

TECHNICAL SPECIFICATIONS

SECTION 01 01 00 - SUMMARY OF WORK

PART 1 - GENERAL

101.01 GENERAL

- A. The WORK to be performed under this Contract shall consist of furnishing all tools, equipment, materials, supplies, and manufactured articles and for furnishing all transportation and services, including fuel, power, water, and essential communications, and for the performance of all labor, WORK, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents.

101.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. The WORK of this Contract includes furnishing and installing a Concrete Flow Measuring Flume together with appurtenant items in accordance with the drawings and these specifications. Appurtenant items include but are not limited to:
1. Access Road Improvements
 2. Riprap
 3. Electrical equipment and conduits
 4. Site grading

101.03 WORK BY OTHERS

- A. INTERFERENCE WITH WORK ON UTILITIES:

The CONTRACTOR shall cooperate fully with all utility forces of the OWNER or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the WORK, and shall schedule the WORK so as to minimize interference with said relocation, altering, or other rearranging of facilities.

101.04 WORK SEQUENCE

- A. WORK under the Contract shall be scheduled and performed in such a manner as to result in the least possible disruption of water flowing to the reservoir.
- B. WORK on stream channel must occur after August 31st and should be completed before significant snow accumulation.
- C. WORK on the access road can occur any time site is accessible and approval to proceed is obtained from Sandy City.

SECTION 01 01 00 - SUMMARY OF WORK

101.05 CONTRACTOR USE OF PROJECT SITE

- A. The CONTRACTOR's use of the project site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices.
- B. The CONTRACTOR shall limit construction operations to areas within the public right-of-way of the OWNER's easements described in the drawings and shall maintain public access to driveways.

101.06 OWNER USE OF THE PROJECT SITE

- A. When the CONTRACTOR's WORK involved rehabilitation of or extension to the existing facilities, the OWNER may utilize all or part of the existing site and existing facilities during the entire period of construction for the conduct of the OWNER's normal operations. The CONTRACTOR shall cooperate with the OWNER/ENGINEER to minimize interference with the CONTRACTOR's operations and to facilitate the OWNER's operations. In any event, the OWNER shall be allowed access to the project site during the period of construction.

101.07 PROJECT MEETINGS

- A. **PRECONSTRUCTION CONFERENCE:**

Prior to the commencement of WORK at the site, a preconstruction conference will be held at a mutually agreed time and place which shall be attended by the CONTRACTOR, its superintendent, and its subcontractors as appropriate. Other attendees will include OWNER Representative, ENGINEER and designated project representative, representatives of other utilities affected by the WORK, others as requested by CONTRACTOR, OWNER, or ENGINEER.

- B. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. This agenda will include the following:
 - 1. CONTRACTOR'S tentative schedules.
 - 2. Transmittal, review, and distribution of CONTRACTOR's submittals.
 - 3. Processing applications for payment.
 - 4. Maintaining record documents.
 - 5. Critical Work sequencing.

SECTION 01 01 00 - SUMMARY OF WORK

6. Field decisions and Change Orders.
 7. Use of project site, office and storage areas, security, housekeeping, and OWNER's needs.
 8. Major equipment deliveries and priorities.
 9. CONTRACTOR's assignments for safety and first aid.
- C. The ENGINEER will conduct the preconstruction conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 02 50 - MEASUREMENT AND PAYMENT

PART 1 - GENERAL

101.01 SCOPE

- A. Payment for various items of the Bid Sheets, as further specified herein, shall include all compensation to be received by the CONTRACTOR for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals appurtenant to the item of WORK being described, as necessary to complete the various items of the WORK all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Bid Schedule, and all costs therefore shall be included in the prices named in the Bid Schedule for the various appurtenant items of WORK.

101.02 LUMP SUM ITEMS

- A. No separate measurement of quantities will be made for those items of WORK performed on a lump sum basis, but the item will be constructed, complete, as required to complete the WORK shown on the Drawings and as described in the Specifications.
- B. Bid prices for lump sum items represent the total cost to the OWNER. Such price shall constitute full compensation for furnishing and placing of materials required to complete the item, and for all labor, equipment, tools, and incidentals needed to complete the WORK in conformity with the plans and specifications.

101.03 UNIT PRICE ITEMS

- A. Determination of the actual quantities and classifications of Unit Price WORK performed by CONTRACTOR will be made by the ENGINEER in accordance with individual sections of specifications. Payment will be for actual quantities and at the price stated in the Bid. Estimated quantities in the Bid are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price.

101.04 BID SCHEDULE

- A. Bid Item #1: Mobilization
 - 1. Measurement: Lump Sum

SECTION 01 02 50 - MEASUREMENT AND PAYMENT

2. Payment Covers: cost of mobilization, demobilization, installation of temporary facilities, pedestrian diversion, public communication, storm control plan, and bringing all necessary construction equipment to the site.

Percent of Original Contract Amount Earned	Percent of Amount Bid for Mobilization to be Paid
5%	30%
50%	20%
90%	20%
100%	30%

B. Bid Item #2: Road Base

1. Measurement: Cubic Yard, CONTRACTOR shall submit copies of actual quantities used for project.
2. Payment Covers: Furnishing all labor, materials, tools, equipment, and incidentals for installation of road base along access road from reservoir to the diversion structure as specified in the contract documents.

C. Bid Item #3: Road Channels

1. Measurement: Linear Feet
2. Payment Covers: Furnishing all labor, materials, tools, equipment, and incidentals for installing drainage channels on side of access road. Item includes excavation, grading, and filter fabric.

D. Bid Item #4: Concrete Pipe

1. Measurement: Each
2. Payment Covers: Furnishing all labor, materials, tools, equipment, and incidentals for installing 18" concrete pipes under access road. Includes pipe, box, inlet, and grate.

E. Bid Item #5: Grubbing Flume Area

1. Measurement: Lump Sum
2. Payment Covers: Furnishing all labor, materials, tools, equipment, and incidentals for preparing area for flume installation. This includes clearing obstacles for riverbed access, water diversion, grading riverbed, removing

SECTION 01 02 50 - MEASUREMENT AND PAYMENT

dead wood, and clearing for road expansion. Item also includes restoration to area to meet Sandy City requirements, stabilization, and establishing access path for future access.

- F. Bid Item #6: New Concrete Flume
 - 1. Measurement: Lump Sum
 - 2. Payment Covers: Furnishing all labor, materials, tools, equipment, and incidentals for construction and installation of new concrete flume. Includes concrete, rebar, railings, structural fill, and other materials required for fully functioning measurement flume according to mechanical and structural plans in contract documents.

- G. Bid Item #7: Rip Rap, d50=18”
 - 1. Measurement: Cubic Yard, CONTRACTOR shall submit copies of actual quantities used for project.
 - 2. Payment Covers: Furnishing all labor, materials, tools, equipment, and incidentals for laying riprap pad downstream of flume.

- H. Bid Item #8: Rip Rap, d50=12”
 - 1. Measurement: Cubic Yard, CONTRACTOR shall submit copies of actual quantities used for project.
 - 2. Payment Covers: Furnishing all labor, materials, tools, equipment, and incidentals for laying riprap on upstream and sides of flume.

- I. Bid Item #9: Rip Rap, d50=8”
 - 1. Measurement: Cubic Yard, CONTRACTOR shall submit copies of actual quantities used for project.
 - 2. Payment Covers: Furnishing all labor, materials, tools, equipment, and incidentals for laying riprap in 18” roadside channel.

- J. Bid Item #10: Rip Rap, d50=6”
 - 1. Measurement: Cubic Yard, CONTRACTOR shall submit copies of actual quantities used for project.
 - 2. Payment Covers: Furnishing all labor, materials, tools, equipment, and incidentals for laying riprap in 14” roadside channel.

SECTION 01 02 50 - MEASUREMENT AND PAYMENT

- K. Bid Item #11: Rip Rap, d50=3”
1. Measurement: Cubic Yard, CONTRACTOR shall submit copies of actual quantities used for project.
 2. Payment Covers: Furnishing all labor, materials, tools, equipment, and incidentals for laying riprap in 7” roadside channel.
- L. Bid Item #12: Electrical and Instrumentation
1. Measurement: Lump Sum
 2. Payment Covers Furnishing all labor, materials, tools, equipment, and incidentals for electrical work as specified in the drawings. Materials include the radar level sensor, conduits, light, wire, and related parts.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 30 00 - CONTRACTOR SUBMITTALS

PART 1 - GENERAL

101.01 REQUIREMENT

- A. Wherever submittals are required hereunder, all such submittals by the CONTRACTOR shall be submitted to the ENGINEER.
- B. Within 14 days after the award of Construction Contract, the CONTRACTOR shall submit the following items to the ENGINEER for review:
 - 1. A preliminary construction schedule indicating the starting and completion dates of the various stages of the WORK.
 - 2. Copies of the manufacturer's technical submittal information for the following items:
 - a. Concrete
 - b. Concrete reinforcement
 - c. Riprap
 - d. Road base
 - e. Filter Fabric
 - f. Radar Level Sensor
 - g. Conduit
 - 3. A list of all permits and licenses the CONTRACTOR shall obtain indicating the agency required to grant the permit and the expected date of submittal for the permit and required date for receipt of the permit.

101.02 CONTRACTOR'S SCHEDULES

A. TIME OF SUBMITTALS:

At the preconstruction conference, the CONTRACTOR shall submit for acceptance by the ENGINEER, a preliminary construction schedule for the WORK, showing its general plan for orderly completion of the WORK, showing its general plan for orderly completion of the WORK and showing in detail its planned mobilization of plant and equipment, sequence of early operations, and timing of procurement of materials and equipment. The construction schedule produced and submitted shall indicate a project completion date on or before the contract completion date. The

SECTION 01 30 00 - CONTRACTOR SUBMITTALS

ENGINEER within 14 days after receipt of the preliminary construction schedule, shall meet with a representative of the CONTRACTOR to review the preliminary plan and construction schedule. After review by ENGINEER, revise and resubmit as required.

B. CONSTRUCTION SCHEDULE REVISIONS:

Submit revised schedules with each Application of Payment, reflecting changes since previous submittal.

101.03 PROPOSED SUBSTITUTES OR EQUAL ITEMS

A. For convenience in designation in the Contract Documents, any material, product, or equipment to be incorporated in the WORK may be designated under a brand or trade name or the name of a manufacturer and its catalog information. The use of any substitute material, product, or equipment which is equal in quality and utility and possesses the required characteristics for the purpose intended will be permitted, subject to the following requirements:

1. The burden of proof as to the quality and utility of any such substitute material, product, or equipment shall be upon the CONTRACTOR.
2. The ENGINEER will be the sole judge as to the quality and utility of any such substitute decision shall be final.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 40 00 - QUALITY CONTROL

PART 1 - GENERAL

101.01 SITE INVESTIGATION AND CONTROL

- A. The Contractor shall verify all dimensions in the field and shall check field conditions continuously during construction. The Contractor shall solely be responsible for any inaccuracies built into the work due to his failure to comply with this requirement.
- B. The Contractor shall inspect related and appurtenant work and shall report in writing to the ENGINEER any conditions which will prevent proper completion of the work. Failure to report any such condition shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor at his sole cost and expense.

101.02 DESCRIPTION OF WORK

- A. The work shall be conducted under the general observation of the ENGINEER and shall be subject to inspection by representatives of the OWNER to ensure strict compliance with the requirements of the Contract Documents. Such inspection may include plant, shop or field inspection, as required. The ENGINEER shall be permitted access to all parts of the WORK, including plants where materials or equipment are manufactured or fabricated.
- B. The presence of the ENGINEER or any inspector(s), however, shall not relieve the Contractor of the responsibility for the proper execution of the WORK in accordance with all requirements of the Contract Documents. Compliance is a duty of the Contractor and said duty shall not be avoided by any act or omission on the part of the ENGINEER or any inspector(s).
- C. All materials and articles furnished by the Contractor shall be subject to rigid inspection, and no materials or articles shall be used in the WORK until they have been inspected and accepted by the ENGINEER or his authorized representative. No WORK shall be backfilled, buried, cast in concrete, hidden, or otherwise covered until it has been inspected by the ENGINEER or is authorized representative. Any WORK so covered in the absence of inspection shall be subject to uncovering. Where uninspected WORK cannot be uncovered, such as in concrete cast over reinforcing steel, all such WORK shall be subject to demolition, removal, and reconstruction under proper inspection, and no additional payment will be allowed, therefore.

SECTION 01 40 00 - QUALITY CONTROL

101.03 TIME OF INSPECTION AND TESTS

- A. Except as otherwise provided in these specifications, performance of the required tests will be by the OWNER, and all costs therefore will be borne by the OWNER at no cost to the Contractor; except that the costs of any test which shows unsatisfactory results shall be borne by the Contractor. Whenever the Contractor is ready to backfill, bury, cast in concrete, hide, or otherwise cover any WORK under the contract, he shall notify the ENGINEER not less than 24 hours in advance to request inspection before beginning any such WORK of covering. Failure of the Contractor to notify the ENGINEER at least 24 hours in advance of any such inspection shall be reasonable cause for the ENGINEER to order a sufficient delay in the Contractor's schedule to allow time for such inspections and any remedial or corrective WORK required, and all costs of such delays, including its effect upon other portions of the WORK, shall be borne by the Contractor.

101.04 RIGHT OF REJECTION

- A. The ENGINEER, acting for the OWNER shall have the right, at all times and places, to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of these specifications, regardless of whether the defects in such articles of materials are detected at the point of manufacture or after completion of the WORK at the site. If the ENGINEER or inspector, through an oversight or otherwise, as accepted materials or WORK which is defective or which is contrary to the specifications, such material, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected by the ENGINEER for the OWNER.
- B. The Contractor shall promptly remove rejected articles or materials from the site of the WORK after notification of rejection.
- C. All costs of removal and replacement of rejected articles or materials as specified herein shall be borne by the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 50 00 - CONSTRUCTION FACILITIES AND ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

101.01 GENERAL

- A. The Contractor shall provide and maintain adequate construction facilities and perform the necessary work to minimize the impact and inconvenience of the construction activities.

101.02 SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures in accordance with Part 1926 of the OSHA Standards for Construction.

101.03 BARRIERS AND ENCLOSURES

- A. Provide as required to prevent public entry to construction areas, and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barricades as required by governing authorities for public rights-of-way and for public access.
- C. Provide barriers around trees and plants designated to remain. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddling or continuous running water.

101.04 PROTECTION OF INSTALLED WORK

- A. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage. Repair or replace at OWNER's option any installed work damaged by traffic, the public, or Work operations.
- B. Prohibit traffic on restored areas.

SECTION 01 50 00 - CONSTRUCTION FACILITIES AND ENVIRONMENTAL CONTROLS

101.05 DUST, WATER AND NOISE CONTROL

A. Surface Water, Erosion and Sediment Control:

1. Surface water shall be controlled so that the construction area is not allowed to become wet from runoff from adjacent areas. Surface water shall be directed away from these areas but not directed toward adjacent property, buildings, or any improvement that may be damaged by water. Surface water shall not be allowed to enter sanitary sewers.
2. Maintain excavations free of water. Provide and operate pumping equipment.
3. Prevent erosion and sedimentation.
4. Provide temporary measures such as beams, dikes, and drains, to prevent water flow.

B. DUST CONTROL:

1. Dust control measures shall be implemented by application of water to all work areas, storage areas, haul and access roads, or other areas affected by construction.
2. All work shall be in compliance with the Federal, State, and local air pollution standards, and not cause a hazard or nuisance to personnel and the public in the vicinity of the work.
3. Provide and operate at least one mobile tank sprinkling unit or other positive means to prevent air-borne dust from dispersing into the atmosphere.
4. Other methods of dust control for haul and access roads may include chemical treatment, light bituminous treatment or other method as approved by the ENGINEER.
5. Execute work by methods to minimize raising dust from construction operations.

C. NOISE CONTROL:

SECTION 01 50 00 - CONSTRUCTION FACILITIES AND ENVIRONMENTAL CONTROLS

1. Execute construction between the hours as allowed unless otherwise approved by SANDY CITY.

101.06 CONSTRUCTION CLEANING

- A. All public and private areas used as haul roads shall be continuously maintained and cleaned of all construction caused debris such as mud, sand, gravel, soils, pavement fragments, sod, etc. Care shall be taken to prevent spillage on haul routes. Any such spillage shall be removed immediately, and the area cleaned.
- B. Public roads shall be maintained in accordance with applicable ordinances and regulations.
- C. Through all phases of construction, including suspension of work, and until final acceptance of the project, the Contractor shall keep the work site clean and shall remove daily all refuse, dirt, damaged materials, unusable materials, and all other trash or debris that he has created from his construction activities.
- D. Materials and equipment shall be removed from the site as soon as they are no longer necessary; and upon completion of the work and before final inspection, the entire work site shall be cleared of equipment, unused materials, and rubbish so as to present a satisfactory clean and neat appearance. All cleanup costs shall be included in the Contractor's Bid.

101.07 REMOVAL

- A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations to a depth of two feet; grade site as indicated. Restore existing facilities used during construction to specified, or to original, condition.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 50 10 – TRAIL TRAFFIC CONTROL

PART 1 - GENERAL

101.01 GENERAL

- A. CONTRACTOR shall maintain trail signs and barricades to keep public trail users out of construction areas and to ensure trail users know open paths to trails. During all times of construction, open paths shall be maintained for public users to hike fully around the Bell Canyon reservoir and on the lower falls trail.

101.02 PUBLIC RELATIONS

- A. The Contractor shall provide a Public Relations Contact to be responsible for interfacing with the public during the project. This person shall:
 - 1. have a 24-hour access phone number to respond to construction inquiries, concerns, and complaints.
 - 2. have the authority to direct the work as required to resolve concerns and complaints.
 - 3. resolve all complaints and expressed concerns within 24 hours.
 - 4. follow-up with individuals or entities making complaints 24 hours after resolution to ensure satisfactory results were obtained.
 - 5. document all complaints in a public relations log, including name, address and contact information of individual or entity, date and time of initial notification, nature of complaint, actions taken to resolve the complaint, date and time of complaint resolution, and date and time of follow-up actions.

101.03 SIGNS

- A. CONTRACTOR shall post construction signs at the three public parking areas for the Bell Canyon Trail System: Granite Trailhead (3450 S Little Cottonwood Rd), Bell Canyon Preservation Trailhead (9983 Wasatch Blvd), and Boulders Trailhead (10245 Wasatch Blvd). These signs shall be large and clearly visible and shall contain:
 - 1. General warning about construction taking place on trails.
 - 2. Maps showing main trail locations affected, locations of construction work, and open trail paths to reach main trails down path of construction. This could be provided via a QR code as construction activity changes.
 - 3. The name and phone number of CONTRACTOR's public relations contact to contact with questions.

SECTION 01 50 10 – TRAIL TRAFFIC CONTROL

- B. CONTRACTOR shall maintain signs at all trail closure locations. These signs shall be put in place before commencing construction and shall be promptly moved upon daily construction completion if the area is safe for hikers. These signs shall:
1. State that the trail beyond is closed to the public for construction.
 2. State PPE required in construction zone.
 3. Show detour routes for accessing open trails on other side of construction (if applicable).

101.04 BARRICADES

- A. CONTRACTOR shall maintain barricades at all trail closure locations. These barricades shall hinder the public from entering construction area and clearly show the trail is closed. If the site is safe, barricades shall be taken down when construction is concluded for the day.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 60 00 - MATERIAL AND EQUIPMENT

PART 1 - GENERAL

101.01 GENERAL

- A. It is the responsibility of the Contractor to provide products as specified in the Contract Documents free from manufacturer defects or damage from shipping.

101.02 PRODUCTS

- A. Products include all material and equipment.
- B. Comply with specifications and referenced standards as minimum requirements.
- C. Components required to be supplied in quantity within a specification section shall be the same and shall be interchangeable.
- D. Do not use products removed from an existing structure, pipeline, etc., except as specifically required, or allowed, by Contract Documents.

101.03 TRANSPORTATION AND HANDLING

- A. Transport products by methods to avoid product damage; deliver in undamaged condition.
- B. Provide equipment and personnel to handle products by methods to prevent damage.
- C. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

101.04 STORAGE AND PROTECTION

- A. Store products in accordance with manufacturer's instructions. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.
- B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
- C. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- D. Arrange storage to provide access for inspection. Periodically inspect to ensure products are undamaged and are maintained under required conditions.

SECTION 01 60 00 - MATERIAL AND EQUIPMENT

101.05 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only; Any product meeting those standards.
- B. Products Specified by Naming One or More Manufacturers with a Provision of Substitutions: Submit a request for substitution for any manufacturer not specifically named.
- C. Product Specified by Naming Several Manufacturers: Products of named manufacturers meeting specifications: no options, or substitutions allowed.
- D. Products Specified by Naming Only One Manufacturer: No options, no substitutions allowed.

101.06 PRODUCTS LISTS

- A. Within 10 days after the date of Owner-Contractor Agreement, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number (if applicable) of each product.

101.07 SUBSTITUTIONS

- A. Only within 30 days after the date established in Notice to Proceed will ENGINEER consider requests from Contractor for substitutions. Subsequently, substitutions will be considered only when a product becomes unavailable due to no fault of Contractor.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- C. Request constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
 - 2. Will provide the same warranty for substitution as for specified product.
 - 3. Will coordinate installation and make other changes which may be required for WORK to complete in all respects.
 - 4. Waives claims for additional costs which may subsequently become apparent.

SECTION 01 60 00 - MATERIAL AND EQUIPMENT

- D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, or when acceptance will require substantial revision of Contract Documents.
- E. ENGINEER will determine acceptability of proposed substitution and will notify Contractor of acceptance or rejection in writing within a reasonable time.
- F. Only one request for substitution will be considered for each product. When substitution is not accepted, Contractor must provide specified product.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 70 00 - CONTRACT CLOSEOUT

PART 1 - GENERAL

101.01 FINAL CLEANING

- A. Execute prior to final inspection.
- B. Clean site;
- C. Remove all waste and surplus materials, rubbish, and construction facilities from the Project and from the site.

101.02 PROJECT RECORD DOCUMENTS

- A. Provide completed record drawings and other required closeout documents prior to requesting final payment.

101.01 MAINTENANCE AND GUARANTEE

- A. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the Contractor which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the Contractor shall have obtained a statement in writing from the affected private owner or public agency releasing the OWNER from further responsibility in connection with such repair or resurfacing.
- B. The Contractor shall make all repairs and replacements promptly upon receipt of written order from the OWNER. If the Contractor fails to make such repairs or replacements promptly, the OWNER reserves the right to do the WORK and the Contractor and his surety shall be liable to the OWNER for the cost thereof.
- C. Make periodic inspections during the guarantee period and correct defective work or correct defective work as directed by the OWNER or appropriate governing authority.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 74 05

NATIVE SEEDING

PART 1 GENERAL

1.1 SUMMARY

- A. This section includes requirements for native seed installation.
- B. Surface preparation.

1.2 RELATED SECTIONS

Section 07000: Topsoil.

1.3 REFERENCES

Utah Seed Law: Utah Code - Title 4, Chapter 16.

1.4 SUBMITTALS

- A. Copy of the purchase order to the Engineer documenting that all seeds, including substitutions, have been acquired before the seeding window begins.
 - 1. For seeding schedule, refer to this Section, article, "Scheduling."
 - 2. The purchase order should list the common and botanical name for each seed species.
- B. Supply legible copy of seed certification reports to Parks Superintendent.
- C. Seed certification: Include the following on seed certification reports and labels:
 - 1. Botanical name (include variety if applicable).
 - 2. Common name.
 - 3. Name of seed testing laboratory.
 - 4. Lot number and address of the seed company.
 - 5. Weed seed (percent).
 - 6. Other crop seed (percent).
 - 7. Inert matter (percent).
 - 8. Pure live seed (percent).
 - 9. Noxious weed seed (name and rate of occurrence).
 - 10. Date tested (month and year).
 - 11. Germination (percent).
 - 12. Hard seed (percent).
 - 13. Net weight (do not include container weight).
 - 14. Pure live seed weight.
 - 15. Collection locations for native shrub and tree species (state, county, elevation).
- D. Installer shall be experienced in establishing un-irrigated native seed stands. Provide proof of three similar sized successful installations prior to commencing work.

- F. Mulch:
 - 1. 100% clean and weed free wood fiber.
 - 2. Apply 1500 - 2000 lbs per acre. On slopes steeper than 3:1 apply 2500 lbs per acres.
- G. Tackifier: Conwed 1000 or approved equal applied at 100 lbs per acre in hydroseeding application. Use 150 pbs per acre for slopes greater than 3:1.
- H. Fertilizer and other soil amendments. Add as required based on soils report.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Notify Parks Superintendent seven working days before seeding operations.
- B. In disturbed areas, complete all weed removal, final grading, trench settling, surface preparation and irrigation work before seeding begins.
- C. Roughen soil receiving seed.
- D. Do not install when seed or soil is saturated or frozen.

3.2 SEEDING

Apply seed at the rate indicated in this Section.

3.3 HYDROSEED METHOD

Following preparation of soil, mix seed, mulch and tackifier in a slurry at the specified rates, apply to all areas disturbed by contractor's activities.

3.4 MAINTENANCE

- A. During the maintenance period the contractor shall be responsible for removing weeds and maintaining the site to provide as good of conditions as possible for seed to grow.
- B. Contractor shall plan on one re-seeding if the native stand has not established at the end of the warranty period.

END OF SECTION

SECTION 02 10 00 - SITE PREPARATION

PART 1 - GENERAL

101.01 DESCRIPTION

This section specifies site preparation which consists of clearing, grubbing and demolition.

101.02 JOB CONDITIONS

A. EXISTING CONDITIONS:

The Contractor shall determine the actual condition of the site as it affects this portion of WORK. Contractor shall coordinate site preparation with OWNER's administration and operation staff.

B. PROTECTION:

Site preparation shall not damage structures, landscaping, or vegetation adjacent to the site. The Contractor shall repair or replace any damaged property.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

303.01 GENERAL

The Contractor shall notify the Project Representative when site preparation is complete.

303.02 PERFORMANCE

A. CLEARING AND GRUBBING:

Unless otherwise specified, the Contractor shall remove obstructions such as brush, trees, logs, stumps, roots, heavy sod, vegetation, rock, stones larger than 6 inches in any dimension, broken or old concrete and pavement, debris, structures and piping where the completion of the work requires their removal.

Material that is removed and is not to be incorporated in the work shall be disposed of off the site, or as directed by the OWNER.

- END OF SECTION -

SECTION 02 59 00 – PROTECTION AND REPLACEMENT OF EXISTING FACILITES

PART 1 - GENERAL

101.01 GENERAL

- A. The WORK of this section includes the restoration of all existing improvements damaged or altered by the construction of the project.
- B. Existing improvements shall include but are not limited to permanent surfacing, curbs, planted areas, ditches, driveways, culverts, fences, walls, signs, and irrigation appurtenances. All improvements shall be reconstructed to equal or better, in all respects, the existing improvements removed. Said existing improvements shall be reconstructed in accordance with the notes and details shown on the drawings and/or the applicable provision of these Specifications.

101.02 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the type of construction required.
- B. The quality of the finished restored improvement, as determined by the OWNER, shall be of equal or better quality than was said improvement prior to being damaged or removed.

101.01 REFERENCES

- A. State of Utah Standard Specifications for Road and Bridge Construction, latest edition including all addendums.

PART 2 - PRODUCTS

202.01 MATERIALS - GENERAL

- A. As required to complete the restoration of existing improvements and shall be at least equal to original improvement at the time of damage or removal, as determined by the OWNER of said improvement, and shall match original construction in finish and dimension.
- B. Shall be in accordance with requirements of local jurisdiction having authority. Obtain approval of all materials from local jurisdiction having authority prior to ordering or delivering.

UNTREATED BASE COURSE

- A. Shall be in accordance with State of Utah Standard Specifications for Road and Bridge Construction, paragraphs 301.02 and 301.13, one-inch gradation:

SECTION 02 59 00 – PROTECTION AND REPLACEMENT OF EXISTING FACILITES

<u>Sieve Size</u>	<u>Percent Passing</u>
1"	100
2"	79-91
No. 4	49-61
No. 16	27-35
No. 200	7-11

202.03 VEGETATION

- A. Bushes, shrubs, and aspen trees can be removed to make room for construction activities. Protect existing evergreen trees, obtain approval before removing any large evergreen tree. Evergreen trees to remain shall be protected from construction activity.
- B. TOPSOIL:
 - 1. Topsoil shall be fertile, friable, natural loam, surface soil, reasonably free of clay lumps, brush weeds, and other litter, and free of rocks, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than four inches.
 - 2. Do not obtain from bogs or marshes.

PART 3 - EXECUTION

303.01 PREPARATION

- A. Obtain all permits necessary for the restoration of existing surface improvements.
- B. Protect all public and private property adjacent to the WORK. Exercise due caution to avoid damage to such property.

303.02 GENERAL RESTORATION REQUIREMENTS

- A. All improvements damaged or removed shall be restored in accordance with local jurisdiction having authority. In case of conflict between these specifications and local authority specifications, the local authority shall govern. Sandy City owns all property on project site.

SECTION 02 59 00 – PROTECTION AND REPLACEMENT OF EXISTING FACILITES

- B. Repair or replace all existing surface improvements, which were damaged or removed as a result of operations of WORK under this contract. Restoration shall be of at least equal quality and identical in dimension to original improvement unless specifically specified otherwise.

303.05 PLANTED AREAS

- A. Prior to placing topsoil, examine and repair the subgrade as necessary to assure a smooth and even surface which will match grade and contours of surrounding undisturbed ground. Finish grade construction areas to match grade prior to construction activities. Assure that a positive slope away from al building walls is maintained for at least ten feet to prevent runoff from approaching walls.
- B. Fences:
 - 1. Restore all fences disturbed, removed, or damaged by construction operations in a condition at least equal to that prior to construction.

303.06 MISCELLANEOUS IMPROVEMENTS

- A. All other improvements interrupted or removed to permit the construction specified herein shall be restored.

303.07 EXISTING UTILITIES AND IMPROVEMENTS

- A. GENERAL:

The Contractor shall protect all utilities and other improvements which may be impaired during construction operations. It shall be the Contractor's responsibility to ascertain the actual location of all existing utilities and other improvements indicated by utility owners that will be encountered in his construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The Contractor shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be directed by the ENGINEER. The OWNER anticipates being able to modify its designated test station or other excavation location in the case that such location is found to conflict with existing utilities.

- B. UTILITIES TO BE MOVED:

In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon proper application by the Contractor, be notified by the ENGINEER to move such property within a specified

SECTION 02 59 00 – PROTECTION AND REPLACEMENT OF EXISTING FACILITES

reasonable time, and the Contractor shall not interfere with said property until after the expiration of the time stipulated.

C. OWNER'S RIGHT OF ACCESS:

The right is reserved to the OWNER and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the WORK of this Contract.

D. KNOWN UTILITIES:

Existing utility lines, the locations of which are made known to the Contractor prior to excavation that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired by the Contractor at his expense.

E. UNKNOWN UTILITIES:

In the event that the Contractor damages any existing utility lines, the locations of which are not made known to the Contractor prior to excavation, a written report thereof shall be made immediately to the ENGINEER. If directed by the ENGINEER, repairs shall be made by the Contractor under the provision for changes and extra WORK contained in Article 10 of the General Conditions.

F. COSTS BORNE BY OTHERS:

All costs of locating, repairing damage not due to failure of the Contractor to exercise reasonable care, and removing or relocating such utility facilities not indicated by the utility owner with reasonable accuracy, will be paid for as extra WORK in accordance with the provisions of Article 10 of the General Conditions if the OWNER requires the Contractor to man such costs; or such repair WORK may be performed by the utility owner.

G. UTILITIES TO BE REMOVED:

When utility lines that are to be removed are encountered within the area of operations, the Contractor shall notify the ENGINEER a sufficient time in advance for the necessary measures to be taken to prevent interruption of the service.

H. APPROVAL OF REPAIRS:

SECTION 02 59 00 – PROTECTION AND REPLACEMENT OF EXISTING FACILITES

All repairs to a damaged improvement shall be inspected and approved by an authorized representative of the improvement OWNER before being concealed by backfill or other WORK.

I. RELOCATION OF UTILITIES:

Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is shown on the drawings, the Contractor shall at his own expense, remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to the ENGINEER and the OWNER of the facility. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by the Contractor in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

J. MAINTENANCE IN SERVICE:

All oil and gasoline pipelines, power and telephone or other communication cable ducts, gas and water mains, irrigation lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the WORK shall be maintained continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the ENGINEER are made with the OWNER of said pipelines, duct, main, irrigation line, storm drain, pole, or wire or cable. The Contractor shall be responsible for and shall make good all damage due to his operations, and the provisions of this section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

303.08 NOTIFICATION BY THE CONTRACTOR

- A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipeline; all buried electric power, communications or television cables; all traffic signal and street lighting facilities; and all roadway and state highway right-of-way the Contractor shall notify the respective authorities representing the OWNERS or agencies responsible for such facilities not less than three working days nor more than five working days prior to excavation so that a representative of said OWNERS or agencies can be present during such work if they so desire.

- END OF SECTION

SECTION 03 30 53
SMALL PROJECT CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including forms, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 REFERENCES

- A. American Concrete Institute (ACI) standards, most recent editions:

ACI 117 Specifications for Tolerances for Concrete Construction and Materials

ACI 301 Specifications for Structural Concrete

ACI 305R Hot Weather Concreting

ACI 306R Cold Weather Concreting

ACI 315 Details of Concrete Reinforcement

ACI 318 Building Code Requirements for Reinforced Concrete

ACI 347 Formwork For Concrete

- B. American Welding Society (AWS):

D1.4 Structural Welding Code – Reinforcing Steel

- C. ASTM International (ASTM) standards, most recent editions:

ASTM A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement

ASTM A185 Standard Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement

ASTM A497 Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete

ASTM A615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM A706 Standard Specification for Low Alloy Steel Deformed Bars for Concrete Reinforcement

ASTM C31	Standard Specification Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specifications for Concrete Aggregates
ASTM C39	Test for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143	Standard Test Method for Slump of Hydraulic Cement Concrete
ASTM C156	Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Specification for Air-Entraining Admixtures for Concrete
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM C1064	Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

D. Concrete Reinforcing Steel Institute (CRSI) standards, most recent editions:

Manual of Standard Practice

- E. U. S. Army Corps of Engineers standards, most recent editions:

CRD-C 572 PVC Waterstops

1.3 SYSTEM DESCRIPTION

- A. The Contractor shall be responsible for the design, engineering, construction, maintenance, and safety of all falsework, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, and the requirements specified herein.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 20 – Submittal Procedures.
- B. Submit details of the concrete reinforcement steel and concrete inserts as soon as possible after receipt of the Notice to Proceed.
- C. Include, but not limit to, the following:
1. Complete bar schedule, bar details and erection drawings to conform to ACI 315.
 2. Each type of bar marked with identification corresponding to identification tag on bar.
 3. Length, type, and location of all splices.
 4. Erection drawings shall be clear, easily legible and to a minimum scale of:
 - a. 1/4 inch = 1 foot.
 - b. 1/8 inch = 1 foot if bars in each face are shown in separate views.
 5. Size and location of openings.
- D. Do not use Contract Documents as erection drawings.

1.5 QUALITY ASSURANCE

- A. Ready mix concrete manufacturer qualifications: Concrete producer shall be a firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.
- B. Perform work in accordance with ACI 301 and the applicable referenced documents.
- C. Welders' Certificates: When welding of reinforcing steel is proposed, submit welders' certificates certifying welders employed on the Work and verifying AWS qualification within the previous 12 months. All welding to be performed in accordance with AWS D1.4.
- D. Conform to ACI 305R and/or ACI 306R when concreting during hot or cold weather as appropriate.

PART 2 - PRODUCTS

2.1 FORMWORK

- A. Conform to ACI 301, ACI 318, and ACI 347, using plywood or metal forms.
- B. Plywood forms: Douglas Fir or Southern Yellow Pine species; solid one side or high density overlaid one side; sound, undamaged sheets designed to support weight of concrete with minimum deflection.
- C. Steel forms: Stiffened to support weight of concrete with minimum deflection.
- D. Glass fiber reinforced resin type: Preformed shape, stiffened to support weight of concrete with minimum deflection.
- E. Tubular column type: Round, spirally wound, laminated fiber material, surface treated with
- F. Form ties: Removable or snap-off metal of fixed length, leaving no metal within 1 inch of finished surface.
- G. Form release agent: Colorless mineral oil that will not stain concrete or absorb moisture.

2.2 STEEL REINFORCEMENT

- A. Reinforcing steel: ASTM A615, Grade 60, deformed billet steel bars, uncoated finish.
 - 1. When shown on Drawings, supply epoxy coated bars in accordance with ASTM A775.
 - 2. Plain-steel wire: ASTM A82 as drawn.
 - 3. Plain steel welded wire reinforcement: ASTM A185, fabricated from as-drawn steel wire into flat sheets.
 - 4. Deformed-steel welded wire reinforcement: ASTM A497, flat sheet.
 - 5. Tie wire: Minimum 16 gage annealed type.
 - 6. Chairs, bolsters, bar supports and spacers: Sized and shaped for strength and support of reinforcement during concrete placement.
- B. Welding reinforcing steel: When welded reinforcing steel is called for on the Drawings or in these Specifications, provide per ASTM A706.

2.3 CONCRETE MATERIALS

- A. Blended Hydraulic Cement: Comply with ASTM C595, Type IL (10) (MS), grey color.
 - 1. Cement shall not contain more than 0.60 percent equivalent alkalis.
 - 2. Limestone content is limited to 10 percent.
 - 3. Single brand of cement used throughout Work; brand approved by Engineer.
- B. Fly ash: ASTM C618, Class F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
 - 1. Maximum of 25 percent replacement at 1.0 pounds of fly ash per pound of cement replaced.
- C. Coarse aggregate: ASTM C33,
 - 1. Graded Size No. 67.

2. Obtain coarse aggregates from sources approved by Engineer.
- D. Fine aggregate: ASTM C33
1. Fineness Modulus: Not over 3.00.
 2. Obtain fine aggregates from sources approved by Engineer.
- E. Lightweight aggregates: Not permitted unless specifically allowed by Engineer.
- F. Water
1. Clean and not detrimental to concrete; potable.
 2. Conform to ASTM C94.

2.4 ADMIXTURES

- A. Air entrainment: ASTM C260.
- B. Water reducing: ASTM C494, Type A.
- C. Water reducing and retarding: ASTM C494, Type D.
- D. Water reducing and accelerating: ASTM C494, Type E.
- E. Water reducing, high range plasticizer: ASTM C494, Type F.
- F. Do not use calcium chloride.
- G. Pigments for underground conduit banks: Pigment shall be added to concrete encasing electrical duct banks as required by Rocky Mountain Power Company.

2.5 RELATED MATERIALS

- A. Bonding agent: Polymer resin emulsion acceptable to Engineer.
- B. Bond breaker: VOC compliant, water or solvent based membrane forming, reactive bond breaker.
- C. Vapor barrier: Multi-ply reinforced polyethylene sheet, ASTM E1745, Class C, not less than 7.8 mils thick or polyethylene sheet, ASTM D4397, not less than 15 mils thick.
- D. Grout: Premixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents, capable of minimum compressive strength of 2500 psi in 3 days and 6000 psi in 28 days.
- E. Construction joints: Locate and install construction joints that are not shown on Drawings so as not to impair strength of concrete, and as acceptable to the Engineer.
- F. Premolded joint filler:
1. Provide expansion joints in concrete construction in locations shown on Contract Drawings.

2. Expansion Joint Filler: Preformed, non-extruding, resilient type, constructed of cellular neoprene sponge rubber, extending full thickness of slab, in accordance with ASTM D1751 or ASTM D1752, Type I.

G. Expansion joints: Locate and install where shown on the Drawings.

H. Joint sealant: 2-component polyurethane conforming to ASTM C920.

2.6 CURING MATERIALS

A. Water: Clean and potable.

B. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C156 shall not exceed 0.055 grams per square centimeter of surface.

C. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (1) (2). The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.

D. Polyethylene-coated burlap for use as concrete curing blanket shall be 4 mils thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.

E. Evaporation retardant to provide thin continuous film over freshly placed flatwork concrete to prevent rapid moisture loss before finishing.

1. Membrane Curing Compound: ASTM C309, Type 1, Class B. Sodium silicate compounds shall not be allowed.

2.7 CONCRETE MIXTURES

A. Normal-weight concrete: Select proportions for normal-weight concrete in accordance with ACI 301 using either the "statistical method" or the "trial batch method".

1. "Statistical method" is preferred with a minimum of 30 tests acceptable to the Engineer.
2. If "trial batches" are used to verify the mix design strength, the proposed mix design shall achieve an average compressive strength of 1200 psi more than strengths given in table below.

B. Concrete strength, cement content and slump per the following table:

Type of Construction	Compressive Strength (psi)	Aggregate Gradation (ASTM C33)	Slump in Inches (Max.)	Max W/C Ratio (by Weight)
Structure walls.	4,500	#57 (1")	4	0.42
Structure footings (Mat Slab).	4,500	#467 (1-1/2")	4	0.42
Reinforced concrete encasements; thrust blocks	4,000	#467 (1-1/2")	4	0.50
Lean Concrete	3,000	#467 (1-1/2")	5	0.60

1. Slump as shown above shall be plus or minus 1 inch.
2. Minimum cement content:
 - a. Reinforced Concrete: Six sacks of Portland Cement per cubic yard.
 - b. Unreinforced Concrete: Five sacks of Portland Cement per cubic yard.
3. Air content: Provide air entrainment resulting in a total air content of 5 to 7 percent for all types of construction.
 - a. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.
 - b. Air may be omitted from interior slabs to be trowel finished.

2.8 CONCRETE MIXING

- A. Measure, batch, mix, and deliver concrete according to ASTM C94 and furnish batch ticket for each truck delivered.
 1. Deliver and place concrete within 90 minutes from the time the water is added to the mix.
 2. When ambient air temperature is above 90 degrees F, reduce delivery and placement time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

- A. Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. Surface shall be free from standing water, mud and debris at the time of placing concrete.
- B. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or elevated floor slabs to drains.
 1. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.
 2. Do not place floor drains through beams.
- C. Unless otherwise indicated, provide exterior corners in concrete members with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise indicated.

3.2 FORMWORK

- A. Verify lines, levels, and measurement before proceeding with formwork.
- B. Hand trim sides and bottom of earth forms. Remove all loose soil.
- C. Align form joints.
- D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coatings that may be affected by the agent.
- E. Coordinate work of other trades in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

3.3 WATERSTOPS

- A. Preparation
 - 1. Uncoil waterstop minimum of 24 hours prior to installation for ease of handling and fabrication.
 - 2. Position waterstop to ensure proper distance from steel reinforcing bars and to prevent rock pockets and honeycomb.
 - 3. Clean concrete joint and waterstop after first pour to remove debris and dirt.
- B. Installation
 - 1. Position waterstop across joints as specified herein and as indicated on Drawings.
 - 2. Center waterstops on joint unless shown otherwise.
 - 3. When centerbulb is present at moving joints, ensure that it is not embedded.
 - 4. All waterstops fully continuous for the extent of the joint.
 - 5. Secure plastic serrated waterstop in correct position before concrete placement with hog rings and wire to adjacent reinforcing steel at 12-inch maximum spacing. Center-to-center spacing may be increased upon written request and approval of Engineer.
 - 6. Take suitable precautions and means to support and protect waterstops during the progress of the work.
 - 7. Carefully place concrete without displacing waterstop from proper position.

3.4 VAPOR BARRIER

- A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier
- B. Place 2" of fine granular fill over the vapor barrier to act as a blotter for the concrete slab.
- C. Lap joints minimum of 6 inches and seal with a compatible pressure-sensitive tape
- D. Patch punctures and tears before placing sand blotter or concrete.

3.5 STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor barrier if used.

3.6 CONCRETE PLACEMENT

- A. Notify Engineer a minimum of 24 hours prior to commencement of concreting operations.
- B. Before placing new concrete on or against concrete which has set, existing surfaces shall be roughened and cleaned free from all laitance, foreign matter, and loose particles.
- C. Place concrete in accordance with ACI 301.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301. In no case shall water be added to exceed the specified water-cement ratio of the mix.
- E. Temperature of Delivered Concrete:
 - 1. Maximum 90 degrees F.
 - 2. Minimum concrete temperature in accordance with following table:

Outdoor Temperature at Placement (In shade)	Concrete Temperature (At delivery to Site)
Below 30 Degrees F	65 Degrees F
Between 30 and 45 Degrees F	60 Degrees F
Above 45 Degrees F	50 Degrees F

- 3. Heating concrete ingredients: Heat ingredients to temperature no higher than necessary to maintain specified placement temperature of concrete; maximum of 80 Degrees F.
 - 4. Methods of heating concrete ingredients subject to approval of Engineer.
 - 5. Pre-cooling of ingredients: Cool ingredients as required to maintain specified placement temperature of concrete.
 - 6. No additional compensation due to the foregoing requirements.
- F. Concrete Protection:
- 1. Protect all concrete against physical injury until final acceptance by Owner.
 - 2. Protect concrete from reduced strength due to weather extremes.
 - 3. Protect concrete that is still plastic and whenever precipitation is imminent or occurring, as determined by Engineer.
 - 4. When the temperature is below 40 Degrees F or is likely to fall below 40 Degrees F during the 24-hour period after placing the concrete, follow the recommendations of ACI 306R, except as modified herein.
 - a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice, or snow.
 - b. After the mean daily temperature in the vicinity of the Project site falls below 40 degrees F for more than 1 day, maintain concrete at a temperature above 50 degrees F for at least 72 hours after it is placed, with additional requirements listed under Article 3.3 - Curing below.
 - c. When removing protection, do not allow concrete to cool suddenly.
 - d. Calcium chloride will not be permitted as a concrete accelerator or to thaw frozen subgrade prior to concrete placement.
 - 5. When the temperature is 90 Degrees F or above, or is likely to rise above 90 Degrees F within the 24-hour period after concrete placement; or when there is any

combination of high air temperature, low relative humidity, and wind velocity which would impair concrete strength or quality, follow the recommendations of ACI 305R and the following:

- a. Keep concrete as cool as possible during placement and curing.
- b. Do not allow concrete temperature to exceed 90 Degrees F at placement.
- c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
- d. Dampen subgrade and forms with cool water immediately prior to placement of concrete.
- e. Apply an evaporation retardant per manufacturer's instructions between placement and finishing operations.
- f. Protect the concrete with temporary wet covering during any appreciable delay between placement and finishing.
- g. Take appropriate precautions per ACI 305R when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R.

3.7 FLOOR SLABS

- A. Install control joints in slab by forming or cutting within 4 hours of placement using an early entry saw.
- B. Separate slabs-on-grade from vertical surfaces using full-depth joint filler. Apply joint sealant when shown on Drawings.

3.8 FINISHING FORMED SURFACES

- A. Rough-formed finish: As-cast concrete texture imparted by form facing material with tie holes and defective areas repaired and patched.
 1. Remove fins and other projections exceeding 1/2 inch.
 2. Apply to concrete surfaces not exposed to view after final grading.
- B. Smooth-formed finish: As-cast concrete texture imparted by form facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 1. Repair and patch tie holes and defective areas.
 2. Remove fins and other projections exceeding 1/8 inch.
 3. Apply to concrete surfaces exposed to view or to be covered with a coating or covering material applied directly to concrete.

3.9 FINISHING UNFORMED SURFACES

- A. Steel trowel surfaces at interior floor slabs which are to be exposed.
- B. Steel trowel surfaces that are to receive carpeting, resilient flooring, seamless flooring, thin-set marble, quarry, or ceramic tile.
- C. Wood float surfaces that are scheduled to receive quarry, ceramic tile, or terrazzo tile, with full bed setting system.
- D. Broom finish at exterior concrete slabs, paving, and steps.

- E. Broom or wood float finish at exposed concrete filled pan stair treads.
- F. Floor densifier/sealer:
 - 1. Apply to all exposed concrete floor surfaces.
 - 2. Apply after concrete has cured minimum 7 days.
 - 3. Apply in accordance with manufacturer's recommendations.
 - 4. Keep floors covered and free of traffic and loads for a minimum of 10 days after completion.

3.10 CONCRETE CURING AND PROTECTION

- A. Evaporation retarder.
 - 1. Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. per hour before and during finishing operations.
 - 2. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- B. Cure concrete for not less than 14 days after placing.
- C. Leave forms in place at least 14 days, or until concrete has attained specified 28-day strength, unless otherwise approved by Engineer. If forms are allowed to be removed within 14 days of placing concrete, continue curing in accordance with other methods specified herein or as directed by Engineer.
- D. Strictly follow careful procedures for the removal of forms and perform with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted.
- E. Keep encasement concrete, concrete cradles and anchor blocks moist until covered. The surface shall be covered with moist earth not less than 4 hours, or more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.
- F. Concrete slabs may be cured by either of the following two methods:
 - 1. Method 1:
 - a. After finishing slab, wet surface with a fine spray of water and cover with polyethylene-bonded waterproof paper sheeting.
 - b. Lap sheets 4 inches at sides and ends and seal with adhesive tape to form a continuous watertight joint.
 - c. Weigh sheeting down with wood planks to keep sheeting in contact with concrete.
 - d. Repair or replace sheets immediately if damage occurs.
 - 2. Method 2:
 - a. Cover concrete with water-saturated polyethylene-coated burlap curing mats and keep continuously wet for curing period.
 - b. Lap sheets 4 inches at sides and ends and seal with adhesive tape to form a continuous watertight joint.
 - c. Weigh sheeting down with wood planks to keep sheeting in contact with concrete.
 - d. Repair or replace sheets immediately if damage occurs.

- G. As an alternate to above referenced curing methods for formed and slab concrete, spray surface with liquid curing compound that does not affect bond of paint to concrete surface.
1. Apply curing compound in accordance with manufacturer's instructions as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after completion of finish or stripping of forms, if stripped in less than 14 days.
 - a. Maximum coverage rate of 200 square feet per gallon, applied in such a manner as to cover surface with a uniform film to seal thoroughly.
 2. Curing vertical surfaces with a curing compound:
 - a. Cover vertical surfaces with a minimum of two coats of the curing compound.
 - b. Apply the first coat of curing compound immediately after form removal. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - c. Allow the preceding coat to completely dry prior to applying the next coat.
 - d. Vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.
 3. Curing Compound: As specified herein.
 4. Take care to avoid damage to seal during curing period.
 5. Repair broken or damaged seals occurring before expiration of curing period by application of additional curing compound over damaged portion.
 6. Do not use curing film method where construction joints are to be made.
 7. In hot weather, follow curing procedures outlined in ACI 305R.
 8. In Cold Weather, following curing procedures outlined in ACI 306R.

3.11 TOLERANCES

- A. Construction Tolerances: Set and maintain concrete forms and perform finishing operations so as to ensure that the completed Work is within the tolerances specified in ACI 117. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown.

3.12 FIELD QUALITY CONTROL

A. General

1. Tests on component materials and for slump, temperature, air content, and compressive strength will be performed as specified herein.
2. The cost of all laboratory tests for qualification of mix designs on cement, aggregates, and concrete, including strength testing will be borne by the Contractor. The cost of all field-testing during construction, including slump, temperature, air, and strength will also be borne by the Contractor. Contractor's testing laboratory shall meet or exceed the requirements of ASTM C1077.
3. Concrete for testing shall be supplied by the Contractor at no additional cost to the Owner, and the Contractor shall assist Engineer in obtaining samples, and disposal and cleanup of excess material.
4. Composite samples of concrete placed in the Work shall be taken in accordance with ASTM C172 from the first placement of each class of concrete and at the following minimum frequency for each class:
 - a. Not less than one sample per day on which concrete it placed.
 - b. Not less than one sample for each 50 cubic yards of concrete placed.

- c. Not less than one sample for each 5,000 square feet of surface area for slabs or walls.
 - d. Not less than 5 samples from randomly selected batches for the Work.
- B. Slump Tests
 - 1. Perform in accordance with requirements of ASTM C143 at frequency indicated for sampling above.
- C. Temperature Tests
 - 1. Test concrete temperature per ASTM C1064 at frequency indicated for sampling above.
- D. Air Content Tests
 - 1. Test air content per ASTM C231 at frequency indicated for sampling above.
- E. Field Compression Tests
 - 1. Field compression test specimens will be made at the frequency indicated for sampling above.
 - 2. Each set of test specimens will be a minimum of five cylinders.
 - 3. Compression test specimens for concrete shall be made in accordance with ASTM C31. Specimens shall be 6-inch diameter by 12-inch high cylinders.
 - 4. Compression tests shall be performed in accordance with ASTM C 39. One test cylinder will be tested at 7 days and two at 28 days. The remaining cylinders will be held to verify test results, if needed.
- F. Evaluation and Acceptance of Concrete
 - 1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318 and as specified herein.
 - 2. All concrete which fails to meet the ACI requirements and these Specifications, is subject to removal and replacement at no increase in cost to the Owner.

3.13 TREATMENT OF SURFACE DEFECTS

- A. As soon as forms are removed, all exposed surfaces shall be carefully examined, and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the Engineer. In no case will extensively patching honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Remove and replace concrete containing extensive voids, holes, honeycombing, or similar depression defects. Promptly execute all repairs and replacements herein specified at no additional expense to Owner.
- B. Perform all repairs in accordance with the manufacturer's recommendations and with ICRI Guideline No 310.1R and Guideline No 320.2R. Follow these guidelines for removal geometry, exposing and undercutting reinforcing steel, cleaning and repair of reinforcing steel, and edge and surface condition of concrete, regardless of the amount of corrosion present or not present in the reinforcing steel.
 - 1. Remove unsound deteriorated concrete from Work by high pressure water blasting machines capable of scoring concrete surfaces to minimum amplitude roughness of

3/16-inch. Remove to provide for minimum thickness specified for mortar. If reinforcing is exposed in this process, remove additional concrete until the surface is a minimum of 1-inch or 1 bar diameter behind the exposed reinforcing.

2. Clean exposed reinforcing bars of rust and other deleterious materials which may prevent bonding of the repair product.
 3. Keep surface at saturated surface dry (SSD) condition for a minimum of 24-hours prior to placement of repair material.
 4. Place and cure repair grout in accordance with manufacturer's written recommendations.
 5. For exposed walls, include a portion of white Portland cement as required to make the color of the patch match the color of the surrounding concrete.
 6. Ream holes left by tie-rod cones with suitable toothed reamers to leave the surfaces of the holes clean and rough. Repair these holes in an approved manner with dry-packed cement grout specified in accordance with manufacturer's written recommendations. Do not ream holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension but repair them in an approved manner with dry-packed cement grout in accordance with manufacturer's written recommendations.
- C. Build up and shape repairs in such a manner that the completed Work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Cure surfaces of said repairs as required for the concrete in the repaired section.

3.14 PATCHING HOLES IN CONCRETE

A. Patching Small Holes

1. Fill holes which are less than 12 inches in their least dimension and extend completely through concrete members, as specified herein.
2. Fill small holes in members which are water-bearing or in contact with soil or other fill material, with nonshrink grout specified in accordance with manufacturer's written recommendations. Where a face of the member is exposed to view, hold the nonshrink grout back 2 inches from the finished surface. Patch the remaining 2 inches according to the paragraph in Part 3 entitled "Treatment of Surface Defects."
3. Fill small holes through all other concrete members with nonshrink grout, with exposed faces treated as above.

B. Patching Large Holes

1. For holes which are larger than 12 inches in their least dimension, provide a keyway chipped into the edge of the opening all around, unless a formed keyway exists. Fill holes with concrete as specified herein.
2. For holes which are larger than 24 inches in their least dimension and which do not have reinforcing steel extending from the existing concrete, set reinforcing steel in drilled holes and epoxy grout as specified in accordance with manufacturer's written recommendations. Match the reinforcing added to the reinforcing in the existing wall unless otherwise shown.
3. For large holes in members which are water bearing or in contact with soil or other fill, place either a hydrophilic type or a plastic adhesive type waterstop material around the perimeter of the hole as specified herein, unless there is an existing waterstop in place.

3.15 APPLICATION OF LOADS

- A. Do not allow traffic, construction equipment, or materials of any kind to be placed on elevated concrete slabs until the concrete has attained a minimum age of 7 days and 80% of the minimum specified 28-day strength as proven by concrete strength tests.
- B. Do not place backfill against cantilevered walls until the concrete has attained a minimum age of 7 days and 100% of the minimum specified 28-day concrete strength as proven by concrete strength tests.

END OF SECTION

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SECTION 16 10 11 - CONDUIT

PART 1 - GENERAL

101.01 SECTION INCLUDES

- A. Metallic conduit.
- B. Nonmetallic conduit.
- C. Fittings and conduit bodies.

101.03 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- D. ANSI/NFPA 70 - National Electrical Code.
- E. NECA "Standard of Installation."
- F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- G. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- H. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

101.04 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70.

101.05 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

101.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept conduit on site. Inspect for damage.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

SECTION 16111 - CONDUIT

- C. Protect PVC conduit from sunlight.

101.07 PROJECT CONDITIONS

- A. Verify routing and termination locations of conduit prior to rough-in.
- B. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

201.01 CONDUIT REQUIREMENTS

- A. Minimum Size: 2 inches unless otherwise specified.
- B. Outdoor Locations, Above Grade or Underground:
 - 1. Use nonmetallic conduit.
- C. Indoor Locations, exposed above grade:
 - 1. Use rigid steel conduit.
- D. Wall/floor penetration:
 - 1. Use PVC coated galvanized rigid steel (robroy).

201.02 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1 to match conduit in building.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

201.03 NONMETALLIC CONDUIT

- A. Description: NEMA TC 2; Schedule 40 PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3.

201.04 PVC COATED STEEL

- A. Rigid Steel conduit coated with a minimum of 40 mil of PVC coating.

PART 3 - EXECUTION

301.01 INSTALLATION

- A. Install conduit in accordance with NECA "Standard of Installation."

SECTION 16111 - CONDUIT

- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange supports to prevent misalignment during wiring installation.
- D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- E. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach conduit to ceiling support wires.
- G. Arrange conduit to maintain headroom and present neat appearance.
- H. Route exposed conduit parallel and perpendicular to walls.
- I. Route conduit in and under slab from point-to-point.
- J. Bring conduit to shoulder of fittings; fasten securely.
- K. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- L. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around buried obstruction.
- M. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- N. Provide suitable pull string in each empty conduit except sleeves and nipples.
- O. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

301.02 INTERFACE WITH OTHER PRODUCTS

- A. Provide a water tight seal around conduits which penetrate concrete walls where one side of wall is below grade.

- END OF SECTION -

SECTION 16 30 00 – RADAR LEVEL SENSOR

PART 1 - GENERAL

101.01 SECTION INCLUDES

- A. Providing and installing radar level sensor.

101.02 DELIVERY, STORAGE, AND HANDLING

- A. Inspect for damage upon receipt.
- B. Protect sensor until ready to install. Protect from damage due to handling or elements.

PART 2 - PRODUCTS

201.01 RADAR SENSOR REQUIREMENTS

- A. Shall be for measuring liquid levels in all temperatures likely to be encountered outdoors.
- B. The unit shall be powered by the A 4-20mA current loop. The maximum loop resistance shall be 750 Ohms. The output shall provide a continuous analog output of signal directly proportional to volume. The gauge shall be capable of local and remote interrogation and/or configuration.
- C. The radar level sensor shall be Siemens LR110, PN 7ML5310-1CA06-0AA0 and shall include
 - 1. 30 m cable length
 - 2. HART
 - 3. 1" NPT (tapered) mounting thread
 - 4. Single Point model with 6 relays
 - 5. Bluetooth configuration or LT500 ready

PART 3 - EXECUTION

301.01 INSTALLATION

- A. Install according to manufacturer's requirements.
- B. On-site start-up assistance required.

- END OF SECTION -

SECTION 31 05 19 - GEOSYNTHETICS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section covers the manufacturing and installation of geosynthetics.

1.2 RELATED WORK

- A. Related work specified in other sections includes, but is not limited to:

1. Section 01 30 00 Contractor Submittals
2. Section 31 37 00 Rip Rap

1.3 REFERENCES

- A. The latest edition of the following publications forms a part of this Specification to the extent referenced. The publications are referred to in the text to by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. B16.1/ASTM D 751 Standard Test Methods for Coated Fabrics
2. ASTM D 1777 Standard Test Method for Thickness of Textile Materials
3. ASTM D 3786 Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method
4. ASTM D 4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles
5. ASTM D 4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
6. ASTM D 4751 Standard Test Method for Determining Apparent Opening Size of a Geotextile
7. ASTM D 4833 Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
8. ASTM D 5034 Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
9. ASTM D 5035 Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
10. ASTM D 5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles

1.4 SUBMITTALS

- A. Provide submittals in accordance with Section 01 30 00 – Contractor Submittals.
- B. Quality Control Certificates shall be provided at a minimum frequency of one (1) per every hundred thousand (100,000) square feet of geosynthetics produced consecutively, and which is supplied to the project. These certificates shall be supplied only for the individual rolls of geosynthetics sampled and tested by the Manufacturer or his representative. An individual Quality Control Certificate shall be provided for each roll of geosynthetics provided to the project, which was not produced consecutively within the hundred

SECTION 31 05 19 - GEOSYNTHETICS

thousand (100,000) square foot lot. Quality Control Certificates shall be submitted two (2) weeks prior to installation of geosynthetics and shall state that the geosynthetics meets the requirements of these specifications for:

1. Mass per Unit Area
 2. Grab Tensile Strength
 3. Mullen Burst Strength
 4. Equivalent Opening Size
- C. Geosynthetics shall not be accepted and/or incorporated into the project without the approved quality control documentation.
- D. Certification stating that all geosynthetics is furnished by one manufacturer shall be submitted two (2) weeks prior to installation.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Storage and handling of the geosynthetics shall be the responsibility of CONTRACTOR.
- B. During shipment, handling and storage, the geosynthetics shall be protected from ultraviolet light exposure, precipitation, or other inundation, mud, dirt, dust, puncture, cutting or any other damage or deleterious conditions. To that effect, geosynthetics rolls shall be shipped and stored in relatively opaque and watertight wrappings. An opaque tarp shall be placed over all rolls where the outer wraps are removed or damaged and where the geotextile is exposed. CONTRACTOR shall be responsible for the replacement of damaged or unacceptable materials at no cost to OWNER.
- C. Storage of Materials: A storage area shall be determined on site by CONTRACTOR. The storage of geosynthetic materials shall be the responsibility of CONTRACTOR until the completed installation is accepted by ENGINEER.
- D. Damaged Geosynthetics: Damaged geosynthetic materials shall be repaired, if possible, in accordance with these specifications, or shall be replaced at no additional cost to OWNER.

1.6 MEASUREMENT AND PAYMENT

- A. Geosynthetics shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

PART 2 PRODUCTS

2.1 GEOSYNTHETICS (FILTER FABRIC)

- A. The geosynthetics shall be 10-ounce (or heavier) non-woven filter fabric.
- B. Geosynthetics shall be provided in rolls.
- C. Each roll of geosynthetics shall be externally labeled or tagged to provide product identification sufficient for field determination as well as inventory and quality control purposes. Each roll shall be labeled with the name of manufacturer, roll number, physical

SECTION 31 05 19 - GEOSYNTHETICS

dimensions (length and width) and the material type. Any roll of geosynthetics from which the labeling has been removed or has become illegible, shall not be used, but shall be removed from the site and replaced at the expense of CONTRACTOR.

- D. The geosynthetics shall be sampled, tested, and certified by the manufacturer for the following properties:

MATERIAL PROPERTIES FOR NON-WOVEN GEOTEXTILE FILTER FABRIC		
Property	Specification	ASTM Test Method
Mass per Unit Area (min)	10.0 oz./S.Y.	D-5261
Grab Tensile Strength (min)	250 lbs.	D-4632
Elongation at Break	50 %	D-4632
Tear Strength (min)	100 lbs	D-4533
Apparent Opening Size (maximum U.S. Sieve size)	100 mesh	D-4751

- E. Filter Fabric shall be **Mirafi 1100N by TenCate, 250NW by U.S. Fabrics**, or approved equal.

PART 3 EXECUTION

3.1 DEPLOYMENT

- A. Prior to deployment, CONTRACTOR shall inspect each roll of geosynthetics to verify that the roll has a valid Quality Control Certificate and that has been previously approved by ENGINEER.
- B. Adjacent rolls shall be joined by overlapping the edges a minimum of twelve (12) inches.
- C. The overlap shall be glued, sewn or otherwise fastened or secured at intervals no greater than two feet along a line through the midpoint of the overlap. Additional fasteners shall be installed as necessary to prevent slippage of the geosynthetics regardless of location.
- D. CONTRACTOR shall visually inspect the geosynthetics during deployment for holes, tears or improperly formed geosynthetics. Defective areas shall be repaired or removed and replaced by CONTRACTOR at no additional cost to OWNER.
- E. Smoking shall not be permitted on the geosynthetics.
- F. CONTRACTOR shall be responsible to provide adequate loading (e.g., sand bags or similar items that will not damage the underlying geosynthetic) to prevent movement of

SECTION 31 05 19 - GEOSYNTHETICS

the geosynthetics. Any damage to the geosynthetics shall be repaired at CONTRACTOR's expense.

- G. The geosynthetics shall not be exposed to the sun and elements for more than 72 hours unless the filter fabric has ultraviolet inhibitors. Fabric with ultraviolet inhibitors shall not be exposed for a period in excess of the manufacturer's recommendations, in which case manufacturer shall provide prior to product delivery.
- H. Any damage to the geosynthetics during installation or any fabric that has been exposed to the sun or elements for longer than the 72 hours, or as specified by the manufacturer, shall be replaced by CONTRACTOR at no additional cost to OWNER.
- I. CONTRACTOR shall be responsible to observe placement of geosynthetics. CONTRACTOR shall provide a daily inventory of all geosynthetics deployed to ENGINEER.

3.2 REPAIRS

- A. Any holes, tears or defective areas in the geosynthetics shall be repaired by patching with same type of geosynthetics. The patch shall extend a minimum of twelve (12) inches in all directions beyond the area to be repaired. The patch shall be secured in place by gluing, sewing, or securing the fabric as per these specifications.

- END OF SECTION -

SECTION 31 37 00 - RIPRAP

PART 1 GENERAL

1.1 DESCRIPTION

- A. This Section covers furnishing and placing the loose riprap materials in accordance with these Specifications and in conformity with the lines, grades, and dimensions shown on the drawings and/or as directed by the ENGINEER.

1.2 RELATED WORK

- A. Related work specified in other sections includes, but is not limited to:
 - 1. Section 01 30 00 Contractor Submittals
 - 2. Section 31 05 19 Geosynthetics

1.3 REFERENCES

- A. The latest edition of the following publications forms a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM C-127 Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
 - 2. ASTM C-535 Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

1.4 SUBMITTALS

- A. Provide submittals in accordance with Section 01 30 00 – Contractor Submittals.
- B. Testing certificates shall be submitted prior to acceptance of the rock source to verify the conformity for abrasion resistance or compressive strength to the requirements of this Section.

1.5 STORAGE OF MATERIALS

- A. Materials shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials.

SECTION 31 37 00 - RIPRAP

PART 2 PRODUCTS

2.1 LOOSE RIPRAP

- A. Riprap shall consist of quarry stone which is sound and durable against disintegration under conditions to be met in handling and placing, and is hard and tenacious and otherwise of suitable quality to ensure permanency in the specified kind of work.
- B. Riprap sources shall be approved by the ENGINEER prior to use. Concrete masonry or concrete pavement may not be used for riprap. Riprap shall be well graded with additional gradation requirements for riprap as follows:

LOOSE RIPRAP GRADATIONS

Riprap Designation	% Smaller Than Given Size By Weight	(Inches)	D ₅₀ ** (Inches)
RIPRAP D50 = 18"	70-100	30	18
	50-70	25	
	35-50	18	
	2-10	6	
RIPRAP D50 = 12"	70-100	21	12
	50-70	18	
	35-50	12	
	2-10	4	
RIPRAP D50 = 8"	70-100	14	8
	50-70	12	
	35-50	8	
	2-10	3	
RIPRAP D50 = 6"	70-100	11	6
	50-70	9	
	35-50	6	
	2-10	2	
RIPRAP D50 = 3"	70-100	5	3
	50-70	4	
	35-50	3	
	2-10	1	

** D₅₀ = Nominal particle size

- C. All stone shall be angular (no rounded rock will be permitted), each piece having its greatest dimensions not greater than three times its least dimensions. All stone shall conform to the following test requirements of the American Society for Testing and Materials Standards:

SECTION 31 37 00 - RIPRAP

	Requirements	ASTM Standard
Specific Gravity (min)	2.6	C 127
Los Angeles Abrasion, (max %)	40	C 535

- D. The Contractor shall be responsible for obtaining (by selective mining, crushing, screening, or some other method) loose riprap that will meet the specified material requirements.

2.2 GEOSYNTHETIC (FILTER FABRIC)

- A. Filter Fabric shall be non-woven and shall conform to the requirements of Section 31 05 19 – Geosynthetics.

PART 3 EXECUTION

3.1 LOOSE RIPRAP

- A. Prior to placement of loose riprap, the subgrade shall be graded to the lines and grades shown on the drawings.
- B. Surfaces to receive riprap shall be smooth and firm, free of brush, trees, stumps, and objectionable material.
- C. Where filter fabric is placed under the riprap, the fabric shall be overlapped a minimum of 2-feet at all joints. Upstream sheets shall overlap downstream sheets. The fabric shall be anchored using trenches or aprons at the crest or toe of the slope. Fabric exposed to sunlight longer than 7 days shall be removed and replaced.
- D. Riprap shall generally be placed starting at the lowest elevations and working upward. Riprap shall be placed to the minimum thickness designated on the drawings and shall be positioned in such a manner that will provide uniform distribution of the various sizes of stone and produce a well-keyed mass of rock with the least practical amount of void space. The surface shall be leveled as necessary, to produce a reasonably uniform appearance and the required thickness.
- E. Where riprap is placed over a filter fabric, the riprap shall be placed so as to avoid damage to the fabric.

- END OF SECTION -