pilings.

The Contractor shall apply a Class 1 finish to the inside surfaces of concrete box drainage Culverts, except as noted in Section 511.3.8.3, “Class 2, Rubbed Surface Finish.”

511.3.9.3 Class 2, Rubbed Surface Finish

The Contractor shall apply a Class 2 finish to concrete surfaces generally exposed to public view.

The Contract may specify a Class 4, Special Surface Finish with selected colors, for various components or parts of components. If the Contract specifies a Class 4, Special Surface Finish, the Contractor shall apply a Class 2 finish first, unless otherwise approved by the Project Manager.

A Class 2 finish consists of a Class 1 finish, then thoroughly wetting the surface and applying a mortar.

The Contractor shall apply a thin mortar, in accordance with Section 511.2.1.1, “Concrete

Surface Finishing Materials," and rub it into holes and pockets in the surface of the concrete. The Contractor shall allow the mortar to remain until it has set sufficiently to prevent removal by subsequent rubbing operations. The Contractor shall rub the surface with a No. 25 to No. 30 carborundum brick, then, rub with burlap to remove excess mortar. If the completed rubbed surface does not look uniform, the Contractor shall make a final finish by wet rubbing with a No. 30 carborundum brick.

The Contractor shall apply Class 2 finish to the following:

1. Outside vertical surfaces of Bridge decks;
2. Outside surfaces of exterior girders, curb and rail posts seen in elevation view;
3. Curb tops, post tops, inside faces of curbs, and faces of hand rails;
4. Exposed surfaces of pier columns and caps;
5. Abutment wingwalls and Bridge seats one (1) ft below final grade;
6. Bridge rehabilitation Projects with existing slope paving;
7. Top surface of slope paving (tops of Bridge seats require only a Class 1 finish);
8. Exposed surfaces of barrier railings on Bridges or concrete box Culverts;
9. Exposed surfaces of miscellaneous concrete Structures extending above Shoulder line grade and inside walls of concrete underpass Structures;
10. Concrete box Culverts used for drainage, on the soffit and streamside faces of headwalls and wingwalls, and for six (6) inches down the back side of wingwalls; and
11. The interiors of sidewalls to one (1) ft back from the face of the Culvert at the tops of the sidewalls, and extending on a 45° line downward and inward.

511.3.9.4 Class 3, Float Finish

The Contractor shall apply a Class 3 finish to upper surfaces not formed, such as tops of walls, headwall, tops of slabs and bottom slabs of box Culverts, copings and Bridge seats, except tops of Bridge decks, Sidewalks, or curbs.

A Class 3 finish consists of placing an excess amount of concrete in the forms and striking off this excess concrete with a template, forcing the coarse aggregate below the surface. After striking off the concrete, the Contractor shall thoroughly work the surface with a wooden, cork, or canvas float without adding water or cement. Before the final finish has set, the Contractor shall use a fine brush to remove surface film and to produce a fine grain, smooth, sanded texture.

511.3.9.5 Class 4, Special Surface Finish

When specified in the Contract documents, the Contractor shall apply a Class 4, Special Surface Finish. The Class 4, Special Surface Finish shall be applied in accordance with Specification Section 548, "Coating of Concrete."

The Contractor shall apply the Class 4 finish over the Class 2 finish, unless directed otherwise by the Project Manager.

The Contractor shall apply the Class 4 finish consistent with the location requirements of Section 511.3.8.3, "Class 2, Rubbed Surface Finish." If repairing existing Structures, apply a Class 4 finish to the entire surface of the repaired components.

511.3.10 Curing

The Contractor shall cure all concrete in accordance with ACI 308 – Guide to Curing Concrete. All concrete shall receive a minimum of seven (7) Days of curing treatment. The Contractor shall use curing methods in accordance with Table 511.3.10:1, "Curing of Concrete Structures," unless the Contract specifies otherwise.

If the Department allows the Contractor to choose the curing method, the Contractor shall obtain the approval of the Project Manager before beginning curing operations.

Table 511.3.10:1
Curing of Concrete Structures

Method designation	Curing method description
Method 1	Water curing
Method 2	Curing compound
Method 3	Form curing
Method 4	Combination of Method 1 and Method 2

Structure description	Curing methods
Top surfaces of:	
Bridge decks[a]	4
Approach slabs	4
Concrete curbs, gutters and Sidewalks	1 or 2
Pier caps, abutment Bridge seats	1 or 2
Wingwalls and parapet walls	1 or 2
All vertical concrete surfaces that begin in contact with form Materials, including but not limited to:	3
Barrier walls, barrier railing, wingwalls, parapet walls, abutments, box culverts, decks, slabs, curbs, gutters, sidewalks, construction joints	
Elevated horizontal surfaces on the underside of structural elements that begin in contact with temporary form Materials including but not limited to:	3
pier caps, girders, structural slabs	
Slip Formed Concrete elements including but not limited to:	2
Concrete wall barriers, curb, gutter	
All other concrete[b]	1, 2, or 3

[a]See Section 512.3.10.1, "Curing," for additional curing requirements for Bridge decks.

[b]Unless the Contract specifies otherwise.

511.3.10.1 Method 1, Water Curing

The Contractor shall keep the concrete thoroughly and continuously wet and covered for at least seven (7) Days. The Contractor shall place and anchor covers, mats, and sheeting to ensure continuous contact with the concrete surfaces.

The Contractor shall cover concrete slabs as soon as possible with a double layer of clean, wet burlap or cotton mats, or other moisture retaining Material approved by the Project

Manager. The Contractor shall ensure that the moisture retaining Materials lay flat with no wrinkles and that adjacent strips of moisture retaining Materials overlap at least 12 inches. After installation, the Contractor shall soak the moisture retaining Material and add moisture as required to ensure that it is not allowed to become dry for the duration of the specified curing period. The Project Manager will determine the suitability of the moisture retaining Material for reuse, based on the cleanliness and absorptive ability of the Materials.

In addition to the moisture absorptive Material, the Contractor shall install plastic sheeting over the moisture absorptive Material. If the slabs are on grade, the Contractor shall extend the cover Materials at least twice the slab's thickness beyond the edges of the slab, and make sure that the entire exposed surface of the concrete is protected. If the slab is a Bridge deck, the Contractor shall place the cover Materials to fully protect exposed edges and unformed surfaces of the concrete.

The Contractor may temporarily remove the cover from surfaces that require a rubbed finish for finishing, but shall restore the cover as soon as possible.

511.3.10.2 Method 2, Curing Compound

Application of curing compound shall be in accordance with manufacturer's application recommendations.

For slabs, Bridge decks and other flatwork, the Contractor shall apply the curing compound to the fresh concrete as soon after finishing as allowed by the manufacturer.

The Contractor shall thoroughly mix the membrane forming curing compound per the manufacturer's recommendations.

The Contractor shall not apply the curing compound in rainy conditions. The Contractor shall adhere to the thermal limitations as specified by the manufacturer – typically, the product when stored should not be allowed to freeze and should not be applied when the air or concrete temperature is less than 40 degrees Fahrenheit.

The Contractor shall apply the curing compound under pressure with an atomizing-type spray nozzle. The Contractor shall uniformly cover the entire surface area at the rate recommended by the manufacturer or at a rate of at least one (1) gal per 175 ft^2 whichever rate is greater. The Contractor shall use spray Equipment with enough pressure to force the curing compound to leave the nozzle as a fine mist. If the nozzle becomes plugged, the Contractor shall immediately clear the nozzle before continuing the application. The Contractor shall not continue to spray curing compound through a nozzle that has become plugged or obstructed.

The Contractor shall apply the curing compound by first spraying back and forth in one (1) direction until a uniform covering has been achieved. Then, the Contractor shall spray back and forth in a direction perpendicular to the first application until a second, uniform covering has been achieved. The Contractor shall ensure that the entire curing surface has been uniformly covered with two (2) coatings of curing compound. The Contractor shall not apply the curing compound to exposed reinforcing steel.

The Contractor shall protect all surfaces covered with curing compound for seven (7) Days after application. The Contractor shall provide walkways and mats for workmen, Material, and Equipment.

The Contractor shall not use a curing compound that exhibits separation, segregation, or skimming.

The Contractor shall not apply curing compound to surfaces that will receive a Class 2 or Class 4 finish, unless the Contractor thoroughly cleans the surfaces per the recommendations of the manufacturer of the Class 2 or Class 4 finish product.

511.3.10.3 Method 3, Form Curing

The Contractor shall leave forms in place in accordance with Section 511.3.6, “Removal of Forms.” The Contractor shall keep wood forms moist during the curing period and replenish the system with water to maintain a continuously moist condition. The Contractor shall cure exposed surfaces with Methods 1 or 2.

Form removal shall be in accordance with Section 511.3.6, “Removal of Forms.” Should forms be removed prior to the specified seven (7) day curing period, the Contractor shall immediately resume curing by Method 2.

For Structures with formed surfaces that require the application of a finish per Section 511.3.8, “Finishing” such as barrier walls, barrier railings on Bridges, wingwalls, or parapets on Bridges or box Culverts, the Contractor shall remove the forms in accordance with Section 511.3.6, “Form Removal,” finish the concrete in accordance with Section 511.3.8, “Finishing,” and resume curing with Method 2 for the duration of the curing period. The Contractor shall not pause curing for more than two (2) hours.

511.3.10.4 Method 4, Combination of Curing Compound and Water Curing

The Contractor shall apply Method 2 curing compound as soon after finishing as is allowed by the manufacturer.

When the concrete is hard enough that placement loads and burlap or cotton mats can be applied without marring the concrete surface or deformation of structural elements, the Contractor shall apply Method 1 curing directly over the curing compound coated surface.

511.3.10.5 Equipment and Personnel Readiness

The Contractor shall show the Project Manager that curing Material and Equipment (including backup sprayers and mixers) are in working order, at least one (1) Day before concrete placement.

511.3.10.6 Temperature Requirements for Storage and Application

The Contractor shall store curing compounds in protected areas away from weather and extreme temperatures and per the manufacturer’s recommendations. The Contractor shall dispose of compounds that have been frozen in storage. The Contractor shall apply curing compounds when the temperature of the compound is between 50 °F and 95 °F.

511.3.10.7 Penetrating Water Repellent Treatment Solution

The Contractor shall saturate the exposed surfaces of the following concrete Structures with a penetrating water repellent treatment in accordance with Section 532, “Penetrating Water Repellent Treatment” for:

1. Bridge wingwalls;
2. Front and side faces of abutment Bridge seats;
3. Front faces of abutments, backwalls and diaphragms;

4. Top surfaces of Bridge seats on piers and abutments;
5. Pier columns, stem walls and vertical surfaces of pier caps;
6. Top and vertical side surfaces of Bridge decks, except in the areas where using epoxy Bridge deck overlays;
7. Top surfaces of concrete approach slabs;
8. Concrete barrier railings;
9. Concrete wall barriers; and
10. Sidewalks, curbs and gutters on Structures.

The Contractor shall extend treatment to at least one (1) ft below the final groundline.

The Contractor shall not treat the underside of pier caps, or side and end surfaces of concrete approach slabs.

511.4 METHOD OF MEASUREMENT

The Department will measure all pay items using the dimensions shown in the Contract or approved modifications.

511.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Structural Concrete, Class ____	Cubic Yard
Structural Concrete, Class ____, ____ inch	Square Yard
Substructure Concrete, Class ____	Cubic Yard

511.5.1 Work Included in Payment

The following Work and items will be considered as included in the payment for the main item(s) and will not be measured or paid for separately:

1. Waterstops and flashings;
2. Waterproofing;
3. Premolded and preformed joint fillers;
4. Concrete required to fill overbreakage in excavation when footings or walls are cast against vertical or horizontal faces of excavation;
5. Installation of drains and weep holes;
6. Extruded polystyrene; and
7. Means and methods associated with placement of concrete in hot and cold weather conditions, including but not limited to wind break, fogging systems, and temporary heat.

TECHNICAL SPECIFICATION 540

STEEL REINFORCEMENT

This specification applies to bid item number:
8: Reinforcing Bars Grade 60

NMDOT Technical Specification 540 unmodified for this project.

END OF SECTION

SECTION 540: STEEL REINFORCEMENT

540.1 DESCRIPTION

This Work consists of providing and placing steel reinforcement.

540.2 MATERIALS

540.2.1 Bar Reinforcement

The Contractor shall provide deformed bars in accordance with AASHTO M 31, Grade 60, or ASTM A706, Grade 60, at the nominal dimensions in accordance with Table 540.2.1:1, "Nominal Dimensions of Reinforcement." AASHTO M31 Grade 40 may be used for Reinforced Concrete for Minor Structures (Section 515 only).

Table 540.2.1:1
Nominal Dimensions of Reinforcement

Bar size	Nominal Weight (lb/ft)	Diameter (inch)
No. 3	0.376	0.375
No. 4	0.668	0.500
No. 5	1.043	0.625
No. 6	1.502	0.750
No. 7	2.044	0.875
No. 8	2.670	1.000
No. 9	3.400	1.128
No. 10	4.303	1.270
No. 11	5.313	1.410
No. 14	7.650	1.693
No. 18	13.600	2.257

540.2.2 Welded Wire Fabric

The Contractor shall provide welded wire fabric in accordance with AASHTO M 55.

540.2.3 Spiral Reinforcement

The Contractor shall provide spiral reinforcement fabricated from steel bars in accordance with AASHTO M 31, or from cold drawn steel wire in accordance with the AASHTO M 32.

540.2.4 Reinforcing Wire

The Contractor shall provide reinforcing wire in accordance with AASHTO M 32.

540.2.5 Corrosion-resistant and Coated Reinforcing Bars

The Contractor may use one (1) of the following corrosion-resistant or coated reinforcement systems for Bridge decks and other concrete components exposed to weather and Road salts:

1. Epoxy-coated reinforcement in accordance with ASTM A775 and from plants certified by the Concrete Reinforcing Steel Institute (CRSI) for the coating and fabrication process;
2. Deformed stainless steel bars in accordance with ASTM A 955;

3. Stainless steel clad deformed steel bars in accordance with AASHTO M 329;
4. Uncoated low-carbon, chromium, steel bars in accordance with AASHTO MP 18 ; or
5. Hot-dipped galvanized reinforcement in accordance with ASTM A767.

540.2.6 Coating and Patching Materials

The Contractor shall provide the following coating and patching Materials:

1. A fusion-bonded powdered epoxy resin coating Material that meets the requirements of ASTM A 775.
2. A liquid, two (2) part epoxy patching Material formulated to be compatible with the fusion-bonded epoxy powder coating, to repair damaged or uncoated areas. The patch Material shall meet the requirements of ASTM A775 Annex A2.
3. Zinc-rich paint with a minimum 65% zinc content in accordance with ASTM A780 for patching damaged and uncoated areas of hot-dip galvanizing.

540.2.7 Accessories

The Contractor shall provide plastic-coated reinforcing tie wire for tying epoxy-coated reinforcing bars, for deformed stainless steel bars, for stainless steel clad deformed steel bars and for uncoated low-carbon, chromium, steel deformed bars. The Contractor shall provide galvanized, annealed wire tires for galvanized reinforcing bars.

The Contractor shall provide continuous chairs or supports which shall be one (1) of the following types of chairs, supports, and clips:

1. Steel, fully coated with plastic or fusion-bonded epoxy.
2. Galvanized steel, with the cradle and the upper two (2) inches of the chair, support, or clip, coated with fusion-bonded epoxy or plastic.
3. Galvanized metal chairs or other metal supports for reinforcement that contacts the exposed concrete surfaces.
4. Galvanized, painted or epoxy-coated metal chairs or other corrosion resistant metal supports for regular reinforcement.
5. Epoxy coated metal chairs or other corrosion resistant metal supports for epoxy-coated reinforcement.
6. Galvanized sand chairs or other metal supports placed directly on the ground; or
7. Concrete blocks in place of sand chairs or other metal supports placed directly on the ground.

The Contractor shall not use uncoated black (ferrous) steel ties, chairs, supports or clips in direct contact with stainless or galvanized reinforcing.

540.2.8 Certificates of Compliance

The Contractor shall provide Certificates of Compliance to the Project Manager with each reinforcing steel shipment.

The Contractor shall show the Project number, the shipping invoice number, name of the manufacturer, pounds shipped, heat numbers, Laboratory test reports, and grade of steel on the Certificates of Compliance. This requirement is the same for each of the coating/cladding systems and the corrosion-resistant systems.

540.2.9 Epoxy-Coated Reinforcing Bar Certificates of Compliance

The Contractor shall submit evidence that the epoxy-coated reinforcing steel furnished for this Project was produced by a plant that is currently Certified by the CRSI.

The Contractor shall provide the Department's Inspector three (3) copies of a Certificate of Compliance for each shipment of coated bars. The Contractor shall state on the certificate that the samples of the coated bars were tested and that the test results were in accordance with ASTM A 775 and this specification. The Contractor shall show epoxy resin batch numbers on the certificate.

The Contractor shall provide coating test results to the Department for inclusion in final inspection reports.

540.2.10 Epoxy-Coated Reinforcing Coating

Epoxy coating shall be applied by the electrostatic spray method or other organic coating methods that meet the requirements of ASTM A 775.

The Contractor shall provide epoxy coated reinforcing steel that is produced by a plant that is currently Certified by the CRSI.

540.2.11 Hot-Dip Galvanized Reinforcing Bars

The Contractor shall provide hot-dip galvanized reinforcing bars in accordance with ASTM A 767. The Contractor shall galvanize bar after cutting and bending.

540.2.12 Galvanizing Material

The Contractor shall provide galvanizing zinc in accordance with ASTM B6.

540.3 CONSTRUCTION REQUIREMENTS

540.3.1 GENERAL

The Contractor shall measure dimensions from centerline of bar to centerline of bar.

The Contractor shall store all reinforcing bars above ground on platform skids or other supports. Reinforcing shall be kept free from dirt, grease, and other foreign matter. Reinforcing shall be kept free of corrosion as far as practicable.

540.3.1.1 Bar Lists and Bending Diagram

When the Contract documents do not include detail bar lists and bending diagrams, the Contractor shall provide such list and diagrams to the State Bridge Engineer for review and approval. The approval of bar lists and bending diagrams shall in no way relieve the Contractor of responsibility for correctness. The bar lists and bending diagrams shall meet the requirements of the current edition of the Concrete Reinforcing Steel Institute's (CRSI) publication Reinforcing Bar Detailing. The Contractor shall allow 30 Days for review of the submittal.

540.3.1.2 Bundling and Tagging

The Contractor shall tag and mark reinforcement bar shipments in accordance with CRSI's *Code of Standard Practice*.

540.3.1.3 Bar Bending

The Department will allow cold bending around a pin. The Contractor shall not field bend Grade 60 bars, epoxy-coated bars or hot-dip galvanized bars.

Unless otherwise directed, the Contractor shall ensure the bend diameter is in accordance with CRSI Manual of Standard Practice current edition.

540.3.1.4 Splicing

The Contractor shall splice bars only in accordance with the Plans unless otherwise approved by the State Bridge Engineer.

The Contractor shall place and tie bars in lapped splices to maintain minimum reinforcing cover.

The Contractor shall splice spiral reinforcement by lapping. The Contractor shall ensure that laps are at least 48 bar or wire diameters, but not less than one (1) ft with 90° hooks around longitudinal bars at ends.

The Department will allow mechanical couplers for AASHTO M 31, Grade 60, and ASTM A706, Grade 60. Mechanical coupler splice strength must be greater than or equal to 125% of the yield strength of the spliced reinforcing bars and must develop the specified tensile strength of the bars. ACI 318 “Type 2” mechanical couplers meet the above splice strength requirements. The Contractor shall submit coupler type (manufacturer and model number) and certified test results from an approved testing agency showing that the coupler meets these requirements.

If the mechanical couplers are included in the Contract Documents, the method of payment for couplers shall be by the each. If the mechanical couplers are not included in the Contract Documents but are requested for the convenience of the Contractor, payment shall be incidental to the reinforcing bar pay item.

If the mechanical couplers are not included in the Contract documents, the Contractor may submit documentation to the Project Manager for showing where mechanical couplers are proposed to be used. The Contractor shall show splice locations and coupler clearance dimensions in the request and submit before fabricating the reinforcing bars that will be coupled. The Contractor shall allow 14 Days for review and approval of submittals.

Unless otherwise specified, the Contractor shall ensure that welded wire fabric and bar-mat reinforcement overlap is at least one (1) spacing of cross wires plus two (2) inches when measured between the outer-most cross wires of each sheet.

540.3.1.5 Field Cutting

Bars may be cut to length in the field by shearing or sawing. Flame cutting will not be permitted. The ends of coated or clad bars cut in the field shall be patched with suitable patching Material.

540.3.1.5.1 Reinforcing Bar Placement

The Contractor shall place reinforcing bars as shown in the Contract drawings, securely tied in position with wire not smaller than 16 gauge. The Contractor shall carefully place, support and tie reinforcing, and place and consolidate concrete around reinforcing with care to avoid any displacement and damage to the coatings.

The Contractor shall tie all intersections where bar spacing is greater than or equal to one (1) ft in either direction. The Contractor shall tie alternate intersections where bar spacing is less than one (1) ft in either direction.

The Contractor shall use metal spacers, chairs, hangers, and other approved devices to hold the reinforcing bars in position.

When using concrete blocks to support the bottom mat of reinforcement in slabs that are cast on ground, the Contractor shall use dense, rectangular concrete blocks that:

1. Have compressive strength and density equal to or greater than the concrete to be placed;
2. Occupy a small area; and
3. Contain embedded, plastic or epoxy-coated, tie wires for attachment of reinforcement.

The Contractor shall not use wooden spacers or supports.

Tie reinforcing bar mats in Bridge deck and concrete box Culvert slabs to beams and forms to prevent upward movement during concrete placement. The Contractor shall ensure that the space between ties does not exceed ten (10) ft.

540.3.1.5.2 Reinforcing Bar Placement Tolerances

The Contractor shall ensure that the space between adjacent bars does not vary more than the greater of ½ inch or 1 /24 of the spacing dimension shown on the Plans.

Except for slabs cast on the ground, the Contractor shall ensure that the clear cover of reinforcement shall not vary more than the greater of either 1/4 inch or 1/8 of the dimension shown on the Plans.

The Contractor shall ensure that the reinforcement clear cover in slabs cast on the ground does not vary more than minus 1/2 inch from the position shown on the Plans.

540.3.1.6 Cleaning Reinforcing Bars

Before placing concrete, the Contractor shall clean the reinforcing bars of Materials that would reduce or destroy the bond.

540.3.1.7 Welding of Reinforcing Steel

The Contractor shall weld reinforcing steel only if the Contract requires it or if the State Bridge Engineer authorizes it in writing. The Contractor shall weld in accordance with AWS Specification D1.4, Reinforcing Steel Welding Code. Welding of bars other than ASTM A706 is allowed only upon approval of qualified welding procedures for those bars that comply with AWS D1.4. The Contractor shall submit a Welding Procedure Specification, stamped by an AWS certified welding Inspector for each procedure.

Welding reinforcing to other steel added by the Contractor for stiffening, cage alignment, lifting, handling and other Contractor needs shall not be allowed unless called for in the Plans.

540.3.1.8 Concrete Cover Requirements

Concrete cover is the distance from the surface of concrete to the edge of the bar nearest to that surface. If cover dimensions are not specified in the Contract, the Contractor shall use the concrete cover dimensions in accordance with Table 540.3.1.8:1, "Concrete Cover Requirements."

Table 540.3.1.8:1
Concrete Cover Requirements

Location	Minimum Cover (inch)
Concrete cast against and permanently exposed to the ground	3
Concrete exposed to the ground or weather	
Principal reinforcement	2
Stirrups, ties and spirals	1 ½
Concrete Bridge slabs	
Top reinforcement	2
Bottom reinforcement	1
Concrete not exposed to weather or in contact with ground	
Principal reinforcement	1 ½
Stirrups, ties and spirals	1
Bar bundles	2[a]
[a]Or equal to the diameter of a single bar of equivalent area, whichever is greater.	

540.3.1.9 Final Inspection

The Contractor shall not place concrete until the Department inspects and accepts the reinforcing steel in place.

Acceptance of the reinforcing steel does not relieve the Contractor of responsibility for the cover and position control of the steel.

540.3.2 Requirements for Epoxy-Coated Reinforcing Bars

540.3.2.1 Storage and Handling of Epoxy- Coated Reinforcing Bars

The Contractor shall transport and store epoxy-coated reinforcing steel on wooden or padded supports. The Contractor shall use devices with padded contact areas to handle epoxy-coated reinforcement bars and prevent bar-to-bar abrasion. The Contractor shall not drop or drag bars or bundles. The Contractor shall use spreader beams and multiple pick points when hoisting bar bundles to prevent sagging. The Contractor shall not store epoxy-coated reinforcing bars in sunlight for more than 30 Days. The Contractor shall use only non-metallic sleeved heads with immersion-type vibrators when placing concrete around epoxy-coated reinforcing.

540.3.2.2 Repair of Damaged Epoxy-Coating

The Contractor shall repair visible damage before shipping. The Contractor shall ensure the total surface area of patched coating Material is not more than one percent (1%) of the total coated area in any one (1) foot section. The Department will reject bars shipped to the Project that show more than one percent (1%) patched coating Material.

The Contractor shall patch sheared ends, cuts and exposed areas promptly before detrimental oxidation occurs. The Contractor shall keep exposed areas free of contaminants before patching.

The Contractor shall patch coating damage before placing concrete. The Contractor shall ensure that the total patched surface area does not exceed two percent (2%) of the coated area in any one (1) foot section. The Department will reject any installed bars with more than two percent (2%) patching.

The Contractor shall apply the patching Material in strict compliance with the manufacturer's instructions. The Contractor shall allow adequate time for the patch to cure before placing concrete over the bars.

540.3.3 Requirements for Galvanized Reinforcing Bars

540.3.3.1 Galvanizing Bent Bars

Where galvanized bars are detailed to be bent or have other types of cold-forming, the bars must be bent before galvanizing.

540.3.3.2 Surface Preparations

The Contractor shall prepare bar surfaces by removing dirt and grease with a hot alkaline solution. The Contractor shall use a diluted solution of sulfuric acid to pickle. The Contractor shall use a solution of zinc ammonium chloride to flux. The Contractor shall ensure that the resulting surface condition is equal to SSPC-SP 10 as described by the SSPC.

540.3.3.3 Thickness of Galvanizing

The Contractor shall ensure that the galvanizing after drying with air, steam or wiping is from three (3) mils to 3.9 mils thick. The Contractor shall determine the thickness with a magnetic thickness gage.

540.3.3.4 Chromating

The Contractor shall treat the galvanized coating with chromate. This prevents a reaction between the bars and fresh Portland cement paste. The Department will allow proprietary chromating treatment solutions of equivalent strength instead of the generic chemical treatment in accordance with ASTM A 767, Section 5.3. Quenching of bent bars or bars to be bent is not allowed. Such bars must be chromated at ambient temperature.

540.3.3.5 Finish and Adherence of Coating

The Contractor shall ensure that the zinc coating is free of bare spots, blisters, flux spots or inclusions, dross, and acid or black spots. The Department will reject bars that stick together after galvanizing. A matte gray finish appearance is not, by itself, a cause for rejection.

The Contractor shall ensure that the coating cannot be removed through normal handling.

540.3.3.6 Installation of Galvanized Reinforcing Bars

The Contractor shall transport and store galvanized bars in a manner to prevent damage to the galvanized coating. All systems for handling galvanized coated bars shall have padded

contact areas. All bundles of bars shall be lifted using spreader beams and multiple pick points or a platform Bridge to prevent bar-to-bar abrasion from sagging in the bar bundle. The bars and bundles shall not be dropped or dragged on the ground, platforms or other bars.

Galvanized reinforcing bars shall not be tied with black steel or left in contact with black steel. Galvanized reinforcing bars shall be left in contact only with galvanized, plastic-coated, or epoxy-coated surfaces.

540.3.3.7 Repair of Damaged Galvanizing

The Contractor shall patch sheared ends, cuts and exposed areas using a zinc-rich paint in accordance with ASTM A780. The Contractor shall prepare the surface to be patched so that it is clean, dry and free of oil, grease and corrosion products. The Contractor shall blast-clean the surface to near-white metal, in accordance with SSPC-SP10. The Contractor shall spray or brush-apply the paint containing the zinc dust as recommended by the manufacturer in one (1) application of as many passes as required to achieve a dry film thickness of four (4) mils as determined using a magnetic or electromagnetic gage.

540.3.4 Repair of Stainless Steel Clad Deformed Steel Bars

The stainless steel clad deformed steel bars shall be shop bent as shown on the Contract documents using tools with non-ferrous surfaces that will not contaminate stainless steel cladding with ferrous particles. All ends of the bars where mild steel core is exposed shall be capped by one (1) of the following methods:

1. Heat shrink cap applied in accordance with the cap manufacturer's instructions.
2. Neoprene cap adhered with silicone or epoxy sealant.
3. Stainless steel cap epoxied in place.
4. Stainless steel seal weld.

No field cutting or bending of stainless steel clad deformed steel bars will be allowed.

540.4 METHOD OF MEASUREMENT

The Department will measure reinforcing bar weight in accordance with Table 540.2.1:1, "Nominal Dimensions of Reinforcement," whether it is black steel, epoxy-coated, galvanized, stainless steel, stainless steel clad, or low-carbon, chrome steel. The computed weights of reinforcing bars will be based on the nominal weights of the bars before application of the epoxy-coating, or galvanizing of the bars. Lap splices shown in the Contract documents shall be included in computing the weight of the bars for payment. For CBC construction, lap splice weight shall be included in computing the weight of the bars for payment when phased construction is required by the Contract documents and when maximum run lengths exceed 60 feet. When lap splices are unscheduled or are made for the convenience of the Contractor and are approved by the Project Manager at locations not shown in the Contract, the extra steel required for lap splices will not be included in computing the weight of the bars for payment. Mechanical couplers that are shown in the Contract documents or are required for construction shall be paid for by "Each." When mechanical couplers are installed for the convenience of the Contractor and are approved by the State Bridge Engineer at locations not shown in the Contract, the mechanical couplers will not be paid for.

540.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Reinforcing Bars, Grade ____	Pound

Epoxy-Coated Reinforcing Bars, Grade ____	Pound
Galvanized Bars, Grade ____	Pound
Uncoated Corrosion Resistant Reinforcing Bars, Grade ____	Pound
Stainless Steel Reinforcing Bars, Grade ____	Pound
Stainless Steel Clad Reinforcing Bars, Grade ____	Pound
Mechanical Couplers	Each

540.5.1 Work Included in Payment

The following Work and items will be considered as included in the payment for the main item(s) and will not be measured or paid for separately:

1. Clips, supports, wire, and other Material used for fastening reinforcement;
2. Samples and submittals; and
3. Mechanical couplers and reinforcing bar lap splices that are installed for the convenience of the Contractor.

TECHNICAL SPECIFICATION 541

STEEL STRUCTURES

This specification applies to bid item number:
10: Trash Rack
30: 6” Orifice Plate

NMDOT Technical Specification 541 Steel Structures is modified as follows:

662.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Trash Rack	Each
6” Orifice Metal Plate	Each

END OF SECTION

SECTION 541: STEEL STRUCTURES

541.1 DESCRIPTION

This Work consists of providing, fabricating, erecting, and coating Structural Steel.

Structural Steel includes forged or cast steel, bolts, tie rods, other ferrous or nonferrous Materials, and miscellaneous steel. Steel shall be divided into the following categories:

Tier 1 – rolled steel beams, plate girders, diaphragms and cross frames for steel Bridges, and overhead sign Structures.

Tier 2 – metal Bridge barrier rails, diaphragms for concrete Bridges, and steel bearing components.

Tier 3 – drop inlets, safety grates, cattle and game guards, pedestrian rails, gates, access panels, and other miscellaneous steel.

For welding of driven pile splices, see Section 541.3.6.4, “Field Welding.”

541.2 MATERIALS

541.2.1 Structural Steel

The Contractor shall provide Structural Steel in accordance with AASHTO M270, Grade 50, unless otherwise designated in the Contract. The Contractor shall provide steel for anchor bolts, sole plates, minor Bridge components, inlet grates, and cattle guards in accordance with AASHTO M270, Grade 36 or Grade 50.

541.2.1.1 Impact Testing Requirements for Non-Fracture-Critical Structures

For Materials requiring impact testing, the Contractor shall not weld repair the base metal at the producing mill. The Department will consider Structures to be non-fracture-critical, unless otherwise designated in the Contract. The Contractor shall fabricate the following in accordance with AASHTO M270, Table 10 when subject to tensile stresses:

1. Wide flange beams used as main load carrying members;
2. Flanges and web plates used in plate girders;
3. Flange cover plates;
4. Flange and web splice plates; and
5. Other components designated in the Contract.

The Contractor shall conduct Charpy V-notch (CVN) impact “H” or “P” frequency testing in accordance with AASHTO T243.

The Contractor shall ensure that Structural Steel meets requirements for minimum service temperatures as described for Zone 2 of the AASHTO’s *Standard Specifications for Highway Bridges* (negative one degrees (–1°)F – 30°F).

The Contractor shall conduct plate-frequency testing instead of hat-lot testing for plate Material thicker than 1-1/2inch.

541.2.1.2 Impact Testing Requirements for Fracture-Critical Bridge Components

The Contract will specify the CVN requirements for fracture-critical Bridge components.

541.2.2 Shear Connector Studs

The Contractor shall provide shear connector studs fabricated from cold-drawn bars, grades 1015, 1018, or 1020, either semi-killed or fully-killed in accordance with AASHTO M169.

If using flux-retaining caps, the Contractor shall use the low carbon grade steel for the caps that is suitable for welding and in accordance with ASTM A109. The Contractor shall produce the finish by cold drawing, cold rolling, or machining.

The Contractor shall ensure stud tensile properties are in accordance with Table 541.2.2:1, "Tensile Properties of Shear Connector Studs," as determined by tests of bar stock (after drawing) or finished studs, in accordance with ASTM A370.

Table 541.2.2:1
Tensile Properties of Shear Connector Studs

Property	Minimum Requirement
Tensile strength	60,000 psi
Yield strength @ 0.2% offset	50,000 psi
Elongation in two (2) inch	20%
Reduction of area	50%

The Contractor shall weld studs with automatic stud welding guns that shall be used to weld studs to girders. The operator shall be qualified per AWS D1.5 Subsection 7.7.4. The base metal where the stud is to be welded shall be ground to bright metal immediately prior to the weld being made. Manual welding will not be allowed except to make repairs. Repairs shall be in accordance with AWS D1.5 Subsection 12.6. Repair fillet size shall be a minimum of 5/16 inch.

541.2.3 Aluminum

The Contractor shall provide aluminum and aluminum alloy Materials in accordance with ASTM aluminum alloy designation and in accordance with the Plans.

541.2.4 Bolts

The Contractor shall provide high-strength bolts in accordance with Section 542, "High-Strength Bolts." The Contractor shall provide other bolts in accordance with ASTM A307, Grade A.

541.2.4.1 Unfinished Bolts

The Contractor shall provide unfinished ASTM A307 bolts. The Contractor shall provide thread bolts so that not more than two (2) threads are within the grip of the connected parts. The Contractor shall use bolts that will extend beyond the nut at least two (2) threads, but not more than 1/2 inch.

541.2.5 Structural Steel Coating

The Contractor shall provide coated Structural Steel in accordance with Table 541.2.5:1, "Coating of Structural Steel."

Table 541.2.5:1
Coating of Structural Steel

Item	Coating Requirement
Galvanizing, Hot-Dip Galvanizing, or Zinc Coating	Section 541.2.5.1
Structural Steel for Steel Bridges	Section 544, “Protective Coating of New Structural Steel”
Structural Steel for Concrete Bridges	Section 544, “Protective Coating of New Structural Steel”
Structural Steel for Miscellaneous Structures	Section 545, “Protective Coating of Miscellaneous Structural Steel”
Metal Bridge Railing	Section 545, “Protective Coating of Miscellaneous Structural Steel”
New Exposed Steel Bridge Piling and Similar Applications	Section 545, “Protective Coating of Miscellaneous Structural Steel”
Recoating Bridges	Section 546, “Recoating Structures”

541.2.5.1 Galvanizing or Zinc Coating

If the Contract requires a galvanized coating, the Contractor shall coat steel after fabrication in accordance with AASHTO M111.

Bolts, washers, nuts, and position dowels used in the assembly and erection of galvanized railing and posts or where specified, shall be galvanized in accordance with AASHTO M232 Class C or shall be zinc coated in accordance with ASTM B695.

After erecting the steel, the Contractor shall coat the galvanized hardware with a product meeting ASTM A780, Type 2.

541.2.5.1.1 Quality Control and Repair of Galvanizing

Uncleaned slag lines, bare spots, blisters, flux spots or inclusions, dross, acid, or black spots that exceed one (1) square inch or occur on more than five percent (5%) of the exposed surface area shall be cause for rejection of the lot. The Materials may be stripped, regalvanized, and again submitted for inspection; otherwise the entire lot shall be rejected.

Pieces with damage to less than five percent (5%) of the exposed surface area may, with the approval of the Project Manager, be repaired in accordance with ASTM A780 Type 1 - zinc-based solders which includes low melting point zinc alloy repair rods or powders or Type 3 - metallizing.

With the approval of the Project Manager, on areas that are concealed from direct weathering and on areas that are not aesthetically visible to the travelling public, ASTM A780 Type 2 (paints containing zinc dust, commonly referred to as “cold galvanizing”) may be used on areas less than one square inch and less than five percent (5%) of the exposed surface area. The dried film must contain no less than 90% pure zinc. Surface preparation and application shall be in accordance with the manufacturer’s requirements.

In any case, galvanizing repair shall not compromise the aesthetic Acceptability of the Project as determined by the Project Manager.

541.3 CONSTRUCTION REQUIREMENTS

541.3.1 Applicable Codes and Documents

The Contractor shall fabricate and erect steel Structures in accordance with the current edition of the following codes and documents:

1. AASHTO/AWS D1.5 – *Bridge Welding Code*;
2. AASHTO/AWS D1.1 – *Structural Welding Code*;
3. AWS D1.4 – Structural Welding Code – *Reinforcing Steel*;
4. AISC 204 – AISC Certification Program for Bridge and Highway Metal Component Manufacturers; and
5. The following AASHTO/NSBA Steel Collaboration documents:
   - 5.1. *S2.1 Steel Bridge Fabrication Guide Specification;*
   - 5.2. S 4.1 Steel Bridge Fabrication QC/QA Guide Specification;
   - 5.3. S10.1 *Steel Bridge Erection Guide Specification;*
   - 5.4. G 1.1 *Shop Detail Drawing Review / Approval Guidelines;*
   - 5.5. G 1.3 *Shop Detail Drawing Presentation Guidelines;* and
   - *5.6.* G12.1 *Guidelines to Design for Constructability*.

Although the AASHTO/AWS Steel Collaboration documents are titled “Guidelines” or “Guide Specifications,” consider them to have the same importance and standing as a code or a Specification. If the content of the collaboration documents appears permissive with words such as “should,” “could,” “may,” etc., consider the content to be a requirement unless otherwise approved by the State Bridge Engineer.

In the event of a conflict between a referenced code and this Specification, this Specification will take precedence.

In AASHTO/NSBA Steel Bridge Collaboration S 4.1, all references to Quality Assurance Inspector (QAI) shall be equivalent to referencing the Project Manager.

541.3.2 Quality Control and Quality Assurance (Contractor)

Quality Control and Quality Assurance shall be in accordance with the following:

Tier 1 – AASHTO/NSBA Steel Bridge Collaboration, S 4.1 Steel Bridge Fabrication QC/QA Guide Specification.

Tier 2 – NMDOT Approval of fabrication shop is required, AISC Certification Program for Bridge and Highway Metal Component Manufacturers (AISC 204) current edition shall be used as the basis for approval (AISC Certification is not required).

Tier 3 – NMDOT Approval of fabrication shop is required, AISC Certification Program for Bridge and Highway Metal Component Manufacturers (AISC 204) current edition shall be used as the basis for approval (AISC Certification is not required).

Fabricators shall contact the State Bridge Engineer to request shop inspection and approval.

541.3.2.1 Qualification of QA Inspector (NMDOT Representative)

Tier 1 – AASHTO/NSBA Steel Bridge Collaboration, S 4.1 Steel Bridge Fabrication QC/QA Guide Specification, Part C is superseded by the following requirement: current AWS Welding Inspector Certification.

Tier 2 – Licensed Professional Engineer or a certified AWS Welding Inspector.

Tier 3 – Project Manager or a certified AWS Welding Inspector.

The individual qualified for steel inspection shall also perform coating inspections with no further qualification with the exception of Tier 2 which may be performed by the Project Manager or certified AWS Welding Inspector. AASHTO/NSBA Steel Bridge Collaboration, S 4.1 Steel Bridge Fabrication QC/QA Guide Specification 3.2 and 8.1.2 shall not apply to the QAI inspector of coatings.

541.3.3 Submittals

For Tier 1, prior to installation, the Contractor shall provide all submittals in accordance with Section 106, "Control of Materials." Additional required submittals follow but are not limited to:

1. Structural Steel Mill Test Reports (MTRs);
2. Certificates of Compliance and other documentation for the protective coating;
3. The manufacturer's Certificate of Compliance for welding consumables;
4. QC inspection reports; and
5. A general Certificate of Compliance for the fabricated product.

The Contractor shall submit Certificates of Compliance instead of MTRs for Materials subjected to minimal stress levels, such as sole plates, shoe plates, anchor bolts, and fill plates.

541.3.3.1 Working Drawings

The Contractor shall allow 30 Days for review and Acceptance of Working Drawings and calculations. Any re-submittals will require an additional 14 Days for review. The Working Drawing submittal process must be complete prior to the Pre-Fabrication Conference (Section 541.3.5.1, "Pre-Fabrication Conference").

The Contractor shall prepare Working Drawings in accordance with AASHTO/NSBA G 1.3, Shop Detail Drawing Presentation Guidelines. The Department will review Working Drawings for Acceptance in accordance with AASHTO/NSBA G 1.1, Shop Detail Drawing Review / Approval Guidelines. The Working Drawing submittal shall include a detailed bill-of-Material in accordance with AASHTO/NSBA Steel Bridge Collaboration G 1.1 with the letter of intent to fabricate. The Contractor shall submit Working Drawings electronically in PDF format to the Project Manager.

The Contractor shall not make any changes to Accepted Working Drawings. If changes are made, the Contractor shall re-submit the Working Drawings for Acceptance.

The Contractor shall include the submittal and review time for its shop drawings and schedule for fabrication of the specialized structural steel components as a milestone per Section 108.3.1.1, "CPM Baseline Schedule" (bullet 5).

541.3.3.2 Working Drawings for Structural Steel Items Detailed on Standard Drawings

The Contractor may submit standardized Working Drawings instead of Project-specific drawings for Structural Steel items such as cattle guard grills and drop inlet grates.

The Contractor shall include the Fabricator's name and address, drawing title, drawing number, drawing date, revision dates, and Standard Drawing number on Working Drawings.

541.3.3.3 Erection Plan

The Contractor shall submit an erection Plan for Tier 1 steel. Erection Plans are not required for OH Sign Structures.

The Contractor shall submit an Erection Plan conforming to Section 2 of the AASHTO/NSBA Steel Bridge Erection Guide Specification S10.1, 2014 Edition and the following Department requirements:

1. The Erection Plan shall be prepared by a Professional Engineer licensed in the State of New Mexico and shall be accompanied by calculations verifying the safety of all aspects of erection;
2. The Erection Plan shall consider the load-bearing capacities of any temporary or permanent Structures used in the erection of the new Bridge, including any need for shoring;
3. The Erection Plan shall be submitted no less than thirty (30) Days prior to any steel erection operations; and
4. All costs for the Erection Plan and shoring of any temporary or permanent Structure used for the erection of the new Bridge shall be considered included in Bid Item 541100 – Structural Steel for Steel Bridges.

The Contractor shall allow 30 Days for review and Acceptance of the erection Plan. Any re-submittals will require an additional 14 Days for review. The erection Plan submittal process must be complete prior to the start of erection.

The Contractor shall include the submittal and review time for its erection Plan and schedule for erection of the specialized structural steel components as a milestone per Section 108.3.1.1, "CPM Baseline Schedule" (bullet 5).

541.3.4 Rolled Girders and Plate Girders

The Contractor shall provide girders to the full length shown in the Plans. Bolted or welded girder splices will not be permitted unless noted otherwise in the Plans.

541.3.5 Fabrication

The Contractor shall ensure that the fabrication shop for Tier 1 steel is certified in accordance with AASHTO/NSBA *Steel Collaboration S2.1*, *Steel Bridge Fabrication Guide Specification*. The Department will not require AISC certification for fabrication shops fabricating Tier 2 and Tier 3 steel items, but the Department must inspect and approve these shops before fabrication.

Steel will be fabricated in the shop unless otherwise approved by the Project Manager.

Tier 1 – AASHTO/NSBA Steel Bridge Collaboration, S2.1 Steel Bridge Fabrication Guide

Specification.

Tier 2 – AISC Certification Program for Bridge and Highway Metal Component Manufacturers (AISC 204) current edition.

Tier 3 – AISC Certification Program for Bridge and Highway Metal Component Manufacturers (AISC 204) current edition.

541.3.5.1 Pre-Fabrication Conference

A Pre-Fabrication Conference is required for Tier 1 steel (a Pre-Fabrication Conference is not required for OH Sign Structures). The Pre-Fabrication Conference shall be held in conjunction with the Pre-Construction Conference. The Pre-Fabrication Conference may be held on an alternate date at the discretion of the Project Manager. The agenda for the Pre-Fabrication Conference shall be based upon S2.1, "Steel Bridge Fabrication Guide Specification."

541.3.5.2 Attachment and Fit of Gussets and Stiffeners

Where welding of gusset plates, stiffeners or other secondary attachments to main structural members would otherwise result in intersections of welds, the Contractor shall clip back the corners of the attachments 1-1/4 inch minimum from the corner in each direction to avoid such intersections.

The Contractor shall terminate welds attaching secondary components to main members 1/4 inch short of the end of the attachments.

If the Plans require bearing stiffeners "finished to bear," the Contractor shall mill or grind the ends and obtain an even bearing against the flange the stiffeners will bear on.

If the Plans require "tight fit" stiffeners, the Contractor shall fit the stiffeners tight against the flange to exclude water after being coated.

541.3.5.3 Straightening of Flanges

At pier bearings, abutment bearings and splices, the Contractor shall straighten girder or beam flanges perpendicular to the webs. At bearings, the Contractor shall straighten flanges before fitting stiffeners. At splices, the Contractor shall straighten flanges before coating and shipment. The Contractor shall not cold bend.

541.3.5.4 Bearing Plates, Pins, and Rollers

541.3.5.4.1 Sole, Masonry, and Shoe Plates

The Contractor shall flatten the top and bottom surfaces of sole masonry and shoe plates to within ± 1/32 inch.

The Contractor shall machine sole plate surfaces that will contact elastomeric bearing pads perpendicular to the direction of expansion.

The Contractor shall machine other expansion surfaces in the direction of expansion.

541.3.5.4.2 Pins and Rollers

The Contractor shall accurately turn pins and rollers to dimensions and ensure that they are smooth, straight, and free of flaws.

541.3.5.4.3 Pin Holes

The Contractor shall bore a two (2) inch diameter hole longitudinally through the center of pins with an eight (8) inch diameter or larger.

The Contractor shall bore pinholes true to the specified diameter, smooth and straight, at right angles to the axis of the member and parallel with each other unless otherwise required. The Contractor shall produce the final surface with a finishing cut.

The Contractor shall not vary the outside to outside distance of end holes in tension members and inside to inside distance of end holes in compression members by more than 1/32 inch. The Contractor shall bore holes in built-up members after shop assembly.

541.3.5.4.4 Threads

The Contractor shall ensure that bolt and pin threads are in accordance with Unified Standard Series UNC-ANSI B1.1, Class 2A for external threads and Class 2B for internal threads. The Contractor shall thread pin ends with a diameter of 1 3/8 inch or greater with six (6) threads per inch.

541.3.5.4.5 Surface Finish

The Contractor shall finish the surfaces of bearings, base plates, pins, rollers, and other bearing steel that will come into contact with each other or with concrete in accordance with ANSI B46.1, Surface Roughness, Waviness and Lay.

541.3.5.5 Connections

541.3.5.5.1 Welding

541.3.5.5.1.1 Welder Qualifications

The Contractor shall use annually certified welders or those who provide documentation demonstrating continuing experience in the process. Welder must be qualified for the position the weld is performed in. All welders shall be certified by AASHTO/AWS D1.1 or D1.5 unless otherwise noted in the Contract.

Tier 1 – AASHTO/NSBA Steel Bridge Collaboration, S2.1 Steel Bridge Fabrication Guide Specification (Built-up plates and open rolled-shape structural elements AWS D1.5, welded tubular structural elements in accordance with D1.1)

Tier 2 – AISC Certification Program for Bridge and Highway Metal Component Manufacturers (AISC 204) current edition. The welder shall be AWS D1.1 certified.

Tier 3 – The welder shall be AWS D1.1 certified.

541.3.5.5.1.2 Testing of Complete Penetration Welds

The Contractor shall conduct nondestructive QC radiographic testing on complete penetration welds in accordance with AWS D1.5 or D1.1 (as applicable).

The Department may allow ultrasonic testing as a substitute for radiography. The Contractor shall submit an ultrasonic testing Plan for approval at least 30 Days before the start of fabrication. The Contractor shall provide detailed information about the Fabricator's previous experience with ultrasonic testing and resumes showing the training and experience of persons performing the testing. The Contractor shall not use ultrasonic testing for cases described in Section 6.7.1.1 of the AASHTO/AWS D1.5-Bridge Welding Code.

541.3.5.5.2 Bolted Connections

The Contractor shall bolt with high strength bolts in accordance with Section 542, "High-Strength Bolts."

The Contractor shall make bolt holes 1/16 inch larger than the nominal diameter of the connector, unless otherwise specified.

541.3.5.5.3 Gaps between Ends of Abutting Members

Where the Contract requires abutting milled joints, the Contractor shall ensure there are no gaps. The Contractor shall face the ends to provide a full and even bearing when assembled.

Where the Contract requires close joints, the Contractor shall not exceed 1/8 inch between the ends of abutting members. The Contractor shall not exceed 1/4 inch between abutting ends of girders at splices.

541.3.5.6 Camber Verification

The Contractor shall verify girder camber during the laydown operation. Unless assembling girders in the horizontal position, the Contractor shall meet the total camber dimensions less the deflections produced by the weight of the girder.

541.3.6 Erection Requirements

The Contractor shall erect the Structure in accordance with AASHTO/NSBA Steel Bridge Collaboration S10.1, *Steel Bridge Erection Guide Specification*.

If requested by the Project Manager, a Pre-Erection Conference shall be held prior to start of erection. The agenda shall be the review of the erection Plan.

541.3.6.1 Placement of Bearings

The Contractor shall ensure that column bases and bearing devices bear fully and uniformly on Substructures. The Contractor shall not place bearings on pier or abutment Bridge seat areas that are improperly finished or irregular. The Contractor shall grout to achieve uniform bearing only when the Contract allows grouting.

The Contractor shall place masonry plates and beam and girder span pedestals on impregnated fabric pads approved by the Project Manager at least 1/8 inch thick.

541.3.6.2 Anchor Bolt Holes

The Contractor shall core drill anchor bolt holes in accordance with Table 541.3.6.2:1, "Required Nominal Anchor Bolt Hole Diameters."

Table 541.3.6.2:1
Required Nominal Anchor Bolt Hole Diameters

Bolt diameter (inch)	Hole diameter (inch)
3/4	1-1/2
1	1-3/4
1-1/4	2

The Contractor shall set anchor bolts using non-shrink grout from the Department's Approved Products List. The Contractor shall remove excess mortar after the grout has set. The Contractor shall ensure that anchor bolt washers and nuts bear evenly against the steel-bearing surface. The Contractor shall ensure anchor bolts at the expansion ends of spans allow the free movement of the span.

541.3.6.3 Field Bolting

The Contractor shall install high strength bolts in accordance with Section 542, "High-Strength Bolts."

The Contractor shall block main structural members to the desired camber before torqueing the bolted splice connections.

For skewed steel Bridges with diaphragms perpendicular to the longitudinal centerline, the Contractor shall finger tighten diaphragm attachment bolts before deck placement. The Contractor shall fully torque bolts after the deck slab is in place.

Following completion of the Superstructure and after priming, the Contractor shall fill open holes in exterior beams and girders with button head bolts before Final Acceptance.

541.3.6.4 Field Welding

Field welding of permanent steel elements will not be permitted unless shown in the Plans, with the following exceptions:

1. Field welds shown in the Plans;
2. Splices for driven pile;
3. Sole plate to girder shoe plate;
4. Pedestrian rails;
5. Shear studs installed in the field for construction means and methods; or
6. As approved by the Project Manager.

541.3.6.4.1 Field Welding Submittal and Qualifications

The Contractor shall submit a welding procedure and the welder's certification for the welder performing the Work. The welder certification must be consistent with the welding procedure and the welding position required to perform the Work. Qualifications of the welders shall be consistent with Section 541.3.5.5.1.1, "Welder Qualifications."

541.3.6.4.2 Field Welding Inspections

The Contractor shall provide a certified AWS Welding Inspector. This Inspector shall review and approve the welding procedure and the welder qualifications. This Inspector shall provide testing and documentation in accordance with Section 541.3.1, "Applicable Codes and

Documents." Documentation shall be submitted to the Project Manager within Seven (7) Days of completion of the welding activity.

541.3.6.4.3 Field Installation of Shear Studs

Should the Contractor elect to install shear studs in the field, the Contractor shall field weld studs with automatic stud welding guns that shall be used to weld studs to girders. The operator shall be qualified per AWS D1.5 Subsection 7.7.4. The base metal where the stud is to be welded shall be ground to bright metal immediately prior to the weld being made. Manual welding will not be allowed except to make repairs. Repairs shall be in accordance with AWS D1.5 Subsection 12.6. Repair fillet size shall be a minimum of 5/16 inch.

Field welded studs shall be inspected in accordance with Section 541.3.6.4.2, "Field Welding Inspections."

541.3.6.5 Pilot and Driving Nuts

The Contractor shall use pilot and driving nuts in driving pins. The Contractor shall show details on the Working Drawings. The Contractor shall furnish one (1) pilot and one (1) driving nut for each size pin.

541.3.7—Reserved

541.3.8 Disposal of Steel Structures, Reinforcing Steel, Steel Debris or Steel Waste

The Contractor shall not reuse salvaged steel items from existing Structures on NMDOT Projects unless directed otherwise in the Plans. Salvaged steel shall be disposed of by Contractor as approved by the Project Manager.

541.3.9 Quality Assurance Inspection Frequency

541.3.9.1 Steel Inspections

The following Quality Assurance Inspections shall be performed by the Quality Assurance Inspector (QAI). Unless otherwise noted, the Inspections shall take place in the fabrication shop.

Tier 1 – Rolled steel beams – minimum of one (1) QA Inspections per Project;
Plate girders – minimum of three (3) QA Inspections per Project;
Diaphragms and cross frames – include with the above inspections; and
Overhead sign structures – minimum of one (1) inspection per fabrication shop per year.

Tier 2 – Metal Bridge barrier rails – 40% of welds by length;
Diaphragms for concrete Bridges – visual inspection upon delivery to site; and
Steel bearing components – 40% of welds by length.

Tier 3 – Drop inlets – visual inspection upon delivery to site;
Safety grates – visual inspection upon delivery to site;
Cattle & game guards – visual inspection upon delivery to site;
Pedestrian rails – visual inspection upon delivery to site;
Gates – visual inspection upon delivery to site;
Access panels – visual inspection upon delivery to site; and
Miscellaneous steel – visual inspection upon delivery to site.

It is recommended that a QA Inspection be performed at or near the completion of

erection; this is in addition to those listed above.

541.3.9.2 Coating Inspections for Paint and Powder Coating

The following Quality Assurance Inspections shall be performed by the Quality Assurance Inspector (QAI). Unless otherwise noted, the Inspections shall take place in the fabrication shop. The Project Manager may waive coating inspections.

Tier 1 – Rolled steel beams – one (1) inspection concurrent with a steel inspection;
Plate girders – one (1) inspection concurrent with a steel inspection;
Diaphragms and cross frames – no requirement; and
Overhead sign Structures – photos of coating process shall be provided to the QAI with QC traveler documentation, visual inspection upon delivery to site.

Tier 2 – Metal Bridge barrier rails – two (2) shop inspections are recommended per Project; this may be waived by the Project Manager;
Diaphragms for concrete Bridges – no requirement; and
Steel bearing components – visual inspection upon delivery to site.

Tier 3 – Drop inlets – visual inspection upon delivery to site;
Safety grates – visual inspection upon delivery to site;
Cattle & game guards – visual inspection upon delivery to site;
Pedestrian rails – visual inspection upon delivery to site;
Gates – visual inspection upon delivery to site;
Access panels – visual inspection upon delivery to site; and
Miscellaneous steel – visual inspection upon delivery to site.

It is recommended that a QA inspection be performed at or near the completion of erection; this is in addition to those listed above.

541.3.9.3 Galvanized Elements

Galvanized elements shall be visually inspected upon delivery to the site by the Project Manager.

541.4 METHOD OF MEASUREMENT

If structural members are specified by a nominal unit weight, the Department will calculate weight based on the nominal weights and dimensions.

When structural members are not designated by a nominal unit weight, the Department will calculate weight using the unit weights listed in Table 541.4:1, “Metal Unit Weights for Measurement.”

The Department will deduct the weight of copes, cuts, bevels, and open holes from the gross weight. The Department will not make deductions for bolt holes.

Table 541.4:1
Metal Unit Weights For Measurement

Material	Unit weight (lb./ft^3)
Steel	490
Cast iron	445
Bronze	536

541.4.1 Bolts

The Department will pay the weight of fasteners as indicated on the Accepted Working Drawings.

541.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Structural Steel for Concrete Bridges	Pound
Structural Steel for Steel Bridges	Pound
Structural Steel for Miscellaneous Structures	Pound

541.5.1 Work Included in Payment

The following Work and items will be considered as included in the payment for the main items and will not be measured or paid for separately:

1. Submittals including re-submittals;
2. Nondestructive testing;
3. Protective coatings;
4. Additional weight of heavier sections provided solely for the Contractor's convenience;
5. All Incidentals necessary for the completion of the Work;
6. Weld Material weight; and
7. All QC/QA requirements.

TECHNICAL SPECIFICATION 543

METAL RAILING

This specification applies to bid item number:
18: Pedestrian / Bicycle Railing

NMDOT Technical Specification 543 unmodified for this project.

END OF SECTION

SECTION 543: METAL RAILING

543.1 DESCRIPTION

This Work consists of providing and placing metal railing.

543.2 MATERIALS

543.2.1 Steel Railings

Unless otherwise shown in the Contract, the Contractor shall provide railing in accordance with ASTM A 36 or AASHTO M 270, Grade 50.

The Contractor shall provide square or rectangular tube steel in accordance with ASTM A 500, Grade B or ASTM A 501.

The Contractor shall provide black, seamless steel pipe in accordance with ASTM A 53. Hydrostatic testing is not required.

543.2.2 Bolts

543.2.2.1 Anchor Bolts

The Contractor shall provide anchor bolts in accordance with ASTM A 325, ASTM A 449, ASTM F 1554 or fabricate alternatively from AISI C-1144 or AISI C-1045 steel bar. The Contractor shall hot dip galvanized anchor bolts in accordance with AASHTO M 232 or mechanically galvanize in accordance with ASTM B 695, Class 50. The Contractor shall provide heavy hex nuts in accordance with ASTM A 563 Grade DH. The Contractor shall provide washers in accordance with ASTM F 436.

If the anchor bolts are fabricated from AISI C1144 or C1045 steel bar, the manufacturer shall supply certifications that demonstrate the anchor bolts meet the strength requirements of ASTM F 1554.

543.2.2.2 Connection Bolts

The Contractor shall provide connection bolts in accordance with ASTM A 307, Grade A; connection nuts in accordance with ASTM A 563, Grade A; connection washers in accordance with ASTM F 844, unless otherwise noted on the Plans or Standard Drawings. The Contractor shall ensure that bolt dimensions are in accordance with ANSI B 18.2.1, and nut dimensions are in accordance with ANSI B 18.2.2. The Contractor shall ensure washer dimensions and tolerances are in accordance with Section 542.2.3, “Washers.”

543.2.3 Caulking Compound

The Contractor shall use cold-applied, single component, chemically curing silicone joint sealant for concrete pavement (non sag). Sealant shall conform to ASTM D5893, Type NS.

543.3 CONSTRUCTION REQUIREMENTS

The Contractor shall fabricate, weld, and erect railing in accordance with Section 541, “Steel Structures.”

For purposes of impact testing, the Department considers steel Bridge railings and posts as main members.

The Contractor shall submit railing shop drawings and erection Plans in accordance with Section 541.3.3, “Shop and Erection Drawings.”

543.3.1 Erection Tolerances

For a Bridge on a tangent, the Contractor shall ensure the railing is visually straight. In general, the Contractor shall ensure that the railing does not deviate more than 3/8 inch within 20 horizontal feet.

For a Bridge on a curve, the Contractor shall not deviate more than 13/16 inch from the curve within 20 horizontal feet.

The Contractor shall ensure the rail posts are plumb within 1/4 inch over the full height.

543.3.2 Protective Coating

When the Contract specifies the railing to be colored, the Contractor shall powder coat the railing in accordance with Section 545, “Protective Coatings of Miscellaneous Structural Steel,” unless otherwise specified in the Contract.

When the Contract specifies railing to be galvanized, the Contractor shall galvanize in accordance with AASHTO M 111.

543.3.3 Cutting Rail Posts

The Contractor shall bevel cut posts to compensate for Roadway grade, crown, and superelevation.

If the Roadway grade is less than or equal to one percent (1%), the Contractor shall fabricate rail posts perpendicular to the grade line, but bevel cut crown and superelevation where necessary.

543.3.4 Caulking Rail Post Base Plates

Before placing rail posts into position on a Bridge deck, the Contractor shall apply a full circle bead of caulking compound on the deck surface around each of the anchor bolts. After erecting and coating the Bridge railing, the Contractor shall apply a bead of caulking compound around the perimeter of each rail-post base plate. The Contractor shall clean the deck surface and the surface of the rail-post anchor plates before applying the caulking compound.

543.4 METHOD OF MEASUREMENT

The Department will measure in place metal railing from end to end.

543.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Metal Railing	Linear Foot

543.5.1 Work Included in Payment

The following Work and items will be considered as included in the payment for the main item(s) and will not be measured or paid for separately:

1. Submittals; nondestructive testing; protective coatings;
2. Additional weight of heavier sections provided solely for the Contractor's convenience; and
3. All Incidentals necessary for the completion of the Work.

TECHNICAL SPECIFICATION 570

PIPE CULVERTS

This specification applies to bid item number:
9: 24” Storm Drain Pipe

NMDOT Technical Specification 570 unmodified for this project.

END OF SECTION

SECTION 570: PIPE CULVERTS

570.1 DESCRIPTION

This Work consists of supplying, constructing, and reconstructing pipe Culverts. Section 12 referred to below is from the AASHTO's LRFD Bridge Design Specification. Sections 26, 27 and 30 referred to below are from the AASHTO's LRFD Bridge Construction Specification.

570.2 MATERIALS

The Contractor shall provide Material in accordance with Table 570.2:1, "Culvert Material Applications."

Table 570.2:1
Culvert Material Applications

	Application[a]				
Category/Material	**Sub-drainage**	**Cross Drains**	**Turnouts**	**Storm Drains[b]**	**Siphons[c]**
Metal (steel or aluminum or steel reinforced polyethylene)					
xCMP	X	X	X		
xSpiral Rib Pipe		X	X	X	
xDouble Wall				X	
xSmooth FLO				X	
xConcrete Lined				X	
Concrete					
Reinforced	X	X	X	X	
xPressure					X
xCylinder					X
Precast CBC [h]		X	X	X	
Polypropylene					
Corrugated[j]	X	X	X	X	
Triple wall[k]	X	X	X	X	
Thermoplastic, high density polyethylene (HDPE)					
Single Wall Pipe [d]	X				
Corrugated	X	X	X	X	
xProfile[e]	X	X	X	X	
xSolid	X			X	X
Thermoplastic, PVC					
xCorrugated (in/out)	X	X	X		
xProfile[f]	X	X	X	X	
xSolid	X[g]			X	
Pressure					X
Miscellaneous					
Ductile Iron					X
xSRPE[v]	X	X	X	X	

Table 570.2:1
Culvert Material Applications

Category/Material	Application[a]				
	Sub-drainage	Cross Drains	Turnouts	Storm Drains[b]	Siphons[c]

X denotes an acceptable application.

A "blank cell" denotes an unacceptable application.

[a]Primary Applications (Could be used in other applications as approved by the Project Manager).

[b]Joints must be watertight in accordance with Section 570.2.2, "Joints," and have a maximum tested Manning's coefficient roughness of 0.013 or less.

[c]Must meet the pressure tight requirements of Section 570.2.2, "Joints."

[e]Type S, Type D, or ASTM F 894.

[f]ASTM F 794, F949, and ASTM F 1803.

[g]Schedule 40.

[h]For Precast box, refer to Special Provision 511 – F, if applicable.

[j]ASTM F2736 and MP-21-11.

[k]ASTM F2764.

[v] Steel Reinforced Polyethylene Pipe.

The Contractor shall design, manufacture, and install Culvert Materials in accordance with Table 570.2:2, "Culvert Materials Specifications, AASHTO LRFD (AWWA)," and Table 570.2:3, "Culvert Materials Specifications, ASTM (ACI)."

Table 570.2:2
Culvert Materials Specifications, AASHTO (ANSI/AWWA)

Category/parameters	Material	Pipe	Design[a]	Installation[a]
Corrugated metal pipe and pipe arch				
Galvanized	M 218	M 36	Section 12	Section 26
Aluminized, Type 2	M 274	M 36	Section 12	Section 26
Aluminum	M 196	M 196	Section 12	Section 26
Fiber-bonded	M 190, A	M 190, A	Section 12	Section 26
Polymeric	M 246	M 245	Section 12	Section 26
Coatings pavements and lining				
Asphalt coating	—	M 190, A	—	—
Concrete lined	—	M 36	—	—
Paved invert	—	—	M 190, B&C	—
Low n value	—	M 190, A	—	—
Reinforced concrete				
Round	—	M 170	Section 12	Section 27
Arch	—	M 206	Section 12	Section 27
Elliptically shaped	—	M 207	Section 12	Section 27
Reinforced D-load	—	M 242	Section 12	Section 27
Cylinder	—	C 303	AWWA M9	—

Table 570.2:2
Culvert Materials Specifications, AASHTO (ANSI/AWWA)

Category/parameters	Material	Pipe	Design[a]	Installation[a]
Pressure	—	C 302	AWWA M9	—
Polypropylene				
Pipe 12 inch-- 30 inch	MP-21	MP-21	Section 12	Section 30
Pipe 36 inch – 60 inch	MP-21	MP-21	Section 12	Section 30
Thermoplastic, HDPE corrugated				
Pipe 3 inch–10 inch	—	M 252	—	—
Pipe 12 inch–60 inch	—	M 294	Section 12	Section 30
Thermoplastic, HDPE profile				
Profile 18 inch–120 inch	—	—	Section 12	Section 30
Thermoplastic, HDPE solid smooth				
Pipe 12 inch–60 inch	—	—	Section 12	Section 30
Thermoplastic, PVC profile				
Profile 4 inch–48 inch	—	M 304	Section 12	Section 30
Thermoplastic, PVC solid smooth				
Pipe 4 inch–15 inch	—	M 278	Section 12	Section 30
Pipe 18 inch–27 inch	—	—	Section 12	Section 30
Thermoplastic, PVC pressure				
Pipe 14 inch–36 inch	—	C 905	—	C 900 & M-23
Miscellaneous				
Ductile Iron Pipe	—	ANSI/ AWWA C150/ A21.50	ANSI/ AWWA C150/ A21.50	ANSI/ AWWA C600
Steel reinforced Polyethylene Pipe 24 inch – 96 inch	D3350			

[a]Install in accordance with Section 206, “Excavation and Backfill for Culverts and Minor Structures,” Section 663, “Utility Items,” for Pressure Pipe.

[b]Must be approved by the Project Manager.

[d]NMDOT approved thru 96 inch.

If flowable fill is used as backfill, Section 30 deflection testing may be performed immediately after the flowable fill has cured in accordance with Section 516, “Flowable Fill.”

Table 570.2:3
Culvert Materials Specifications, ASTM (ACI)

Category/parameter	Material	Pipe	Design	Installation[a]

Table 570.2:3
Culvert Materials Specifications, ASTM (ACI)

Category/parameter	Material	Pipe	Design	Installation[a]
Corrugated metal pipe and pipe arch				
Galvanized	A 929	A 760	A 796	A 798
Aluminized, Type 2	A 929	A 760	A 796	A 798
Aluminum	B 744	B 745	B 790	A 798
Fiber-bonded	A 885	A 760	A 796	A 798
Polymeric	A 742	A 762	A 796	A 798
Coatings, pavement, and lining				
Asphalt coating	—	A 849	—	—
Concrete lined	—	A 849	—	—
Paved invert	—	A 849	—	—
Low n value	—	A 849	—	—
Reinforced concrete				
Round	—	C76	—	C 1479
Arch	—	C506	—	—
Elliptically shaped	—	C507	—	—
Reinforced D-load	—	C655	—	C 1479
Cylinder	—	—	—	—
Pressure	—	C 361	C 361	—
Non-reinforced concrete[c]				
<36 inch	—	C 14		C 1479
Cast-in-place Concrete[d]	—	ACI 346	—	—
Polypropylene				
Pipe 12 inch – 30 inch	F 2736	F 2736		D 2321
Pipe 36 inch – 60 inch	F 2881	F 2881		D 2321
Pipe 30 inch – 60 inch	F 2764	F 2764		D 2321
Thermoplastic, HDPE corrugated				
Pipe 3 inch–10 inch	D 3350, 335420C	—	—	D 2321
Pipe 12 inch–60 inch	D 3350, 324420C	—	—	D 2321
Thermoplastic, HDPE profile				
Profile 18 inch–120 inch	D 3350, 334433C	F 894[b]	—	D 2321
Thermoplastic, HDPE solid smooth				
Pipe 12 inch–60 inch	D 3350, 335434C	F 714	—	D 2321
Thermoplastic, PVC profile				
Profile 4 inch–48 inch	D 1784, 12364C	F 794, F949, F 1803	—	D 2321
Thermoplastic, PVC solid smooth				

Table 570.2:3
Culvert Materials Specifications, ASTM (ACI)

Category/parameter	Material	Pipe	Design	Installation[a]
Pipe 4 inch–15 inch	D 1784, 12454	D 3034, F 679	—	D 2321
Pipe 18 inch–27 inch	D 1784, 12454	F 679	—	D 2321
Thermoplastic, PVC pressure				
Pipe 14 inch–36 inch	D 2241	—	D 3139	D 2321
Miscellaneous				
Ductile Iron Pipe	—	A716	A 746	—
Steel reinforced Polyethylene Pipe 24 inch – 96 inch	D3350	F2562	---	D 2321

[a]Install in accordance with Section 206, "Excavation and Backfill for Culverts and Minor Structures," Section 663, "Utility Items," for Pressure Pipe.

[b]Use R. S. C. = 100 and 160 only.

[c]Must be approved by the Project Manager.

570.2.1 Pipe

570.2.1.1 Metal Pipe

The Contractor shall provide helical corrugated pipe that have re-rolled ends with at least two (2) annular corrugations. If using stab joints, only one (1) end may have a factory attached coupling as appropriate for the end.

The following ends of pipe do not have to be re-rolled:

1. Connected to an existing pipe with helical corrugations;
2. Connecting to an end section; or
3. To be embedded in concrete.

The Department will allow direct connection of end sections utilizing a dimple band for cut ends on existing pipe, and straps or rods on new installations.

The Contractor shall use a half smooth, half corrugated sleeve or a concrete collar for extensions of concrete pipe to metal pipe.

If using smooth interior lined steel Culvert pipe (double wall), the Contractor shall provide lock seams of the smooth interior liner and the corrugated shell that are continuous from end to end of each length of pipe section. The Contractor shall ensure the exterior gauge is not less than the specified gauge in the Contract for unlined corrugated steel Culvert pipe. The interior metal lines shall be at least 0.040 inch.

The Contractor shall use pipe with gasketed lock seams and re-rolled ends for watertight installations. Joints must meet the requirements per Section 570.2.2.1.2, "Watertight Joints."

570.2.1.2 Reinforced Concrete Pipe

The Contractor shall provide reinforced concrete pipe (RCP) with a bell and spigot design, a tongue and groove design or a single offset joint design. All RCP shall be fabricated

in a plant that is certified by the American Concrete Pipe Association (ACPA).

The Contractor may use lift holes or lifting anchors to handle and place RCP. The Contractor shall not use more than two (2) lift holes in the wall of each piece of pipe. The Contractor shall place lift at the top of the pipe in line with the centerline of the pipe and along the minor axis of the reinforcement. When using a single lift hole, the Contractor shall place it at the balance point. When using two (2) lift holes, the Contractor shall place them equidistant from the balance point. The lift holes shall not interfere with the load carrying capacity of the pipe, shall be neatly made, shall be straight, and may be either drilled or cast.

After the Contractor has placed the pipe and before beginning backfill operations, the Contractor shall fill the lift holes with:

1. Non-shrink grout, in accordance with Section 521, "Non-Shrink Grout;"
2. Joint mortar, in accordance with Section 570.2.2.2.2, "RCP Joint Material," to which non-shrink admixture in accordance with Section 521, "Non-Shrink Grout" has been added; or
3. Non-shrink grout, in accordance with Section 521, "Non-Shrink Grout."

570.2.1.3 Plastic Pipe

When required for thermoplastic pipe, the Contractor shall provide end sections located out of the clear zone that are either metal or HDPE with a minimum two percent (2%) carbon black in accordance with ASTM D 1248.

570.2.1.4 Pipe Certification and Identification Requirements

The Contractor shall provide certified test results showing that the Material supplied meets Specifications.

The Contractor shall provide record heat numbers and supply chemical analysis for metal pipe. The Department will inspect the RCP factory out of state RCP Suppliers shall arrange for witnessed plant tests at no additional cost to the Department. The Contractor shall provide certification of cell classification and pipe stiffness for thermoplastic pipe in accordance with the Material selected using the fill height table in the Standard Plans.

The Contractor shall label each pipe before shipment. All thermoplastic pipe sections will clearly display the "Date Code Number." RCP will display NMDOT stamp. Metal pipe will display a stencil or stamp displaying the manufacturer's name, date and country of manufacture, thickness, coating, heat number, and applicable ASTM or AASHTO Specification. All labels will correspond to test reports with a permanent print, stamp, or stencil.

The Contractor shall provide test reports and certification for in plant joint tests required by Section 570.2.2.1.2, "Watertight Joints."

570.2.1.5 Selecting Pipe

The Contractor may select any approved type of pipe, unless otherwise specified.

If the Plans specify storm drain Culvert pipes, the Contractor may select an approved type with a maximum tested Manning's coefficient of roughness of 0.013.

If the Plans specify siphon Culvert pipes, the Contractor may select an approved pressure pipe.

The Contractor shall select a type of pipe based on the corrosion resistance number in accordance with Section 570.2.3.1, "Corrosion Resistance Number," except when using siphon Culvert pipe.

If the Plans specify a nominal diameter for pipe arch, the Contractor may supply arched or elliptical pipe equal to the nominal round pipe.

570.2.2 Joints

The Contractor shall select the appropriate joint in accordance with Table 570.2.2:1, "Joint Selection."

Table 570.2.2:1
Joint Selection

Type of pipe Structure	Soil-tight	Water-tight	Pressure Tight	Restrained
Culverts under turnouts (not under Road)	X			
Cross drain Culverts	X			
Elbowed drop Culverts		X		X[a, c]
Storm drains		X[b]		
Rundowns or downdrains[a]		X		X[a, c]
Pond outlet pipes and risers		X		
Irrigation pipe (non-pressure)		X[b]		
Irrigation siphons and sag pipes (pressure)			X	

[a]Use where pipe slopes are steep (>10%) and or velocities are high.

bTongue and groove joints for Elliptical and Arched Concrete, and Steel Arch pipe are not considered watertight without special joint design considerations (for RCP refer to Section 570.2.2.2.2, "RCP Joint Material;" for CMP refer to Section 570.2.2.2.1, "CMP Joint Material") or as approved by the Project Manager.

[c]RCP and CMP only.

570.2.2.1 Joint Types

570.2.2.1.1 Soil-tight Joints

A soil-tight joint does not allow migration of soil into the pipe.

570.2.2.1.2 Watertight Joints

A gasketed joint restricts infiltration/exfiltration and exhibits no visible leakage when subject to 10.8 psi over the crown for ten (10) min under testing conditions as outlined in the appropriate product ASTM Specification.

When plant tested, the appropriate product joint shall meet the requirements of ASTM D 3212 (thermoplastic or steel reinforced **polyethylene**), ASTM C 443/C 497 (concrete) or ASTM-A760 (metal).

570.2.2.1.3 Pressure-tight Joints

The Contractor shall use pressure pipe in accordance with Section 663, “Utility Items,” and the associated sections of the *New Mexico Standard Specifications for Public Works Construction* (*NMSSPWC*). The Contractor shall provide pipe with a pressure rating equal to or greater than the static head shown on the drawings. The Contractor shall select Materials in accordance with Table 570.2.2.1.3:1 “Pressure-Tight Joint Materials.”

The Contractor shall test pressure-tight installations used in siphons and sag pipes shall show no leakage in excess of the allowable line leakage requirement when filled with water to the highest operating elevation and allowed to stand full for 24 h.

The minimum coupling requirement will be in accordance with the testing requirements of AASHTO’s *LRFD Bridge Construction Specifications*, Section 26 & 30, for standard joints in non-erodible soils.

Table 570.2.2.1.3:1
Pressure-Tight Joint Materials

Material	NMSSPWC Section
Polyvinyl chloride	121 (AWWA C 905)
Reinforced concrete	124 (ASTM C 361M)
Concrete cylinder	128 (AWWA C 303)
Ductile iron	129 (ANSI/AWWA C150/A21.50)
Ductile and cast iron fittings	130 (ANSI/AWWA C153/A21.53 & ANSI/AWWA C111/A21.11)
Solid wall HDPE	ASTM F 714

570.2.2.1.4 Restrained joint

A restrained joint resists a tensile force in accordance with AASHTO’s *LRFD Bridge Construction Specifications,* Section 26 or as approved by the Project Manager.

570.2.2.2 Joint Materials

570.2.2.2.1 CMP Joint Material

If the Contract specifies soil-tight joints, factory-attached metal or plastic stab joints with modified gaskets, hugger-type bands without gaskets or fully corrugated bands without gaskets can be supplied.

If the Contract specifies watertight joints, the requirements of Section 570.2.2.1.2, "Watertight Joints" must be met, which shall include the following: Factory-attached metal or plastic stab joints with modified gaskets, or hugger-type bands with lubed O-ring gaskets, is watertight when backfilled with flowable fill. With round pipe a minimum of 5C fully corrugated bands (13 inch wide) with a lubed, 12 inch wide, closed cell neoprene flat gasket is watertight without flowable fill. With pipe arch a minimum of 5C fully corrugated bands (13 inch wide) using rods and lugs with a lubed, 12 inch wide, closed cell neoprene flat gasket is watertight without flowable fill.

If the Contract specifies restrained joints all pipe affected will use rods and lugs.

570.2.2.2.2 RCP Joint Material

The Contractor shall provide flexible watertight sealing gaskets in accordance with ASTM C 443, ASTM C 877, or AASHTO M 198 for watertight applications.

The Contractor shall provide external sealing bands in accordance with ASTM C 877 for arch and elliptical pipes with tongue and groove joints in watertight applications.

The Contractor shall provide closed-cell neoprene gaskets in accordance with ASTM D 1056 and AASHTO M 198, Type B when required on the Contract.

The Contractor shall provide butyl rubber mastic sealant in accordance with AASHTO M 198 for soil-tight applications for round, arch, and elliptical concrete pipe.

The Contractor shall grout watertight and pressure-tight joints as directed by the Project Manager.

570.2.2.2.3 Thermoplastic and Steel Reinforced Polyethylene Joint Material

The Contractor shall provide couplings that snap on, and engage an equal number of corrugations on either side of the pipe joint. The Department will not accept wrap-around bands.

The Contractor shall provide bell and spigot joints in accordance with ASTM D 3212 and ASTM F 477.

The Contractor shall provide concrete Structure connections with a water stop or boot.

570.2.2.2.4 Thermoplastic (Polypropylene) Joint Material

The Contractor shall provide bell and spigot joints in accordance with ASTM D3212 and ASTM F477. Spigot shall have two (2) gaskets installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. The bell shall be reinforced with a polymer composite band installed by the manufacturer.

570.2.3 Durability

570.2.3.1 Corrosion Resistance Number

Unless specified on the Contract, the Contractor shall provide pipe Culverts with a minimum corrosion resistance number of CR1. However, the Contractor shall provide pipe Culverts with a minimum corrosion resistance number of CR3 for storm drains, rundowns, non-pressure irrigation pipe, and elbowed drop Culverts. If the Contract specifies a corrosion resistance number, the Contractor shall use Table 570.2.3.1:1, "Pipe Culvert Durability," to choose a pipe type from the column below the corrosion resistance number. The Contractor shall not use Table 570.2.3.1:1, "Pipe Culvert Durability," for siphon Culvert pipe.

Table 570.2.3.1:1
Pipe Culvert Durability

	Corrosion resistance number						
Type of pipe	**CR1**	**CR2**	**CR3**	**CR4**	**CR5**	**CR6**	**CR7**
Galvanized steel	Yes	No	No	No	No	No	No
Aluminized steel, Type 2[a]	Yes	Yes	Yes	Yes	No	No	No
Aluminum alloy	Yes	Yes	Yes	Yes	Yes	No	No

Table 570.2.3.1:1
Pipe Culvert Durability

Type of pipe	Corrosion resistance number						
	CR1	CR2	CR3	CR4	CR5	CR6	CR7
RCP, Type II cement[b]	Yes	Yes	Yes	Yes	Yes	Yes	No
Polymeric coated steel	Yes	Yes	Yes	Yes	Yes	Yes	No
Aramid fiber bonded steel	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thermoplastic[c]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Steel reinforced and non-reinforced polyethylene pipe	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCP Type V cement[b]	Yes	Yes	Yes	Yes	Yes	Yes	Yes

[a]The table is based on a minimal structural gauge thickness. The Contractor may use a heavier gauge to increase the corrosion resistance number as approved by the Project Manager.

[b]Cement type based on Section 510, "Portland Cement Concrete." If pH ≤5.0, use a rapid chloride permeability ≤1,200 coulombs.

[c]Cell Class corresponding to highest values on Fill Height Table must be used for CR4 – 7.

570.2.3.2 Dissimilar Metal Pipe Joints

The Contractor shall use rubber gaskets on joints between dissimilar metal pipes.

570.2.3.3 Coating Aluminum and Aluminized Steel Pipe, Type 2

The Contractor shall coat aluminum and aluminized steel pipe, Type 2 for the entire length of pipe in contact with fresh concrete (except for grouted pipe or flowable filled pipe) to a distance of 12 inch beyond the back face of the concrete in accordance with the Contract. The Contractor shall provide a zinc-rich paint coating in accordance with AASHTO M 36.

570.3 CONSTRUCTION REQUIREMENTS

570.3.1 General

The Contractor shall install pipe in accordance with Section 206, "Excavation and Backfill for Culverts and Minor Structures" and the requirements of Table 570.2:2, "Culvert Materials Specifications, AASHTO (AWWA)," and current AASHTO *LRFD Bridge Construction Specifications* section applying to the pipe type. The Contractor shall ensure that no "floating" occurs during installation of pipe Culverts.

The Contractor shall use siphon Culvert pipe in accordance with Section 663, "Utility Items," and the associated sections of the *NMSSPWC*.

570.3.2 Excavation and Backfill

The Contractor shall excavate trenches in accordance with Section 206, "Excavation and Backfill for Culverts and Minor Structures." The Contractor shall make the trenches wide enough to properly join the pipe and thoroughly compact the bedding Material under and around the pipe. Where possible, the Contractor shall make the trench wall vertical. When

using flowable fill for backfill, in accordance with Section 516, "Flowable Fill," the Contractor shall make trench widths in accordance with AASHTO's *LRFD Bridge Construction Specifications*, Section 26 for metal pipe and steel reinforced polyethylene pipe; Section 27 for RCP; and Section 30 for thermoplastic pipe. The Contractor shall refer to NMDOT 206 Standard Drawings for additional pipe installation requirements.

570.3.3 Fill Height Requirements

The Contractor shall verify minimum and maximum cover over the pipe in accordance with the Standard Drawings. If the cover for the pipe is less than the minimum or greater than the maximum, contact the State Bridge Engineer for direction.

570.3.4 Laying Pipe

The Contractor shall begin laying pipe at the downstream end of the pipeline except for extensions of existing pipes. The Contractor shall place the bottom of the pipe in contact with the shaped bedding throughout its full length.

The Contractor shall place the bell ends or outside circumferential laps of pipes facing upstream to obtain a shingling effect. The Contractor shall place pipe with longitudinal laps or seams with the laps or seams at the sides.

The Contractor shall lay paved or partially lined pipe so that the longitudinal centerline of the paved segment coincides with the flow line. The Contractor shall place elliptical and elliptically reinforced pipes with the major axis within five degrees (5°) of a horizontal plane.

570.3.5 Joining Pipe

570.3.5.1 Joining RCP

The Contractor shall join pipe sections so that the ends are fully centered and the inner surfaces are flush within the inside diameter tolerance variations of AASHTO M 170, but shall not exceed 5/8 inch.

The Contractor shall make watertight joints with the following:

1. Cement grout;
2. Flexible watertight gaskets;
3. External sealing bands; or
4. Any combination of these types.

For grouted joints, molds or runners shall be used to retain the poured grout. Flexible watertight gaskets shall be installed to form a flexible watertight seal.

If using portland cement mixtures, the Contractor shall protect the completed joints against rapid drying with a curing method approved by the Project Manager. The Contractor shall replace coupling systems that do not fit snugly, in accordance with Section 570.2.1.2, "Reinforced Concrete Pipe," at no additional cost to the Department.

570.3.5.2 Joining Flexible Pipe

The Contractor shall join metal or thermoplastic pipe with a flexible pipe coupling system. The Contractor shall ensure the coupling systems engage an equal number of corrugation or length on either side of the pipe joint. The Contractor shall replace coupling systems that do

not fit snugly to the pipe ends, in accordance with Section 570.2.2.2.1, "CMP Joint Material," and Section 570.2.2.2.3, "Thermoplastic Joint Material," at no additional cost to the Department.

The Contractor shall use dimpled bands to attach end sections. The Contractor shall ensure the dimples fit snugly within the given pipe's corrugations. If the dimpled band connections do not fit correctly, the Contractor shall use an alternate way to connect the pipes.

Where joints must have beveled ends to meet construction requirements, the Contractor shall form a continuous unit in accordance with the Plans.

The Contractor shall make water tight joints using a bell and spigot conforming to ASTM D3212 and F477. The Contractor shall push spigot into bell end so spigot reaches homing mark on bell end.

The Contractor shall repair damaged protective coatings in accordance with AASHTO M 36 at no additional cost to the Department.

570.3.5.3 Pipe Installation Inspection

The Contractor shall inspect the pipe before placing any backfill. The Contractor shall replace or re-lay unacceptable pipe at no additional cost to the Department.

The Contractor shall ensure that pipe is installed in full compliance with AASHTO's *LRFD Bridge Construction Specification,* Section 26 (metal and steel reinforced polyethylene pipe), Section 27 (RCP) or Section 30 (thermoplastic) requirements.

For thermoplastic pipe, the Contractor shall provide the Department with the results of the deflection test detailed in Section 30 of AASHTO's *LRFD Bridge Construction Specification* and a certification that the testing was completed. The required deflection testing shall be performed at no additional cost to the Department.

570.3.5.4 Salvaging Culvert Pipe

The Contractor shall remove Culvert pipe to be salvaged or reinstalled from the existing location in accordance with Section 601, "Removal of Structures and Obstructions." The Contractor shall clean salvaged pipe of Deleterious Material before storing or reinstalling.

570.4 METHOD OF MEASUREMENT

The Department will measure all pay items using the dimensions shown in the Contract or approved modifications.

570.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Culvert Pipe	Linear Foot
Culvert Pipe End Section	Each
Culvert Pipe Arch	Linear Foot
Culvert Pipe Arch End Section	Each
Storm Drain Culvert Pipe	Linear Foot
Storm Drain Culvert Pipe End Section	Each

Storm Drain Culvert Pipe Arch	Linear Foot
Storm Drain Culvert Pipe Arch End Section	Each
Siphon Culvert Pipe	Linear Foot
Reinstalling Culvert Pipe	Each

The Department will pay for the removal of Culvert pipe in accordance with Section 601, "Removal of Structures and Obstructions."

The Department will pay for Culvert pipe cleaning in accordance with Section 613, "Cleaning of Culverts and Drainage Structures" when specified on the Plans.

The Department will pay for excavation for Culverts in accordance with Section 206, "Excavation and Backfill for Culverts and Minor Structures."

570.5.1 Work Included in Payment

The following Work and items shall be considered as included in the payment for the major items and will not be measured or paid for separately:

1. All joint Materials, shear connectors required for joining sections;
2. Testing and Certification of all Culverts; and
3. The coating of aluminum and aluminized steel pipe Type 2 when placed with fresh concrete. Removal of Culvert pipe shall be paid for in accordance with Section 601, "Removal of Structures and Obstructions." Excavation for Culverts shall be measured and paid for in accordance with Section 206, "Excavation and Backfill for Culverts and Minor Structures." Siphon Culvert pipe Work shall include trenching, connections to transitions, pipe joining, dewatering, installation of pipe, fittings miscellaneous components; including elbows, drains and blowoffs, backfill and compaction, encasing or special backfill and hydrostatic testing.

TECHNICAL SPECIFICATION 601

REMOVAL OF STRUCTURES & OBSTRUCTIONS

Revised 11/16/2021

This specification applies to bid item numbers:
11: Removal of Structures and Obstructions

SSCAFCA Technical Specification 1515 Removal of Structures and Obstructions was given NMDOT number designation (601) as in general the NMDOT specifications are more widely referenced for this project. No other changes to the specification were made.

TECHNICAL SPECIFICATION 1515

REMOVAL OF STRUCTURES & OBSTRUCTIONS

Revised 11/16/2021

1515.1 DESCRIPTION

This work shall consist of removing and disposing of surface and subsurface features to clear the project site for construction. This includes concrete debris, fences, structures, pavements, curb and gutter, sidewalks, buried pipes, and any other items listed within the construction plans. All removal and salvage features included in these items will be designated in the contract.

1515.2 MATERIALS

Suitable materials are those materials which can be compacted to the required embankment densities and meet all other contract requirements for embankment materials. If applicable, the project Geotechnical Report would include this information.

1515.3 CONSTRUCTION REQUIREMENTS

1515.3.1 Suitable Materials

Suitable materials are those materials which can be compacted to the required embankment densities and meet all other contract requirements for embankment materials. If applicable, the project Geotechnical Report would include this information.

1515.3.1.1 Marking of Removal Limits

Prior to work on the site, the Contractor shall establish the right-of-way lines and construction limits confining the removal operations and will designate those surface and subsurface features for removal and those for preservation. The Owner or designee shall be offered the opportunity to review the removal limits before work commences.

1515.3.1.2 Temporary Erosion Control

Ensure all erosion control requirements and all necessary temporary sediment and erosion control protection devices (TESCP), if called for in the contract, are installed prior to initiating removal operations on the construction site. The TESCP items will be paid for under the SWPPP pay item.

1515.3.1.3 Protection of Site Features

The Contractor shall preserve and protect all existing improvements, adjacent property, utilities, and surface or subsurface features not to be removed from injury or damage resulting from their operations. This may require the Contractor to install

temporary signing, temporary fencing, or other temporary features at their cost. Should any damage occur to these site features due to the Contractor's operations, the Owner or designee may withhold payment until the damage is remediated or require the damaged items to be replaced at the Contractor's expense.

1515.3.2 Removal and Salvage Operations

Remove all surface features and subsurface features designated for removal in the contract and dispose of them at a properly permitted disposal site. Provide the Owner or designee with a copy of the written permission from the property owner and copies of any other necessary disposal permits or approvals.

Carefully remove and salvage all surface features and subsurface features designated for salvage in the contract and store and deliver these materials in accordance with the contract requirements. The Contractor shall repair any damage to salvageable items that occurs during their removal, storage, or delivery operations at no cost to the Owner.

Backfill holes created by structure or obstruction removals as per SSCAFCA Standard Specification 1510 with suitable materials, unless the area is within the area of new construction.

1515.3.2.1 Removal of Pavements, Sidewalks, Curb and Gutter

Pavements, sidewalks, and curb and gutter shall be removed to neat saw cut lines as identified in the Contract, and dispose of them off the project site.

1515.3.2.2 Removal of Culverts and Drainage Structures

The Contractor shall sequence the removal of existing culverts and drainage structures so drainage is maintained on the project. This may require installation of temporary drainage features at Contractor's sole cost.

1515.3.2.3 Removal of Sanitary Sewer and Water Utilities

The Contractor shall sequence the removal of existing sanitary sewer and water utilities to minimize the impacts to local businesses and residents. The sequencing of removals shall be coordinated with the City Utilities Department or designee prior to performing removal operations in the field.

1515.3.2.4 Removal of Bridges and Arroyo Features

If the Contract includes the removal of a bridge or feature in an arroyo, remove the existing structures down to the arroyo bottom elevation OR an elevation sufficient to allow for proposed grading, proposed over-excavation, or proposed installation of infrastructure, as shown in the Contract documents.

Remove existing structures outside the arroyo to one (1) foot below ground surface, unless otherwise directed in the Contract.

1515.3.2.5 Removal and/or Salvage of Fencing

If the contract includes removal of fencing materials, remove all fence materials, including posts and post foundations and backfill holes with suitable materials.

If the Contract includes salvaging of fencing materials, place barbed wire into single-strand rolls and minimize the damage to fence posts when pulling them.

1515.3.2.6 Hauling and Stockpiling Salvageable Material

If the Contract requires the Contractor to haul and stockpile salvageable material, load, haul, unload, and stockpile the materials in accordance with the Contract.

Place the salvageable material on blocks or other approved materials and maintain the stockpile area, as directed by the Owner or designee.

1515.3.2.7 Site Appearance

The site shall have a neat and finished appearance when removal operations are finished, except for areas where construction activities are planned.

1515.3.2.8 Disposal

Dispose of all removal items outside the project at a permitted location. If applicable, a disposal plan, including written permission from private property owners used for debris material disposal, shall be submitted to the Owner or designee prior to commencement of disposal activities.

1515.3.2.9 Burying

No burying of any removed debris will be allowed on the project site.

1515.3.2.10 Burning

No burning of any removed debris will be allowed on the project site. In addition, no accumulation of combustible materials shall be stored on the project site near property lines or areas where an unexpected fire could cause damage to existing site features.

1515.4 METHOD OF MEASUREMENT

No measurement will be made for lump sum removal of structures and obstructions.

No measurement of the removal of surfacing will be made if the lump sum basis of payment is used.

Removal of surfacing will be made by the Square Yard if Square Yard basis of payment is used.

1515.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Removal of Structures and Obstructions	Lump Sum
Removal of Surfacing	Lump Sum or Square Yard

Removal of Structures and Obstructions payment shall be considered all-inclusive of the costs of the work including: marking the removal limits; installation of temporary features to protect the site; saw- cutting, removing, and salvaging all items as designated in the Contract; filling depressions associated with the work; providing temporary drainage features associated with the removals; obtaining disposal locations and disposing of debris; and, removing, stockpiling, transporting, and unloading salvaged items.

Removal of Surfacing payment shall be considered all-inclusive of the costs of the work including: removing the surfacing to neat lines; filling depressions associated with the work; providing temporary drainage features associated with the removals; obtaining disposal locations and disposing of debris; and, removing, stockpiling, transporting, and unloading items.

Additional payment for minor removals not specified in the Contract shall not be made.

Unknown buried features not identified in the Contract are not included in this item.

Payments shall be made based on percentage of the pay item completed at the date of monthly Pay Application submittal.

END OF SECTION

TECHNICAL SPECIFICATION 607

FENCE

This specification applies to bid item numbers:
17: Five Strand Wire Fence
19: Maintenance Access Gate

NMDOT Technical Specification 607 Fence is modified as follows:

662.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Five Strand Wire Fence	Linear Foot
Standard Gate	Each

END OF SECTION

SECTION 607: FENCE

607.1 DESCRIPTION

This Work consists of constructing fence and gates.

607.2 MATERIALS

607.2.1 Certification

The Contractor shall submit independent testing Laboratory certification to the Project Manager that indicates the fencing Materials meet these Specifications. The Department may inspect the manufacturing methods at manufacturing plants and may obtain Material samples for testing and may base Acceptance on the quality of manufacturing lots.

607.2.2 Barbed Wire and Woven Wire Fence

607.2.2.1 Wire

The Contractor shall provide wire and wire components with at least a Class 1 zinc coating in accordance with ASTM A 121 or ASTM A 116, unless otherwise specified in the Contract. Instead of Class 1 coating, the Contractor may coat the wire with aluminum alloy covering at least 0.3 oz per square foot of wire surface.

607.2.2.1.1 Barbed Wire

The Contractor shall provide barbed wire and barbs in accordance with ASTM A 121. The Contractor shall provide composite barbed wire strands that consist of two (2) coated wires with diameters of 0.099 inch. The Contractor shall provide round barbs that have a coated diameter of 0.08 inch, with either two (2)-point barbs spaced four (4) inches apart or four (4)-point barbs spaced five (5) inches apart. The Contractor shall provide stays for barbed wire fences in accordance with ASTM A 116, with a coated diameter of at least 0.142 inch and with lengths and spacing in accordance with the Contract.

607.2.2.1.2 Woven Wire

The Contractor shall provide woven wire in accordance with ASTM A 116, Design Number 832-6-11, unless otherwise specified in the Contract.

607.2.2.1.3 Post Fasteners

The Contractor shall provide coated staples with a diameter of at least 0.148 inch and a length of at least 1 1/2 inch; use for fastening fence wire to wood posts.

607.2.2.1.4 Brace Wire

The Contractor shall provide coated brace wire with a diameter of at least 0.148 inch; use for constructing braces and intermediate braces with wood posts.

607.2.2.1.5 Tie Wire

The Contractor shall provide coated tie wire for fastening barbed or woven wire to steel posts with a diameter of at least 0.099 inch. The Contractor may use wire fasteners or metal clamps with thicknesses of 0.12 inch or greater instead of tie wires, if approved by the Project Manager.

607.2.2.2 Posts

The Contractor shall provide metal or wood corner, brace, intermediate brace gate, and line posts of the specified type, size, and length in accordance with the Contract. The Contractor shall permanently cap all vertical metal pipes on fence and gate supports. The Contractor shall ensure that the top coating and color of the pipe is maintained.

607.2.2.2.1 Metal Posts

The Contractor shall provide metal posts and braces of rail, billet, or commercial-grade steel in accordance with ASTM A 702 or ASTM F 1083 for galvanized, standard weight pipe. The Contractor shall provide C-section posts in accordance with ASTM A 1011.

The Contractor shall galvanize steel posts in accordance with AASHTO M 181 for Grade 1 steel and provide a top coating specified for Grade 2 steel, or an equivalent or better coating, from the Department's *Approved Products List.* The Contractor shall coat edges and damaged areas of posts in accordance with ASTM A 780. The Contractor shall use posts of the same coating and color.

The Contractor shall provide posts that weigh no less than 95% of the specified weight; and are of the specified length + two (2) inch, - one (1) inch.

The Contractor shall provide line posts with a minimum weight of 1.33 lb per foot, not including anchor plates. The Contractor may provide I-beam, T-beam, U-beam, Y-bar, or C-section line posts. The Contractor shall provide line posts with corrugations, lugs, ribs, or notches spaced one (1) inch on centers to attach fence wire. The Department will not Accept posts with punched tabs used for crimping around the wire.

The Contractor shall provide anchor plates with an area of at least 18 $inch^2$ and that weigh at least 0.67 lb. The Contractor shall clamp, weld, or rivet anchor plates to the post section to prevent displacement when driving the posts.

607.2.2.2.2 Wood Posts

The Contractor shall provide wood posts cut from live southern yellow pine, lodge pole pine, or ponderosa pine trees. The Contractor shall provide straight posts that are free of decay and other defects, bark-free, trimmed smooth of knots and projections, and with both ends sawed off perpendicular to the centerline.

The Contractor shall provide an average nominal diameter at the top of each post of at least six (6) inches. The Contractor shall ensure the circumference of corner, brace, intermediate brace, and gate posts is at least 19 inches, measured six (6) inches below the top of the post.

The Contractor may provide line posts with a slight crook in one (1) direction, but the post may not vary more than 1 1/2 inch from a straight line connecting both ends of the post. The Contractor shall ensure the average nominal diameter of the top of each line post is at least three (3) inches. The Contractor shall ensure the circumference of line posts is at least nine (9) inches, measured six (6) inches below the top of the post.

The Contractor shall provide coast region douglas fir or New Mexico red spruce or fir braces for wood posts.

607.2.2.2.2.1 Preservative Treatment of Wood Posts

The Contractor shall provide wood posts pressure treated with pentachlorophenol in accordance with Section 550.2.2, “Preservatives and Treatment Methods,” treated according to AASHTO M-133, all in accordance with AWPA Standard U1 and Commodity Standard B: Posts and AWPA Standards P8 and P9.

607.2.2.3 Gates

The Contractor shall provide two (2)-inch 16-gauge tubular gates meeting the requirements of ASTM A513 with a wall thickness of .065 inches and a tolerance of plus (+0.003) or minus (-0.011) unless otherwise specified in the Contract.

Gates shall be coated in accordance with Section 607.2.2.2.1, “Metal Posts,” or coat in accordance with Section 545, “Protective Coating for Miscellaneous Structural Steel.” The Contractor shall use “Interstate Green” as the finished color coating, except for galvanized gates and unless otherwise shown in the Contract.

607.2.2.4 Fittings

The Contractor shall provide fittings, hardware, and appurtenances for fences and gates that are of commercial-quality steel, malleable iron, or wrought iron, and galvanized in accordance with ASTM A 153.

607.2.3 Chain Link Fence

607.2.3.1 Posts

The Contractor shall provide posts that are tubular steel, H-column, or C-section (for line posts). The Contractor shall provide either Grade 1 or Grade 2 steel posts in accordance with AASHTO M 181. The Contractor shall provide Grade 1 tubular posts, braces, and top rails in accordance with ASTM F 1083 for galvanized, standard weight pipe. The Contractor shall provide Grade 2 steel posts in accordance with ASTM A 1011 or ASTM A 653.

The Contractor shall provide C-section line posts in accordance with ASTM A 1011. The Contractor shall provide H-column posts in accordance with ASTM A 36.

The Contractor shall provide pipe with minimum wall thickness as specified in the Contract. The Contractor shall ensure that the product of the yield strength and section modulus of the pipe is in accordance with ASTM F 1083.

The Contractor shall provide posts that securely hold tension wires in position without vertical movement.

607.2.3.2 Fittings

The Contractor shall provide fittings in accordance with Section 607.2.2.4, “Fittings.”

The Contractor shall provide stainless steel straps and seals in accordance with ASTM A 176.

The Contractor shall provide coated tension wires that are galvanized coil spring steel wire of commercial quality with a diameter of 0.148 inch. The Contractor shall provide galvanized ferrules for tension take-up in accordance with ASTM A 1011.

The Contractor shall provide pull cable and tension truss rods with diameters of at least

3/8 inch, with drop forged turnbuckles or other approved tension devices.

The Contractor shall provide pull cable and tension wires with a minimum zinc coating of 0.8 oz per square foot of uncoated individual wire surface, tested in accordance with ASTM A 90.

The Project Manager will determine the uniformity of the coating by visual inspection. The Project Manager may reject coating with excessive roughness, blisters, discoloration spots, bruises, and flaking. The Department may make other inspections and tests at the manufacture's plant, before shipment.

607.2.3.3 Tie Wires and Fasteners

The Contractor shall provide galvanized, coated tie wires for fastening chain link fabric to posts and rails with a diameter of at least 0.148 inch. The Contractor may provide galvanized steel or non-corrosive metal bands or fasteners instead of tie wires, as recommended by the manufacturer.

607.2.3.4 Compression Braces

The Contractor shall provide compression braces that meet the same requirements as top rails in accordance with Section 607.2.3.1, "Posts."

607.2.3.5 Chain Link Fabric

The Contractor shall provide chain link fabric in accordance with AASHTO M 181, with a Class C coating or better. The Contractor shall provide chain link fabric full height. The Contractor shall provide galvanized, coated wire with a diameter of 0.148 inch. The Contractor shall provide two (2) inch mesh fabric. The Contractor shall measure the mesh size as the distance between the wires forming parallel sides of the mesh.

607.2.3.6 Gates

The Contractor shall provide double drive, single drive, or single walk gates. The Contractor shall provide galvanized steel pipe gate frames in accordance with ASTM F 1083 and ASTM A 123.

607.2.3.7 Vinyl-Coated Chain Link Fence

The Contractor shall provide vinyl-coated chain link fences in accordance with Section 607.2.3, "Chain Link Fence," except as modified in this subsection.

If providing PVC coated chain link fabric, the Contractor shall use vinyl-coated fabric, posts, and hardware in accordance with AASHTO M 181 for Class A PVC coating. The Contractor shall continuously bond the vinyl coating (do not spray or dip) over the galvanized steel wire by the extrusion bonding process under pressure.

The Contractor shall ensure the vinyl coating resists damage from prolonged exposure to dilute solutions of common mineral acids, sea water, and dilute solutions of salts and alkali.

The Contractor shall galvanize using the electrolytic process before coating with PVC.

The Contractor shall provide wire that was vinyl-coated before weaving and is free and flexible at the joints.

607.2.4 Post and Cable Access Fence

607.2.4.1 Cable

The Contractor shall provide wire cable in accordance with AASHTO M 30. The Contractor shall provide cable of Type I, Class A, 0.75 in diameter rope, unless otherwise specified in the Contract.

607.2.4.2 Hardware and Fittings

The Contractor shall provide galvanized or cadmium plated parts, hardware, and fittings. The Contractor shall galvanize in accordance with AASHTO M 232. The Contractor shall provide cadmium plating in accordance with ASTM B 766, for Class 12, Type III. The Contractor shall provide bolts in accordance with ASTM A 307 and nuts in accordance with ASTM A 563.

The Contractor shall provide externally threaded fittings such as end tie rods, anchor rods, and splicing rods that transmit direct tensile stress, having a minimum tensile strength of 75,000 psi.

The Contractor shall provide internally threaded fittings such as turnbuckles, cable sockets, and nuts capable of withstanding a proof load that is 85% of the proof load requirements for nuts, as specified in accordance with ASTM A 563, Table 3.

The Contractor shall provide cable splices and connections that withstand a proof load equal to the tensile strength required of the attached wire rope cable.

The Contractor shall provide steel rectangular plate washers and cable clamps with a minimum tensile strength of 60,000 psi. The Contractor shall provide plain washers of ferrous metal in accordance with ANSI B 18.22.1, Type A.

607.2.4.3 Wood Posts

The Contractor shall provide wood posts from one (1) of the following species:

1. Northern White Cedar;
2. White Pine;
3. Jack Pine;
4. Red (Norway) Pine;
5. Southern Yellow Pine; or
6. Ponderosa Pine.

The Contractor shall provide posts from live trees that are stacked and properly seasoned. The Contractor shall peel the entire length of each post, closely trim knots, saw both ends square, and shave the entire length of the post to the white.

The Contractor shall provide posts with a top diameter after shaving of four (4) inches; -1/2 inch, +1 1/4 inch.

The Contractor shall ensure posts are free of sap rot, woodpecker holes, plugged holes, ant-eaten areas, and hollow knots extending to center of the post. The Contractor shall not allow butt rot to exceed five percent (5%) of the butt area. The Contractor shall provide posts with sound tops, however, the Department will allow one (1) pipe rot not exceeding a diameter of 3/8 inch on a cedar post. The Contractor shall provide posts that do not have excessive

checking. The Contractor shall ensure that the posts do not have short kinks or more than one (1) one-way sweep exceeding two (2) inches, however, the post may have a winding twist.

The Department will not allow posts exhibiting both the maximum crook and maximum butt rot, and will not allow more than ten percent (10%) of the posts specified in the Contract to contain the maximum crook or butt rot.

The Department may reject posts with other defects that give the post an unsightly appearance or impair its durability or strength. The Contractor shall complete debarking, trimming, and sizing operations before treatment.

607.2.4.4 Preservative Treatment of Posts for Post and Cable Barrier

The Contractor shall provide pressure treated wood posts with pentachlorophenol in accordance with Section 550.2.2, “Preservatives and Treatment Methods,” treated according to AASHTO M-133, in all accordance with AWPA Standard U1 and Commodity Standard B: Posts and AWPA Standards P8 and P9.

607.2.5 Snow Fence

The Contractor shall provide snow fence of 1/2 inch × 1 1/2 inch wooden pickets spaced 3 1/2 inch on center and woven between five (5) cables. Each cable will consist of at least two (2) strands of galvanized steel wire with diameters of 0.099 in or larger.

The Contractor shall provide wooden pickets that are at least 48 inches long and treated or painted in accordance with the manufacturer’s recommendations.

The Contractor shall provide wire, braces, attachments, and fittings in accordance with ASTM A 116 and applicable requirements of Section 607.2.2, “Barbed Wire and Woven Wire Fence.”

607.2.6 Concrete

The Contractor shall provide Class A concrete bearing blocks and anchors in accordance with Section 510, “Portland Cement Concrete.” The Contractor may provide a prepackaged, pre-blended cementitious Material to which the Contractor only adds water at the site.

607.3 CONSTRUCTION REQUIREMENTS

607.3.1 General

The Contractor shall clear the fence lines of trees, bush, stumps, logs, weeds, existing fences, and other obstructions that may interfere with fence construction, unless the Project Manager requires certain trees to remain in place. The Contractor shall dispose of removed Material in accordance with Section 601, “Removal of Structures and Obstructions.”

If the Contractor is to embed posts, braces, or anchors in concrete, the Contractor shall install temporary guys or bracing to hold the posts in position until the concrete sets. Unless otherwise specified, the Contractor shall not install Materials on posts and do not strain posts, braces, or anchors set in concrete until seven (7) Days after concrete placement, or until the concrete has reached a compressive strength of 2,500 psi, whichever occurs first. The Contractor shall crown the concrete at the top of the foundation to shed water.

The Contractor shall only cut the tops of posts as approved by the Project Manager. The

Contractor shall apply protective coating to cut posts in accordance with Section 607.3.8, “Repair of Damaged Coating on Pull Cables and Tension Wires.”

The Contractor shall firmly attach wire and fencing to the posts and braces. The Contractor shall tightly stretch wire and install it at the required elevations. The Contractor shall place fence wire on the field side of the posts, except on the inside of curves.

At each location where an electric transmission, distribution, or secondary line crosses new fence, the Contractor shall provide and install a ground connection in accordance with the NEC®.

The Contractor shall build new fences adjacent to existing fence before removing existing fences. When removing and rebuilding fences, the Contractor shall maintain the security of livestock and protect adjacent properties and the traveling public. The Contractor shall remove the existing fence or unused Materials and neatly roll it up in single strand rolls. The Contractor shall remove the fence posts without damaging them and place the posts with the rolls of wire within the Right of Way for property owners to salvage, unless otherwise directed by the Project Manager. If the property owners do not pick the fence up within the allotted time, the Contractor shall dispose of the fence as directed by the Project Manager.

607.3.2 Barbed Wire and Woven Wire Fence

The Contractor shall set posts plumb and in accordance with the Plans. The Contractor may drive metal line posts. The Contractor shall excavate for footings and anchors in accordance with the Plans or as directed by the Project Manager. The Contractor shall place post hole backfill in thin layers and compact each layer.

The Contractor shall attach Right of Way fences to Roadway Structures, in accordance with the Plans.

607.3.2.1 Fence Tensioning

The Contractor shall stretch fence wire with a mechanical stretcher or other similar device. The Contractor shall not allow the length between pull posts to exceed 990 ft for barbed wire, and 660 ft for woven wire.

607.3.2.2 Braces and Corner Posts

The Contractor shall place intermediate braces at intervals of 990 ft or less and at every fence grade-change, such as edges of arroyos, bottoms and tops of hills, and as directed by the Project Manager. The Contractor shall maintain the required distance between the bottom wire and the ground. The Contractor shall space intermediate braces evenly between corner and gateposts or cattle guards. The Contractor shall place a corner post and brace at the intersection of cross fences and the Right of Way fence. The Contractor shall stretch the wires and firmly attach them to the corner posts.

607.3.3 Chain Link Fence

The Contractor shall install braces, tension rods, cables, hardware, and appurtenances in accordance with the manufacturer’s recommendations and the Contract.

The Contractor shall not attach chain link fabric to posts until the concrete footings have reached a compressive strength of 2,500 psi, or until three (3) Days after concrete placement, whichever occurs first.

After permanently positioning posts, setting anchorages firmly, and drawing tension wires and pull cables tight with turnbuckles or other approved tension devices, the Contractor shall secure the tension wires to the posts with tension bands and tie wires. The Contractor shall secure the chain link fabric at one end and stretch away from the secured end. The Contractor shall stretch the fabric with a mechanical stretcher or other device approved by the Project Manager.

607.3.3.1 Chain Link Fence Post Placement

The Contractor shall set posts plumb in concrete footings. The Contractor shall space chain link fence posts at intervals of ten (10) feet or less. The Contractor shall measure the intervals from center to center of posts. Pull posts are line posts braced to adjacent line posts. The Contractor shall position pull posts at intervals of 500 ft or less. The Contractor shall provide end posts with an outside diameter of at least 2.875 inch. The Contractor shall brace end posts in the same way as corner posts.

607.3.3.2 Chain Link Security Fence

The Contractor shall use chain link security fence in accordance with Section 607.3.3, “Chain Link Fence.” The Contractor shall supply security appurtenances on gates for access.

607.3.4 Post and Cable Access Fence

607.3.4.1 Post Placement

The Department will allow a depth of post embedment that is greater than specified in the Contract if the finished top of the post meets the required elevation. The Contractor shall compact the bottom of the holes to provide a stable foundation. The Contractor shall set the posts plumb with the front faces in a neat uniform line and with full contact on the foundation surface. The Contractor shall backfill holes with granular Material and compact in layers so the posts maintain the specified position and alignment.

Instead of setting posts in previously dug holes and backfilling, the Contractor may drive the posts, except if the Contract specifies bearing blocks. The Contractor shall only drive if there is adequate lateral stability and as long as the Shoulders and adjacent slopes are not damaged from the driving operations.

The Contractor shall remove posts that do not meet the requirements or are damaged below cutoff during driving, and replace with sound posts. If upward vertical adjustment of posts is necessary, the Contractor shall remove and reinstall them.

The Contractor may cut off the tops of posts to the elevation specified in the Contract. The Contractor shall round the tops of round posts to an approximate domed hemispherical shape centered on the axis of the post. After cutting off treated posts, the Contractor shall apply two (2) coats of pentachlorophenol preservative to the cut surfaces.

607.3.4.2 Setting of Anchors, Cable, and Fittings for Post and Cable Access Fence

If a bolt projects more than one (1) inch from the nut, the Contractor shall cut off 1/2 inch and burr. The Contractor shall paint the ends of cut-off bolts with aluminum paint. The Contractor shall bore holes for cable supports after the posts are set. The Contractor shall place end and intermediate anchorages and bearing blocks in accordance with the Contract.

The Contractor shall excavate trenches for anchor blocks to their neat lines. The Contractor shall perform excavation for anchor rod installation without excessively disturbing

the earth between the block and the anchored posts. The Contractor shall excavate holes for bearing blocks to their neat lines, then place and level the block with anchor rods in place on undisturbed soil. The Contractor shall place backfill Material and compact in layers. The Contractor shall not apply final tension to the anchor assembly until after completing the backfilling.

After completing the anchor assemblies, the Contractor shall properly adjust and securely fasten the cables, draw the cables tight, then loosen them to meet Contract requirements for the applicable temperature range.

The Contractor shall use three (3) inch wide reflective sheeting in accordance with Section 701.2.2.1, “Retroreflective Sheeting,” Silver White No. 2. The Contractor shall mount the sheeting on flexible aluminum alloy. The Contractor shall fix the sheeting to each end post and at maximum intervals of 100 ft on intermediate posts, with a minimum of three (3) strips per installation. The Contractor shall completely wrap the reflective strips around each post before installing the post plate washers.

607.3.5 Snow Fence

The Contractor shall construct snow fence in accordance with the manufacturer’s recommendations and the Contract.

607.3.6 Pedestrian/Bicycle Railing

The Contractor shall construct pedestrian and bicycle railing in accordance with the Contract or as directed by the Project Manager.

607.3.7 Removing and Rebuilding Fence

The Contractor shall remove and rebuild existing fences in accordance with the Contract or as directed by the Project Manager. The Contractor shall construct new fences in the same or better condition than the original fence.

The Contractor shall salvage Materials from removed fences and incorporate into the rebuilt fences. If the Project Manager determines that some Materials are not reusable, the Contractor shall replace those Materials as necessary and in accordance with Section 109.5, “Payment for Changes, Differing Site Conditions, and Extra Work.”

The Contractor shall firmly reset posts to the staked alignment. The Contractor shall use the same spacing of the posts and the same number of wires strung and stapled to the posts as the original fence. The Contractor shall use new staples to fasten the wires to the posts.

607.3.8 Repair of Damaged Coating on Pull Cables and Tension Wires

The Contractor may repair pull cables and tension wires that exhibit minor damage to the zinc coating by wire-brushing the damaged area and removing loose, cracked, or weld-burned zinc coating. The Contractor shall paint the cleaned area with two (2) coats of zinc oxide-zinc dust paint in accordance with Federal Specification TT-P-641 or Military Specification MIL-P-21035 or with an equivalent coating approved by the Project Manager. The Contractor shall make repairs and provide repair Materials at no additional cost to the Department.

607.3.9 Gates

The Contractor shall fabricate and construct gates, and stile and post wire traps in accordance with the Contract.

607.3.9.1 Remove and Reset Gate

The Contractor shall remove and reset existing gates in accordance with the Contract or as directed by the Project Manager.

607.4 METHOD OF MEASUREMENT

The Department will measure fences and watergap gates along the top from outside to outside of end posts for each continuous run of fence or watergap gate.

607.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Barbed Wire Fence ___ft	Linear Foot
Game Fence ___ft	Linear Foot
Woven Wire Fence ___ft	Linear Foot
Chain Link Fence ___ft	Linear Foot
Chain Link Security Fence ___ft	Linear Foot
Vinyl-Coated Chain Link Fence ___ft	Linear Foot
Snow Fence ___ft	Linear Foot
Pedestrian/Bicycle Railing ___ft	Linear Foot
Pedestrian Screening Fence Type ____ft	Linear Foot
Post and Cable Access Fence ___ft	Linear Foot
Remove and Rebuild (type) Fence	Linear Foot
Standard Gate ___ft	Each
Barbed Wire Gate, ___ft	Each
Chain Link Gate, ___ft Span	*Each*
Chain Link Gate, ___ft Span by ___ft Rise	*Each*
Pipe Gate ___ft	Each
Water Gap Gate	Linear Foot
Turnstile Gate ___ft	Each
Remove and Reset Gate	Each
Stile and Post Wire Trap	Each
Braces/Corner Posts	Each

607.5.1 Work Included in Payment

The following Work and items will be considered as included in the payment for the main item(s) and will not be measured or paid for separately:

1. Clearing and grubbing,
2. Grading,
3. Excavation,
4. Backfill,
5. Disposal of surplus Material,
6. Concrete, fasteners,

7. Galvanizing,
8. Coating repairs; and
9. All additional bracing required for grade changes.

TECHNICAL SPECIFICATION 662

MANHOLES

This specification applies to bid item number:
24: Manhole Type C-4’ Diameter over 6’ to 10’ Depth
32: Manhole Type C-4’ Diameter over 0’ to 6’ Depth

NMDOT Technical Specification 662 Manholes is modified as follows:

662.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Manhole Type C, 4ft diameter, 6 ft to 10 ft Depth	Each
Manhole Type C, 4ft diameter, 0 ft to 6 ft Depth	Each

END OF SECTION

SECTION 662: MANHOLES

662.1 DESCRIPTION

This Work consists of constructing manholes. The Contractor shall construct manholes complete with covers, steps, fittings, and other appurtenances. This Work also includes installation of reducing cones, manhole extensions, ties to existing manholes, manhole adjustments, and manhole frame and covers.

662.1.1 NMSSPWC Appurtenant Stipulations

The Contractor shall adhere to the applicable requirements of the *NMSSPWC,* except for the procedures for Method of Measurement and Basis of Payment.

662.1.1.1 Terms

The Contractor shall substitute "Engineer," as it appears in the applicable sections of the *NMSSPWC,* with "Project Manager." The term "Owner" refers to the entity owning the affected utilities on this Project.

662.1.2 Manhole Types

The Contractor shall use precast concrete sections to construct "Drop" and "Standard" manholes.

The Department defines "Drop" manholes as manholes that have outside pipe and fittings for dropping sewage into the lower line.

The Department defines "Standard" manholes as inside drop manholes, where the incoming line discharges directly into the manhole and does not require special fittings.

662.2 MATERIALS

622.2.1 General

The Contractor shall use new Materials of the best standard quality available for the intended purpose.

The Contractor may substitute Contract specified brand name Materials with generic Materials of equal quality if the Contractor provides adequate technical and descriptive data and the Project Manager approves.

662.2.1.1 Referenced Materials

The Contractor shall provide Materials in accordance with these *Standard Specifications* and the following sections of the *NMSSPWC:*

1. Section 106, "Cement Mortar and Grout";"
2. Section 108, "Brick;"
3. Section 123, "Reinforced Concrete Pipe;"
4. Section 124, "Reinforced Concrete Pressure Pipe;"
5. Section 128, "Concrete Cylinder Pipe;"
6. Section 130, "Gray Iron and Ductile Iron Fittings;"

7. Section 143, “Galvanizing;”
8. Section 160, “Steel Castings;”
9. Section 161, “Gray Iron Castings;” and
10. Section 162, “Aluminum Castings.”

If the above-referenced Specifications and these *Standard Specifications* conflict, the Contractor shall use the more stringent.

662.2.1.2 Certification

Before installing an item or type of Material, the Contractor shall provide the Project Manager with a certification that the item or type of Material meets these *Standard Specifications* or the referenced Specifications.

662.2.2 Masonry

662.2.2.1 Concrete

The Contractor shall provide Materials for concrete in accordance with Section 509, “Portland Cement Concrete Mix Designs.”

662.2.2.2 Non-Shrink Mortar

The Contractor shall provide non-shrink mortar in accordance with Section 521, “Non-Shrink Mortar.”

662.2.3 Fine Aggregate

The Contractor shall provide fine aggregate that passes a No. 8 sieve, but no more than four percent (4%) passes the No. 200 sieve.

662.2.4 Precast Sections

The Contractor shall provide circular precast concrete in accordance with ASTM C 478, except that the minimum thickness and the reinforcement will be in accordance with the Contract.

The Contractor shall provide circular or horseshoe-shaped box out openings for each connecting pipe, with the surfaces grooved or roughened to improve mortar bond.

662.2.5 Gaskets

The Contractor shall provide rubber or mastic gasket Materials in accordance with the following:

1. Mastic in accordance with Federal Specification SS-S-210; and
2. Rubber that is Neoprene, or another synthetic, and 40 ± five (5) hardness if, measured in accordance with ASTM D 2240 and Type A durometer.

662.2.6 Coal Tar Paint

The Contractor shall provide one (1) of the following types of coal tar paint:

1. Koppers Bitumastic Super-Service Black;

2. Porter Tarmastic 103;
3. Tnemec 450 heavy Tenemecol, or;
4. An approved equal.

662.2.7 Castings

The Contractor shall provide castings in accordance with ASTM A 48, with asphalt varnish coating applied at the foundry.

The Contractor shall provide the following manhole rings and covers:

1. Neenah R-1736;
2. Clay and Bailey No. 2008;
3. McKinley ET 24 M; or
4. An approved equal.

The Contractor shall provide aluminum manhole steps or polypropylene-encased deformed-steel reinforcing bar manhole steps in accordance with ASTM C 478.

662.3 CONSTRUCTION REQUIREMENTS

662.3.1 General

The Contractor shall make excavations, as necessary, to determine the exact location of existing utilities that affect the new construction.

The Contractor shall repair damage to existing utilities at no additional cost to the Department.

The Project Manager will establish the final locations for new fittings, connections, etc. in the field. The Project Manager must approve modifications to the Contract before beginning the Work.

The Contractor shall submit a proposed sequence of construction to the Project Manager for approval before beginning the Work.

662.3.1.1 Waste Containment and Disposal Requirements

The Contractor shall dispose of Materials taken from sanitary sewers during cleaning operations at no additional cost to the Department.

The Contractor shall retrieve and dispose of sand and other debris from the sewers and secure a legal disposal site at no additional cost to the Department.

The Contractor shall not discharge removed sewage or solids onto Streets, ditches, catch basins, or storm drains.

662.3.2 Delivery

The Contractor shall not deliver precast concrete sections to the Project until representative concrete control cylinders have attained at least 80% of the specified minimum compressive strength. The Contractor shall inspect precast concrete sections upon delivery and the Contractor shall not use cracked, broken, or visibly defective units.

662.3.3 Placement Requirements

The Contractor shall use mortar within 40 min after mixing. The Contractor shall discard mortar that has begun to take on initial set and the Contractor shall not mix it with additional cement or new mortar. If necessary, the Contractor shall extend the manhole as directed by the Project Manager.

662.3.3.1 Inverts

The Contractor shall ensure that the dimension of the invert section through a manhole is greater than that of the outgoing pipe. The Contractor shall ensure that the shape of the invert conforms exactly to the lower half of the pipe it connects. The Contractor shall connect side branches with as large a radius of curve as practical. The Contractor shall trowel inverts to a smooth, clean surface.

662.3.3.2 Precast Sections

The Contractor shall provide circular precast sections with a rubber or mastic gasket to seal joints between sections. The Contractor shall fill the space between connecting pipes and the wall of precast sections completely with non-shrinking mortar.

662.3.4 Connections

The Contractor shall make connections in a sequence and method that minimizes inconvenience to the Owner. The Contractor shall obtain Project Manager approval of the sequence and method before making the connections.

To stop the flow of water to make the connection to the existing line, the Contractor shall only close existing valves in the presence of an Owner representative.

662.3.5 Manhole Frames and Covers

The Contractor shall cast or finish manhole frames and covers in accordance with the Plans.

The Contractor shall use machined cover seats and frame seats made of tough gray iron, free of cold chutes or blow holes, and with a finish to industry standards. The Contractor shall produce an indentation on a rectangular edge using a hammer without flaking the metal.

The Contractor shall perform the following to castings at the foundry:

1. Hammer inspection;
2. Thoroughly clean;
3. Dip in asphalt or coal tar; and
4. Oil at a temperature of from 290 °F to 310 °F.

The Contractor shall use manhole frames and covers in accordance with the Contract. The Contractor shall cast, finish, and machine the frame and cover so that the cover sits true and even, without rocking within the frame.

The Contractor shall ensure the position and spacing of the manhole step rungs are in accordance with the Contract.

662.3.6 Submittals

Two (2) weeks before installation, the Contractor shall submit drawings and data regarding precast concrete sections to the Department. The Contractor shall submit data and drawings regarding cast-in-place manholes to the Department in accordance with Section 510, "Portland Cement Concrete," and Section 511, "Concrete Structures."

662.3.7 Manhole Adjustments

The Contractor shall adjust manhole rings in existing paved Roadway using the following procedure:

1. Remove the existing ring and cover;
2. Place a 5/8 inch thick (minimum) steel plate cover on the manhole opening;
3. Salvage the existing manhole rings and manhole covers and return them to the Owner as directed;
4. Place and compact the required surfacing;
5. Locate the steel-plate manhole cover with a metal detector or other method approved by the Project Manager;
6. Cut a five (5) foot × five (5) foot square opening in the surfacing and remove the surrounding Material in accordance with the Plans (the control point of the square opening is the center of the manhole);
7. Install a manhole ring and adjust in accordance with the Plans;
8. Place the steel reinforcement and concrete (the Project Manager will determine the curing time allowed for the placed concrete before other Work adjacent to or over the concrete can be started); and
9. Place and compact the required surfacing.

The Contractor may propose an alternate method of adjusting manholes by providing the Project Manager the proposed procedure in writing. The Contractor shall not use the proposed procedure until Project Manager approval.

662.3.8 Miscellaneous Manhole Construction

If specified, the Contractor shall install reducing cones, manhole extensions, ties to existing manholes, manhole adjustments, and manhole frame and covers in accordance with the NMSSPWC.

662.4 METHOD OF MEASUREMENT

The Department will measure additional depth for adjusted manholes from the inside bottom of the manhole to the adjusted finished top of the manhole ring and compare that measurement to the Plan depth.

662.5 BASIS OF PAYMENT

Pay Item	Pay Unit
Manhole Type __, __ft diameter ___ft to ___ft Depth	Each
Manhole Type __, __ft diameter over ___ft to ____ft Depth	Each
Manhole Type ___	Each
Special Manhole Type ___	Each
Manhole, ___ft diameter	Each

Sewer Manhole, ___inch diameter	Each
Drop Manhole, ___inch diameter	Each
___ inch × ___inch Reducing Cone	Each
Manhole Adjustment	Each
Manhole Extension	Each
Tie to Existing Manhole	Each
Manhole Frame and Cover	Each

SUPPLEMENTAL TECHNICAL SPECIFICATION

APWA (2006) SECTION 1012

NATIVE GRASS SEEDING

Revised 07/24/2020

1. In subsection 1012.4 MATERIALS delete paragraphs 1012.4.1.1 and 1012.4.1.2 in their entirety and replace with the following:

Grass Seed Mix shall include the following species and rates:

Indian Rice Grass	5 lb/ac
Galleta	5 lb/ac
Sideoats Gramma	5 lb/ac
Blue Gramma	5 lb/ac
Sand Dropseed	5 lb/ac

Total Grass Seed Mix application rate = 25.0 lbs / acre

Wildflower Seed Mix shall include the following species and rates:

Globemallow	1 lb/ac
Purple Aster	1 lb/ac
Blue Flax	1 lb/ac
Mexican Hat	1 lb/ac
Blanket Flower	1 lb/ac

Total wildflower seed mix application rate = 5.0 lbs / acre

Seed rate is given in pounds of pure live seed (P.L.S.) per acre.

END OF SECTION

SECTION 1012

NATIVE GRASS SEEDING

1012.1 GENERAL:

Work under this section consists of preparing all area indicated on the plans for native grass seeding, furnishing and installing all seed, fertilizer and soil amendments as specified herein and on the plans, or as authorized by the ENGINEER.

1012.2 REFERENCES:

1012.2.1 This Publication:

Section 1011

1012.3 WORK AREA/TIMING:

1012.3.1 Areas that are disturbed by the CONTRACTOR that are outside the construction limits shown on the plans or authorized by the ENGINEER shall be seeded with native grasses as specified herein at no cost to the OWNER.

1012.3.2 The seeding of disturbed areas shall commence upon completion of the other work in the area.

1012.4 MATERIALS:

1012.4.1 Native Seed: The native seed species and rate of application shall be as shown below and shall be used based on the type of soil or as specified on the plans or in the Supplemental Technical Specification.

1012.4.1.1 Sandy Soils. Seed rate is given in pounds of pure live seed (P.L.S.) per acre.

Variety/ Common Name	Genus/ Species	P.L.S/Acre
"Paloma"Indian Rice grass	Oryzopsis hymenoides	5.0
"Viva" Galleta grass	Hilaria jamesii	1.0
"Niner" Side oats grama	Bouteloua curtipendula	3.0
"Hatchita" Blue grama	Bouteloua gracilis	1.0
Sand dropseed (NM Region)	Sporobolus cryptandrus	1.0
Fourwing saltbush (NM Region)	Atriplex canescens (de-winged)	1.0
Total rate		12.0 lbs/ acre

1012.4.1.2 Clay, Clay Loam, and Sandy gravelly clay loam soils. Seed rate is given in pounds of pure live seed (P.L.S.) per acre.

Common Name	Genus/species	PLS/acre
"Paloma" Indian rice grass	Oryzopsis hymenoides	2.0
“Viva” Galleta grass	Hilaria jamesii	2.0
"Niner" Sideoats grama	Bouteloua curti pendula	2.0
"Hatchita" Blue grama	Bouteloua gracilis	3.0
Sand dropseed (NM Region)	Sporobolus cryptandrus	1.0
Four-wing Saltbush (NM Region)	Atriplex canescens (de-winged)	1.0 1.0
Total rate		11.0 lbs/ac

NOTE: If the area to be seeded is along a recreational trail of any type the seed mixes for either type of soil listed above shall exclude the one (1) pound per acre of Four-wing saltbush. The seeding rate shall be lowered by one (1) pound per acre.

1012.4.1.3 Seeds may be pre-mixed by a seed dealer. Each bag of seed shall be sealed and labeled by the seed dealer in accordance with Federal Seed Laws and New Mexico Department of Agriculture Labeling Laws. This includes: variety, kind of seed, lot number, purity, germination, percent crop, percent inert, percent weed (including noxious weeds), origin, test data and net weight. Federal Seed Laws require that analysis shall be no older than 5 months for seed shipped interstate and no older than 9 months for seed shipped intra-state. The ENGINEER shall receive all labels from all bags of seed used for verification.

1012.4.2 Fertilizer and Soil Amendments: Unless otherwise specified on the plans or in the Supplemental Technical Specification, no fertilizer or other soil amendments are required on areas specified to receive native seeding. If fertilizer and/or other soil amendments are required they shall be in accordance with Section 1011 of these specifications.

1012.4.3 MULCH:

1012.4.3.1 Hay Mulch: Perennial native or introduced grasses of fine-stemmed varieties shall be used unless otherwise specified on the plans. At least 65 percent of the herbage by weight of each bale of hay shall be 10 inches in length or longer. Hay with noxious seed or plants will not be acceptable. Rotted, brittle, or moldy hay will not be acceptable. Marsh grass or prairie hay composed of native grass of species to be seeded will be acceptable. Tall wheat grass, intermediate wheat grass, switch grass, or orchard hay will be acceptable if cut prior to seed formation. Marsh grass hay shall be composed of mid and tall native, usually tough and wiry grass and grass-like plants found in the lowland areas within the Rocky Mountain region. Hay shall be properly cured prior to use. Hay which is brittle, short fibered or improperly cured is not acceptable.

1012.5.2 Straw Mulch: Small grain such as wheat, barley, rye, or oats will not be allowed except by prior approval of the ENGINEER and with the concurrence of the Air Division, Environmental Health Department. Alfalfa or the stalks of corn, maize or sorghum is not acceptable. Material which is brittle, shorter than 10 inches or which breaks or fragments during the crimping operation will not be acceptable.

1012.4.3.3 Gravel Mulch: Gravel mulch shall be crushed or screened gravel 3/4" to 1" maximum size with a minimum of one fractured face unless otherwise specified.

1012.4.3.4 Erosion Control Matts, Fabric or Blankets: The type of erosion control mats, fabric or blankets used shall be as specified or allowed on the plans or in the Supplemental Technical Specifications.

1012.5 SEED BED PREPARATION:

1012.5.1 General:

1012.5.1.1 Prior to the starting of any seed bed preparation the final grades of all earth work shall be inspected and approved by the ENGINEER.

1012.5.1.2 No preparation shall be performed when the surface is wet or muddy or when the soil moisture content is such that the soil is not fully loosened by the discing operation.

1012.5.1.3 The extent of seed bed preparation shall not exceed the area on which seeding, mulching and crimping operations can be completed prior to crusting or wind or water erosion of the prepared surface. If erosion, crusting or re-compaction occurs, the affected area shall be re-worked beginning with seed bed preparation. Depth of preparation must be approved by the ENGINEER prior to the seeding and mulching operations.

1012.5.2 Mechanical Preparation: The seed bed shall be loosened to a minimum depth of 6" (six inches) by means of disc or harrow. Area of heavy or compacted soil may require additional preparation such as chiseling or ripping if discing alone does not result in preparation to the full minimum depth of 6". The soil shall be worked to a smooth surface free of clods, stones 4" and larger or any other debris or foreign material that could interfere with seeding or crimping equipment operations.

1012.5.3 Hand Preparation: Areas which cannot be prepared with mechanized equipment because of small size irregular shape or slope angle may be prepared to a minimum depth of 2" using hand tools or a rototiller. Any such areas will be specified on the plans.

1012.6 SEEDING:

1012.6.1 General:

1012.6.1.1 Seeding shall not start until the seed bed preparation has been inspected and approved by the ENGINEER.

1012.6.1.2 No more area may be seeded than can be covered with mulch and crimped, or covered with gravel mulch or erosion control mats by the end of the work day. No seeding operations may be conducted when steady wind speed exceeds 10 miles per hour. If winds exceed 10 mph while seeding is underway, seeding operations will be halted and any areas seeded to that point completed.

1012.6.2 Seed Application:

1012.6.2.1 Drill Seeding: Drill seeding is required unless otherwise specified on the plans or in the Supplemental Technical Specifications. Seed shall be applied with a "rangeland" type seed drill equipped with packer wheels. Seed shall be drilled to a maximum depth of 1/2" unless otherwise specified. Direction of seeding shall be across slopes and on the contour whenever possible.

1012.6.2.2 Broadcast Seeding: Seed may be applied using the broadcast method when size, irregular shape or slope angle exceeding 3.1 prevents the use of a seed drill. Seed may be broadcast by hand or by means of a mechanical seeder provided that the seed is evenly distributed over the seeding area. Areas of broadcast seeding

will be hand raked to cover seed. Areas which are broadcast seeded shall be seeded at rate which is double that used for drill seeding.

1012.6.2.3 Seeding With Gravel Mulch: Areas to receive gravel mulch will be seeded at the broadcast seed rate with 1/2 the seed applied prior to application of gravel and 1/2 the seed applied on the surface of the gravel. Water shall be applied in quantity sufficient to wash seed from the surface and into the gravel.

1012.6.2.4 Hydro Seeding: Hydro seeding will not be allowed on areas of non-irrigated native grass seeding unless specified on the plans or in the Supplemental Technical Specifications or authorized by the ENGINEER.

1012.7 MULCHING:

1012.7.1 General:

1012.7.1.1 All seeded areas shall be mulched unless otherwise specified on the plans or in the Supplemental Technical Specifications.

1012.7.1.2 On seeded areas that are level or have slopes 3:1 or less, any of the four (4) types of mulching or erosion control specified herein may be used. On seeded areas that have slopes steeper than 3:1 only gravel mulch or erosion control materials may be used as specified on the plans and in the Supplemental Technical Specifications.

1012.7.2 Hay Mulch: Hay mulch shall be applied at a minimum rate of 1.5 tons per acre of air dry hay.

1012.7.3 Straw Mulch: Straw mulch shall be applied at a minimum rate of 2.5 tons per acre of air dry straw.

1012.7.4 Crimping: Hay and/or Straw mulch shall be crimped into the soil. The mulch shall be spread uniformly over the area either by hand or with a mechanical mulch spreader. When spread by hand, the bales of mulch shall be torn apart and fluffed before spreading. Mulching will not be permitted when wind velocity exceeds 15 miles per hour. The mulch shall be wetted down and allowed to soften for 15 to 20 minutes prior to crimping. A heavy disc such as a mulch-tiller, with flat serrated discs at least 1/4 inch in thickness, having dull edges and the disc spaced 6 inches to 8 inches apart shall be used to crimp (or anchor) the mulch into the soil to a minimum depth of 2 inches or as specified on the plans or the Supplemental Technical Specifications. The discs shall be of sufficient diameter to prevent the frame of the equipment from dragging the mulch. The crimping operations shall be across the slope where practical but not be parallel to prevailing winds or by tight interlocking “S” curves to avoid straight crimp lines.

If small grain straw mulch is used it shall be crimped in two (2) directions in a cross-hatch pattern.

1012.7.5 Gravel Mulch: Gravel mulch shall be placed by hand or by mechanized equipment that provides full coverage at a uniform thickness of 2 inches in depth.

1012.7.6 Erosion Control Matts, Fabric or Blankets: the type of erosion control mats, fabric or blankets used shall be as specified on the plans or the Supplemental Technical Specifications or as approved by the ENGINEER. The anchoring of the erosion control items shall be as per the manufacturer's recommendations.

1012.8 PROTECTION OF NATIVE GRASS SEEDED AREA:

1012.8.1 GENERAL: The CONTRACTOR shall be responsible for protecting and caring for seeded areas until final acceptance of the work and shall repair at his expense any damage to seeded areas caused by pedestrian or vehicular traffic or vandalism.

1012.9 INSPECTION FOR NATIVE GRASS AREA:

1012.9.1 The following inspection shall be the minimum required inspections to native grass during the course of construction. Additional inspections shall be made at any time at the discretion of the ENGINEER.

1012.9.2 It shall be the responsibility of the CONTRACTOR to notify the ENGINEER, in writing, 48 hours in advance of each required inspection.

1012.9.3 The sequence of required inspections shall not be changed from the sequence listed below. The CONTRACTOR shall not proceed with work of the next sequence without written approval of the work of the previous sequence. Payment will not be approved for items which have not been inspected and approved in writing.

1012.9.3.1 Each phase of soil preparation shall be inspected in process.

1012.9.3.2 Finish grade shall be inspected.

1012.9.3.3 Seed shall be inspected prior to seeding.

1012.9.3.4 Seeded area shall be inspected after completion.

1012.9.3.5 Final inspection of the project and acceptance.

1012.10 MEASUREMENT AND PAYMENT

1012.10.1 MEASUREMENT: The measurement of native grass seeding shall be by the acre.

1012.10.2 Payment: Payment shall be made at the contract unit price per acre of native grass seeding complete in place, which shall include the seed, fertilizer, (if required) area preparation, seeding, soil amendments, (if required) and mulching.

TECHNICAL SPECIFICATION 1503

MOBILIZATION

Revised 12/10/2024

This specification applies to Bid Item Number:
23: Mobilization

1503.1 DESCRIPTION

This work shall consist of preparatory and final work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site; for the establishment of all offices, buildings and other facilities necessary for work on the project; and, for all other work and operations which must be performed or costs incurred prior to beginning work on the project.

1503.2 ADMINISTRATION REQUIREMENTS

1503.2.1 DEFINITIONS

The following definitions shall apply:

Total Original Contract Amount shall mean the total amount bid as compensation for the contract.

Total Original Contract Amount Less Mobilization shall mean the total amount bid as compensation for the contract less the amount bid for mobilization.

1503.2.2 GENERAL

It is the intent of this specification to provide for the contractor to receive 100% of the amount bid for Mobilization by the time the Contractor has performed 10% of the total original contract amount less Mobilization.

1503.2.3 PAYMENT PROCEDURES

The following will apply in effecting mobilization payments:

a) When the Contractor is eligible for payment of less than 5% of the total original contract amount bid less mobilization, the Contractor will be paid 25% of the amount bid for mobilization.

b) When the Contractor is eligible for payment of from 5% to less than 10% of the total original amount bid less mobilization, the Contractor will be paid 50% of the amount bid for mobilization minus any mobilization amount already paid.

c) When the Contractor is eligible for payment of 10% or more of the total original contract amount less mobilization, the Contractor will be paid 100% of the amount bid for mobilization minus any mobilization amount already paid.

1503.2.4 PAYMENT CALCULATION

PM = Mobilization Payment

M = Total amount bid for Mobilization

fM = Mobilization payment percentage factor (0.25, 0.50, or 1.0, as applicable)

PM = M x fM

EXAMPLE MOBILIZATION PAYMENT CALCULATION

Total Original Contract Amount Bid		$110,000
Amount Bid for Mobilization	$	5,000
Total Original Contract Amount Less Mobilization		$105,000

Percent of Work Completed	Fm	M	PM

<5% of $105,000	0.25	5,000	$1,250
>5% to <10% of $105,000	0.50	5,000	$2,500*
≥10% of $105,000	1.00	5,000	$5,000*

**minus previously paid amounts*

1503.3 METHOD OF MEASUREMENT

The Contractor shall be responsible for all control, slope stakes, cut stakes, offset stakes, benchmarks, blue tops or other staking necessary for proper execution of the work, or as requested by the Project Manager, to assure compliance with the plans.

1503.4 BASIS OF PAYMENT

Mobilization will be paid for at the contract price provided in the Unit Cost Bid Proposal, in accordance with this specification.

No additional payments will be made for demobilization and remobilization due to shutdowns or suspensions of the work or for other mobilization and demobilization activities required to complete the contract.

END OF SECTION

TECHNICAL SPECIFICATION 1507

MATERIALS TESTING

Revised 12/10/2024

1507.1 DESCRIPTION

This SPECIFICATION includes testing and quality control measures required on this project. This specification is additional to requirements specified for testing and quality assurance in the construction plans.

Materials and equipment are subject to inspection, sampling, and testing before acceptance of the work.

1507.2 RELATED WORK

General and Supplemental General Conditions of the Contract.

1507.3 REFERENCES AND DEFINITIONS

A. All materials and equipment shall be tested, by the CONTRACTOR, pursuant to their technical specification (unless otherwise specified herein) and the manufacturer's recommendations.
B. Structure shall include but is not limited to: parking lots, pavement, sidewalk, curb and gutter, foundations, structural concrete, piping, wet-wells, manholes, retaining walls, junction boxes, and buildings.

1507.4 SUBMITTALS

A. Test Reports from tests performed by independent testing firm: Submit for acceptance, complete test reports from approved independent testing laboratories certifying that product conforms to performance characteristics and testing requirements specified

herein and in other supplemental/standard specifications. Independent firm to submit reports to the ENGINEER and CONTRACTOR, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

B. Test Reports from tests performed by CONTRACTOR: Submit for acceptance, complete test reports from CONTRACTOR certifying that product conforms to performance characteristics and testing requirements specified herein and in other supplemental/standard specifications.

1507.5 QUALITY ASSURANCE

A. Quality Assurance/Control of Installation – The CONTRACTOR shall:

1. Comply fully with manufacturers' instructions, including each step in sequence.
2. Request clarifications from ENGINEER before proceeding should manufacturers' instructions conflict with Contract Documents.
3. Request clarification from ENGINEER before proceeding should specified reference standards conflict with Contract Documents. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.
4. Comply with specified standards as a minimum quality for the work except when more stringent specified tolerances, codes, or requirements indicate higher standards or more precise workmanship are required.
5. Make sure work is performed by qualified persons.
6. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

B. Testing Laboratory Services

1. Reports will be submitted by the independent firm to the ENGINEER and CONTRACTOR, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

1507.6 TESTING METHODS

Testing methods shall comply with ASTM Standards and as specified in the technical specifications for the project.

1507.7 EXECUTION

A. Testing Laboratory Services

1. The CONTRACTOR will employ and pay for services of an independent testing firm to perform testing.

2. The independent firm will perform tests and other services specified in individual Specification Sections and as required by the OWNER.
3. CONTRACTOR shall:
    a. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.
    b. Notify ENGINEER and independent firm 8 hours prior to expected time for operations requiring services.
    c. Make arrangements with independent firm and pay for additional samples and tests required for CONTRACTOR'S use.

B. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the ENGINEER. No additional payment will be made for re-testing due to failing tests.

1507.8 TESTING FREQUENCY & TYPES OF TESTING

Frequency and type of testing shall be per the requirements listed in the specifications for each type of Work. The Engineer may increase and/or add testing for any Work items. The Testing Allowance will be adjusted for increases in testing by Section 1507.9.D.

1507.9 MEASUREMENT & PAYMENT

Testing shall be paid for as an ALLOWANCE. The Contractor may request percent of MATERIALS TESTING payments during construction, however, the Contractor shall provide actual testing lab invoices as back-up for the percent complete that is being requested in a Pay Application.

Testing allowances are provided as part of the project and invoiced for testing will be paid for through this allowance.

Costs included in testing price include:

A. Cost of engaging an independent testing firm, execution of tests by the testing firm, and reporting results by the testing firm.
B. Costs of incidental labor and facilities required to assist testing firm.
C. Costs of testing laboratory services used by CONTRACTOR separate from Contract Document requirements
D. Costs of re-testing due to failure of previous tests will be included in the cost for testing and no additional payment will be made for this work.

The CONTRACTOR shall submit two copies of the testing firm's invoice to OWNER with Pay Application. Reimbursement to the Contractor will be for actual invoiced costs and no mark-up will be added to this invoice. The Contractor shall receive reimbursement for actual invoice of testing firm upon certification that payment has been made to the testing laboratory. Payment will be made at the next application for payment from OWNER.

END OF SECTION

TECHNICAL SPECIFICATION 1511

NPDES COMPLIANCE

Revised 08/21/2020

This specification applies to Bid Item Number:
16: NPDES & SWPP

1511.1 SCOPE OF WORK

The work under this section includes compliance with the U.S. Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES) Regulations for Storm Water Discharges from construction sites. This work consists of implementing and maintaining a plan to control erosion, pollution, sediment and runoff during the construction of the project.

1511.2 MEASUREMENT AND PAYMENT

1511.2.1 UNIT PRICE BID PROPOSALS

For Unit Price Bid Proposals, NPDES Compliance shall be a Lump Sum (LS) item, paid for as follows:

1511.2.1.1 Fifteen (15) percent of the Lump Sum unit price amount shall be paid after the Contractor has completed an EPA Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity Under a NPDES General Permit, Form 3510-9, or a Low Erosivity Waiver (LEW) form, if applicable. A copy of the NOI or LEW form must be delivered to the Owner and the original filed with the EPA. All required erosion control measures sufficient to begin construction must also be in place. This will be defined in the plan specifications and/or the SWPPP.

1511.2.1.2 Payment for an additional sixty percent (60%) of the Lump Sum unit price amount shall be prorated based on the Actual Percent Complete on the

Application for Payment as approved by the Architect, Engineer or Landscape Architect. For example, if the Contractor is 20% complete, the contractor can take the 20% (0.2) and multiply it by 60% (0.6) of the Lump Sum unit price amount and receive that portion.

In order to receive payments, the field inspection forms must be sent in with the Application for Payment each month. If there are deficiencies maintaining or implementing the SWPPP and its Best Management Practices (BMPs), the payment will be withheld until the deficiencies are corrected.

1511.2.1.3 The remaining twenty-five (25) percent of the Lump Sum unit price amount will be based on the completion of an EPA Notice of Termination (NOT) of Coverage Under a NPDES General Permit for Storm Water Discharges Associated with Construction Activity and BMP removal. A copy of the NOT must be delivered to the Owner and the original filed with the EPA. BMPs must be removed as defined in the plan specifications or SWPPP. This is done in case there are some BMPs that must remain until final stabilization is met, and that there are no more NPDES concerns for the Contractor.

END OF SECTION

TECHNICAL SPECIFICATION 1512

CONTROL OF STORM WATER AND NUISANCE FLOW

Revised 07/24/2020

This specification applies to Bid Item Number:
20: Control of Storm Water & Nuisance Flow

1512.1 DESCRIPTION

This work covers the control of storm and nuisance flow water in the vicinity of this project.

1512.2 CONSTRUCTION REQUIREMENTS

All permanent work shall be performed in areas free from water. The CONTRACTOR shall construct and maintain all dikes and drainage ditches necessary for the elimination of water from work areas and shall furnish, install, maintain, and operate all necessary pumping and other dewatering equipment required for dewatering the various work areas. Two (2) types of flow can be expected;

1) Continuous or intermittent flow through the main arroyo;

2) Local sheet flow from adjacent properties or adjacent streets.

The CONTRACTOR is responsible for adequacy of the scheme or plans, or for furnishing all equipment, labor and materials necessary for dewatering the work areas and breaking up and removing such ice or snow as may have formed or settled in the work area. The CONTRACTOR shall be fully responsible for all dewatering operations, and the cost of all dewatering operations shall be included in the lump sum price for this work. The CONTRACTOR shall also be responsible for removal of any sediment deposited by storm and nuisance water, and the cost of sediment removal work shall be included in the lump sum price for this work.

In the event that storm flow, snowmelt or other water flows overtop the Contractor's diversion method, the Contractor will be responsible for any and all damage, including damage to the existing channel and any damage to new work and is responsible for immediate resolution and repair in a manner acceptable to SSACFCA.

Diversion methods may be by use of sandbag diversion channels, sandbag dams, pumping or piping around or over the work areas, or any method or combination.

1512.3 BASIS OF PAYMENT

The bid item for this effort will be on a Lump Sum (LS) basis. Providing and maintaining the diversion and care of water, regardless of the amount of water actually handled, shall be paid for as follows:

Payment will be made as a percentage of the dollar amount of work completed to date minus the

Mobilization bid item.

Pay Item	Pay Unit
Control of Storm Water and Nuisance Flow	LS

END OF SECTION

TECHNICAL SPECIFICATION 1513

CONSTRUCTION STAKING

Revised 09/16/2021

This specification applies to Bid Item Number:
27: Construction Staking by Contractor

1513.1 DESCRIPTION

This work consists of construction staking lines, grades, and layouts by the Contractor in accordance with the plans and specifications and as directed by the Engineer for the control and completion of the project.

1513.2 MATERIALS

The Contractor shall furnish all stakes, templates, straightedges, surveying equipment and other devices necessary for establishing, checking, marking, and maintaining points, including P.I.'s, P.C.'s, P.T.'s, and lines, grades and layouts. As directed by the Engineer, points shall be referenced so that they may later be re-established.

1513.3 CONSTRUCTION REQUIREMENTS

The Contractor shall be responsible for all control, slope stakes, cut stakes, offset stakes, benchmarks, blue tops or other staking necessary for proper execution of the work, or as requested by the Project Manager, to assure compliance with the plans.

1513.4 CONSTRUCTION SURVEYS

The contractor shall obtain and pay for the services of a Professional Surveyor licensed in the State of New Mexico to perform surveys consisting of the following phases:

Phase 1: A topographic survey, with a contour resolution of 1-ft or greater, to determine the Project Site (including Borrow Area, if applicable) existing ground elevations prior to construction, after clearing and grubbing and after removal of trash and debris. Data collected shall be of sufficient detail, including all breaks in the terrain, to be able to create an original ground digital terrain model (DTM). The Project Site & Borrow Area (if applicable) "original ground" DTM shall be submitted to the Engineer for review and acceptance prior to proceeding with excavation and export of material. Survey data must be sufficient to determine future earthwork quantities.

Phase 2: A topographic survey, with a contour resolution of 1-ft or greater, to determine the Borrow Area (if applicable) finished ground elevations post-construction, after all required borrow material is removed. Data collected shall be of sufficient detail, including all breaks in the terrain, to be able to create a finished ground digital terrain model (DTM). The Borrow Area "finished ground" DTM shall be submitted to the Engineer for review and acceptance prior to payment for "Borrow" Bid Item. Survey data must be sufficient to determine earthwork quantities.

Phase 3: A topographic survey, with a contour resolution of 1-ft or greater, will be completed for the project site (excluding borrow area) after construction to demonstrate compliance with the design grades, structure elevations, inverts, alignments/profiles, etc. shown on the plan set. Phase 3 Survey will also include the update and completion of as-built survey for the project. It is the responsibility of the contractor to coordinate with the surveyor on a regular basis to provide as-built information to incorporate in the survey.

All surveys must be certified by the Professional Surveyor and include complete documentation. Borrow Area surveys (Phases 1 and 2) must be used by the Professional Surveyor to compute the quantity of excavation, subject to the provisions for measurement in Technical Specification 1510. Volume shall be determined based on the "average end area" computation. All computations of excavation must be submitted to the Engineer in sufficient detail. This submittal shall be such that methods and computations can be fully verified and are subject to approval by the Engineer. The Contractor shall also submit the electronic survey point files, including break lines, in a format compatible with AutoCAD Civil3D such that the Engineer can use the data for verification of cut/fill quantities.

At the end of the Project, the Engineer will transcribe the as-built information provided by the Contractor onto the Record Drawing. The Contractor's Professional Surveyor will be required to stamp, sign and certify the information shown on the as-built drawings.

1513.5 METHOD OF MEASUREMENT

Submit a construction-staking schedule of values as part of each Pay Application to the Project Manager for approval.

1513.6 BASIS OF PAYMENT

Pay Item	Pay Unit
Construction Staking	Lump Sum

1513.7 SSCAFCA will make partial payments in accordance with the approved construction-staking schedule of values.

END OF SECTION

SITE LOCATION

SSCAFCA Industrial Park Drainage Improvements ■ Rio Rancho, NM
August 12, 2021 ■ Terracon Project No. 66205217

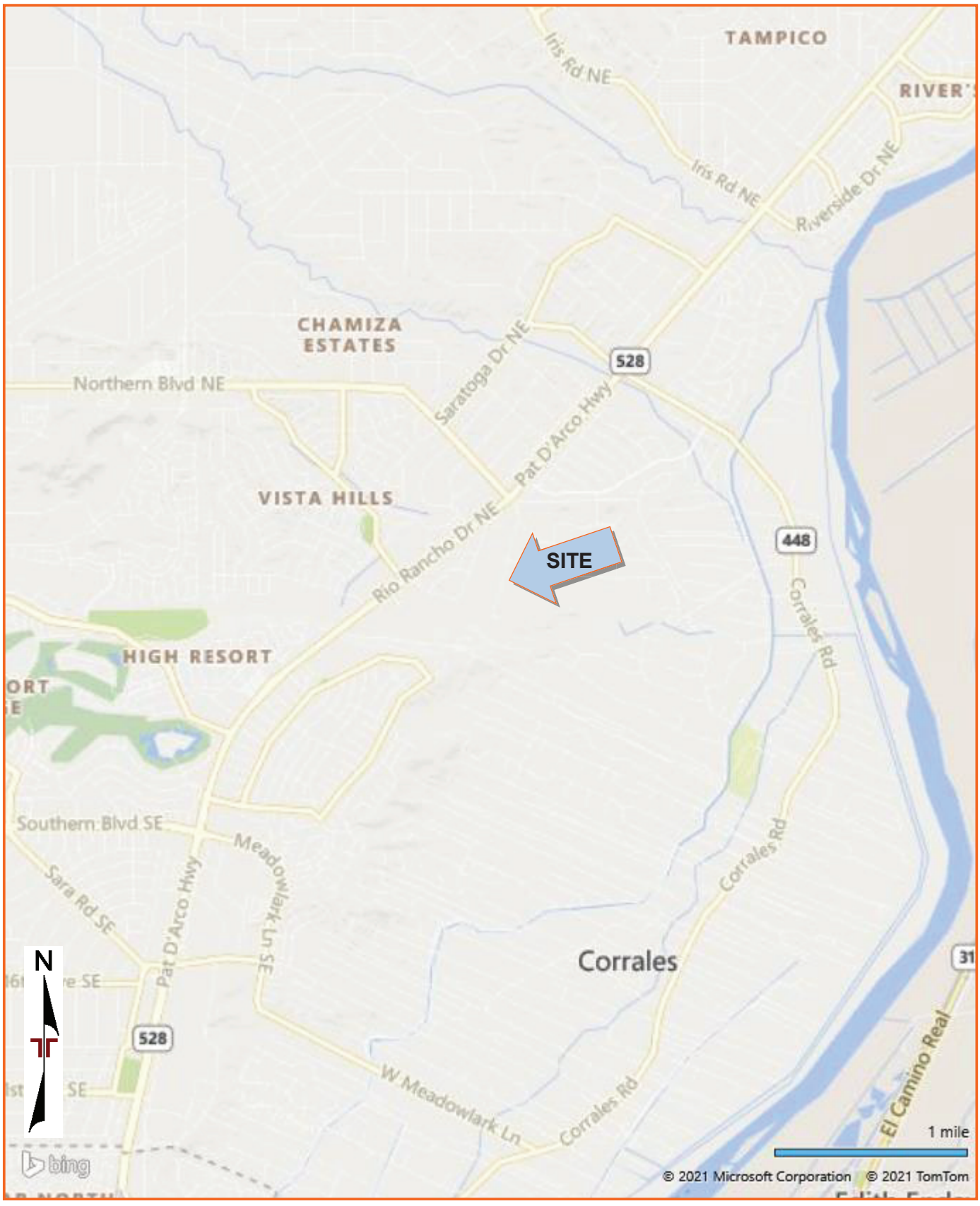


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

ROAD MAPS PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

SSCAFCA Industrial Park Drainage Improvements ■ Rio Rancho, NM
August 25, 2021 ■ Terracon Project No. 66205217

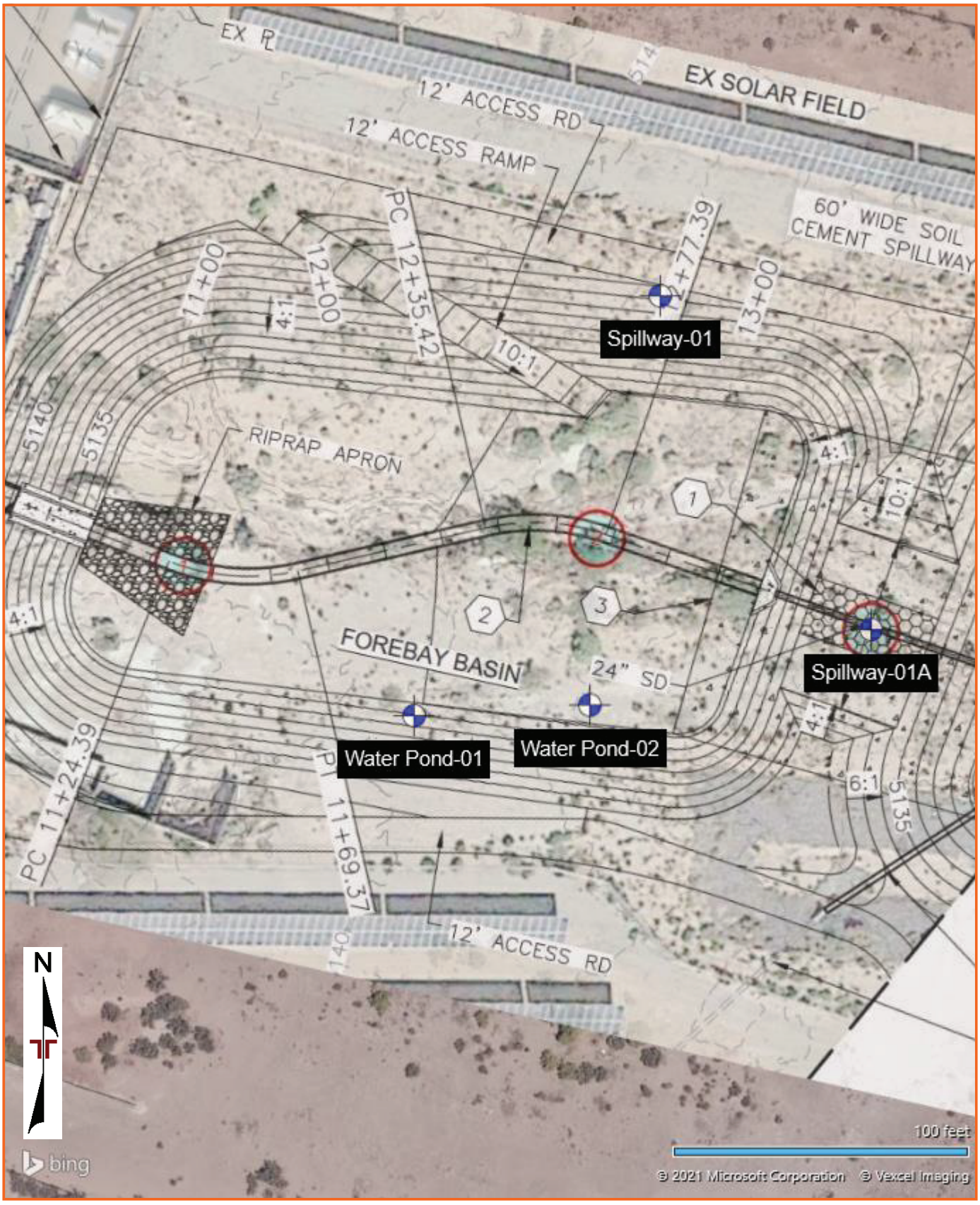


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

SSCAFCA Industrial Park Drainage Improvements ■ Rio Rancho, NM
August 12, 2021 ■ Terracon Project No. 66205217

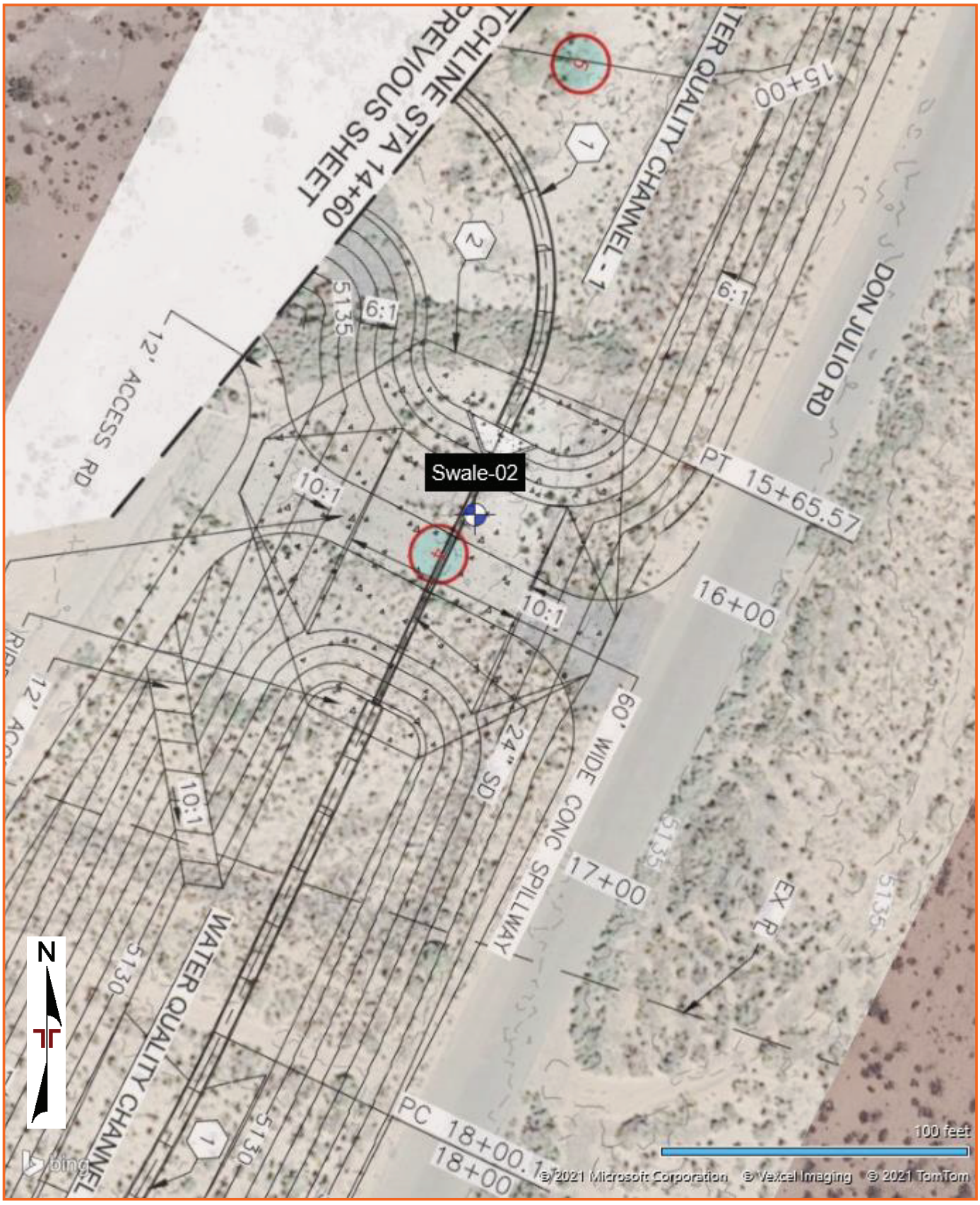


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

SSCAFCA Industrial Park Drainage Improvements ■ Rio Rancho, NM
August 12, 2021 ■ Terracon Project No. 66205217

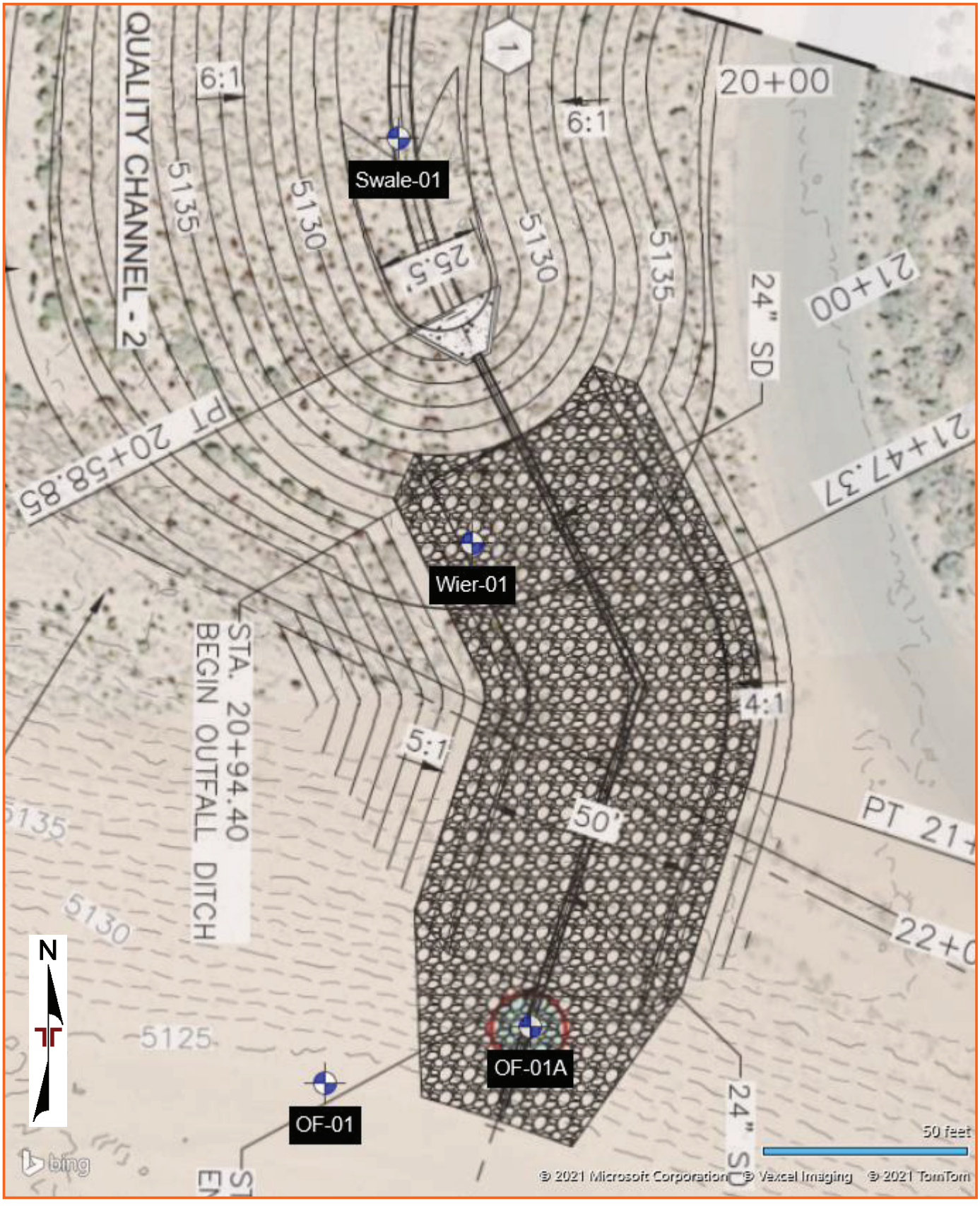


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Field Exploration Description

A total of nine (9) borings were advanced at the site on May 26 and July 28, 2021. The borings were drilled to depths ranging from approximately 11.5 to 31.5 feet below the ground surface. The exploration locations are shown on the attached Site Location Map and Exploration Plans, Exhibits A1 and A2. The test borings were located as follows:

Boring Designation	Location	Depths (feet)
Outfall-01	Outfall (original location)	16.5
Outfall-01A	Outfall	16.5
Spillway-01	Spillway (original location)	31.5
Spillway-01A	Spillway	31.5
Swale-01*	Swale Alignment	16.5
Swale-02*	Swale Alignment	16.5
Water Pond-01*	Water Quality Pond	16.5
Water Pond-02	Water Quality Pond	11.5
Wier-01	Weir	16.5

*Field percolation test performed within this boring

The test borings were advanced with a truck-mounted CME-75 drill rig utilizing 7-½ inch outside diameter hollow-stem augers. The surface samples were obtained using a portable hand auger.

The borings were located in the field by using existing site features. The latitude and longitude readings and elevations were taken at each boring location using a hand held GPS unit. The accuracy of boring locations and elevations should only be assumed to the level implied by the method used.

Lithologic logs of the borings were recorded by the Terracon representative during the drilling operations. At selected intervals, samples of the subsurface materials were taken by driving split-spoon or ring-barrel samplers.

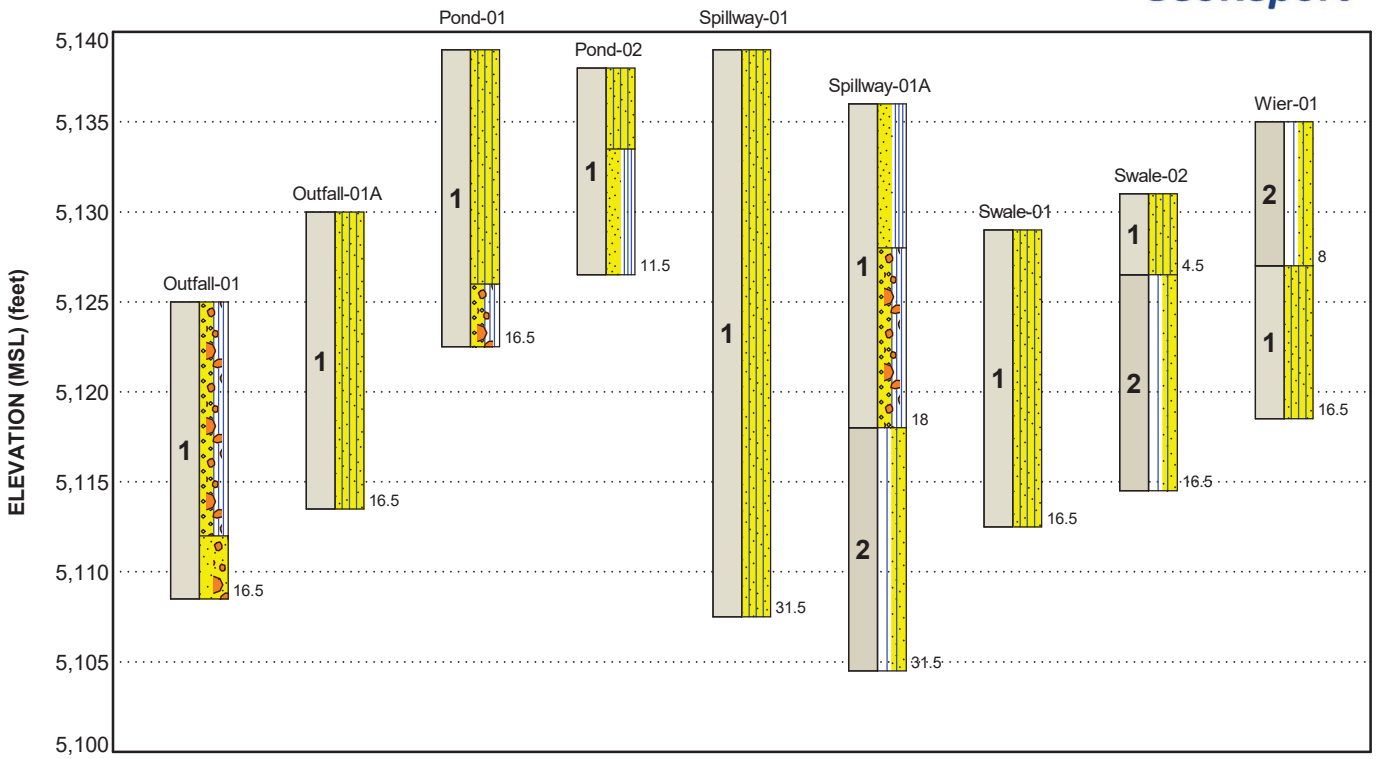
Penetration resistance measurements were obtained by driving the split-spoon and ring-barrel samplers into the subsurface materials with a 140-pound automatic hammer falling 30 inches. The penetration resistance value is a useful index in estimating the consistency or relative density of materials encountered.

A CME automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Groundwater conditions were evaluated in the borings at the time of site exploration. Due to safety considerations, the existing borings were backfilled with native soils.

GEOMODEL

SSCAFCA Industrial Park Drainage Improvments ■ Rio Rancho, NM
Terracon Project No. 66205217



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	**Loose to Dense Coarse Grained Soil**	Sand soils with variable amounts of silt and gravel, loose to dense in relative density.
2	**Medium Stiff to Very Stiff Fine Grained Soil**	Silt soils with variable amounts of sand and gravel, with medium stiff to very stiff consistency.

LEGEND

- Well-graded Sand with Silt and Gravel
- Poorly-graded Sand with Silt
- Poorly-graded Sand with Gravel
- Silt with Sand
- Silty Sand

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

BORING LOG NO. Outfall-01

PROJECT: SSCAFCA Industrial Park Drainage Improvments

CLIENT: HDR Engineering Inc
Albuquerque, NM

SITE: NM528 and Industrial Park Loop
Rio Rancho, NM

LOCATION See Exploration Plan

Latitude: 35.2571° Longitude: -106.6296°

Surface Elev.: 5125 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1												
			WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM), brown, medium dense to dense									
							10-12-14 N=26		2.2			
				5			19-27		2.0	118	NP	9
				10			9-14-16 N=30		2.4			
		13.0	5112									
			POORLY GRADED SAND WITH GRAVEL (SP), brown, dense	15			10-15-16 N=31		6.1		NP	1
		16.5	5108.5									
			Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
7" Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 05-26-2021 | Boring Completed: 05-26-2021

Drill Rig: CME 55 | Driller: Terracon ABQ

Project No.: 66205217

BORING LOG NO. Outfall-01A

PROJECT: SSCAFCA Industrial Park Drainage Improvments

CLIENT: HDR Engineering Inc
Albuquerque, NM

SITE: NM528 and Industrial Park Loop
Rio Rancho, NM

LOCATION See Exploration Plan

Latitude: 35.2573° Longitude: -106.6293°

Surface Elev.: 5130 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1												
			SILTY SAND (SM), light brown, loose									
							4-4-5 N=9		3.2			
				5			5-9				NP	13
				10			3-2-2 N=4		2.5			
				15			3-4-5 N=9		2.1			
		16.5	5113.5									
			Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
7" Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-28-2021 | Boring Completed: 07-28-2021

Drill Rig: CME 55 | Driller: Terracon ABQ

Project No.: 66205217

BORING LOG NO. Spillway-01

PROJECT: SSCAFCA Industrial Park Drainage Improvments

CLIENT: HDR Engineering Inc
Albuquerque, NM

SITE: NM528 and Industrial Park Loop
Rio Rancho, NM

LOCATION See Exploration Plan

Latitude: 35.2595° Longitude: -106.6295°

Surface Elev.: 5139 (Ft.)

DEPTH ELEVATION (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		0								
					2-3-3 N=6		1.3		NP	32
		5			4-6	-0.57 @ 500psf	3.2	100	NP	32
		10			6-6-11 N=17		1.6			
		15			4-6-7 N=13					
		20			5-10-11 N=21					
		25			7-9-10 N=19					
		30			6-10-9 N=19					

SILTY SAND (SM), brown, loose to medium dense

31.5 5107.5

Boring Terminated at 31.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
7" Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 05-26-2021 Boring Completed: 05-26-2021

Drill Rig: CME 55 Driller: Terracon ABQ

Project No.: 66205217

BORING LOG NO. Spillway-01A

PROJECT: SSCAFCA Industrial Park Drainage Improvments

CLIENT: HDR Engineering Inc
Albuquerque, NM

SITE: NM528 and Industrial Park Loop
Rio Rancho, NM

LOCATION See Exploration Plan

Latitude: 35.2592° Longitude: -106.6293°

Surface Elev.: 5136 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		0.0	5136									
							7-13	-0.16 @ 500psf	2.6	105		
				5			6-8-8 N=16				NP	12
		8.0	5128									
				10			4-11-11 N=22		1.8			
				15			9-13-18 N=31		1.8			
		18.0	5118									
2				20			5-5-3 N=8		6.1			
				25			3-5-9 N=14		4.6			
				30			2-3-3 N=6		7.0			
		31.5	5104.5									

POORLY GRADED SAND WITH SILT (SP-SM), trace gravel, light brown, medium dense

WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM), light brown, medium dense to dense

SILT WITH SAND (ML), trace gravel, light brown, medium stiff to stiff

Boring Terminated at 31.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
7" Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-28-2021 | Boring Completed: 07-28-2021

Drill Rig: CME 55 | Driller: Terracon ABQ

Project No.: 66205217

BORING LOG NO. Swale-01

PROJECT: SSCAFCA Industrial Park Drainage Improvments

CLIENT: HDR Engineering Inc
Albuquerque, NM

SITE: NM528 and Industrial Park Loop
Rio Rancho, NM

LOCATION See Exploration Plan

Latitude: 35.2577° Longitude: -106.6296°

Surface Elev.: 5129 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1												
			SILTY SAND (SM), brown, loose to medium dense									
							5-8		2.6	99	NP	24
				5			4-4-4 N=8		2.2			
				10			4-4-6 N=10		0.2		NP	23
				15			5-9-11 N=20		1.9			
		16.5	5112.5									
			Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
7" Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 05-26-2021 | Boring Completed: 05-26-2021

Drill Rig: CME 55 | Driller: Terracon ABQ

Project No.: 66205217

BORING LOG NO. Swale-02

PROJECT: SSCAFCA Industrial Park Drainage Improvments

CLIENT: HDR Engineering Inc
Albuquerque, NM

SITE: NM528 and Industrial Park Loop
Rio Rancho, NM

LOCATION See Exploration Plan

Latitude: 35.2587° Longitude: -106.6290°

Surface Elev.: 5131 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1			**SILTY SAND (SM)**, trace gravel, brown, medium dense						0.3		NP	18
							4-4-7 N=11		3.0		NP	21
		4.5	5126.5									
2			**SILT WITH SAND (ML)**, brown, medium stiff to very stiff	5			3-6		6.0	88	NP	82
				10			4-6-5 N=11		3.0			
				15			7-8-9 N=17		1.4			
		16.5	5114.5									
			Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
7" Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 05-26-2021 | Boring Completed: 05-26-2021

Drill Rig: CME 55 | Driller: Terracon ABQ

Project No.: 66205217

BORING LOG NO. Water Pond-01

PROJECT: SSCAFCA Industrial Park Drainage Improvments

CLIENT: HDR Engineering Inc
Albuquerque, NM

SITE: NM528 and Industrial Park Loop
Rio Rancho, NM

LOCATION See Exploration Plan

Latitude: 35.2591° Longitude: -106.6298°

Surface Elev.: 5139 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1												
			SILTY SAND (SM), trace gravel, brown, loose to medium dense, concrete debris at ground surface				7-8		6.1	99	NP	32
				5			3-4-5 N=9		3.0			
				10			4-5-6 N=11		2.0		NP	17
		13.0	5126									
			WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM), brown, dense	15			12-15-16 N=31		1.7			
		16.5	5122.5									
			Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
7" Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 05-26-2021 | Boring Completed: 05-26-2021

Drill Rig: CME 55 | Driller: Terracon ABQ

Project No.: 66205217

BORING LOG NO. Water Pond-02

PROJECT: SSCAFCA Industrial Park Drainage Improvments

CLIENT: HDR Engineering Inc
Albuquerque, NM

SITE: NM528 and Industrial Park Loop
Rio Rancho, NM

LOCATION See Exploration Plan

Latitude: 35.2591° Longitude: -106.6296°

Surface Elev.: 5138 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		0										
			SILTY SAND (SM), brown, loose									
							4-3-3 N=6		1.7		NP	17
		4.5	5133.5									
1			**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, medium dense	5			8-16		1.1	111		
				10			5-7-9 N=16		1.5		NP	7
		11.5	5126.5									
			Boring Terminated at 11.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
7" Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 05-26-2021 | Boring Completed: 05-26-2021

Drill Rig: CME 55 | Driller: Terracon ABQ

Project No.: 66205217

BORING LOG NO. Wier-01

PROJECT: SSCAFCA Industrial Park Drainage Improvments

CLIENT: HDR Engineering Inc
Albuquerque, NM

SITE: NM528 and Industrial Park Loop
Rio Rancho, NM

LOCATION See Exploration Plan

Latitude: 35.2574° Longitude: -106.6295°

Surface Elev.: 5135 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
2			**SILT WITH SAND (ML)**, trace gravel, brown, medium stiff									
							4-5	-0.75 @ 500psf	6.9	89	NP	79
				5			2-3-3 N=6		5.4			
		8.0	5127									
1			**SILTY SAND (SM)**, brown, loose to medium dense	10			3-4-5 N=9		1.7		NP	16
				15			6-6-5 N=11		1.5			
		16.5	5118.5									
			Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
7" Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 05-26-2021 | Boring Completed: 05-26-2021

Drill Rig: CME 55 | Driller: Terracon ABQ

Project No.: 66205217

Project Name: SSCAFCA Drainage Improvements
Project Number: 66205217

Boring Number: WP-01
Date of Test: 5/27/2021

	Δ Time	Water Level	Δ Level	Perc Rate	Perc Rate	Perc Rate
Time	min	ft	in	Min/in	Min/cm	cm/s
12:21:00 PM	--	2.50	0	--		
12:31	10	2.00	-6.00	-1.67	-4.23	-3.94E-03
12:41	10	1.58	-5.00	-2.00	-5.08	-3.28E-03
12:51	10	1.46	-1.50	-6.67	-16.93	-9.84E-04
13:01	10	1.27	-2.25	-4.44	-11.29	-1.48E-03
13:11	10	0.63	-7.75	-1.29	-3.28	-5.09E-03
13:21	10	0.25	-4.50	-2.22	-5.64	-2.95E-03
13:31	10	0.08	-2.00	-5.00	-12.70	-1.31E-03
13:41	10	0.00	-1.00	-10.00	-25.40	-6.56E-04
			Average	-4.16	-10.57	-2.46E-03

Project Name: SSCAFCA Drainage Improvements
Project Number: 66205217

Boring Number: Swale-01
Date of Test: 5/27/2021

	Δ Time	Water Level	Δ Level	Perc Rate	Perc Rate	Perc Rate
Time	min	ft	in	Min/in	Min/cm	cm/s
12:28:00 PM	--	2.50	0	--		
12:38	10	1.67	-10.00	-1.00	-2.54	-6.56E-03
12:48	10	1.31	-4.25	-2.35	-5.98	-2.79E-03
12:58	10	0.79	-6.25	-1.60	-4.06	-4.10E-03
13:08	10	0.15	-7.75	-1.29	-3.28	-5.09E-03
13:18	10	0.00	-1.75	-5.71	-14.51	-1.15E-03
			Average	-2.39	-6.07	-3.94E-03

Project Name: SSCAFCA Drainage Improvements
Project Number: 66205217

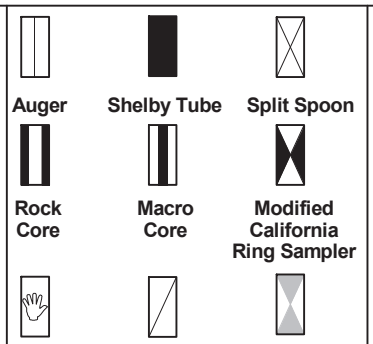
Boring Number: Swale-02
Date of Test: 5/27/2021

	Δ Time	Water Level	Δ Level	Perc Rate	Perc Rate	Perc Rate
Time	min	ft	in	Min/in	Min/cm	cm/s
12:24:00 PM	--	3.00	0	--		
12:34	10	1.38	-19.50	-0.51	-1.30	-1.28E-02
12:44	10	0.08	-15.50	-0.65	-1.64	-1.02E-02
12:54	10	0.00	-1.00	-10.00	-25.40	-6.56E-04
			Average	-3.72	-9.45	-7.87E-03

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING



WATER LEVEL

- Water Initially Encountered
- Water Level After a Specified Period of Time
- Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
N	N value
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, psf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

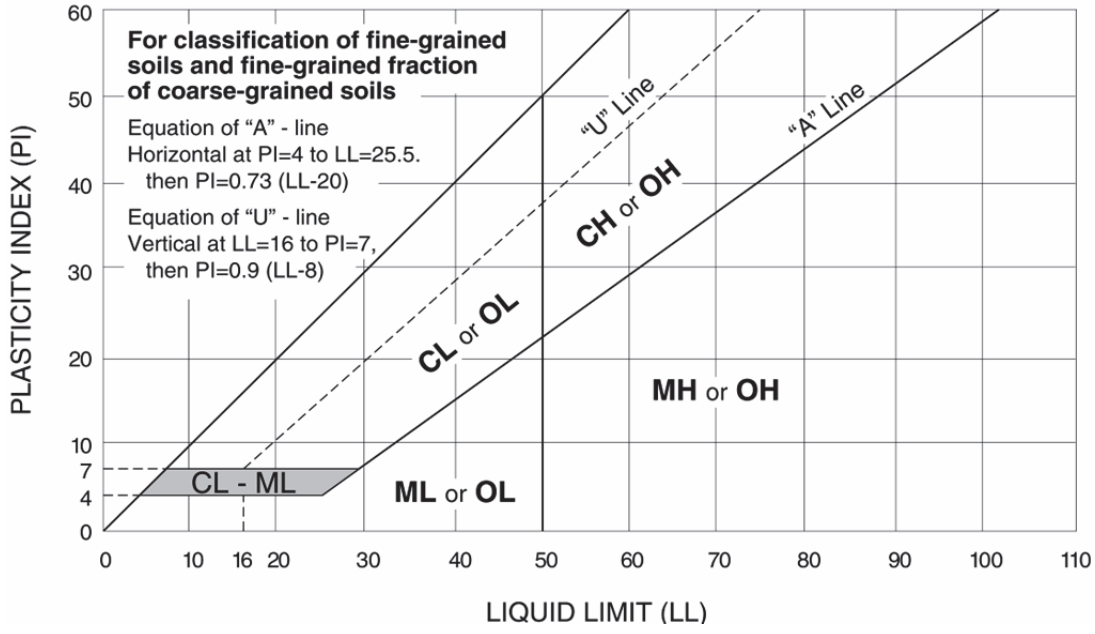
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Terracon

Exhibit A-20

APPENDIX B

LABORATORY TESTING

Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) described in Appendix A. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

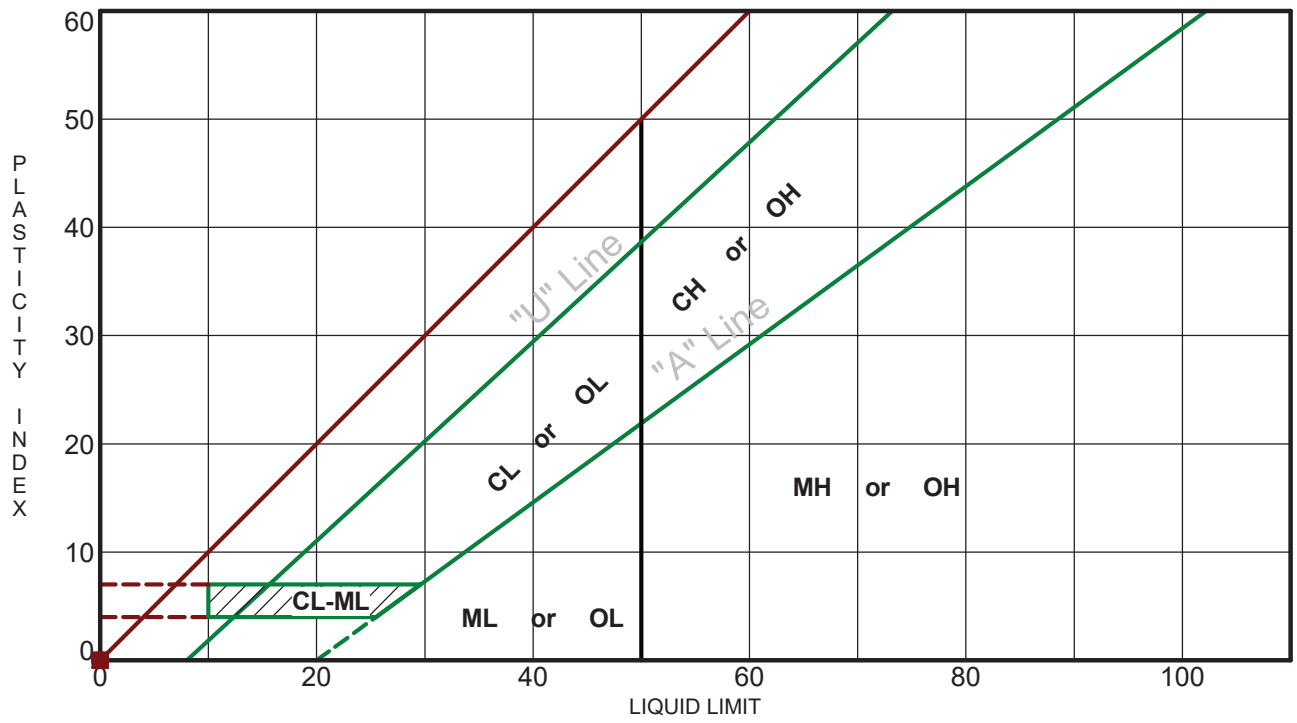
Laboratory tests were conducted on selected soil samples and the test results are presented in this appendix. The laboratory test results were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Sieve Analysis
- Atterberg Limits
- pH
- Resistivity
- Swell/Consolidation
- In-situ Dry Density
- In-situ Water Content
- Soluble Sulfates
- Maximum density optimum moisture
- Soil cement compressive strength

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth	LL	PL	PI	Fines	USCS	Description
●	Outfall-01	5 - 6	NP	NP	NP	8.5	SW-SM	WELL-GRADED SAND with SILT and GRAVEL
⊠	Outfall-01	15 - 16.5	NP	NP	NP	1.1	SP	POORLY GRADED SAND with GRAVEL
▲	Outfall-01A	5 - 6	NP	NP	NP	13.4	SM	SILTY SAND
★	Pond-01	2.5 - 3.5	NP	NP	NP	32.2	SM	SILTY SAND
⊙	Pond-01	10 - 11.5	NP	NP	NP	17.3	SM	SILTY SAND
✿	Pond-02	2.5 - 4	NP	NP	NP	16.7	SM	SILTY SAND
○	Pond-02	10 - 11.5	NP	NP	NP	7.2	SP-SM	POORLY GRADED SAND with SILT
△	Spillway-01	2.5 - 4	NP	NP	NP	31.8	SM	SILTY SAND
⊗	Spillway-01	5 - 6	NP	NP	NP	31.8	SM	SILTY SAND(SM)
⊕	Spillway-01A	5 - 6.5	NP	NP	NP	11.9	SP-SM	POORLY GRADED SAND with SILT
□	Swale-01	2.5 - 3.5	NP	NP	NP	23.8	SM	SILTY SAND
⊛	Swale-01	10 - 11.5	NP	NP	NP	22.9	SM	SILTY SAND
◕	Swale-02	0	NP	NP	NP	18.1	SM	SILTY SAND
☆	Swale-02	2.5 - 4	NP	NP	NP	21.1	SM	SILTY SAND
⊠	Swale-02	5 - 6	NP	NP	NP	81.8	ML	SILT with SAND
■	Wier-01	2.5 - 3.5	NP	NP	NP	79.2	ML	SILT with SAND
◆	Wier-01	10 - 11.5	NP	NP	NP	16.5	SM	SILTY SAND

PROJECT: SSCAFCA Industrial Park Drainage Improvments

SITE: NM528 and Industrial Park Loop Rio Rancho, NM

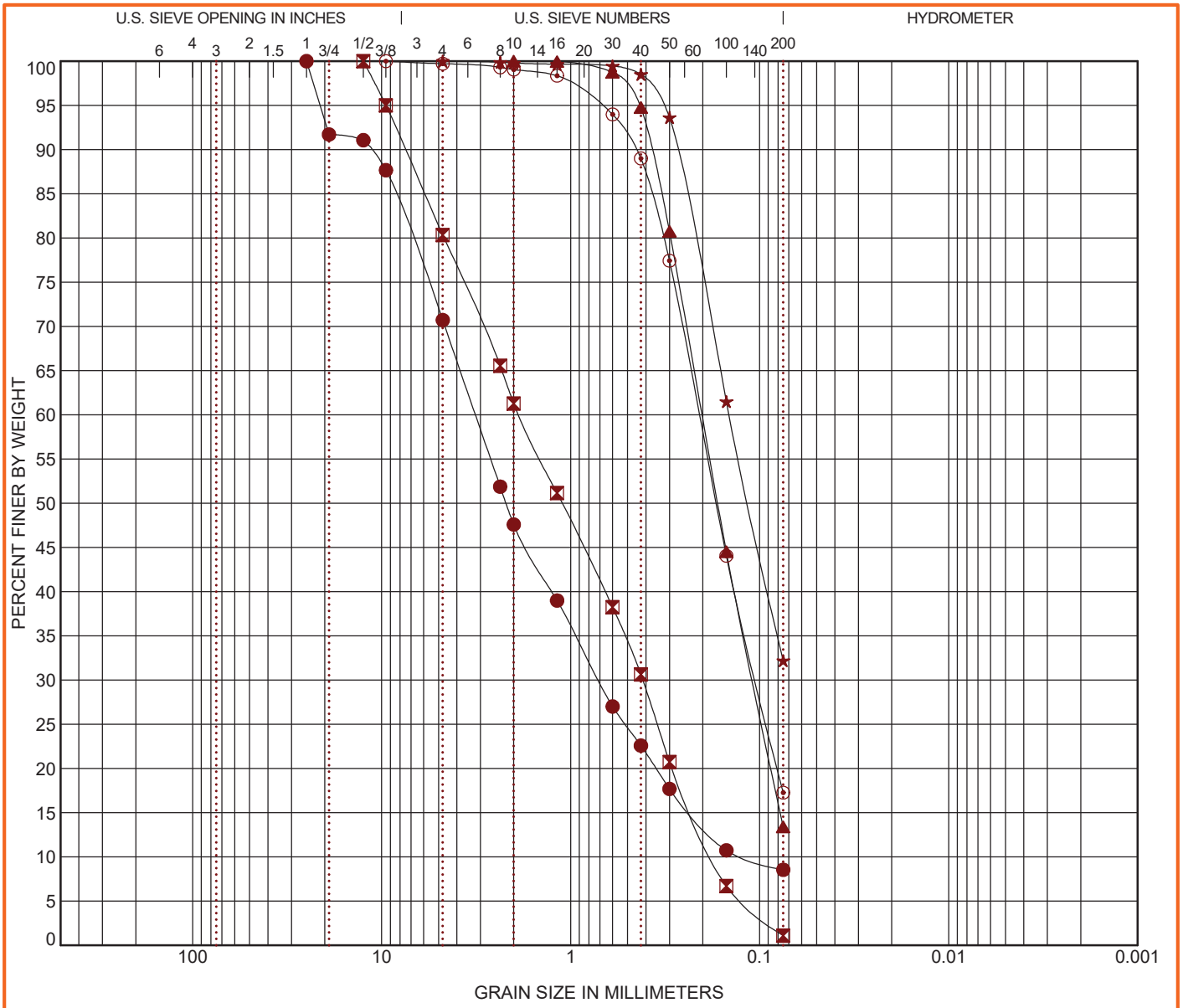
Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

PROJECT NUMBER: 66205217

CLIENT: HDR Engineering Inc Albuquerque, NM

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	Outfall-01	5 - 6	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	2.0	NP	NP	NP	1.33	26.82
⊠	Outfall-01	15 - 16.5	POORLY GRADED SAND with GRAVEL (SP)	6.1	NP	NP	NP	0.52	10.60
▲	Outfall-01A	5 - 6	SILTY SAND (SM)		NP	NP	NP		
★	Pond-01	2.5 - 3.5	SILTY SAND (SM)	6.1	NP	NP	NP		
⊙	Pond-01	10 - 11.5	SILTY SAND (SM)	2.0	NP	NP	NP		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	Outfall-01	5 - 6	25	3.191	0.711	0.119	0.0	29.3	62.2		8.5	
⊠	Outfall-01	15 - 16.5	12.5	1.872	0.416	0.177	0.0	19.7	79.3		1.1	
▲	Outfall-01A	5 - 6	2	0.202	0.109		0.0	0.0	86.6		13.4	
★	Pond-01	2.5 - 3.5	4.75	0.145			0.0	0.0	67.8		32.2	
⊙	Pond-01	10 - 11.5	9.5	0.209	0.104		0.0	0.3	82.5		17.3	

PROJECT: SSCAFCA Industrial Park Drainage Improvments

PROJECT NUMBER: 66205217

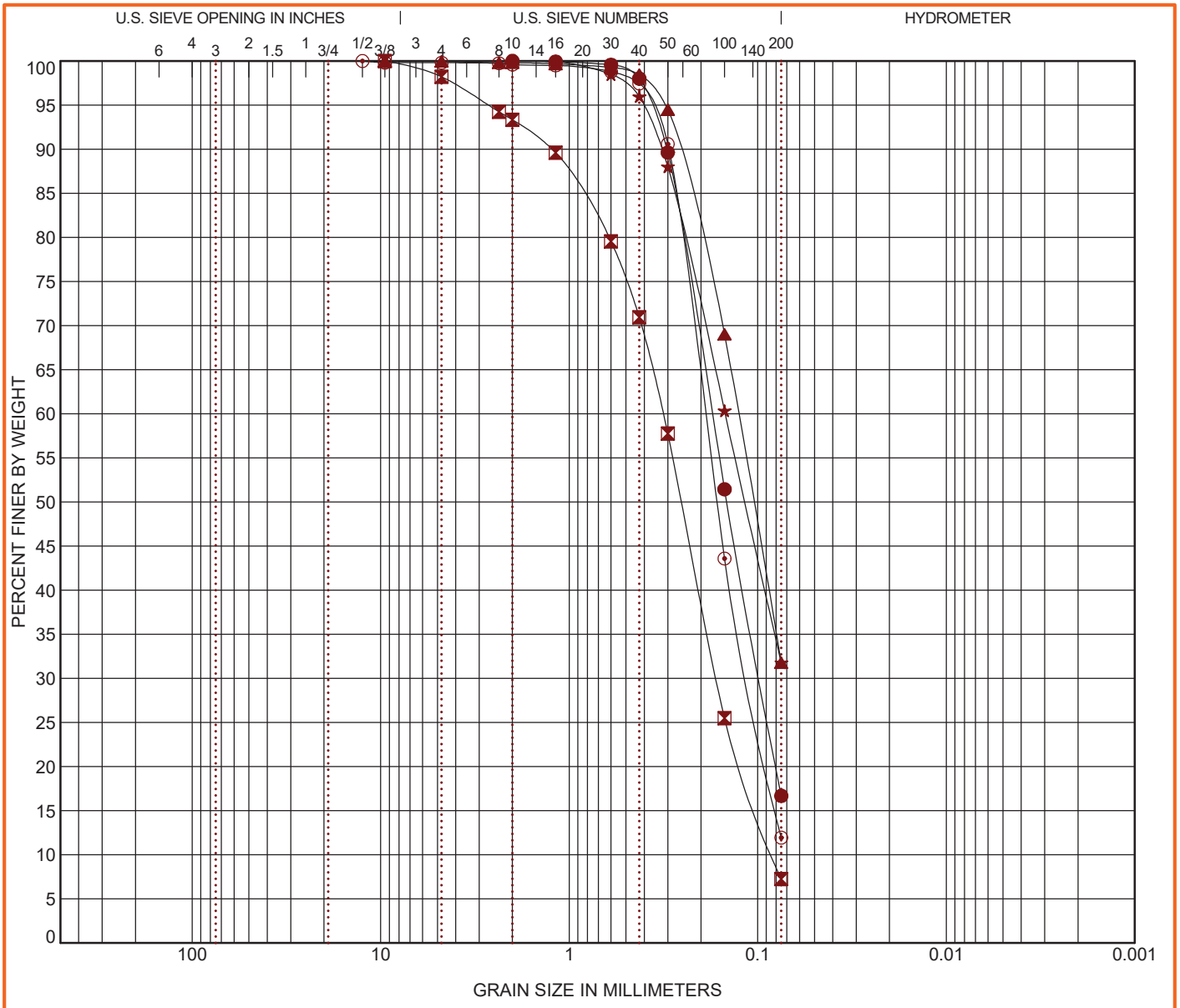
SITE: NM528 and Industrial Park Loop Rio Rancho, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

CLIENT: HDR Engineering Inc Albuquerque, NM

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	Pond-02	2.5 - 4	SILTY SAND (SM)	1.7	NP	NP	NP		
⊠	Pond-02	10 - 11.5	POORLY GRADED SAND with SILT (SP-SM)	1.5	NP	NP	NP	1.03	3.82
▲	Spillway-01	2.5 - 4	SILTY SAND (SM)	1.3	NP	NP	NP		
★	Spillway-01	5 - 6	SILTY SAND (SM)	3.2	NP	NP	NP		
⊙	Spillway-01A	5 - 6.5	POORLY GRADED SAND with SILT (SP-SM)		NP	NP	NP	0.90	2.66

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	Pond-02	2.5 - 4	2	0.175	0.098		0.0	0.0	83.3		16.7	
⊠	Pond-02	10 - 11.5	9.5	0.318	0.165	0.083	0.0	1.8	91.0		7.2	
▲	Spillway-01	2.5 - 4	9.5	0.127			0.0	0.0	68.2		31.8	
★	Spillway-01	5 - 6	2	0.149			0.0	0.0	68.2		31.8	
⊙	Spillway-01A	5 - 6.5	12.5	0.191	0.111		0.0	0.2	87.9		11.9	

PROJECT: SSCAFCA Industrial Park Drainage Improvments

PROJECT NUMBER: 66205217

SITE: NM528 and Industrial Park Loop Rio Rancho, NM

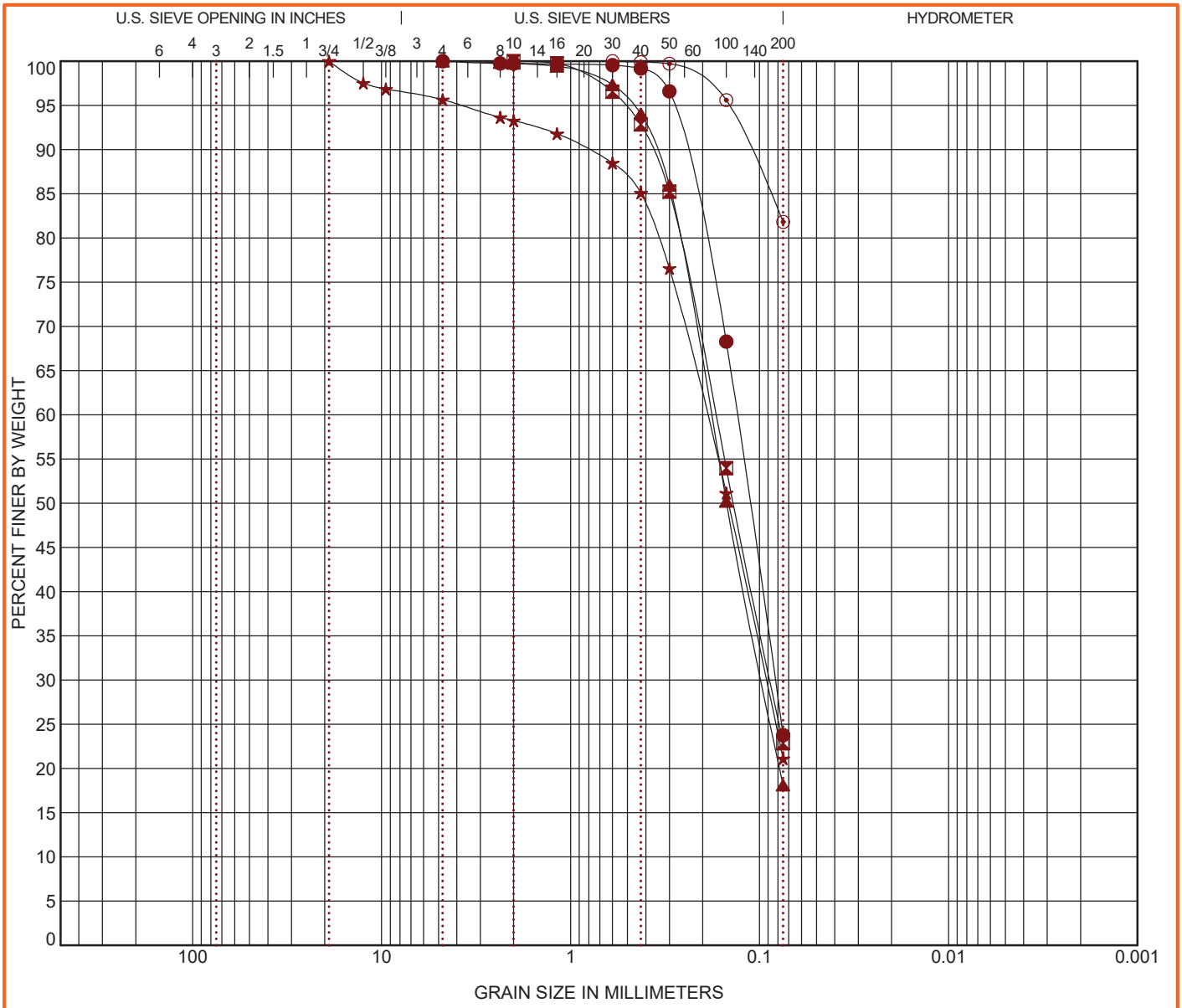
Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

CLIENT: HDR Engineering Inc Albuquerque, NM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66205217 SSCAFCA INDUSTRIA.GPJ TERRACON_DATATEMPLATE.GDT 8/12/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	Swale-01	2.5 - 3.5	SILTY SAND (SM)	2.6	NP	NP	NP		
⊠	Swale-01	10 - 11.5	SILTY SAND (SM)	0.2	NP	NP	NP		
▲	Swale-02	0	SILTY SAND (SM)	0.3	NP	NP	NP		
★	Swale-02	2.5 - 4	SILTY SAND (SM)	3.0	NP	NP	NP		
⊙	Swale-02	5 - 6	SILT with SAND (ML)	6.0	NP	NP	NP		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	Swale-01	2.5 - 3.5	4.75	0.132	0.083		0.0	0.0	76.2		23.8	
⊠	Swale-01	10 - 11.5	2	0.171	0.088		0.0	0.0	77.1		22.9	
▲	Swale-02	0	4.75	0.181	0.097		0.0	0.0	81.9		18.1	
★	Swale-02	2.5 - 4	19	0.191	0.092		0.0	4.4	74.5		21.1	
⊙	Swale-02	5 - 6	0.6				0.0	0.0	18.2		81.8	

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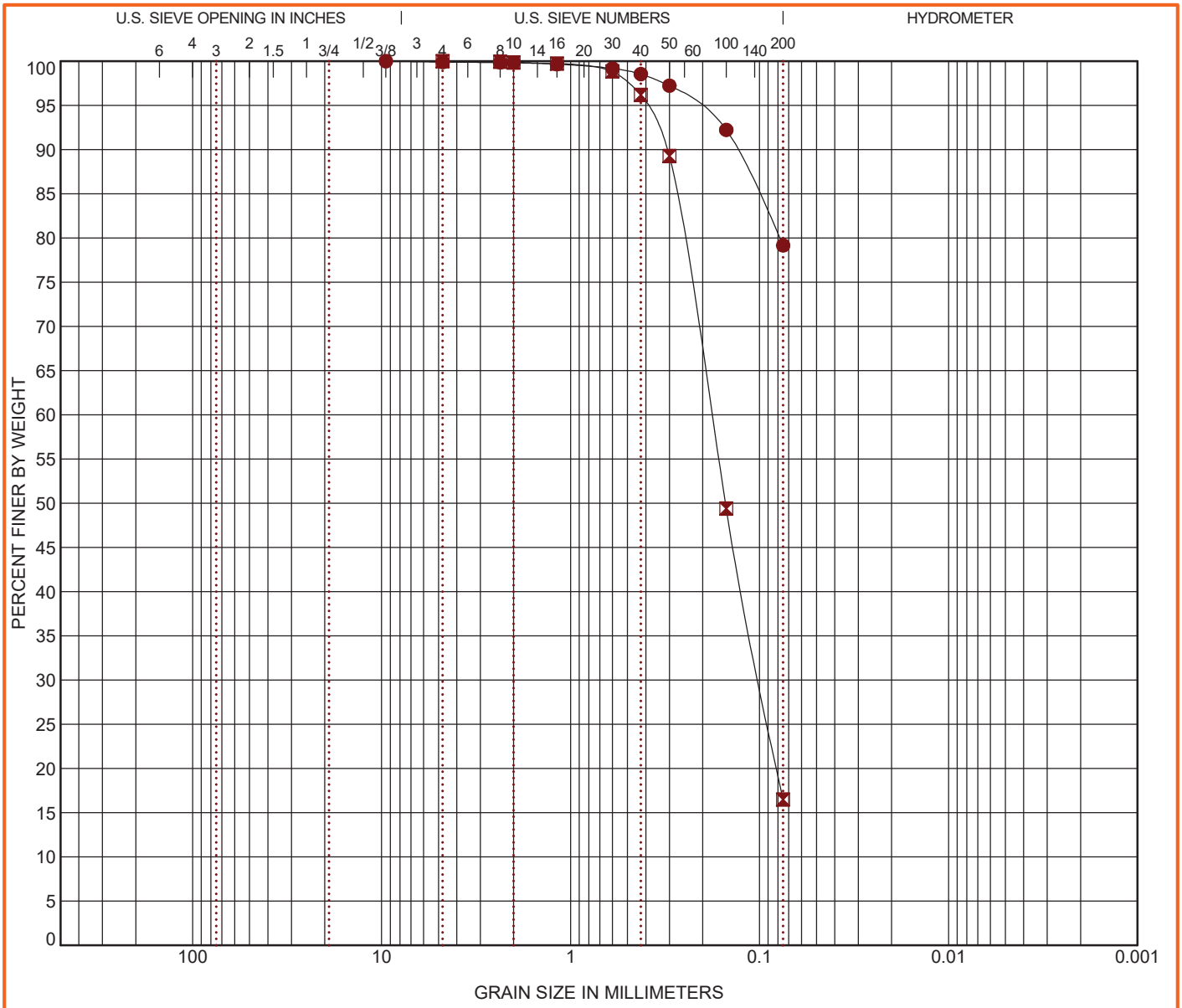
GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	Wier-01	2.5 - 3.5	SILT with SAND (ML)	6.9	NP	NP	NP		
⊠	Wier-01	10 - 11.5	SILTY SAND (SM)	1.7	NP	NP	NP		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	Wier-01	2.5 - 3.5	9.5				0.0	0.1	20.7		79.2	
⊠	Wier-01	10 - 11.5	4.75	0.18	0.1		0.0	0.0	83.5		16.5	

PROJECT: SSCAFCA Industrial Park Drainage Improvments

SITE: NM528 and Industrial Park Loop Rio Rancho, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

PROJECT NUMBER: 66205217

CLIENT: HDR Engineering Inc Albuquerque, NM

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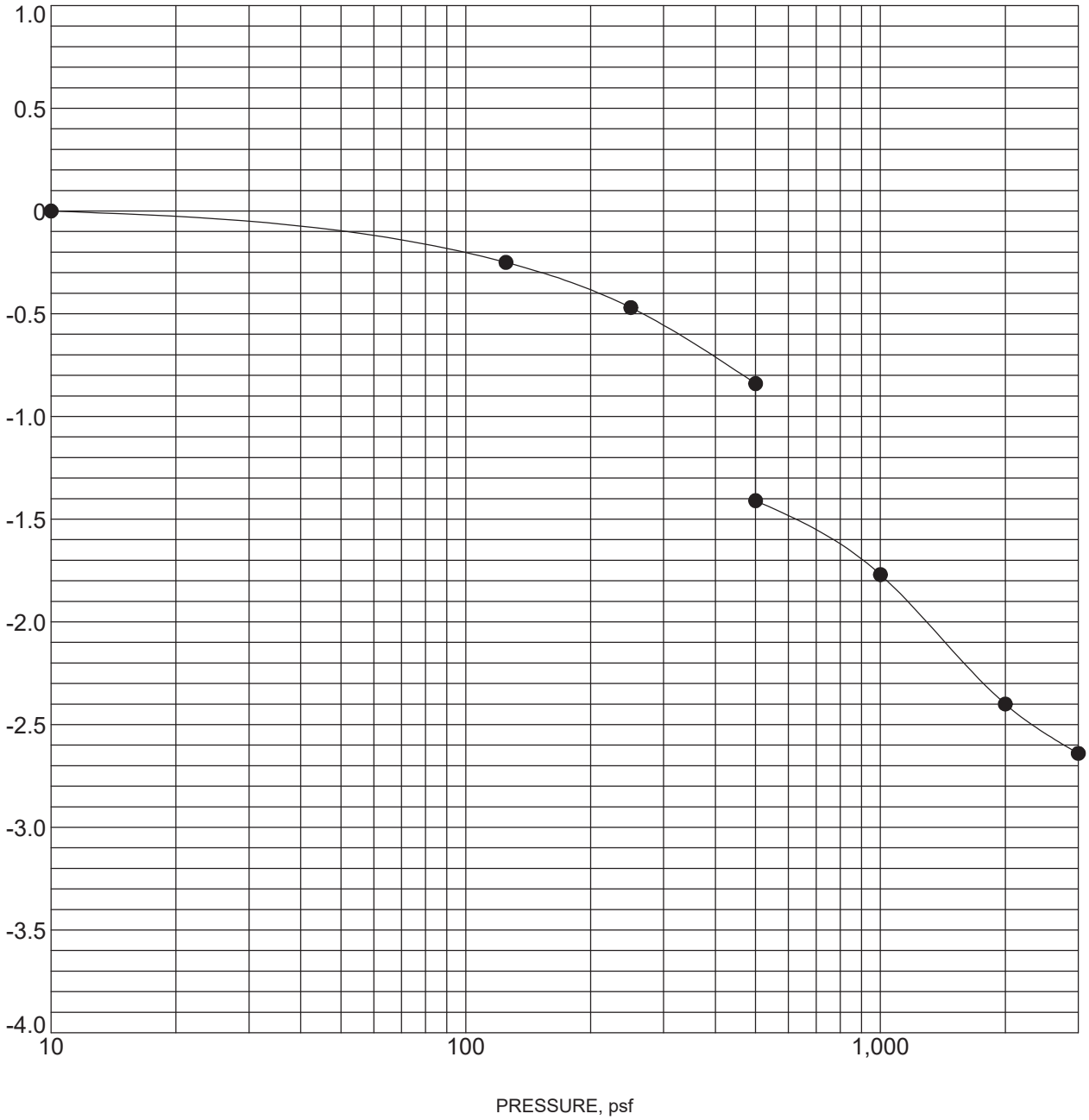
SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification		Classification	γ_d, pcf	WC, %
●	Spillway-01 5 - 6 ft	SILTY SAND(SM)	100	3.2

NOTES: Sample inundated with water at 500 pounds per square foot (psf).

PROJECT: SSCAFCA Industrial Park Drainage Improvments

SITE: NM528 and Industrial Park Loop Rio Rancho, NM

Terracon
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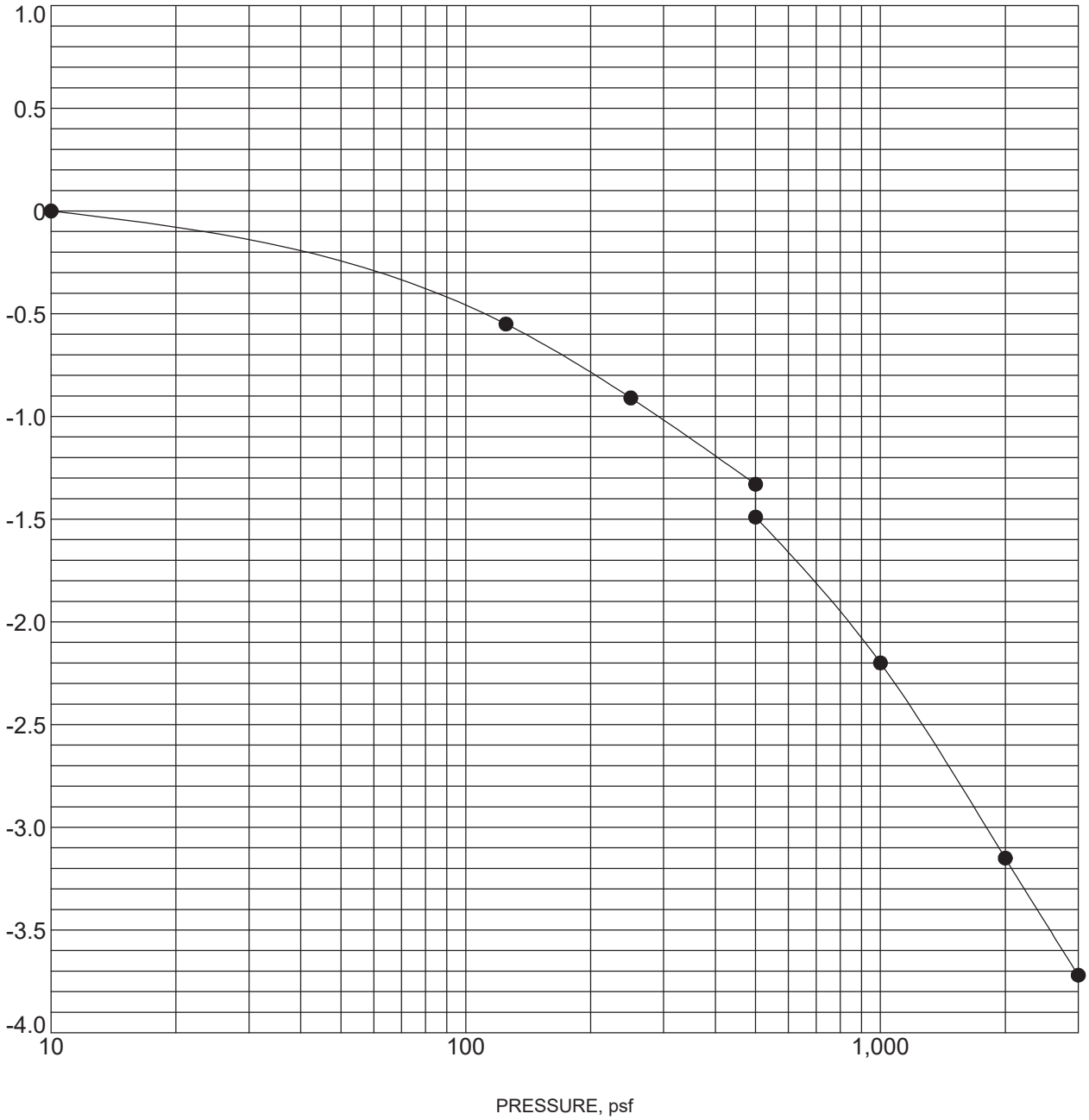
Albuquerque, NM

PROJECT NUMBER: 66205217

CLIENT: HDR Engineering Inc Albuquerque, NM

SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification		Classification	γ_d, pcf	WC, %
●	SW-01A2.5 - 3.5 ft	POORLY GRADED SAND with SILT(SP-SM)	105	2.6

NOTES: Sample inundated with water at 500 pounds per square foot (psf).

PROJECT: SSCAFCA Industrial Park Drainage Improvments

SITE: NM528 and Industrial Park Loop Rio Rancho, NM

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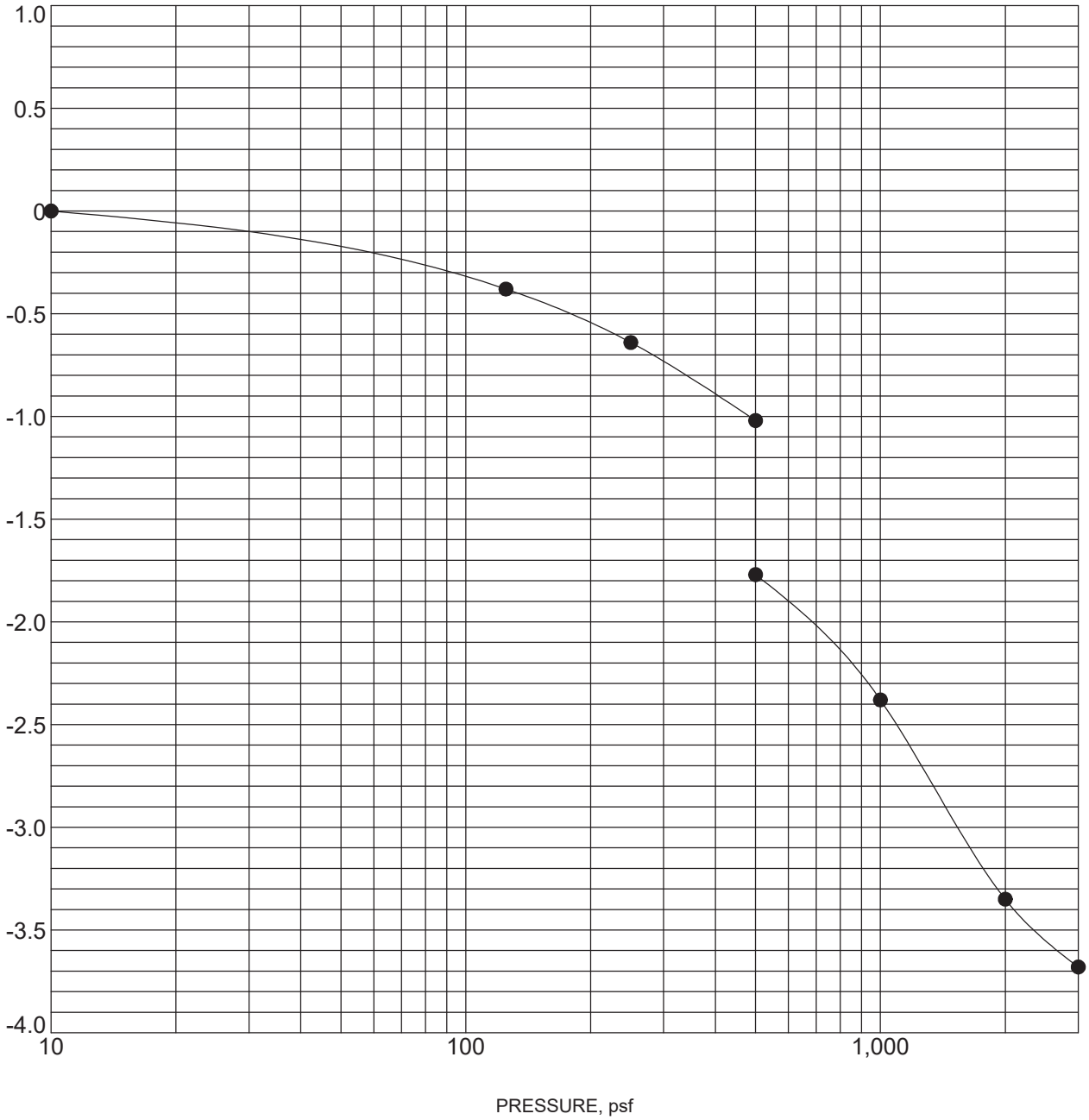
6805 Academy Pkwy West NE
Albuquerque, NM

PROJECT NUMBER: 66205217

CLIENT: HDR Engineering Inc Albuquerque, NM

SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification		Classification	γ_d, pcf	WC, %
●	Wier-01 2.5 - 3.5 ft	SILT with SAND(ML)	89	6.9

NOTES: Sample inundated with water at 500 pounds per square foot (psf).

PROJECT: SSCAFCA Industrial Park Drainage Improvments

SITE: NM528 and Industrial Park Loop Rio Rancho, NM

Terracon
6805 Academy Pkwy West NE
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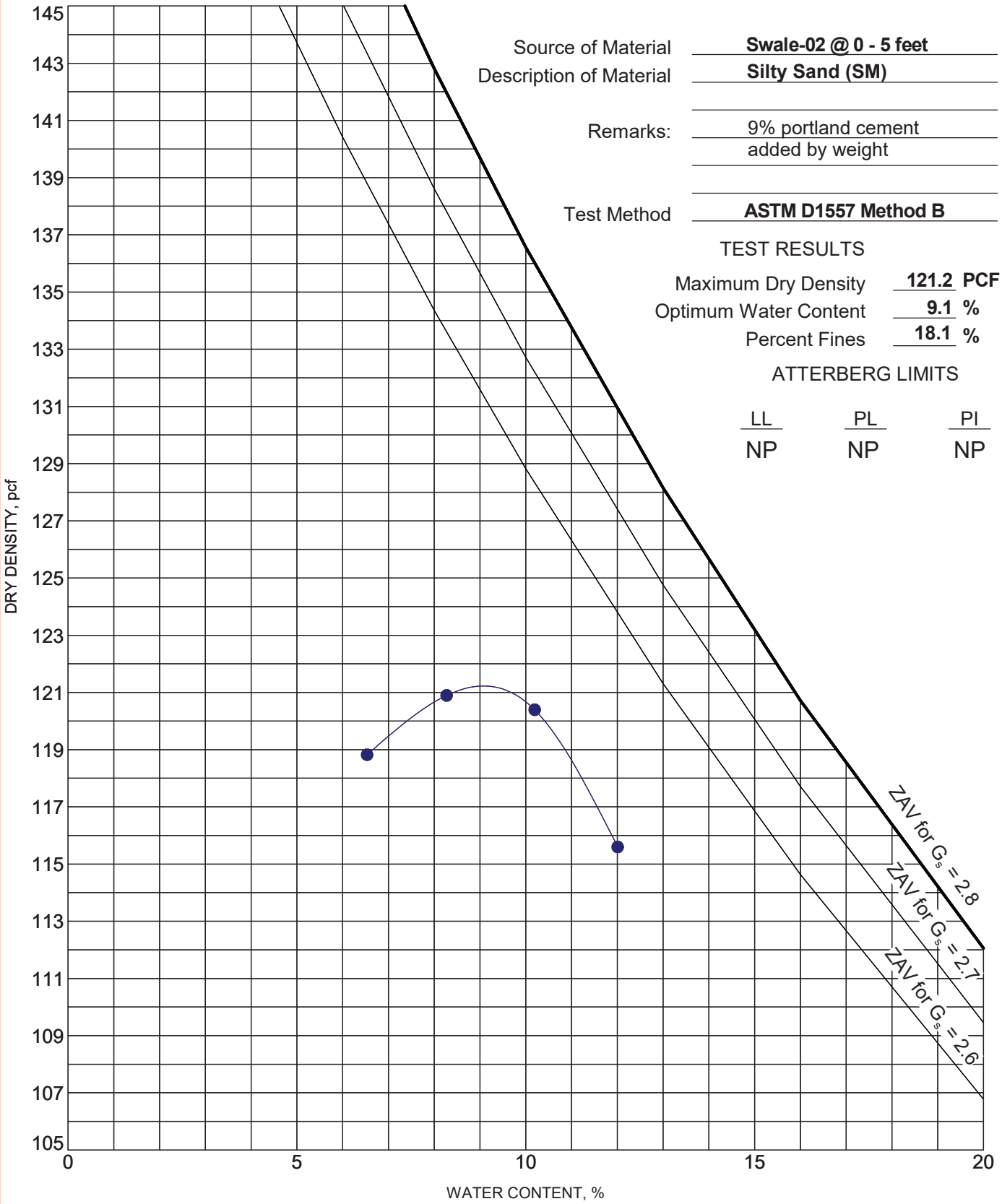
PROJECT NUMBER: 66205217

CLIENT: HDR Engineering Inc Albuquerque, NM

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material	**Swale-02 @ 0 - 5 feet**
Description of Material	**Silty Sand (SM)**
Remarks:	9% portland cement added by weight
Test Method	**ASTM D1557 Method B**

TEST RESULTS

Maximum Dry Density	**121.2 PCF**
Optimum Water Content	**9.1 %**
Percent Fines	**18.1 %**

ATTERBERG LIMITS

LL	PL	PI
NP	NP	NP

PROJECT: SSCAFCA Industrial Park Drainage Improvments

SITE: NM528 and Industrial Park Loop Rio Rancho, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

PROJECT NUMBER: 66205217

CLIENT: HDR Engineering Inc Albuquerque, NM

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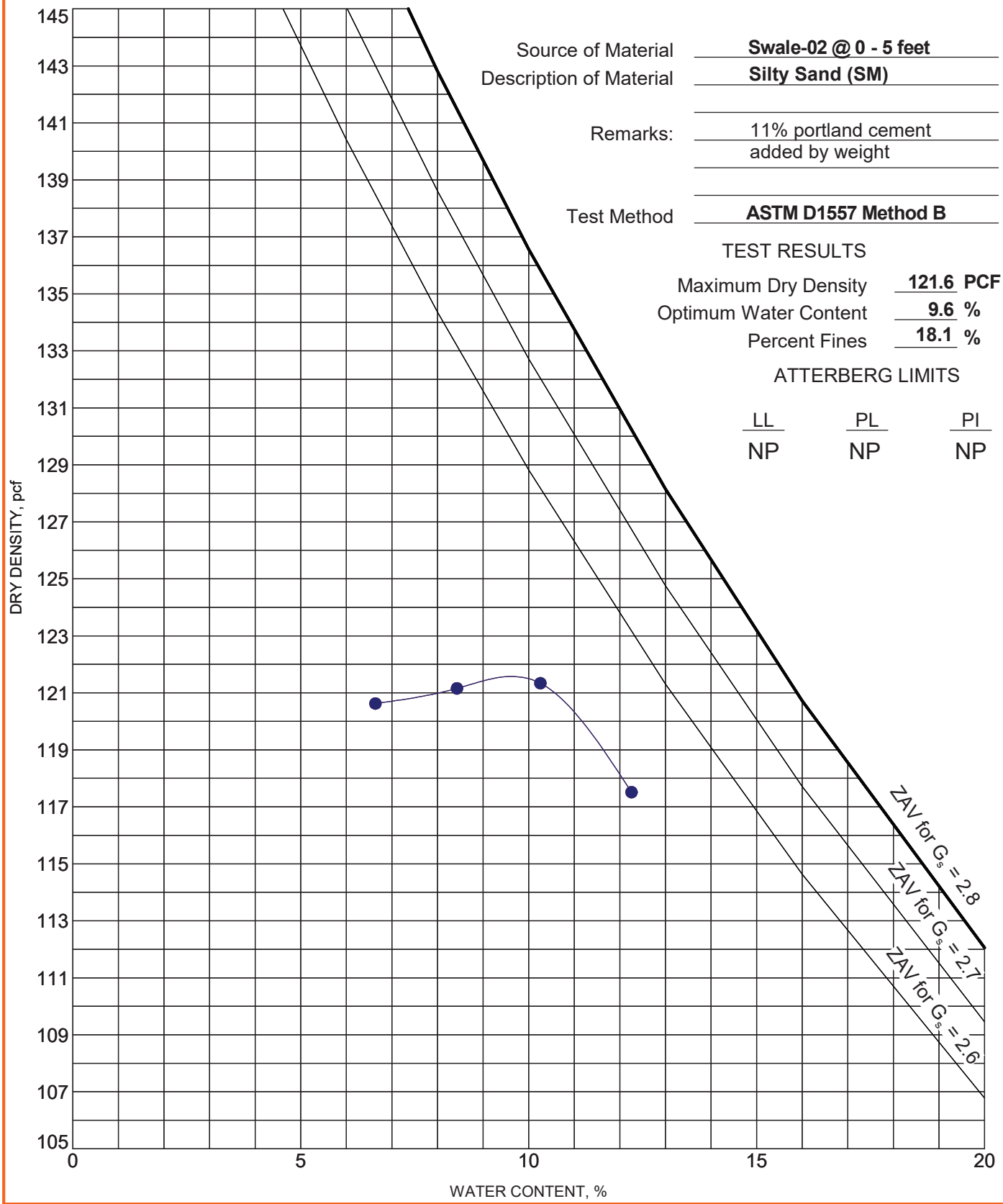
MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material	**Swale-02 @ 0 - 5 feet**
Description of Material	**Silty Sand (SM)**
Remarks:	11% portland cement added by weight
Test Method	**ASTM D1557 Method B**

TEST RESULTS

Maximum Dry Density	**121.6 PCF**
Optimum Water Content	**9.6 %**
Percent Fines	**18.1 %**

ATTERBERG LIMITS

LL	PL	PI
NP	NP	NP

PROJECT: SSCAFCA Industrial Park Drainage Improvments

SITE: NM528 and Industrial Park Loop Rio Rancho, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

PROJECT NUMBER: 66205217

CLIENT: HDR Engineering Inc Albuquerque, NM

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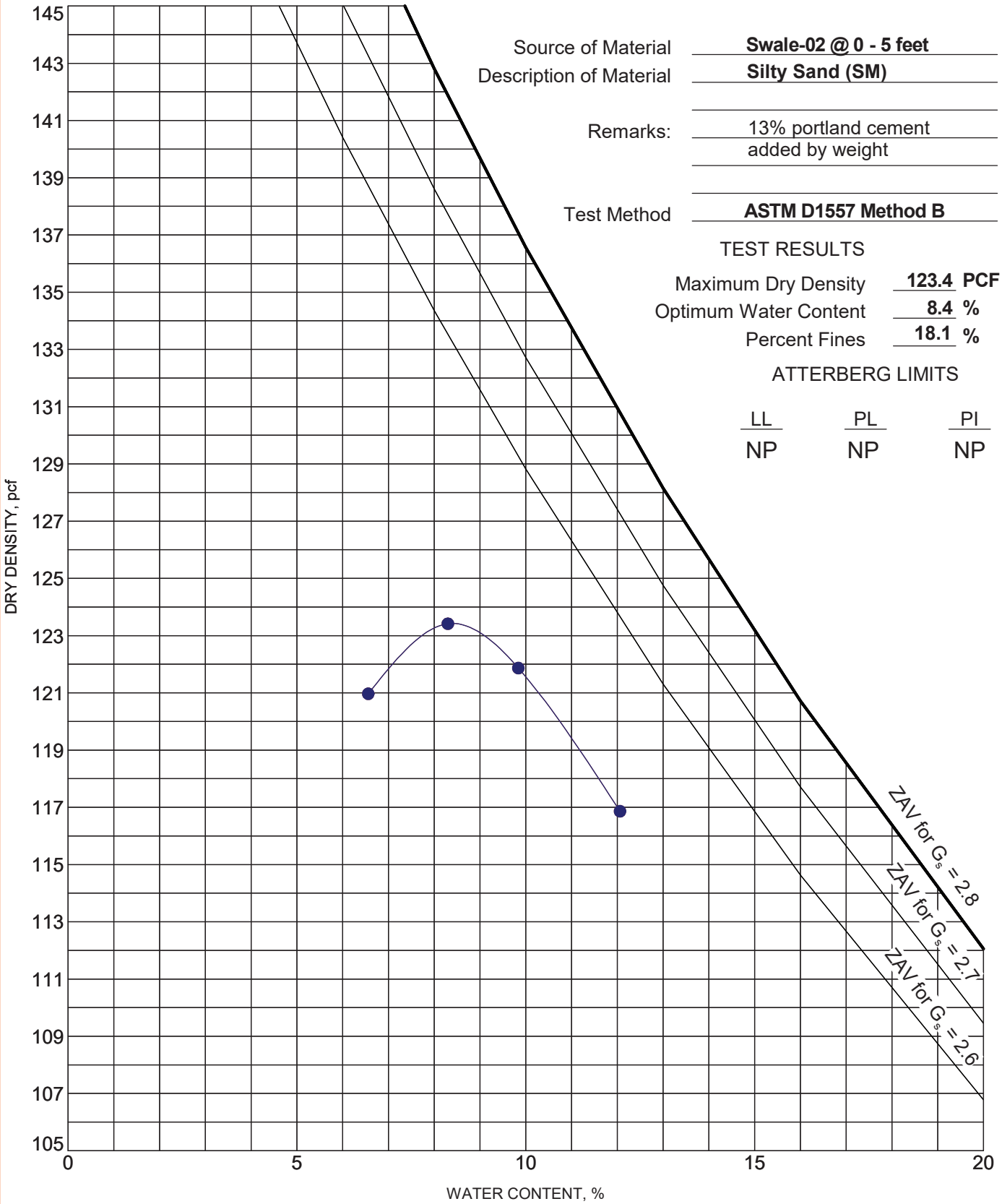
MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material	**Swale-02 @ 0 - 5 feet**
Description of Material	**Silty Sand (SM)**
Remarks:	13% portland cement added by weight
Test Method	**ASTM D1557 Method B**

TEST RESULTS

Maximum Dry Density	**123.4 PCF**
Optimum Water Content	**8.4 %**
Percent Fines	**18.1 %**

ATTERBERG LIMITS

LL	PL	PI
NP	NP	NP

PROJECT: SSCAFCA Industrial Park Drainage Improvments

SITE: NM528 and Industrial Park Loop Rio Rancho, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

PROJECT NUMBER: 66205217

CLIENT: HDR Engineering Inc Albuquerque, NM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V1 66205217 SSCAFCA INDUSTRIA.GPJ TERRACON_DATATEMPLATE.GDT 8/12/21

SSCAFCA Industrial Park Improvements
Terracon Project No. 66205217
Soil Cement Compressive Strength
ASTM D1632 and D1633

9-1: Avg Diameter (in)	Avg Height (in)	Weight (g)
4.03	4.6	2037.1
Max Load (lbs)	Area (in^2)	Strength (psi)
8950	12.66	710

L/D ratio: 1.15 Correction of : 0.87 Unit weight (pcf): 116.5 pcf Corrected PSI: 620

9-2: Avg Diameter (in)	Avg Height (in)	Weight (g)
4.02	4.5	2053.1
Max Load (lbs)	Area (in^2)	Strength (psi)
14140	12.63	1120

L/D ratio: 1.12 Correction of : 0.87 Unit weight (pcf): 115.5 Corrected psi: 970

9-3-Avg Diameter (in)	Ave Height (in)	Weight (g)
4.03	4.5	2053.3 g
Max Load (lbs)	Area (in^2)	Strength (psi)
11200	12.66	880

L/D ratio: 1.12 Correction of : 0.87 Unit weight (pcf): 114.6 Corrected psi: 770

Average for 9% Cement molded at 95% max dry density: 790 psi

#11-1:Avg Diameter (in)	Avg Height (in)	Weight (g)
4.02	4.5	2064.8 g
Max Load (lbs)	Area (in^2)	Strength (psi)
16810	12.63	1330

L/D ratio: 1.12 Correction of : 0.87 Unit weight (pcf): 115.2 Corrected psi: 1160

#11-2- Avg Diameter (in)	Avg Height (in)	Weight (g)
4.02	4.5	2010.3
Max Load (lbs)	Area (in^2)	Strength (psi)
18930	12.63	1500

L/D ratio: 1.12 Correction of : 0.87 Unit weight (pcf): 115.3 Corrected psi: 1350

#11-3-Avg Diameter (in)	Avg Height (in)	Weight (g)
4.02	4.6	2009.2

SSCAFCA Industrial Park Improvements
Terracon Project No. 66205217
Soil Cement Compressive Strength
ASTM D1632 and D1633

Max Load (lbs)	Area (in^2)	Strength (psi)
15000	12.63	1190

L/D ratio: 1.14 Correction of : 0.87 Unit weight (pcf): 116.1 Corrected psi: 1045

Average for 11% cement molded at 95% max dry density: 1190 psi

13-1: Avg Diameter (in)	Avg Height (in)	Weight (g)
4.02	4.5	1999.0
Max Load (lbs)	**Area (in^2)**	**Strength (psi)**
16080	12.63	1270

L/D ratio: 1.12 Correction of : 0.87 Unit weight (pcf): 118.1 Corrected psi: 1100

13-2: Avg Diameter (in)	Avg Height (in)	Weight (g)
4.02	4.6	2040.0
Max Load (lbs)	**Area (in^2)**	**Strength (psi)**
12240	12.63	970

L/D ratio: 1.12 Correction of : 0.87 Unit weight (pcf): 117.5 Corrected psi: 840

13-3: Avg Diameter (in)	Avg Height (in)	Weight (g)
4.02	4.5	2034.1
Max Load (lbs)	**Area (in^2)**	**Strength (psi)**
13520	12.63	1070

L/D ratio: 1.12 Correction of : 0.87 Unit weight (pcf): 118.3 Corrected psi: 930

Average for 13% Cement molded at 95% max dry density: 960 psi

Hall Environmental Analysis Laboratory, Inc.

Analytical Report
Lab Order: **2107G03**
Date Reported: **8/9/2021**

CLIENT: Terracon
Project: SSCAFCA
Lab Order: 2107G03

Lab ID: 2107G03-001
Collection Date: 7/30/2021 1:00:00 PM
Client Sample ID: Outfall 01A @5'
Matrix: SOIL

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch ID
EPA METHOD 300.0: ANIONS						Analyst: **VP**	
Sulfate	11	7.5		mg/Kg	5	8/6/2021 1:32:47 AM	61794

Lab ID: 2107G03-002
Collection Date: 7/30/2021 1:00:00 PM
Client Sample ID: Spillway 01A @25'
Matrix: SOIL

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch ID
EPA METHOD 300.0: ANIONS						Analyst: **VP**	
Sulfate	67	7.5		mg/Kg	5	8/6/2021 1:57:36 AM	61794

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

Analytical Report
Lab Order **2106545**
Date Reported: **6/22/2021**

CLIENT: Terracon
Client Sample ID: Wier-01 @ 5'
Project: SSCAFCA Industrial Park Drainage
Collection Date: 6/9/2021
Lab ID: 2106545-001 **Matrix:** SOIL
Received Date: 6/9/2021 4:05:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **VP**	
Sulfate	28	7.5		mg/Kg	5	6/10/2021 12:25:00 PM	60543
RESISTIVITY AND EC SOIL						Analyst: **MRA**	
Resistivity	2950	100		Ohms * c	1	6/10/2021 6:40:00 AM	60538
SM4500H+B/EPA 9040C						Analyst: **VP**	
pH	6.20			pH Units	1	6/18/2021 10:22:00 AM	R79190

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Terracon
Client Sample ID: Spillway-01 @ 10'
Project: SSCAFCA Industrial Park Drainage
Collection Date: 6/9/2021
Lab ID: 2106545-002
Matrix: SOIL
Received Date: 6/9/2021 4:05:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **VP**	
Sulfate	ND	7.5		mg/Kg	5	6/10/2021 1:39:28 PM	60543
RESISTIVITY AND EC SOIL						Analyst: **MRA**	
Resistivity	5180	100		Ohms * c	1	6/10/2021 6:40:00 AM	60538
SM4500H+B/EPA 9040C						Analyst: **VP**	
pH	8.38			pH Units	1	6/18/2021 10:22:00 AM	R79190

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Terracon
Client Sample ID: Outfall-01 @ 2.5'
Project: SSCAFCA Industrial Park Drainage
Collection Date: 6/9/2021
Lab ID: 2106545-003 **Matrix:** SOIL **Received Date:** 6/9/2021 4:05:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **VP**	
Sulfate	ND	7.5		mg/Kg	5	6/10/2021 2:29:06 PM	60543
RESISTIVITY AND EC SOIL						Analyst: **MRA**	
Resistivity	12800	100		Ohms * c	1	6/10/2021 6:40:00 AM	60538
SM4500H+B/EPA 9040C						Analyst: **VP**	
pH	8.73			pH Units	1	6/18/2021 10:22:00 AM	R79190

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Swell/Consolidation Testing	Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Consolidation (%)	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI						
OF-01	2.5 - 4.0	SW-SM		2						8.7	12800	< 7.5		2
OF-01	5.0 - 6.0	SW-SM	118	2	9	NP	NP	NP						1
OF-01	10.0 - 11.5	SW-SM		2										2
OF-01	15.0 - 16.5	SP		6	1	NP	NP	NP						
OF-01A	2.5 - 4.0	SM		3										2
OF-01A	5.0 - 6.0	SM			13	NP	NP	NP				11		
OF-01A	10.0 - 11.5	SM		2										2
OF-01A	15.0 - 16.5	SM		2										2
Pond-01	2.5 - 3.5	SM	99	6	32	NP	NP	NP						1
Pond-01	5.0 - 6.5	SM		3										2
Pond-01	10.0 - 11.5	SM		2	17	NP	NP	NP						
Pond-01	15.0 - 16.5	SW-SM		2										2
Pond-02	2.5 - 4.0	SM		2	17	NP	NP	NP						
Pond-02	5.0 - 6.0	SP-SM	111	1										1, 2
Pond-02	10.0 - 11.5	SP-SM		1	7	NP	NP	NP						
SW-01	2.5 - 4.0	SM		1	32	NP	NP	NP						
SW-01	5.0 - 6.0	SM	100	3	32	NP	NP	NP	-0.57 at 500 psf					1
SW-01	10.0 - 11.5	SM		2						8.4	5180	< 7.5		2
SW-01A	2.5 - 3.5	SP-SM	105	3					-0.16 at 500 psf					1, 2
SW-01A	5.0 - 6.5	SP-SM			12	NP	NP	NP						
SW-01A	10.0 - 11.5	SW-SM		2										2
SW-01A	15.0 - 16.5	SW-SM		2										2
SW-01A	20.0 - 21.5	ML		6										2
SW-01A	25.0 - 26.5	ML		5								67		2
SW-01A	30.0 - 31.5	ML		7										2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: SSCAFCA Industrial Park Drainage Improvments

SITE: NM528 and Industrial Park Loop
Rio Rancho, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM
PH. 505-797-4287 FAX. 505-797-4288

PROJECT NUMBER: 66205217

CLIENT: HDR Engineering Inc
Albuquerque, NM

EXHIBIT: B19

SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Swell/Consolidation Testing	Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Consolidation (%)	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI						
Swale-01	2.5 - 3.5	SM	99	3	24	NP	NP	NP						1
Swale-01	5.0 - 6.5	SM		2										2
Swale-01	10.0 - 11.5	SM		0	23	NP	NP	NP						
Swale-01	15.0 - 16.5	SM		2										2
Swale-02	0.0 - 5.0	SM		0	18	NP	NP	NP						
Swale-02	2.5 - 4.0	SM		3	21	NP	NP	NP						
Swale-02	5.0 - 6.0	ML	88	6	82	NP	NP	NP						1
Swale-02	10.0 - 11.5	ML		3										2
Swale-02	15.0 - 16.5	ML		1										2
Wier-01	2.5 - 3.5	ML	89	7	79	NP	NP	NP	-0.75 at 500 psf					1
Wier-01	5.0 - 6.5	ML		5						6.2	2950	28		2
Wier-01	10.0 - 11.5	SM		2	16	NP	NP	NP						
Wier-01	15.0 - 16.5	SM		1										2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: SSCAFCA Industrial Park Drainage Improvments

SITE: NM528 and Industrial Park Loop
Rio Rancho, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM
PH. 505-797-4287 FAX. 505-797-4288

PROJECT NUMBER: 66205217

CLIENT: HDR Engineering Inc
Albuquerque, NM

EXHIBIT: B20