BUESCHER STATE PARK
SPILLWAY REPAIR
TECHNICAL REFERENCE MANUAL

Technical Specifications
Geotechnical Reports

TPWD PROJECT # 118686

HALFF ASSOCIATES, INC.
TBPE Firm No. 312
AVO 33245

January 2019
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**GEOTECHNICAL**

PSI dated November 2017

**PERMITTING**

U.S. Army Corps of Engineers’ Nationwide Permit 37
Special Instructions to Bidders

If there is any discrepancy or confusion with contractual language contained in these technical specifications the contractual provisions and methods within the Texas Parks and Wildlife Department’s Uniform General Conditions 2015 (UGC) document will govern this project.

Any reference in the technical specifications to “the Contracting Officer” relates to the TPWD’s Owner’s Designated Representative (ODR). Submittals will follow the TPWD’s regular submittal review process in the UGC. Payment methods referenced in the specifications are superseded by the UGC standard practices.
SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 SUMMARY

This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the spillway remediation work. All the standard project management coordination, scheduling and reporting requirements are already provided for in the Texas Parks and Wildlife Department’s Uniform General Conditions 2015 (UGC). The contractual provisions and methods established within the UGC document will govern this project if there is any discrepancy or confusion with contractual language contained in these technical specifications.

1.2 INFORMATIONAL SUBMITTALS

Submit the required informational submittals per the TPWD Uniform General Conditions in PDF electronic format:

1. Contractor’s construction schedule.
2. Monthly reports which include:
   a. The work accomplished during the month;
   b. The percent of the contract time used;
   c. The percentage of completion of the project on the date of the report;
   d. A description of problem areas encountered during construction;
   e. The dates of the reporting period; and
   f. Any changes in the contact information.
3. Construction test results originated by the Contractor.

The Contractor must maintain construction records during construction which will be used to generate the final Record Drawings.

END OF SECTION 01 32 00
SECTION 01 32 33
PHOTOCGRAPHIC DOCUMENTATION

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 specifications sections apply to this section.

1.2 SUMMARY

Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs
2. Periodic construction photographs.
3. Final completion construction photographs.
4. Preconstruction video recordings.
5. Periodic construction video recordings.

1.3 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three (3) days of taking photographs.
   1. Submit photos on thumb-drive. Include copy of key plan indicating each photograph's location and direction.
   2. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Engineer.
      d. Name of Contractor
      e. Date photograph was taken.
      f. Description of location, vantage point, and direction.
      g. Unique sequential identifier keyed to accompanying key plan.

C. Video Recordings: Submit video recordings within seven (7) days of recording.
   1. Submit video recordings on thumb-drive. Include copy of key plan indicating each video's location and direction.
   2. Identification: With each submittal, provide the following information in file metadata tag:
      a. Name of Project.
      b. Name and address of photographer.
      c. Name of Engineer.
      d. Name of Contractor.
      e. Date video recording was recorded.
      f. Description of vantage point, indicating location, and direction by compass point.

1.4 FORMATS AND MEDIA
A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of twelve (12) megapixels, and at an image resolution of not less than 3200 by 2400 pixels and with vibration-reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of twelve (12) megapixels and capable of recording in full high-definition mode with vibration-reduction technology. Provide supplemental lighting in low light levels or backlit conditions.

C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

D. Metadata: Record accurate date and time and GPS location data from camera.

E. File Names: Name media files with date, project area and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs with maximum depth of field and in focus.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before starting construction, take photographs of Project site, surrounding properties, staging areas, haul roads and access roads, including existing items to remain during construction, from different vantage points, and/or as directed by Engineer.
   1. Flag excavation areas and construction limits before taking construction photographs.
   2. Take at least twenty (20) photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
   3. Take at least twenty (20) photographs to show existing conditions adjacent to property before starting the Work.
   4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take at least twenty (20) photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take at least fifty (50) photographs after date of Substantial Completion for submission as Project Record Documents.

F. Additional Photographs: Engineer may request photographs in addition to periodic photographs specified.
   1. Three days' notice will be given, where feasible.
   2. In emergency situations, take additional photographs within 24 hours of request.
   3. Circumstances that could require additional photographs include, but are not limited to, the following:
a. Immediate follow-up when on-site events result in construction damage or losses.
b. Substantial Completion of a major phase or component of the Work.
c. Extra record photographs at time of final acceptance.

1.6 CONSTRUCTION VIDEO RECORDINGS

A. Video Recording Photographs: Engineer may request photographs in addition to periodic photographs specified.

B. Narration: Describe scenes on video recording by audio narration by microphone while or dubbing audio narration off-site after video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, and direction by compass point.
   1. Confirm date and time at beginning and end of recording.
   2. Begin each video recording with name of Project, Contractor’s name, videographer’s name, and Project location.

C. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, and/or as directed by Engineer.
   1. Flag excavation areas and construction limits before recording construction video recordings.
   2. Show existing conditions adjacent to Project site before starting the Work.
   3. Show existing buildings or structures either on or adjoining Project site to accurately record physical conditions at the start of construction.
   4. Show protection efforts by Contractor.

END OF SECTION 01 32 33
SECTION TABLE OF CONTENTS DIVISION 01

GENERAL REQUIREMENTS SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

Temporary construction facilities, construction traffic provisions, construction signage and controls over contractor operations required for use in all projects.

PART 1  GENERAL

1.1 REFERENCES
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1.3 CONSTRUCTION SITE PLAN
1.4 TREE REMOVAL AND PROTECTION PLAN
1.5 TRAFFIC CONTROL PLAN

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2.2 TEMPORARY TRAFFIC CONTROL
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   2.2.2 Barricades
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PART 3  EXECUTION

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3.8 CLEANUP
3.9 RESTORATION OF STORAGE AREA

-- End of Section Table of Contents --
PART 1       GENERAL

1.1       REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)


1.2       SUBMITTALS

Submittals will be handled in accordance with the TPWD UGC.

Preconstruction Submittals

Construction Site Plan

Tree Removal and Protection Plan

Traffic Control Plan

1.3       CONSTRUCTION SITE PLAN

Prior to the start of work, submit a site plan showing the locations and dimensions of temporary facilities (including layouts and details), equipment and material storage area (onsite and offsite), access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and employee parking areas.

1.4       TREE REMOVAL AND PROTECTION PLAN

Prior to the start of work, submit a plan showing the locations for tree trimming and removal. Tree removal and protection plan shall include all locations detailed in the construction site plan including but not limited to temporary facilities (equipment and material storage area (onsite and offsite)), access and haul routes, and construction site. Show locations of tree protection temporary fences, limits of trimming and quantity (including species) of removal. Tree removal and protection plan shall be in accordance with the plans. Any tree identified for removal on the tree removal plan shall be marked (nail and visible flagging) a minimum of 5 days prior to removal.

1.5       TRAFFIC CONTROL PLAN

Prior to the start of work, submit a traffic control plan showing, but not limited to, the locations, types of devices, and flaggers sign and sealed by a professional engineer licensed in the state of Texas. The traffic control plan shall conform to the latest edition of the MUTCD. The extent of the traffic control plan shall encompass the project area, laydown and staging area and access roads located within the park boundary.

PART 2       PRODUCTS

TEMPORARY CONSTRUCTION
FACILITIES AND CONTROLS     2 of 6     01 50 00
2.1 TEMPORARY SIGNAGE

Temporary signage shall be in accordance with the TPWD UGC.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Haul Roads

Construct access and haul roads necessary for proper prosecution of the work under this contract. Construct with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic are to be avoided. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads are subject to approval by the Contracting Officer. Lighting must be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Access and haul roads shall be cleaned at the end of each work day or as directed by the Department.

2.2.2 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic barricades will be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.2.3 Fencing

Provide fencing along the construction site at all open excavations to control access by unauthorized people.

a. The safety fencing must be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 48 inches high and maximum mesh size of 2 inches, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. Install fencing to be able to restrain a force of at least 250 pounds against it.

b. Enclose the Contractor lay-down area with a temporary 6 ft high chain link fence and gates. Remove the fence upon completion and acceptance of the work.

c. In addition, prior to the start of work, enclose those areas as shown on plan designated with a temporary construction fence, no construction activities shall be permitted in these areas.

Hard Fencing

Construct a temporary 6 foot high chain link fence. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit.

Soft Fencing

The fence shall be high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 48 inches high and maximum mesh size of 2 inches, supported and tightly secured to steel posts located on maximum 10 foot centers

Remove the fence from the work site upon completion of the contract.

PART 3 EXECUTION

TEMPORARY CONSTRUCTION

FACILITIES AND CONTROLS 3 of 6 01 50 00
3.1 Work Area Limits

Mark the areas that need not be disturbed under this Contract prior to commencing construction activities. Mark or fence isolated areas within the general work area that are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

3.2 EMPLOYEE PARKING

Contractor employees will park privately owned vehicles in an area designated in the Construction Site Plan as approved by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking must not interfere with existing and established parking requirements of the TPWD installation.

3.3 AVAILABILITY AND USE OF UTILITY SERVICES

3.3.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

3.4 TRAFFIC PROVISIONS

3.4.1 Maintenance of Traffic

3.4.1.1 Conduct operations in a manner that will not close any thoroughfare or interfere in any way with traffic on railways or highways except with written permission of the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Make all notifications and obtain any permits required for modification to traffic movements outside TPWD facilities. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

3.4.1.2 Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

3.4.1.3 Provide, erect, and maintain, at contractors expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.

3.4.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment performing the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of any damage to roads caused by construction operations.

3.4.3 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Treat dust abatement on
access roads with applications of calcium chloride, water sprinklers, or similar methods or treatment.

3.5 CONTRACTOR'S TEMPORARY FACILITIES

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Move or relocate the Contractor facilities only when approved by the Contracting Officer.

3.5.1 Storage Area

Construct a temporary 6 foot high chain link fence around trailers and materials. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store Trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

3.5.2 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor is responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area.

3.5.3 Maintenance of Storage Area

Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, will be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles; gravel gradation will be at the Contractor's discretion. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers will be edged or trimmed neatly.

3.5.4 Temporary Project Safety Fencing

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. Maintain the safety fencing during the life of the contract and, upon completion and acceptance of the work, will become the property of the Contractor and be removed from the work site.

3.5.5 Dumpsters

Equip dumpsters with a secure cover and painted the standard installation color. Keep dumpster closed, except when being loaded with trash and debris. Locate dumpsters behind the construction fence or out of the public view. Empty site dumpsters at least once a week, or as needed to keep the site free of debris and trash. If necessary, provide 55 gallon trash containers painted the darker installation color to collect debris in the construction site area. For large demolitions, large dumpsters without lids are acceptable, but must not have debris higher than the sides before emptying.

3.5.6 Cleanup

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt
or mud which is tracked onto paved or surfaced roadways must be cleaned away daily, or as directed by the Department. Store any salvageable materials resulting from demolition activities within the fenced area described above or at the supplemental storage area. Neatly stack stored materials not in trailers, whether new or salvaged.

3.5.7 Restoration Of Storage Area

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence that will become the property of the Contractor. Restore areas used by the Contractor for the storage of equipment or material, or other use to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

3.5.8 Restoration Of Haul Roads and Access Routes

Upon completion of the project all haul routes and access roadways damaged by Contractor activities must be restored to pre-construction condition or better at no additional cost to the Department. Pre-Construction documentation provided by the contractor of access roads and haul routes will be used to assess damage and extent of repairs.

-- End of Section 01.50.00--
SECTION 01 56 39 –

TEMPORARY TREE AND PLANT PROTECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions
      and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes general protection and pruning of existing trees and plants that are affected by
      execution of the Work, whether temporary or permanent construction.

1.3 DEFINITIONS
   A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches above the ground for trees up
      to, and including, 4-inch size; and 12 inches above the ground for trees larger than 4-inch size.
   B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation
      to be protected during construction, as indicated on Drawings.
   C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during
      construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of
      the drip line, within a minimum of 5 feet clearance barrier between drip line and fence, unless
      otherwise indicated on Drawings.
   D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For qualified tree service firm.
   B. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which
      establishes preconstruction conditions that might be misconstrued as damage caused by construction
      activities.
      1. Use sufficiently detailed photographs or videotape.
      2. Include plans and notations to indicate specific wounds and damage conditions of each tree or
         other plants designated to remain.

PART 2 – PRODUCTS

2.1 MATERIALS
   A. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements.
      Previously used materials may be used when approved by Owner or Engineer.
      1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density
         extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and
         weighing a minimum of 0.4 lb/ft remaining flexible from minus 60 to plus 200 deg F; inert to
         most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile
         strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties;
         and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet apart.
         a. Height: 4 feet.
         b. Color: High-visibility orange, nonfading.
   B. Plywood Wood for Protection Zone vehicle Crossings:
      1. ¾ inch thick, exterior grade plywood veneer sheathing.
   C. Trunk Protection (Planking) Wood:
      1. 2 X 4-inch or 2 X 6-inch planking or plastic strapping and shall be attached in a manner
         that does not damage the tree.
PART 3 – EXECUTION

3.1 PREPARATION
A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Tie a 1-inch blue-vinyl tape around each tree trunk at 54 inches above the ground.
B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.2 TREE AND PLANT-PROTECTION ZONES
A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
   1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Owner and Engineer.
   2. Post to be set in vertical plumb position with top of posts aligning with adjacent post where grades allow. Fence to be kept tight and neat.
B. Maintain protection zones free of weeds and trash.
C. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Engineer and in accordance to the General Notes.
D. Maintain protection-zone fencing in good condition as acceptable to Consultant and remove when construction operations are complete and equipment has been removed from the site.
   1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
E. Vehicle Crossing of Protection Zone:
   1. Plywood shall be laid down over root zone to distribute weight of construction vehicle.

3.3 EXCAVATION
A. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
B. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.4 ROOT PRUNING
A. Prune roots that are affected by temporary and permanent construction. Prune roots by hand as directed by the Owner and as follows:
   1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, ears, or pulls roots.
   2. Cut Ends: Coat cut ends of roots with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to Owner.
   3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
   4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible.
   B. Root Pruning at Edge of Protection Zone: Prune roots 12 inches outside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.
   C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.5 CROWN PRUNING
   A. Prune branches that are affected by temporary and permanent construction and as approved by the Owner. Prune branches as follows:
      1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period.
      2. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
   B. Chip removed branches and dispose of off-site.

3.6 REPAIR AND REPLACEMENT
   A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations.
      1. Treat damaged trunks, limbs, and roots.
      2. Perform repairs within 24 hours.
      3. Replace vegetation that cannot be repaired and restored to full-growth status in accordance with the General Notes.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS
   A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 01 56 39
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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 57 23

TEMPORARY STORM WATER POLLUTION CONTROL

Temporary construction measures most used in complying with the Best Management Practices of the storm water pollution prevention plan as required by a TPDES Permit

**PART 1 GENERAL**

1.1 SUMMARY

1.2 REFERENCES

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TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 GENERAL

1.1 SUMMARY

The work consists of implementing the storm water pollution prevention measures to prevent sediment from entering streams or water bodies as specified in this Section in conformance with the requirements of the Texas Pollutant Discharge Elimination System (TPDES).

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4873 (2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)


1.3 EROSION AND SEDIMENT CONTROLS

The controls and measures required of the Contractor are described below.

1.3.1 Stabilization Practices

The stabilization practices to be implemented include geotextiles, erosion control mats, protection of trees, preservation of mature vegetation, etc. On the daily Report, record the dates when the major grading activities occur, (e.g., clearing and grubbing, excavation, embankment, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, initiate stabilization practices as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1.3.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases or is precluded by unsuitable conditions caused by the weather, initiate stabilization practices as soon as practicable after conditions become suitable.

1.3.1.2 No Activity for Less Than 21 Days

When the total time period in which construction activity is temporarily ceased on a portion of the site is 21 days minimum, stabilization practices do not have to be initiated on that portion of the site until 14 days have elapsed after construction activity temporarily ceased.
1.3.1.3 Burnoff

Burnoff of the ground cover is not permitted.

1.3.1.4 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified, and protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

1.3.2 Erosion, Sediment and Stormwater Control

a. Stabilized Construction Entrance/Exits

b. Temporary Sediment Control Fence

c. Rock Berm Filter Dam

d. Mulch Sock/Fiber Roll

e. Storm Water Notice of Intent for Construction Activities

f. Submit a Storm Water Notice of Intent for TPDES coverage under the general permit for construction activities and a Storm Water Pollution Prevention Plan (SWPPP) for the project to the TPWD’s Owner’s Designated Representative (ODR) prior to the commencement of work. The SWPPP shall meet the requirements of the State of Texas general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the TPWD’s ODR, to the appropriate State agency for approval, a minimum of 14 calendar days prior to the start of any land disturbing activities. Maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, to reflect current site conditions. Include within the SWPPP:

1) Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

2) Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.

3) Ensure compliance with terms of the State of Texas general permit for storm water discharge.

4) Select applicable best management practices from Texas Commission on Environmental Quality, Erosion Control BMPs.

5) Include a completed copy of the Registration Statement, BMP Inspection Report Template and Notice of Termination except for the effective date.

6) Storm Water Pollution Prevention Measures and Notice of Intent 40 CFR 122.26, EPA 832-R-92-005. Provide a "Storm Water Pollution Prevention Plan" (SWPPP) for the project. The SWPPP will meet the requirements of the State of Texas general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the TPWD’s ODR, to the appropriate State agency for approval, a minimum of 14 calendar days prior to the start of construction. A copy of the approved SWPPP will be kept at the construction on-site office, and continually updated as regulations require to reflect current site conditions.
1.3.3 Stormwater Drainage

There will be no direct discharge of excavation ground water to the sanitary sewer, storm drains, or to the river. Discharge of hazardous substances will not be permitted under any circumstances. Provide erosion protection of the surrounding soils.

1.3.4 Structural Practices

Implement structural practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement structural practices in a timely manner, during the construction process, to minimize erosion and sediment runoff. Location and details of installation and construction are shown on the drawings.

1.3.5 Vegetation

a. Provide temporary protection on slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

b. Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to establish a suitable stand of grass. Seeding shall comply with the requirements of Section 32 92 19 SEEDING and 32 05 33 LANDSCAPE ESTABLISHMENT.

1.4 WATERS OF THE UNITED STATES

Do not enter, disturb, destroy, or allow discharge of contaminants into waters of the United States except as authorized herein. The protection of waters of the United States shown on the drawings in accordance with paragraph LICENSES AND PERMITS is the Contractor's responsibility. Authorization to enter specific waters of the United States identified does not relieve the Contractor from any obligation to protect other waters of the United States within, adjacent to, or in the vicinity of the construction site and associated boundaries.

1.4.1 LICENSES AND PERMITS

Proposed construction activities are under the jurisdiction of the U.S. Army Corps of Engineers' Nation Wide Permit 37. See contract book for a copy of the permit and contractor responsibilities under the permit.

1.5 SUBMITTALS

Submittals will be handled in accordance with the TPWD UGC.

SUBMITTAL PROCEDURES:

Preconstruction Submittals

Storm Water Pollution Prevention Plan Storm Water Notice of Intent (NOI)

Approved Storm Water Pollution Prevention Plan (SWPPP)

Test Reports

Storm Water Inspection Reports for General Permit
Erosion and Sediment Controls
PART 2 PRODUCTS

2.1 Refer to construction plans for details and information regarding temporary erosion control procedures

2.2 STABILIZED CONSTRUCTION ENTRANCE/EXIT Provide materials that meet the details shown on the plans and this Section.

a. Rock Construction Exit. Provide crushed aggregate for long and short-term construction exits. Furnish aggregates that are clean, hard, durable, and free from adherent coatings such as salt, alkali, dirt, clay, loam, shale, soft, or flaky materials and organic and injurious matter. Use 4 to 8 in. open graded aggregate for Type 1 and 2- to 4-in. aggregate for Type 3.

b. Timber Construction Exit. Furnish No. 2 quality or better railroad ties and timbers for long-term construction exits, free of large and loose knots and treated to control rot. Fasten timbers with nuts and bolts or lag bolts, of at least 1/2 in. diameter, unless otherwise shown on the plans or allowed.

c. Foundation Course. Provide a foundation course consisting of flexible base, bituminous concrete, hydraulic cement concrete, or other materials as shown on the plans or directed. Details provided are typical and standard. Foundation course thickness shown on plans is a minimum section. Contractor’s means and methods dictate equipment to be used. Contractor is responsible for ensuring foundation course is sufficient for anticipated equipment loading.

2.3 TEMPORARY SEDIMENT CONTROL FENCE Provide a net-reinforced fence using woven geo-textile fabric. Logos visible to the traveling public will not be allowed. Toad Exclusion Fence detail shown in plans are intended to serve dual purpose and shall be used as Sediment Control Fence.


b. Posts. Provide essentially straight steel posts with a minimum length of 48 in., unless otherwise shown on the plans. T or L shaped steel posts must have a minimum weight of 1.3 lb. per foot. All post are to be capped with safety caps.

c. Net Reinforcement. Provide net reinforcement of at least 12 1/2 gauge galvanized welded wire mesh, with a maximum opening size of 2 x 4 in., at least 24 in. wide, unless otherwise shown on the plans.

d. Staples. Provide staples with a crown at least 3/4 in. wide and legs 1/2 in. long.

e. Used Materials. Use recycled material meeting the applicable requirements if accepted by the Engineer.

2.4 ROCK BERM FILTER DAM – TYPE 2

a. Aggregate. Furnish Aggregate with hardness, durability, cleanliness, and resistance to crumbling, flaking, and eroding acceptable to Engineer. Use 3 to 6 inch aggregate.

b. Wire. Provide minimum 20 gauge galvanized wire for the steel wire mesh and tie wires for Types 2 and 3 rock filter dams. Type 4 dams require:

- double-twisted, hexagonal weave with a nominal mesh opening of 2 1/2 in. x 3 1/4 in.;
- minimum 0.0866 in. steel wire for netting;
- minimum 0.1063 in. steel wire for selvages and corners, and minimum 0.0866 in. for binding or tie wire.
c. **Sand Bag Material.** Furnish sandbags meeting Section 506.2.1, “Sandbags,” except that any gradation of aggregate may be used to fill the sandbags.

2.5 MULCH SOCK/EROSION CONTROL LOG

a. Mulching material can be manufactured on or off the project site and may consist of:

1. Shredded bark
2. Stump grindings
3. Composted bark

b. The mulch shall have the following composition:

1. Wood chips shall be produced from a 3-inch minus screening process (equivalent to TxDOT item 161, Compost, Section 1.6.2.8 Wood Chip Requirements).
2. Large portions of silts, clays, or fine sands are not acceptable.
3. The pH of the mulch shall be between 5.5 and 8.5.
4. The organic matter content shall be greater than or equal to 25% on a dry weight basis.

c. Mulch material must be free of refuse, physical contaminants, and material toxic to plant growth. It is not acceptable for the mulch material to contain ground construction debris, biosolids, manure, or recyclable material.

d. Prior to placement, a representative sample of the mulching material must be tested and certified accepted by the TPWD ODR.

e. “Sock” material will be 100% biodegradable, photodegradable, or recyclable such as burlap, twine, UV photodegradable plastic, polyester, or any other acceptable material. The material mesh opening should be equal to or less than 3/8 inch (10 mm) and the material tensile strength should be equal to or greater than 44 psi (3.09 kg/cm²).

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitats. Prior to the commencement of activities, consult with the TPWD ODR regarding rare species or sensitive habitats that need to be protected. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor’s responsibility. The following species are known and could be affected within the construction area: Houston Toad.

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work that is consistent with the requirements of the U.S. Army Corps of Engineers’ Nation Wide Permit 37. Confine construction activities to within the limits of the work indicated or specified.

3.1.1 Flow Ways

Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as specified and permitted.

3.1.2 Streams
Stream crossings must allow movement of materials or equipment without violating water pollution control standards of the federal, state, and local governments. Construction of stream crossing structures must be in compliance with any required permits including, but not limited to, Clean Water Act Section 404, and Section 401 Water Quality. The TPWD ODR’s approval and appropriate permits are required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Obtain TPWD ODR’s approval prior to installation. Remove temporary culverts or bridges upon completion of work, and repair the area to its original condition unless otherwise required by the TPWD ODR.

3.2 FIELD QUALITY CONTROL

Maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. Use the following procedures to maintain the protective measures.

3.3 INSPECTIONS

3.3.1 General

Inspect disturbed areas of the construction site, areas that have not been finally stabilized used for storage of materials exposed to precipitation, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Conduct inspections at least once every month where sites have been finally stabilized.

3.3.2 Inspections Details

Inspect disturbed areas and areas used for material storage that are exposed to precipitation for evidence of, or the potential for, pollutants entering the drainage system. Observe erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan to ensure that they are operating correctly. Inspect discharge locations or points to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Inspect locations where vehicles exit the site for evidence of offsite sediment tracking.

3.3.3 Inspection Reports

For each inspection conducted, prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. Furnish the report to the TPWD’s ODR within 24 hours of the inspection as a part of the Contractor’s daily CQC Report. A copy of the inspection report shall be maintained on the job site.

3.4 STABILIZED CONSTRUCTION ENTRANCE/EXIT

When tracking conditions exist, prevent traffic from crossing or exiting the construction site or moving directly onto a public roadway, alley, sidewalk, parking area, or other right of way areas other than at the location of construction exits. Construct exits for either long or short-term use.

a. Long-Term. Place the exit over a foundation course, if necessary. Grade the foundation course or compacted subgrade to direct runoff from the construction exits to a sediment trap as shown on the plans or as directed. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed.

1. Type 1. Construct to a depth of at least 8 in. using crushed aggregate as shown on the plans or as directed.
2. Type 2. Construct using railroad ties and timbers as shown on the plans or as directed.
b. Short-Term.
1. Type 3. Construct using crushed aggregate. This type of exit may be used for daily operations where long-term exits are not practical.
2. Type 4. Construct as shown on the plans or as directed.

3.5 TEMPORARY SEDIMENT CONTROL FENCE

Provide temporary sediment-control fence near the downstream perimeter of a disturbed area to intercept sediment from sheet flow. Incorporate the fence into erosion-control measures used to control sediment in areas of higher flow. Install the fence as shown on the plans, as specified in this Section, or as directed.

a. Installation of Posts. Embed posts at least 12 in. deep, or adequately anchor, if in rock, with a spacing of 6 to 8 ft. and install on a slight angle toward the run-off source.
b. Fabric Anchoring. Dig trenches along the uphill side of the fence to anchor 6 to 8 in. of fabric. Provide a minimum trench cross-section of 6 x 6 in. Place the fabric against the side of the trench and align approximately 2 in of fabric along the bottom in the upstream direction. Backfill the trench, then hand-tamp.
c. Fabric and Net Reinforcement Attachment. Unless otherwise shown under the plans, attach the reinforcement to steel posts with T clips, in at least 4 places equally spaced. Sewn vertical pockets may be used to attached reinforcement to end posts. Fasten the fabric to the top strand of reinforcement by hog rings or cord every 15 in. or less.
d. Fabric and Net Splices. Locate splices at a fence post with a minimum lap of 6 in. attached in at least 6 places equally spaced, unless otherwise shown under the plans. Do not locate splices in concentrated flow areas.
e. Requirements for installation of used temporary sediment-control fence include the following:
   i. fabric with minimal or no visible signs of biodegradation (weak fibers),
   ii. fabric without excessive patching (more than 1 patch every 15 to 20 ft.),
   iii. posts without bends, and
   iv. backing without holes.

3.6 ROCK BERM FILTER DAM
a. Rock Berm Filter Dam shall be Reinforced
b. Height. At least 18 in. measured vertically from existing ground to top of filter dam.
c. Top Width. At least 2 ft
d. Slopes. At most 2:1

3.6 MULCH SOCK/ FIBER ROLL
a. Use 12 or 18 inch diameter mulch socks for all sediment control applications. This diameter of mulch sock material has proven to be the most consistent for all sediment control applications.
b. Install mulch socks as shown on the plans or as directed.
c. Mulch socks should be used at the base of slopes no steeper than 2:1
d. Place mulch socks at a 5 ft or greater distance away from the toe of the slopes to maximize space available for sediment deposition.
e. When placed on level contours, sheet flow of water should be perpendicular to the mulch sock at impact and unconcentrated. Install mulch socks using rebar (#5 minimum with safety caps) a minimum of 48 inches in length placed on 2-ft centers. In order to prevent the movement or floating of the mulch sock during rain events or construction operations, install steel posts on alternating sides of the sock. Drive the posts into the ground to a minimum depth of 24 inches, leaving less than 12 inches of post above the exposed mulch sock.
f. In order to prevent water flowing around the ends of the mulch socks, point the ends of the socks up slope.
g. In order to prevent water from flowing between the gaps at adjacent ends of mulch socks, overlap the ends of adjacent mulch socks a minimum of 24 inches. Never stack mulch socks on top of one another.
h. Mulch Socks should be placed using ‘smiles’ and ‘j-hooks’.
i. For steeper slopes, an additional mulch sock can be constructed on the top of the slope and within the slope area as shown on the plans or determined by specific field conditions. Multiple mulch socks are recommended on steeper slopes.
j. Do not use mulch socks in areas of concentrated flow as they are intended to control sheet flow only.

-- END OF SECTION 01 57 23 --
PART 1 – GENERAL

1.01 WORK INCLUDED:
   A. Removal and disposal of designated foundations, walls, concrete, utilities, mechanical, lighting and other structures.

1.02 QUALITY ASSURANCE:
   A. Contractor Qualifications: Minimum of 5 years experience in demolition of comparable structures.
   B. Requirements of Regulatory Agencies:
      1. Comply with requirements of codes.
      2. Comply with requirements of local Public Health Authority.
      3. Comply with local utility companies and/or utility districts.

1.03 SUBMITTALS:
   A. Certificates of severance of utility services.
   B. Permit for transport and disposal of debris.
   C. Demolition procedures and operational sequence for review by Owner's Representative

1.04 JOB CONDITIONS:
   A. Protection:
      1. Erect barriers, fences, guard rails, enclosures, chutes, and storing to protect structures, and utilities remaining intact.
      2. Protect designated trees and plants from damage.
   B. Maintaining Traffic:
      1. Ensure minimum interference with roads, street, driveways, sidewalks, and adjacent facilities.
      2. Do not close or obstruct streets, sidewalks, alleys or passageways without permission from authorities having jurisdiction.
      3. If required by governing authorities, provide alternate routes around closed or obstructed traffic ways.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 PREPARATION:
   A. Prepare adjacent areas to prevent injury, movement or settlement of structures which are to remain.
   B. Arrange for, and verify termination of utility services to include removing meters and capping lines.
   C. Examine the areas and conditions under which the work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.
   D. Remove items scheduled to be salvaged for Owner, and place in designated storage area.

3.02 DEMOLITION:
A. Remove designated foundations, walls, concrete, utilities, mechanical, lighting & other structures and dispose of as follows:
   1. Dispose of items which are not more than two feet below subgrade elevation.
   2. Break items more than two feet below subgrade elevation into sizes not to exceed twelve inches in maximum dimension and leave in place, unless it interferes with succeeding items of construction.
   3. Stockpile ballast, gravel other pavement materials when required.
B. Coordinate removal and relocation of power poles, street lighting, telephone lines and site lighting, with the local electric utility.
C. Remove existing water services, sanitary sewer and storm drainage pipe and structures as indicated and as necessary to facilitate new construction.
D. Remove old foundations, cisterns, etc., which may be encountered within the building area.

3.03 SELECTIVE STRUCTURAL DEMOLITION

A. General:
   1. Prior to the start of demolition, carefully study the drawings and these Specifications.
   2. In company with the Owner or the Owner’s representative, visit the site and verify the extent of demolition to be performed under this contract.
B. Observe all safety and health precautions as required for removal of hazardous materials when hazardous materials are identified as part of the demolition activity. Refer to specific work requirements associated with hazardous material removal.
C. Protect other components, materials and landscaping in the vicinity of the demolition to prevent unintentional damage to components and materials that are not to be removed. Provide temporary support of structures that are to remain that are affected by the materials to be demolished and removed.
D. Remove materials as designated on the drawings. Salvage brick to the extent reasonably feasible for use in re-constructing exterior facades.
E. Demolished materials that are not to be salvaged for reuse on this project shall be considered to be the property of the contractor and shall be completely removed from the jobsite and disposed of properly.
F. The contractor shall be responsible for repair of all components, materials and landscaping damaged as part of the demolition process at no additional cost to the Owner.

3.04 DEBRIS REMOVAL:

A. Promptly remove demolition debris from site.
B. Obtain permission from applicable regulatory authority for disposal of debris to waste disposal site.
C. Do not store or burn materials on site.

END OF SECTION 02 41 00
PART 1 – GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.

1.2 SUMMARY
   A. Section includes:
      1. Removing below-grade construction.
      2. Disconnecting, capping or sealing, and removing site utilities.

1.3 DEFINITIONS
   A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

1.4 MATERIALS OWNERSHIP
   A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 FIELD CONDITIONS
   A. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
      1. Hazardous materials will be removed by Owner before start of the Work.
      2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner.

PART 2 – PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
   B. Standards: Comply with ANSI/ASSE A1.6 and NFPA 241.

PART 3 – EXECUTION

3.1 EXAMINATION
   A. Verify that utilities have been disconnected and capped before starting demolition operations.
   B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS
A. Existing Utilities to be disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
   1. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

3.3 DEMOLITION, GENERAL
A. Explosives: Use of explosives is not permitted.

3.4 DEMOLITION BY MECHANICAL MEANS
A. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.5 SITE RESTORATION
A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

3.6 DISPOSAL OF DEMOLISHED MATERIALS
A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.7 CLEANING
A. Clean adjacent structures and improvements of dust
B. Clean roadways of debris caused by transport daily.

END OF SECTION 02 41 16
SECTION 02 42 91
REMOVAL AND SALVAGE OF HISTORIC CONSTRUCTION MATERIALS

PART 1  GENERAL

1.1  PROJECT DESCRIPTION

The work includes removal and salvage of identified historic items and materials, and removal of resulting rubbish and debris. General demolition of non-historic materials and removal of resulting rubbish and debris shall comply with the requirements of Section 02 41 00 DEMOLITION AND DECONSTRUCTION. Materials to be salvaged or recycled shall be stored daily in areas and manner specified by the Contracting Officer. In the interest of conservation, salvage and recycling shall be pursued to the maximum extent possible. Submit a Work Plan describing the procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, careful removal and disposition of materials specified to be salvaged or recycled, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations.

1.1.1  Protection

1.1.1.1  Protection of Existing Historic Property

Before beginning any removal, salvage or demolition work, survey the site and examine the drawings and specifications to determine the extent of the work. Take necessary precautions to avoid damage to existing historic items that are to remain in place, to be reused, or to remain the property of the TPWD. Repair or restore items damaged by the Contractor to original condition, or replaced, as approved by the TPWD ODR. Coordinate the work of this section with all other work and shall construct and maintain shoring, bracing and supports, as required. Ensure that structural elements are not overloaded and shall provide additional supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.2  SUBMITTALS

Submittals will be handled in accordance with the TPWD UGC.

Product Data

Salvage Work Plan

1.3  QUALIFICATIONS

Provide qualified workers trained and experienced in removal and salvage of historic materials.

PART 2  PRODUCTS

Not Used

PART 3  EXECUTION

3.1  SALVAGED ITEMS
Buescher State Park – Spillway Repair

Salvage items to the maximum extent possible. Prior to any demolition work, historic items to be salvaged shall be removed from the site. Removal of salvageable items shall be accomplished by hand labor to the maximum extent possible. Care shall be taken to not damage historic portions of the structure to remain or items identified for salvage. Furnishings, equipment, and materials not scheduled for salvage or recycling shall be removed prior to any salvaging procedures. Keep a complete recording of all salvaged materials including the condition of such materials before, and after, salvage operations.

3.1.1 Masonry

The following masonry items shall be removed intact and salvaged: Sand Stone Rubble 1-FT or greater in diameter.

3.2.1 Items Salvaged for the TPWD

Salvaged items to remain the property of the TPWD shall be removed in a manner to prevent damage, packed or crated to protect the items from damage, or as directed by the TPWD ODR. Items damaged during removal or storage shall be repaired or replaced to match existing items. Containers shall be properly identified as to contents.

3.3 CLEAN-UP

Upon completion of the work, adjacent areas and structures shall be cleaned of debris caused by salvage and demolition operations. Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

End of Section 02 42 91
SECTION 03 30 00

PREPLACED AGGREGATE CONCRETE
Preplaced Aggregate Concrete (PAC), including concrete materials, mixture design, placement procedures, and finishes.

GENERAL

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182 (2005; R 2017) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)


ACI 214R (2011) Evaluation of Strength Test Results of Concrete

ACI 304 Preplaced Aggregate Concrete for Structural and Mass Concrete


ASME INTERNATIONAL (ASME)

ASME B36.10M (2015; Errata 2016) Welded and Seamless Wrought Steel Pipe

ASTM INTERNATIONAL (ASTM)


ASTM C231/C231M (2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method


ASTM C295/C295M (2012) Petrographic Examination of Aggregates for Concrete


ASTM C441/C441M (2017) Standard Test Method for Effectiveness of Pozzolans or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to the Alkali-Silica Reaction


ASTM C618 (2017a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

ASTM C666/C666M (2015) Resistance of Concrete to Rapid Freezing and Thawing

ASTM C937 (2016) Grout Fluidifier for Preplaced-Aggregate Concrete

ASTM C938 (2016) Standard Practice for Proportioning Grout Mixtures for Preplaced-Aggregate Concrete


ASTM D4791 (2010) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44 (2016) Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 100 (1975) Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing

COE CRD-C 104 (1980) Method of Calculation of the Fineness Modulus of Aggregate

COE CRD-C 114 (1997) Test Method for Soundness of Aggregates by Freezing and Thawing of Concrete Specimens


COE CRD-C 400 (1963) Requirements for Water for Use in Mixing or Curing Concrete


DEFINITIONS

1.1.1 Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

1.1.2 Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.2 MEASUREMENT

1.2.1.1 Preplaced Aggregate Concrete will be measured for payment based on the actual volume placed within the paylines of the structures as indicated.
1.2.1.1.2 Unit of measure: cubic yard, or as otherwise noted in the construction documents.

1.3 SUBMITTALS

1.3.1 Product Data: For each of the following.
  1.3.1.1 Grout Mixture Proportioning
  1.3.1.2 Grout Mixer
  1.3.1.3 Equipment
  1.3.1.4 Vibrators
  1.3.1.5 Testing and Quality Verification for Contractor Quality Control
  1.3.1.6 Curing and Protection
  1.3.1.7 Cold-Weather Placing
  1.3.1.8 Hot-Weather Placing
  1.3.1.9 Aggregates
  1.3.1.10 Admixtures

1.3.1.10.1 Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

1.3.1.11 Color pigments.
1.3.1.12 Repair materials.

1.3.2 Samples: Cured grout sample (for color verification)

1.3.3 Test Reports
  1.3.3.1 Quality of Aggregates
  1.3.3.2 Testing and Quality Verification for Contractor Quality Control

1.4 QUALITY ASSURANCE

1.4.1 The individuals who sample and test concrete or the constituents of concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete construction shall have demonstrated a knowledge and ability equivalent to the ACI minimum guidelines for certification of Concrete Construction Inspector (CCI), Level II.

1.4.1.1 Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1.4.1.1.1 Include the following information in each test report:
  1.4.1.1.1 Admixture dosage rates.
  1.4.1.1.2 Slump.
  1.4.1.1.3 Air content.
  1.4.1.1.4 Seven-day compressive strength.
  1.4.1.1.5 28-day compressive strength.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Comply with ASTM C94/C94M, ACI 301 (ACI 301M) and ACI 304 (ACI 304M).
1.5.2 Comply with manufacturer’s written instructions for minimum and maximum temperature requirements and other conditions for storage.

1.5.3 Store cementitious materials off the ground, under cover, and in a dry location.

1.5.4 Store aggregates covered and in a dry location; maintain grading and other required characteristics and prevent contamination.

1.5.5 Store materials per contract documents with regard to endangered species in the area.

1.6 FIELD CONDITIONS

1.6.1 Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1 and as follows:

1.6.1.1 Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1.6.1.2 When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).

1.6.1.3 Do not use frozen materials or materials containing ice or snow.

1.6.1.4 Do not place concrete in contact with surfaces less than 35 deg F (1.7 deg C), other than reinforcing steel.

1.6.1.5 Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

1.6.2 Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:

1.6.2.1 Maintain concrete temperature at time of discharge to not exceed 95 deg F (35 deg C).

1.6.2.2 Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

2 PRODUCTS

2.1 Design of Preplaced Aggregate Concrete

2.1.1 ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

2.1.1.1 ACI 304 – Preplaced Aggregate Concrete for Structural and Mass Concrete

2.1.2 Specified compressive strength shall be as follows:

2.1.2.1 Minimum 2,000 psi @ 28 Days

2.1.3 Maximum Water-Cement Ratio (W/C)

2.1.3.1 0.5 to 0.6 water-cement ratio, by mass

2.2 MATERIALS

2.2.1 Source Limitations:
2.2.1.1 Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.

2.2.1.2 Obtain aggregate from single source.

2.2.1.3 Obtain each type of admixture from single source from single manufacturer.

2.2.2 Portland Cement: ASTM C150/C150M, [Type I/II], except that the maximum amount of tricalcium aluminate (C3A) in Type I cement shall be 15 percent including the heat of hydration at 7 days, including false set requirements.

2.2.3 Pozzolan for Grout: ASTM C618.

2.2.4 Aggregates

2.2.4.1 Fine Aggregates shall conform to the following requirements as delivered to the grout mixer:

<table>
<thead>
<tr>
<th>U.S. Standard Sieve Size</th>
<th>Percent By Mass, Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4</td>
<td>100</td>
</tr>
<tr>
<td>No. 8</td>
<td>90-100</td>
</tr>
<tr>
<td>No. 16</td>
<td>80-90</td>
</tr>
<tr>
<td>No. 30</td>
<td>55-70</td>
</tr>
<tr>
<td>No. 50</td>
<td>25-50</td>
</tr>
<tr>
<td>No. 100</td>
<td>5-30</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10</td>
</tr>
</tbody>
</table>

In addition to the grading limits specified above, the fine aggregate shall have a fineness modulus of not less than 1.60 nor more than 2.45. The grading of the fine aggregate shall also be controlled so that the fineness moduli of at least four of any five consecutive test samples shall not vary more than 0.15 from the average fineness modulus of all samples previously taken.

2.2.4.2 Coarse Aggregates shall conform to the following requirements:

As specified on the plans

2.2.4.2.1 Particle Shape: The quantity of flat and elongated particles of the coarse aggregate, as defined and determined by ASTM D4791, shall not exceed 25 percent.

2.2.4.2.2 Source: After the award of the contract, designate in writing only one source or combination of sources from which to furnish aggregates. If the Contractor proposes to furnish aggregates from a source or from sources not listed at the end of this section, designate only a single source or single combination of sources for aggregates. If a source for coarse or fine aggregates does not meet the quality requirements stated in paragraph QUALITY OF AGGREGATES, the Contractor may not submit for approval other nonlisted sources but shall furnish the coarse or fine aggregate, as the case may be, from sources listed at the end of this section at no additional cost to the Department.

2.2.5 Quality of Aggregates

2.2.5.1 Fine Aggregates

2.2.5.1.1 Deleterious Substances: ASTM C33

2.2.5.1.2 Soundness: ASTM C33

2.2.5.2 Coarse Aggregates

2.2.5.2.1 Deleterious Substances: Containing no chert and meets requirements ASTM C33, Table 4, Class Designation 2N.

2.2.6 Chemical Admixtures: Chemical admixtures to be used, when required or permitted, shall conform to the appropriate specification listed.
2.2.6.1 Water-Reducing Admixture: ASTM C494/C494M, Type A.
2.2.6.2 Retarding Admixture: ASTM C494/C494M, Type B.
2.2.6.3 Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
2.2.6.4 Air-Entraining Admixture: ASTM C260/C260M.
2.2.6.5 Grout fluidifier: ASTM C937
2.2.6.6 Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments, color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
   2.2.6.6.1 Color: Tan/Brown

2.2.6.7 Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.2.7 CURING MATERIALS

2.2.7.1 Impervious-Sheet Curing Materials
   2.2.7.1.1 Impervious-sheet curing materials shall conform to STM C171, type optional, except polyethylene film shall not be used.

2.2.7.2 Membrane-Forming Curing Compound
   2.2.7.2.1 Membrane-forming curing compound shall meet the requirements of ASTM C309 Type 1-D or 2.

2.2.7.3 Burlap
   2.2.7.3.1 Burlap used for curing shall conform to AASHTO M 182.

2.2.7.4 Water
   2.2.7.4.1 Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that nonpotable water may be used if it meets the requirements of COE CRD-C 400.

2.2.8 Nonshrink Grout
   2.2.8.1 Nonshrink grout shall conform to ASTM C1107/C1107M and shall be a commercial formulation suitable for the application proposed.

2.2.9 RELATED MATERIALS

2.2.9.1 Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

2.2.9.2 Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.

2.2.9.3 Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.2.9.4 Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   2.2.9.4.1 Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
2.2.10 CONCRETE MIXTURES, GENERAL

2.2.10.1 Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).

2.2.10.2 Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

2.2.10.3 Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

2.2.10.3.1 Fly Ash or Other Pozzolans: 25 percent by mass.
2.2.10.3.2 Slag Cement: 50 percent by mass.
2.2.10.3.3 Silica Fume: 10 percent by mass.
2.2.10.3.4 Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
2.2.10.3.5 Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

2.2.10.3.6 Admixtures: Use admixtures in accordance with manufacturer's written instructions.

2.2.10.3.7 Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.3 Grout Mixture Proportioning

Submit determined grout mixture proportions for review, including the quantities of all ingredients per cubic yard and stating the grading of the fine aggregate size that will be used in the manufacture of each quantity of concrete. The submission shall be accompanied with test reports from a laboratory complying with ASTM C1077 which show that proportions thus selected will produce preplaced aggregate concrete of the qualities indicated. Grout mixture proportioning shall meet the following requirements:

2.3.1 Quality of Mixture

2.3.1.1 For each portion of the structure, mixture proportions shall be selected so that the strength and water-cement ratio requirements listed in paragraph DESIGN OF PREPLACED AGGREGATE in PART 1 are met. The source of materials and proportions of Portland cement, pozzolan, fluidifier, fine aggregate, and water shall be stated. The grout proportions for the preplaced aggregate concrete shall be determined in accordance with ASTM C938. The grout proportions for the preplaced aggregate concrete shall meet the specified strength as determined by specimens molded in accordance with ASTM C943 and tested in accordance with ASTM C39/C39M. The maximum water-cement ratios required in paragraph MAXIMUM WATER-CEMENT RATIO (W/C) in PART 1, shall be converted to a ratio by mass of water to cement plus pozzolan or GGBF slag by mass equivalency as described in ACI 211.1. In the case where GGBF slag is used, the mass of the slag shall be included in the equations for the term P, which is used to denote the mass of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent of the total cementitious material. No substitution shall be made in the source or type of materials used in the work without additional tests to show that the new quality of materials and concrete are satisfactory.

2.3.2 Air Content
The air content of the grout mixture as determined by ASTM C231/C231M within 15 minutes after mixing shall be 9.0 plus or minus 1.0 percent.

2.3.3 Grout Flow

The grout flow shall be 18.0 plus or minus 2.0 seconds when sampled from the agitator and tested in accordance with ASTM C939/C939M.

2.4 EQUIPMENT

Submit data on the pumping equipment and methods for pumping and delivering the grout for preplaced aggregate concrete for review by the Contracting Officer, including the methods for transporting, handling, and depositing the coarse aggregate, the location, arrangement, and size of the pipe and inserts, sequence of pumping, method of withdrawal of injection pipe, and the rate of grout injection.

2.4.1 Capacity

The minimum volume of the grout mixer tank and the grout agitator tank should be 17 cubic feet. The grout should be mixed using a high-speed centrifugal mixer operating at a minimum of 1,500 rotations per minute. The grout pump should be a progressive cavity pump that is capable of pumping at least 20 gallons of grout per minute at injection pressure. Alternative equipment should be submitted to the Engineer for approval prior to use.

2.4.2 Batching Equipment

All materials shall be mechanically batched by mass except the water and admixture which may be batched by volume.

2.4.2.1 Scales

The equipment used for determining mass shall conform to the applicable requirements of NIST HB 44, except that the accuracy shall be plus or minus 0.2 percent of scale capacity. Provide standard test reference masses and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices.

2.4.2.2 Batching Tolerances

2.4.2.2.1 Tolerances on Mass

Cementitious materials: Zero to plus 2 percent

Aggregate: Plus or minus 2 percent

Water: Plus or minus 1 percent

Chemical admixture: Zero to plus 6 percent

2.4.2.2.2 Volumetric Tolerances

For volumetric batching equipment, the following tolerances shall apply to the required volume of material being batches:

Water: Plus or minus 1 percent

Chemical admixture: Zero to plus 6 percent.
2.4.2.3 Grout Mixer

Provide a machine especially designed for the mixing of grout, capable of mixing grout mechanically to a uniform consistency. The mixer shall be maintained in satisfactory operating condition and kept free of hardened grout. Should any grout mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until the condition is corrected. Provide the grout mixer with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. Use of revolving-drum concrete mixers will not be permitted. Submit Grout-mixer data including the make, type, and capacity of grout mixers, grout agitators, tank, pump, and pipe system proposed for producing the grout for preplaced aggregate concrete.

2.4.2.4 Agitator Tank

The agitator tank shall have at least the same capacity as the mixer and shall be equipped to agitate the grout effectively and continuously. All grout entering the tank shall be passed through a wire sieve. The sieve size shall not be less than 4.75 mm (No. 4) and not greater than 9.5 mm (3/8 inch).

2.4.2.5 Grout Pump

The grout pump shall operate by positive displacement or progressive cavity. The pump shall be equipped with a bypass line connecting the discharge and inlet or provide circulation into the agitator for continuous operation if line blockage or temporary shutdown of grouting operation occurs. Install a pressure gauge on the pump discharge line to indicate incipient line blockage or a plugged insert pipe. Provide standby pumping equipment.

2.4.3 Grout Pipe System

2.4.3.1 Delivery Pipes

The main delivery line carrying grout from the grout pump to the vicinity of the insert pipes shall be of such diameters that grout velocity at the planned operating rate will range between 0.6 and 1.2 meters (2 and 4 feet) per second. All pipe fittings shall be watertight. Provide unions for quick disconnect to facilitate pipe cleanup when required. A manifold system, in which more than one grout insert is operative at the same time, will not be permitted.

2.4.3.2 Grout Insert Pipes

The pipes shall be 4 inch in diameter conforming to ASME B36.10M Schedule 40. Standard pipe couplings may be used if the couplings are to be withdrawn not more than 15 feet through the preplaced aggregate. Connections between grout delivery hoses and insert pipes shall be by means of quick-opening fittings. Quick-disconnect pneumatic fittings will not be permitted for this purpose. All valves in the pipe system shall be plug or ball type, quick-opening, and which can be easily taken apart and cleaned. Valves over 1 inch in diameter shall be stem lubricated.

2.4.3.3 Sounding Wells

The sounding wells shall be 50 mm (2 inch) diameter steel pipe provided with milled (not burned) 13 mm (1/2-inch) open slots 150 mm (6 inches) long with 300 mm (12 inches) between slots. The pipe shall be reamed and burrs removed before installation. The sounding line shall be equipped with a 25 mm (1 inch) diameter float having a mass so as to sink in water, yet float on the grout surface within the slotted pipe.
3 EXECUTION

3.1 PREPARATION FOR PLACEMENT

3.1.1 Embedded Items

Before placement of coarse aggregate for preplaced aggregate concrete, take care to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Embedded items shall be free of oil and other foreign matter such as loose coatings or ruts, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of grout into voids. Welding, including tack welding, will not be permitted on embedded metals within 600 mm (2 feet) of the surface of the preplaced aggregate concrete.

3.1.2 Construction Joint Treatment

3.1.2.1 Air-water Cutting

Air-water cutting of a construction joint shall be performed at the proper time and only on horizontal construction joints. The air pressure used in the jet shall be 690 kPa (100 psi) plus or minus 70 kPa (10 psi), and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. When approved by the Contracting Officer, a retarder complying with the requirements of COE CRD-C94 may be applied to the surface of the lift to prolong the period of time during which air-water cutting is effective. Prior to receiving approval, furnish samples of the material to be used and demonstrate the method to be used in applications. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, high-pressure water jet or sandblasting will be required as the last operation before placing the next lift.

3.1.2.2 High-Pressure Water Jet

A stream of water under a pressure of not less than 20.7 mPa (3,000 psi) may be used for cleaning. Its use shall be delayed until the concrete is sufficiently hard so that only the surface skin or mortar is removed, and there is no undercutting of coarse-aggregate particles. If the water jet is incapable of a satisfactory cleaning, the surface shall be cleaned by sandblasting.

3.1.2.3 Wet Sandblasting

This method may be used when the concrete has reached sufficient strength to prevent undercutting of the coarse-aggregate particles. The surface of the concrete shall then be washed thoroughly to remove all loose materials.

3.1.2.4 Waste Disposal

The method used in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor, or affect exposed surfaces of the structures, or damage the environment of the project area. The method of disposal shall be subject to approval. NOTE: Project is located in endangered species habitat.

3.2 COARSE-AGGREGATE AND GROUT PLACEMENT

3.2.1 Coarse-Aggregate Washing and Screening
Coarse aggregate shall be washed, screened, and saturated immediately before placement. Washing of the aggregate in the forms will not be permitted. If more than one size of coarse aggregate is used, the aggregate shall be weighed, batches, and mixed in the proper proportions onto the wash screen. The wash screen maybe a vibrating deck or revolving.

3.2.2 Transporting and Placing Coarse Aggregate

Coarse aggregate shall be transported to the forms and placed in substantially horizontal layers by means which will prevent objectionable segregation and breakage. Foreign material and excessive accumulation of fine material on the lift surface shall be removed before placing the next lift. There shall be no vertical drop greater than 1.5 m (5 feet) except where suitable equipment is provided to prevent breakage and segregation and where specifically authorized. Vehicle traffic on top of preplaced coarse aggregate shall not be permitted.

3.2.3 Cold-Weather Placing of Preplaced Aggregate Concrete

When the cold-weather placing of preplaced aggregate concrete is likely to be subjected to freezing temperatures before the expiration of the curing period, concrete shall be placed in accordance with the approved procedures. Submit for approval the proposed materials, methods, and protection if preplaced aggregate concrete is to be placed under cold-weather conditions. The ambient temperature of the space adjacent to the preplaced aggregate concrete placement and surfaces to receive preplaced aggregate concrete shall be above 0 degrees C (32 degrees F). The placing temperature of the preplaced aggregate concrete having a minimum dimension less than 300 mm (12 inches) shall be between 13 and 24 degrees C (55 and 75 degrees F) when measured in accordance with ASTM C1064/C1064M. The placing temperature of the preplaced aggregate concrete having a minimum dimension greater than 300mm (12 inches) shall be between 10 and 21 degrees C (50 and 70 degrees F). Heating of the mixing water or aggregates will be required to regulate the concrete placing temperatures. Materials entering the grout mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals, or other materials shall not be mixed with the grout to prevent freezing. The forms shall be free of frost, and the aggregate, when deposited in the form, shall be free of ice, snow, and frozen lumps.

3.2.4 Hot-Weather Placing of Preplaced Aggregate Concrete

Hot-weather placing of preplaced aggregate concrete shall be properly performed and finished per the approved procedures. Submit for review and approval by the Contracting Officer the proposed materials and methods, if preplaced aggregate concrete is to be placed under hot-weather conditions. The preplaced aggregate concrete temperature shall not exceed 35 degrees C (95 degrees F) when measured in accordance with ASTM C1064/C1064M. Cooling of the mixing water may be required to obtain an adequate placing temperature. A retarder meeting the requirements of paragraph WATER-REDUCING OR RETARDING ADMIXTURES in PART 2, may be used to facilitate placing and finishing. Steel forms and reinforcement shall be cooled prior to concrete placement when steel temperatures are greater than 49 degrees C (120 degrees F).

3.2.5 Grout Mixing and Pumping

3.2.5.1 Charging Sequence

The order of placing material in the mixer shall be as follows:

- Water, or premixed water and fluidifier, if the fluidifier is in a liquid form.
- Cement, or preblended cement and fluidifier, if the fluidifier is in a powder form.
- Remaining ingredients.
3.2.5.2 Mixing Time

The mixing time for each batch, after all solids are in the mixer, shall be not less than 2 minutes. Provide the mixer with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. Mixer shall not be charged in excess of the capacity recommended by the manufacturer nor shall it be operated at a speed in excess of the manufacturer's recommendation.

3.2.5.3 Pumping Procedure

Before starting to mix and pump grout, disconnect the grout hoses from inserts or from inlet points and flush the lines with water. Excess water shall be cleared from the pumps and lines. At the start of grouting, with the grout delivery lines disconnected at the inserts, grout shall be pumped and wasted until grout exiting the line is the same uniform consistency as that being discharged from the mixer. The coarse aggregate within the forms shall be in a moist condition at the time of intrusion. The intrusion shall be started at the lowest point in the aggregate. All pumping shall be done uniformly and at the rate that will permit the grout to fill all voids and avoid displacing the aggregate. After being discharged into the agitator tank, each batch of grout shall be continuously agitated until the batch is fully discharged into the pump. Grout insert pipes shall be properly arranged and spaced to ensure a relatively level uniform grout surface. Initially the outlet end of the intrusion lines shall penetrate the aggregate mass to within 50 mm (2 inches) of the base of the aggregate, unless otherwise directed. The outlets shall be raised as the grout rises, and after grouting has progressed sufficiently to so permit, the outlets shall extend into the grout not less than 300 mm (12 inches). Satisfactory means shall be provided for venting the underside of embedded projections with procedures previously submitted in accordance with paragraph SUBMITTALS. Grouting shall be continued until grout of the specified quality is returned from the vent pipes, thereby indicating completeness of grout injection. During the intrusion procedure, the forms shall be externally vibrated in the vicinity of the grout surface. Sounding wells or other approved means of accurately locating the grout surface without interrupting the intrusion procedure shall be provided for observation and regulation of the level of the grout. Agitation of grout shall be continuous during any shutdown of the intrusion procedure. When there is a lapse in the operation of intrusion in excess of 15 minutes, the grout shall be recirculated through the pump or agitator and pump. The grout delivery lines shall be flushed with clean water if they become blocked. They shall be disconnected from grout insert pipe before the flushing operation is performed and shall not be reconnected to grout insert pipe after flushing until pumping is resumed and grout appears. In no case shall grout be used after appreciable stiffening of the grout mixture has occurred.

3.2.5.4 Blocked Pipes

Exercise care to avoid blocking grout insert pipes by avoiding interruptions in pumping; however, when a pipe becomes blocked, it shall be withdrawn immediately until the end is at least 600 mm (2 feet) above the level of the grout before an attempt is made to unblock it by washing out the line. In no case shall washing be attempted with the end of the grout line inserted in the grout.

3.2.5.5 Placing Temperature

Intrusion grout shall not be placed when the ambient temperature is below 2 degrees C (35 degrees F), unless specifically approved by the Contracting Officer. The preplaced aggregate concrete, without special protection, shall not be subjected to freezing temperatures before grout reaches a unconfined compressive strength of 3500 kPa (500 psi). Grout which is intruded during cold weather shall have a temperature of not less than 5 degrees C (40 degrees F) nor more than 15 degrees C (60 degrees F). Heating of the mixing water or fine aggregate will not be permitted until the temperature of the grout has decreased to 7 degrees C (45 degrees F). All methods and equipment for heating shall be subjected to approval.
3.3 CURING AND PROTECTION

Submit curing medium and methods to be used, for review and approval. Curing and protection shall conform to the following requirements:

3.3.1 Duration

The length of the curing period shall be determined by the type of cementitious material, as specified below. Concrete shall be cured by an approved method.

- Type I Portland Cement: 7 Days
- Type II Portland Cement: 14 Days
- Portland cement blended with 25% or less fly-ash: 14 Days
- Portland cement blended with more than 25% fly-ash: 21 Days

Immediately after placement, preplaced aggregate concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, and mechanical damage. All materials and equipment needed for adequate curing and protection shall be available and at the placement site to the start of grouting. Preplaced aggregate concrete shall be protected from the damaging effects of rain for 12 hours and from flowing water for 14 days. No fire or excessive heat, including welding, shall be permitted near or in direct contact with concrete or concrete embedments at any time.

3.3.2 Moist Curing

Preplaced aggregate concrete that is moist-cured shall be maintained continuously, not periodically, wet for the entire curing period. If water or curing materials stain or discolor concrete surfaces that are to be permanently exposed, they shall be cleaned as required in paragraph APPEARANCE, below. Where wooden form sheathing is left in place curing, the sheathing shall be kept wet at all times. Where steel forms are left in place during curing, the forms shall be carefully broken loose from the hardened concrete and curing water continuously applied into the void to continuously saturate the entire concrete surface. Horizontal surfaces may be moist cured by ponding, by covering with a minimum uniform thickness of 50 mm (2 inches) of continuously saturated sand, or by covering with saturated non-staining burlap or cotton mats. Burlap and cotton mats shall be rinsed to remove soluble substances before using. Water for curing shall comply with the requirements of paragraph WATER in PART 2.

3.3.3 Curing with Membrane-Forming Curing Compound

Concrete may be cured with an approved membrane-forming curing compound in lieu of moist curing, except that membrane curing will not be permitted on any surface to which a grout-cleaned finish is to be applied or other concrete is to be bonded, on any surface containing protruding steel reinforcement, on an abrasive aggregate finish, or any surface maintained at curing temperature by use of free steam. A styrene acrylate or chlorinated rubber compound may be used for surfaces that are to be painted. The curing compound selected shall be compatible with any subsequent paint specified.

3.3.3.1 Pigmented Curing Compound

A pigmented curing compound meeting the requirements of paragraph MEMBRANE-FORMING CURING COMPOUND in PART 2, may be used on surfaces that will not be exposed to view then the project is completed.

3.3.3.2 Nonpigmented Curing Compound
A nonpigmented curing compound containing a fugitive dye may be used on surfaces that will be exposed to view when the project is completed. Concrete cured with nonpigmented curing compound must be shaded from the sun for the first 3 days when the ambient temperature is 32 degrees C (90 degrees F) or higher.

3.3.3.3 Application

The curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. The surfaces shall be thoroughly moistened with water, and the curing compound shall be applied as soon as free water disappears. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 520 kPa (75 psi), at a uniform

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SECTION 31 00 00

EARTHWORK

Earthwork activities for earthen toe berm, buildings, utilities, roadways, railroads, and airfields.

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EARTHWORK

PART 1  GENERAL

1.1  MEASUREMENT PROCEDURES

1.1.1  Excavation

The unit of measurement for excavation and borrow will be the cubic yard, in its original position, as computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. The measurements will include authorized excavation of rock (except for piping trenches that is covered below), authorized excavation of unsatisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material that is scarified or plowed and reused in-place, and will not include the volume excavated without authorization or the volume of any material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow pits, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed grade. Shrink or swelling factors will not be considered in determining the calculated quantities.

1.1.2  Topsoil Requirements

Separate excavation, hauling, and spreading or piling of topsoil and related miscellaneous operations will be considered subsidiary obligations of the Contractor, covered under the contract unit price for excavation except as noted.

1.2  PAYMENT PROCEDURES

Payment will constitute full compensation for all materials, labor, equipment, tools, supplies, and incidentals necessary to complete the work.

1.2.1  Unclassified Excavation

Unclassified excavation will be paid for on a lump sum basis, or as otherwise designated in construction documents, complete in place, including all labor, materials and equipment as necessary to satisfactory complete the work as required, with quantities as shown on the construction plans.

1.2.2  Unclassified Borrow

Unclassified borrow will be paid for on a lump sum basis, or as otherwise designated in construction documents, complete in place, including all labor, materials and equipment as necessary to satisfactory complete the work as required, with quantities as shown on the construction plans.

1.3  CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.
c. Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.

d. Material character is indicated by the boring logs.

e. Hard materials and rock will be encountered at varying depths below existing surface elevations. Contractor shall review boring logs and geotech report for further information.

f. Borrow material in the quantities required is not available at the project site.

1.4 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180 (2010) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

AASHTO T 224 (2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600 (2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

AMERICAN WELDING SOCIETY (AWS)


ASTM INTERNATIONAL (ASTM)


ASTM D 1140 (2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve

ASTM D 1556 (2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 (2009) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2700 kN-m/m³)

ASTM D 2434 (1968; R 2006) Permeability of Granular Soils (Constant Head)
ASTM D 2487 (2010) Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 422 (1963; R 2007) Particle-Size Analysis of Soils


U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)


1.5 DEFINITIONS

1.5.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D 2487 with plasticity index between 12 and 25 with greater than 40% by weight passing No. 200 sieve. Satisfactory materials for grading comprise stones less than 4 inches, except for fill material for pavements which comprise stones less than 3 inches in any dimension or as shown on plans.

1.5.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the TPWD's ODR when encountering any contaminated materials.

1.5.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic per ASTM D4318. Perform testing, required for classifying materials, in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.5.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224.

1.5.5 Topsoil

Material in accordance with Section 32 92 19 Seeding
1.5.6 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 6 inch in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.5.7 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.5.8 Unstable Material

Unstable materials are too wet to properly support the concrete structure.

1.5.9 Porous Fill Material

Clean sand less than 5 percent fines.

1.5.10 Expansive Soils

Expansive soils are defined as soils that have a LL >50% and plasticity index equal to or greater than 25 when tested in accordance with ASTM D 4318.

1.6 SYSTEM DESCRIPTION

Subsurface soil boring logs are shown on the Geotechnical Report appended to the Technical Specifications. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.6.1 Classification of Excavation

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.6.2 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.7 SUBMITTALS

Submittals will be handled in accordance with the TPWD UGC.

Preconstruction Submittals

Shoring and Sheeting Plan (Signed & Sealed by PE Registered in Texas)

Dewatering work plan
Submit 15 days prior to starting work.

Test Reports

Borrow Site Testing

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFF SITE SOIL

Soils brought in from off site for use as backfill shall be tested for petroleum hydrocarbons, BTEX, PCBs and HW characteristics (including toxicity, ignitability, corrosivity, and reactivity). Backfill shall not contain concentrations of these analytes above the appropriate State and/or EPA criteria, and shall pass the tests for HW characteristics. Determine petroleum hydrocarbon concentrations by using appropriate State protocols. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5035/8260B. Perform complete TCLP in accordance with EPA SW-846.3-3 Method 1311. Perform HW characteristic tests for ignitability, corrosivity, and reactivity in accordance with accepted standard methods. Perform PCB testing in accordance with accepted standard methods for sampling and analysis of bulk solid samples. Provide borrow site testing for petroleum hydrocarbons and BTEX from a grab sample of material from the area most likely to be contaminated at the borrow site (as indicated by visual or olfactory evidence), with at least one test from each borrow site. For each borrow site, provide borrow site testing for HW characteristics from a composite sample of material, collected in accordance with standard soil sampling techniques. Do not bring material onsite until tests results have been received and approved by the TPWD ODR.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of 6 to 9 inches. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Remove from the site any surplus of topsoil from excavations and gradings as approved by the TPWD ODR. Care must be taken to not strip off and remove any artifacts from the topsoil excavation sites. The TPWD reserves the right to preview the proposed topsoil excavation site for readily visible artifacts.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes
Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on the Drawings. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum 4 feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, notify Engineer, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed, as approved by the Engineer.

3.2.3 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least 1 feet below the working level. Operate dewatering system continuously until construction work below existing water levels is complete.

3.2.4 Removal of Unyielding Material

Where overdepth is not indicated and unyielding material is encountered in the bottom of the trench, remove such material 12-24 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.5 Removal of Unstable Material

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

3.2.6 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Perform work adjacent to utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known TPWD-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is
granted by the TPWD's ODR. Report damage of utility lines or subsurface construction immediately to the
TPWD's ODR.

3.3 SHORING

Submit drawings and calculations, certified by a registered professional engineer, describing the methods
for shoring and sheeting of excavations. Drawings shall include material sizes and types, arrangement of
members, and the sequence and method of installation and removal. Calculations shall include data
and references used.

A Professional Geotechnical Engineer will provide inspection of excavations and soil/groundwater
conditions throughout construction. The Geotechnical Engineer shall be responsible for performing
pre-construction and periodic site visits throughout construction to assess site conditions. A written report
shall be submitted, at least weekly, informing the Contractor and TPWD ODR of the status of the plan and
an accounting of the Contractor's adherence to the plan addressing any present or potential problems.

3.4 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in
embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to
another grading area except when so directed in writing. Place and grade stockpiles of satisfactory and
unsatisfactory and wasted materials as specified. Keep stockpiles in a neat and well drained condition, giving due
consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at
stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of
satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material.
If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace
such material with satisfactory material from approved sources.

3.5 GROUND SURFACE PREPARATION

3.5.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the TPWD ODR, in
surfaces to receive fill or in excavated areas. Upon concurrence with Engineer, scarify the surface to a depth of 6
inches before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4
horizontal so that the fill material will bond with the existing material. When subgrades are less than the
specified density, break up the ground surface to a minimum depth of 6 inches, pulverizing, and compacting to
the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated
or natural ground portion to a depth of 12 inches and compact it as specified for the adjacent fill.

3.5.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by sheepsfoot
rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being
compacted. Moisten material as necessary to provide the moisture content that will readily facilitate obtaining
the specified compaction with the equipment used.

3.6 UTILIZATION OF EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the
permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory
material in excess of that required for the permanent work and all unsatisfactory material shall be disposed
of as specified in Paragraph "DISPOSITION OF SURPLUS MATERIAL."
3.7 EMBANKMENTS

3.7.1 Earth Embankments

Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Place the material in successive horizontal layers of loose material not more than 8 inches in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise break up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 95 percent laboratory maximum density at a moisture content between -1 percent to 3 percent of optimum moisture content. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements are identical with those requirements specified in paragraph SUBGRADE PREPARATION. Finish compaction by sheepfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.7.2 Subgrade Preparation

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the TPWD ODR. As specified in construction documents or upon concurrence with Engineer, the surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to plus 3 or minus 1 percent of optimum moisture to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified herein.

3.7.3 Proof Rolling

Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. After stripping, proof roll the existing subgrade embankment with six passes of a dump truck loaded with 15 ton, or pneumatic-tired roller. Operate the roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 2 1/2 to 3 1/2 miles per hour. Notify the TPWD ODR a minimum of 5 days prior to proof rolling. Proof rolling shall be performed in the presence of the TPWD ODR. Rutting or pumping of material shall be undercut as directed by the TPWD ODR and replaced with fill and backfill material. Bids shall be based on replacing existing material to an average elevation of 446.00 for areas to receive embankment fill.

3.7.4 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, diskig, and any moisturing or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified.

3.7.4.1 Common Fill Placement

Provide for general site. Use satisfactory materials. Place in 8 inch uncompacted thickness lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both.
3.7.4.2 Porous Fill Placement

Provide as shown on plan on a compacted subgrade. Place in maximum 8 inch lifts with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.7.4.3 Borrow

Where satisfactory materials are not available in sufficient quantity from required excavations, approved borrow materials shall be obtained as specified herein.

3.7.5 Compaction

Finish compaction by sheepfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors operating at minimum 25 Hz, or other approved equipment. Compact each layer of the embankment to at least 95 percent of laboratory maximum density.

3.8 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.8.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until topsoil is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay topsoil until the subgrade has been checked and approved.

3.9 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a 2 inches depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of 4 inches and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from offsite areas.

3.10 TESTING

TPWD UGC and Special Specifications define contractor testing responsibilities.

a. Determine field in-place density in accordance with ASTM D1556/D1556M.

b. Calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938; the calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at intervals as directed by the TPWD ODR. When test results indicate, as determined by the TPWD ODR, that compaction is not as specified, remove the material, replace and recompact to meet specification requirements.
c. Perform tests on recompacted areas to determine conformance with specification requirements. A TPWD appointed registered professional civil engineer shall certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.10.1 Fill and Backfill Material Testing

Test fill and backfill material in accordance with ASTM C136/C136M for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D4318 for liquid limit and for plastic limit; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.

3.10.2 Porous Fill Material Testing
Test porous fill in accordance with ASTM C136/C136M for conformance to gradation specified in ASTM C33/C33M.

3.10.3 Density Test

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Location of Material</th>
<th>Test Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undisturbed native soil</td>
<td>Any</td>
<td>Two random tests on subgrade within construction line.</td>
</tr>
<tr>
<td>Embankments or borrow</td>
<td>Any</td>
<td>One test per lift and per 5,000 sq. ft</td>
</tr>
<tr>
<td>Native soil subgrade other than structures and parking</td>
<td>Any</td>
<td>One test per lift and per 2,500 sq. ft</td>
</tr>
</tbody>
</table>

3.10.5 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 2000 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.11 DISPOSITION OF SURPLUS MATERIAL

Remove from TPWD property surplus or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber. Special Specifications define onsite TPWD disposal area and only at the direction of the TPWD ODR.

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GEOTEXTILE

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END OF SECTION TABLE OF CONTENTS
SECTION 31 05 19

GEOTEXTILE

PART 1 GENERAL

1.1 MEASUREMENT

Measure the as-built surface area, covered by geotextile, in square yards. Allowance will be made for geotextile in anchor and/or drainage trenches but no allowance will be made for waste, overlaps, damaged materials, repairs, or materials used for the convenience of the Contractor.

1.2 PAYMENT

Geotextile installed and accepted will be paid for lump sum, or as specified in construction documents. This lump sum price will include the cost of materials, equipment, installation, testing, and other costs associated with placement of the geotextile.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4354 (1999; R 2009) Sampling of Geosynthetics for Testing
ASTM D4355 (2007) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D4491 (1999a; R 2009) Water Permeability of Geotextiles by Permittivity
ASTM D4533 (2011) Trapezoid Tearing Strength of Geotextiles
ASTM D4873 (2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

US ARMY CORPS OF ENGINEERS (USACE)

COE CW02215 Method to Determine Percent Open Area
Grid Aperture Stability by In-Plane Rotation
1.4 SUBMITTALS

Submittals will be handled in accordance with the TPWD UGC.

PROCEDURES:

Product Data

Thread
Manufacturing Quality Control Sampling and Testing

Samples

Quality Assurance Samples and Tests

Certificates

Geotextile

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle geotextile in accordance with ASTM D4873.

1.5.1 Delivery

Notify the TPWD ODR a minimum of 24 hours prior to delivery and unloading of geotextile rolls packaged in an opaque, waterproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, immediately rewrap rolls with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Label each roll with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

1.5.2 Storage

Protect rolls of geotextile from construction equipment, chemicals, sparks and flames, temperatures in excess of 160 degrees F, or any other environmental condition that may damage the physical properties of the geotextile. To protect geotextile from becoming saturated, either elevate rolls off the ground or place them on a sacrificial sheet of plastic in an area where water will not accumulate.

1.5.3 Handling

Handle and unload geotextile rolls with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

1.6 DEFINITIONS

Minimum Average Roll Value (MARV): Property calculated as typical minus two standard deviations. Statistically, it yields a 97.7 degree of confidence that any sample taken during quality assurance testing will exceed value reported.

PART 2 PRODUCTS

2.1 RAW MATERIALS

A minimum of 7 days prior to scheduled use, submit manufacturer's certificate of compliance stating that the geotextile meets the requirements of this section. For needle punched geotextiles, the manufacturer shall also
certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors and does not contain any needles which could damage other geosynthetic layers. The certificate of compliance shall be attested to by a person having legal authority to bind the geotextile manufacturer.

The contractor shall provide the Engineer with a certificate stating the name of the manufacturer, product name, style number, chemical composition of the product and other pertinent information to fully describe the geosynthetic. The certification shall state that the furnished geosynthetic meets MARV requirements of the specification as evaluated under the Manufacturer’s quality control program.

The manufacturing facility shall be ISO 9001 registered.

2.1.1 Geotextile

Provide geotextile that is a non-woven pervious sheet of polymeric material consisting of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Add stabilizers and/or inhibitors to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material may also be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>UNITS</th>
<th>ACCEPTABLE VALUES</th>
<th>TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>FABRIC WEIGHT</td>
<td>oz/yd²</td>
<td>6</td>
<td>Tex-616-J</td>
</tr>
<tr>
<td>PERMITTIVITY</td>
<td>1/sec</td>
<td>0.5, min</td>
<td>ASTM D4491</td>
</tr>
<tr>
<td>TENSILE STRENGTH</td>
<td>lbs.</td>
<td>200, min</td>
<td>ASTM D4632</td>
</tr>
<tr>
<td>APPARENT OPENING SIZE</td>
<td>U.S. SIEVE</td>
<td>80-120</td>
<td>ASTM D4751</td>
</tr>
<tr>
<td>ELOGATION AT YIELD</td>
<td>percent</td>
<td>20-100</td>
<td>ASTM D4632</td>
</tr>
<tr>
<td>TRAPEZOIDAL TEAR</td>
<td>lbs.</td>
<td>75, min</td>
<td>ASTM D4533</td>
</tr>
</tbody>
</table>

2.1.2 Thread

A minimum of 7 days prior to scheduled use, submit proposed thread type for sewn seams along with data sheets showing the physical properties of the thread. Construct sewn seams with high-strength polyester, nylon, or other approved thread type. Thread shall have ultraviolet light stability equivalent to the geotextile and the color shall contrast with the geotextile.
2.2 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. A minimum of 7 days prior to scheduled use, manufacturer’s quality control manual must be submitted. Documentation describing the quality control program shall be made available upon request. Perform manufacturing quality control sampling and testing in accordance with the manufacturer’s approved quality control manual. At minimum, geotextile shall be randomly sampled for testing in accordance with ASTM D4354, Procedure A. Acceptance of geotextile shall be in accordance with ASTM D4759. Tests not meeting the specified requirements will result in the rejection of applicable rolls.

PART 3 EXECUTION

3.1 QUALITY ASSURANCE SAMPLES AND TESTS

3.1.1 Quality Assurance Samples

Provide assistance to the TPWD ODR in the collection of quality assurance samples for quality assurance testing; assign 7 days in the schedule to allow for testing. Collect samples upon delivery to the site at the request of the TPWD’s ODR. Identify samples with a waterproof marker by manufacturer’s name, product identification, lot number, roll number, and machine direction. The date and a unique sample number shall also be noted on the sample. Discard the outer layer of the geotextile roll prior to sampling a roll. Samples shall then be collected by cutting the full-width of the geotextile sheet a minimum of 3 feet long in the machine direction. Rolls which are sampled shall be immediately resealed in their protective covering.

3.1.2 Quality Assurance Tests

At the TPWD ODR’s option, the Department will provide quality assurance samples to an Independent Laboratory. Samples will be tested to verify that geotextile meets the requirements specified in Table 1. Test method ASTM D4355 shall not be performed on the collected samples. Geotextile product acceptance shall be based on ASTM D4759. Tests not meeting the specified requirements will result in the rejection of applicable rolls.

3.2 INSTALLATION

3.2.1 Subgrade Preparation

The surface underlying the geotextile shall be smooth and free of ruts or protrusions which could damage the geotextile. Subgrade materials and compaction requirements shall be in accordance with Section 31 00 00.

3.2.2 Placement

Notify the TPWD ODR a minimum of 24 hours prior to installation of geotextile. Geotextile rolls which are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid flat and smooth so that it is in direct contact with the subgrade. The geotextile shall also be free of tensile stresses, folds, and wrinkles. On slopes steeper than 10 horizontal on 1 vertical, lay the geotextile with the machine direction of the fabric parallel to the slope direction.

3.3 SEAMS

3.3.1 Overlap Seams

Continuously overlap geotextile panels a minimum of 12 inches at all longitudinal and transverse joints. Where seams must be oriented across the slope, lap the upper panel over the lower panel. If approved, sewn seams may be used instead of overlapped seams.
3.3.2 Sewn Seams

Factory and field seams shall be continuously sewn. The stitch type used shall be a 401 locking chain stitch or as recommended by the manufacturer. For field and factory seams which are sewn, provide at least a 2-meter sample of sewn seam before the geotextile is installed. For seams that are field sewn, the seams shall be sewn using the same equipment and procedures as will be used for the production seams. If seams are sewn in both the machine and cross machine direction, provide samples of seams from both directions. Provide Quality Assurance seam samples to the TPWD at the request of the TPWD's ODR. Seam strength shall meet the minimum requirements specified in Table 1. The thread at the end of each seam run shall be tied off to prevent unraveling. Skipped stitches or discontinuities shall be sewn with an extra line of stitching with a minimum of 18 inches of overlap.

3.4 PROTECTION

Protect the geotextile during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed. Use adequate ballast (e.g. sand bags) to prevent uplift by wind. The geotextile shall not be left uncovered for more than 14 days after installation.

3.5 REPAIRS

Repair torn or damaged geotextile. Clogged areas of geotextile shall be removed. Perform repairs by placing a patch of the same type of geotextile over the damaged area. The patch shall extend a minimum of 12 inches beyond the edge of the damaged area. Patches shall be continuously fastened using approved methods. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Remove and replace geotextile rolls which cannot be repaired. Repairs shall be performed at no additional cost to the Department.

3.6 PENETRATIONS

Construct engineered penetrations of the geotextile by methods recommended by the geotextile manufacturer.

3.7 COVERING

Do not cover geotextile prior to inspection and approval by the TPWD ODR. Place cover soil in a manner that prevents soil from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile and prevents wrinkles from folding over onto themselves. On side slopes, soil backfill shall be placed from the bottom of the slope upward. Cover soil shall not be dropped onto the geotextile from a height greater than 3 feet. No equipment shall be operated directly on top of the geotextile without approval of the TPWD's ODR. Use equipment with ground pressures less than 7 psi to place the first lift over the geotextile. A minimum of 12 inches of soil shall be maintained between full-scale construction equipment and the geotextile. Cover soil material type, compaction, and testing requirements are described in Section 31.00.00 EARTHWORK. Equipment placing cover soil shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 5 mph.

END OF SECTION 31 05 19
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DIVISION 31 – EARTHWORK

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 GENERAL

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1.2 DELIVERY, STORAGE, AND HANDLING

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2.1 TREE WOUND PAINT
2.2 HERBICIDE

PART 3 EXECUTION

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  3.1.1 Roads and Walks
  3.1.2 Trees, Shrubs, and Existing Facilities
  3.1.3 Utility Lines
3.2 CLEARING
3.3 TREE REMOVAL
3.4 PRUNING
3.5 GRUBBING
3.6 DISPOSAL OF MATERIALS
  3.6.1 Saleable Timber
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END OF SECTION TABLE OF CONTENTS
SECTION 31 11 00
CLEARING AND GRUBBING

PART 1GENERAL

1.1 SUBMITTALS

Submittals will be handled in accordance with the TPWD UGC.

Submittals shall include:

Tree wound paint

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2PRODUCTS

2.1 TREE WOUND PAINT

Submit samples in cans with manufacturer’s label of bituminous based paint of standard manufacture specially formulated for tree wounds.

2.2 HERBICIDE

Herbicides will not be permitted unless specifically authorized by the TPWD ODR.

PART 3EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the TPWD ODR immediately of damage to or an encounter with an unknown existing utility line. The Contractor is responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, notify the TPWD ODR in ample time to minimize interruption of the service.

3.2 CLEARING
Clearing shall consist of the felling, trimming, and cutting of trees into sections, as well as the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches at the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branch. Cuts more than 1 inches in diameter shall be painted with an approved tree-wound paint. Clearing and grubbing must be done on all graded areas.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in General Notes, Tree Removal. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS or as listed below.

3.4 PRUNING

Prune trees designated to be left standing within the cleared areas of dead branches 1 1/2 inches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1 inches in diameter with approved tree wound paint.

3.5 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform to the original adjacent surface of the ground.

3.6 DISPOSAL OF MATERIALS

3.6.1 Saleable Timber

All timber on the project site noted for clearing and grubbing shall become the property of the Contractor, and shall be removed from the project site and disposed of off stations.

3.6.2 Nonsaleable Materials

Written permission to dispose of such products on private property shall be filed with the TPWD ODR. Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for saleable timber, shall be disposed of outside the limits of TPWD-controlled land at the Contractor's responsibility, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

END OF SECTION 31 11 00
SECTION 31 36 00
GABIONS AND REVET MATTRESSES

PART 1 GENERAL

1.1 DESCRIPTION

The work to be performed under this specification shall include furnishing, assembling, filling, and tying rock-filled wire mesh compartmented gabions and revet mattresses in accordance with the lines, grades, and dimensions shown on the Drawings or otherwise established in the field by the Engineer or designated representative. The type of construction (i.e. twisted woven mesh, welded mesh or both) and wire sizes [i.e. 13.5 gage (2.2 mm), 12 gage (2.7 mm) or 10 gage (3.4 mm)] shall be as defined in the Drawings or otherwise established by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

PART 2 MATERIALS

Gabions and revet mattresses shall be constructed of galvanized steel wire with polyvinylchloride (PVC) flexible coating. The gabions and revet mattresses shall be of the construction and sizes specified in the Drawings and shall meet the specifications presented herein. Unless otherwise specified in the Drawings or approved by the Engineer or designated representative, the gabions and revet mattresses may be constructed of either double twist woven mesh or welded wire mesh.

Gabions shall be furnished in the specified dimensions within a tolerance of ± 5 percent. Revet mattresses shall be furnished in the specified dimensions within a tolerance of 5 percent for the length and width and 10 percent for the height. For each individual gabion or revet mattress, the same mesh style shall be used for the base, front, ends, back, diaphragms and lid panels. Each gabion or revet mattress shall be manufactured and divided into cells of equal length, no greater than 3 feet (0.9 meter), by diaphragm panels.

2.1 Gabion and Revet Mattress Wire

Gabion wire shall be galvanized steel, Class 3 or A coating, soft temper conforming to ASTM A 641, and shall specifically meet the requirements given below for gabions (12 gage wire) and/or revet mattresses (13.5 wire gage) as called for in the Drawings. PVC coating of the wire may be fusebonded or extruded onto the wire. Galvanization of welded wire shall be performed either before or after welding.

Table 1: Requirements - Mesh Wire for Gabions and Revet Mattress Units

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Gabions</th>
<th>Revet Mattresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire Gage</td>
<td>12 gage</td>
<td>13.5 gage</td>
</tr>
<tr>
<td>Maximum Tensile Strength (ASTM 641)</td>
<td>70,000 psi (483 mPa)</td>
<td>75,000 psi (517 mPa)</td>
</tr>
<tr>
<td>Nominal Wire Diameter (ASTM A 641)</td>
<td>0.106 inch (2.7 mm)</td>
<td>0.0866 inch (2.2 mm)</td>
</tr>
<tr>
<td>Minimum Diameter (ASTM A 641, Table 3)</td>
<td>0.102 inch (2.6 mm)</td>
<td>0.0826 inch (2.9 mm)</td>
</tr>
<tr>
<td>Galvanizing, Zinc (ASTM A 641, Table 1)</td>
<td>0.80 oz/ft² (245 gr/m²)</td>
<td>0.70 oz/ft² (215 gr/m²)</td>
</tr>
</tbody>
</table>
2.2 Gabion Mesh

(A) Woven Mesh

Woven mesh shall be of a uniform nonraveling, double twist hexagonal pattern nominally of dimensions 3.25 inches by 4.5 inches (83 mm by 114 mm). Selvedge wire shall be 10 gage (nominal diameter of 3.4 mm).

(B) Welded Mesh

Mesh opening shall be nominally 3 inches by 3 inches (75 mm by 75 mm). Strength of welds shall meet the following requirements when tested in accordance with section 13.4 of ASTM A-974:

Table 2: Minimum Weld Strength Requirements

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Wire Size (Diameter)</th>
<th>Minimum Average Weld Shear Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gage (mm)</td>
<td>English Units (SI Units)</td>
</tr>
<tr>
<td>Gabions</td>
<td>12 (2.7)</td>
<td>472 lbf (2.10 kN)</td>
</tr>
<tr>
<td>Revet Mattress</td>
<td>13.5 (2.2)</td>
<td>292 lbf (1.30 kN)</td>
</tr>
</tbody>
</table>

(C) Manufacturing

Twisted wire mesh gabions shall be manufactured in conformance with ASTM A-975, while welded wire mesh gabions shall be manufactured in conformance with ASTM A-974.

2.3 Revet Mattresses

(A) Woven Mesh

Woven mesh shall be of a uniform nonraveling, double twist hexagonal pattern, nominally of dimensions 2.5" × 3.25" (64 mm by 83 mm). Selvedge wire shall be 12 gage (nominal diameter of 2.7 mm).

(B) Welded Mesh

Mesh opening shall be nominally 1.5" × 3.0" (38 mm by 76 mm). Strength of welds shall meet the requirements listed in Table 2 for 13.5 gage (2.2 mm) wire, when tested in accordance with section 13.4 of ASTM A-974:

(C) Manufacturing

Twisted wire mesh revet mattresses shall be manufactured in conformance with ASTM A-975, while welded wire mesh revet mattresses shall be manufactured in conformance with ASTM A-974.

2.4 PVC Coating

All wire used in fabrication of the gabions, revet mattresses and wiring operations during construction shall, after zinc coating, have a fusebonded or extruded coating of PVC. The coating shall be brown in color. The thickness shall be nominally 0.020 inch (0.5 mm), and shall not be less than 0.015 inch (0.38 mm) in thickness. It shall be capable of resisting deleterious effects of natural weather exposure, and immersion in salt water.
For PVC-coated welded wire fabric panel, cutting of the panels shall not be allowed closer than \( \frac{3}{4} \) inch (1/8 inch (6 mm (3.18 mm)) after fabrication in order to prevent exposure near the welds.

(A) Initial Properties:

1) Woven Mesh:

The initial properties of the PVC coating material shall have a demonstrated ability to conform to the following requirements specified in ASTM A-975:

a) Specific Gravity:

The specific gravity as determined in accordance with ASTM D-792 shall be between 1.3 to 1.35.

b) Durometer Hardness:

The hardness as determined in accordance with ASTM D-2240 shall be between 50 to 60, Shore D.

c) Tensile Strength:

The tensile strength when tested in accordance with ASTM D-412 shall not be less than 2985 psi (20.6 mPa).

d) Modulus of Elasticity at 100% Elongation:

The Modulus of Elasticity when determined in accordance with ASTM D-412 shall not be less than 2700 psi (18.6 mPa).

e) Resistance to Abrasion:

The percentage loss in weight (mass) during abrasion testing in accordance with ASTM D-1242 shall be less than 12%.

f) Brittleness Temperature:

The brittleness temperature shall not be higher than 150F (-9.00C) or a lower temperature specified by the Engineer, when tested in accordance with ASTM D-746. The maximum brittleness temperature should be at least 150F (80C) below the minimum temperature at which the gabion will be handled or filled.

2) Welded Mesh:

The initial properties of the PVC coating material shall have a demonstrated ability to conform to the following requirements specified in ASTM A-974:

a) Specific Gravity:

The specific gravity as determined in accordance with ASTM D-792 shall be between 1.20 and 1.40.

b) Durometer Hardness:

The hardness as determined in accordance with ASTM D-2240 shall not be less than 75, Shore A.

c) Tensile Strength:

The tensile strength when tested in accordance with ASTM D-638 shall not be less than 2275 psi (15.7 mPa).
d) Modulus of Elasticity:
The Modulus of Elasticity when determined in accordance with ASTM D-638 shall not be less than 1980 psi (13.7 mPa).

e) Resistance to Abrasion:
The percentage loss in weight (mass) shall be less than 12 % during abrasion testing in accordance with ASTM D-1242, Method B, at 200 cycles, CSI-A abrader tape, 80 grit.

f) Brittleness Temperature:
The brittleness temperature shall not be higher than 150F (-9.00C) or a lower temperature specified by the Engineer, when tested in accordance with ASTM D-746. The maximum brittleness temperature should be at least 150F (80C) below the minimum temperature at which the gabion will be handled or filled.

g) Adhesion:
The PVC coating on the wire shall adhere to the wire such that the coating breaks rather than separates from the wire, when tested in accordance with the PVC Adhesion Test described in Section 13.3 of ASTM A-974.

h) Mandrel Bend:
The PVC-coated wire, when subjected to a single 3600 bend at 00F (-180C) around a mandrel ten times the diameter of the wire, shall not exhibit breaks or cracks in the PVC coating.

(B) Performance Tests:
The PVC coating shall have the demonstrated ability to withstand the specified exposure testing.

1) Exposure to Salt Spray: The PVC shall show no effect after 3000 hours of salt spray exposure in accordance with ASTM Test Method B-117.

2) Exposure to Ultraviolet Rays:
The PVC shall show no effect of exposure to ultraviolet light with test exposure of 3000 hours, using apparatus Type E and 145°F (63°C), when tested in accordance with ASTM Practice D-1499 and G-23.

(C) Properties After Exposure Tests:
After conclusion of the salt spray and exposure to ultraviolet light tests, the PVC shall not show cracks, blisters or splits, nor any noticeable change in color. In addition the PVC coating shall not show cracks or breaks after the wires are twisted in the fabrication of the mesh, nor shall there be any moisture intrusion under the PVC coating as a result of the test.

After completion of the exposure tests the following criteria shall also be met:

1) Woven Mesh:
   a) The Specific Gravity shall not change more than 6% of its initial value.
   b) The Durometer Hardness shall not change more than 10% of its initial value.
   c) The Tensile Strength shall not change more than 25% of its initial value.
   d) The Resistance to Abrasion shall not change more than 10% of its initial value.

2) Welded Mesh:
a) The Specific Gravity shall not change more than 6% of its initial value.
b) The Modulus of Elasticity shall not change more than 25% of its initial value.
c) The Tensile Strength shall not change more than 25% of its initial value.
d) The Resistance to Abrasion shall not change more than 10% of its initial value.

(D) Salt Spray Resistance for Fastener:

The fasteners for twisted mesh wire gabions and revet mattresses shall be subjected to Salt Spray Test of Test Method B-117 for a period of not less than 48 ±1 hour cycle length. After testing the fasteners, the selvedge, or mesh wire confined by the fasteners shall show no rusty spots on any part of the surface excluding the cut ends.

2.5 Stone

(A) Gabion Basket Stones

Stone fill shall be durable and of suitable quality to ensure permanence in the structure. The stone used to fill the gabion baskets shall be a clean, sound, and durable rock meeting the following requirements. It shall have a wearing loss less than 35 percent when the stone is tested with the Los Angeles Abrasion Machine in accordance with ASTM Test Method C535 (TxDOT Test Method Tex-410A). The loss of material experienced during five cycles of magnesium sulfate exposure conducted in accordance with TxDOT Test Method Tex411A for Rock RipRap shall not exceed 18 percent. The stone shall be well graded to produce a dense fill, angular in texture, while meeting the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent by Weight (Mass) % Passing Each Individual Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 8 Inch</td>
<td>100</td>
</tr>
<tr>
<td>200 mm</td>
<td></td>
</tr>
<tr>
<td>US 4 Inch</td>
<td>0—5</td>
</tr>
<tr>
<td>100 mm</td>
<td></td>
</tr>
<tr>
<td>US 3 Inch</td>
<td>0</td>
</tr>
<tr>
<td>75 mm</td>
<td></td>
</tr>
</tbody>
</table>

The minimum unit weight (unit mass) of a rockfilled gabion shall be 120 pcf [1.92 megagrams (mg) per cubic meter]. Verification of unit weight (mass) shall be performed when ordered by the Engineer, by constructing a test gabion with materials supplied for construction with the same effort and method intended for production gabions.

(B) Revet Mattress Stone:

The stone used to fill the revet mattresses shall be as specified for gabions except that it shall have a maximum dimension of 5 inches (125mm) and a minimum dimension of 3 inches (75 mm). The majority of the stone shall be in the 3 to 4 inch (75 to 100 mm) range; cubical or rounded in shape. A tolerance of 5% shall be allowed on the upper and lower dimensions of the rock.

2.6 Connections

(A) Wire
Lacing wire and connecting wire shall be 13.5 gage (0.087 inch (2.20 mm)) PVC coated galvanized steel, Class 3, soft temper, conforming to ASTM A-641. During testing, any separation of 2 inches (50 mm) or more between connecting wires shall be considered as a failure.

(B) Spiral Binder for Welded Wire Mesh

Spiral binders shall consist of 0.106 inch (2.7 mm) PVC coated wire for the gabion and 0.087 inch (2.2 mm) PVC coated wire for the revet mattresses. Spiral binders shall have a 3.0 inch (75 mm) maximum separation between continuous successive loops (3 inch or 75mm pitch).

The binder shall be made of galvanized steel, Class 3, soft temper, conforming to ASTM A-641.

(C) Alternate Fasteners for Twisted Woven Mesh

Alternate fasteners, acceptable for use by the intended gabion basket manufacturer, may be submitted to the Engineer for consideration and approval prior to construction. The fasteners may consist of split ring or interlocking fasteners. Alternate fasteners systems shall produce a joint that meets the requirements of ASTM A-975, Section 7, Table 2.

2.7 Fastener System

The Contractor shall provide a complete description of the fastener system, including the number of fasteners required for all vertical and horizontal connections for single- and multiple-basket joinings, as well as the number and size wires the fastener is capable of properly joining. The Contractor shall provide a description of a properly installed fastener, including test reports, drawings and/or photographs. Properly formed fasteners shall meet the requirements of ASTM A-974 for welded wire mesh or ASTM A-975 for twisted woven mesh.

(A) Each interlocking fastener shall be locked and closed.

(B) Each overlapping ring fastener shall be closed and the free ends shall overlap an average of 1 inch (25 mm).

(C) Spiral binders shall be screwed into position such that they pass through each mesh opening along the joint. In order to prevent unraveling, both ends of the spiral shall be crimped back around itself.

(D) Wire fasteners shall not be used to join more wires, or larger wires, than tested and approved for the application.

2.8 Panel to Panel Joint Strength

The minimum strength of the joined panels shall be as specified in Section 7.3 of ASTM A-974 for Welded wire panels or Section 7.3 of ASTM A-975 for twisted woven mesh.

2.9 Miscellaneous

Aggregate bedding, geotextiles or other materials shall conform to the requirements established on the Drawings.

2.10 Certificate of Compliance

The Contractor shall submit Certificates of Compliance for all materials proposed for use to the Engineer for review and approval one week prior to construction.

PART 3 EXECUTION

3.1 Construction

Twisted wire mesh Gabon's and revet mattresses shall be supplied in the forms allowed in ASTM A-975, while welded wire mesh Gabon's and revet mattresses shall be supplied in a form allowed in ASTM A-974.
The Gabion/revet mattress manufacturer/supplier will be required to have a qualified representative on site at the start of gabion/revet mattress construction. The Contractor shall submit work experience documentation of the representative for review/approval by the Engineer or designated representative. The representative shall be available for consultation as needed throughout the gabion construction.

Gabions and revet mattresses shall be constructed to the lines and grades shown on the Drawings. Individual or groups of gabions or revet mattresses, which deviate from line and grade, shall, at the direction of the Engineer or designated representative, be removed and replaced at no cost to the owner. Gabions or revet mattresses, which are constructed with bulges, and/or underfilled, loosely filled, or otherwise lacking a neat and compact appearance shall, at the direction of the Engineer or designated representative, be repaired/replaced at no cost to the owner. Underfilling of gabion/revet mattress corners to facilitate insertion of spirals shall not be permitted.

3.1 Foundation Preparation

The foundation shall be excavated to the extent shown on the Drawings or as directed by the Engineer or designated representative. All loose or otherwise unsuitable materials shall be removed. All depressions shall be carefully backfilled to grade. The depressions shall be backfilled with suitable materials from adjacent required excavation, or other approved source, and compacted to a density at least equal to that of the adjacent foundation. If pervious materials are encountered in the foundation depressions, the areas shall be backfilled with free draining materials.

Any buried debris protruding from the foundation that will impede the proper installation and detrimentally impact the final appearance of the gabion, shall also be removed, and the voids carefully backfilled and compacted as specified above. Immediately prior to gabion or revet mattress placement, the prepared foundation surface shall be inspected and approved by the Engineer and no material shall be placed thereon until that area has been approved.

Placement of filter material and/or filter fabric shall be as shown on the Drawings or directed by the Engineer.

3.2 Gabion/Revet Mattress Basket Assembly

No work shall take place using PVC coated materials unless both the ambient air temperature and the temperature of the PVC materials are at least 15°F (8°C) above the brittleness temperature of the PVC materials.

Assembly of gabions and revet mattresses shall consist of shaping and tying each individual basket. Baskets shall be assembled by connecting all untied edges including diaphragms with lacing wire, spirals or approved fasteners. The connections for the completed assemblies shall conform to the requirements of Section 7 of ASTM specifications A-974 (welded wire) and Section 7.3 and Table 2 of A-975 (double twisted).

Assembly of baskets, connection of baskets together and lid closures shall be accomplished in accordance with one of the following approved procedures:

(A) Lacing Wire:

Using lacing wire of appropriate length, secure one end of the wire onto the basket corner by looping and twisting the lacing wire together. Proceed along the joint by tying with double loops every other mesh opening at intervals not more than 6 inches (150 mm) apart, while pulling the basket elements tightly together. Secure the other end of the lacing wire again by looping and twisting the wire around itself.

(B) Spiral Binders for Welded Wire Mesh:
Spiral binders, meeting the minimum acceptance criteria of article 594S.2(6)(c) shall be screwed into position such that they pass through each mesh opening along the joint. To prevent unraveling, each end of the spiral binder shall be crimped back against itself.

(C) Alternate Fasteners for Twisted Woven Mesh:

Interlocking fasteners meeting the minimum acceptance criteria of article 594S.2(6)(c), shall be installed with, as a minimum, one interlocking fastener in every other opening.

Ring fasteners meeting the minimum acceptance criteria of 594S.2(6)(c), shall be installed with, as a minimum, one split ring fastener in every opening, having a minimum 1 inch (25 mm) total overlap and securing only the number and diameter of wires for which tested.

Placing of gabions and revet mattresses shall consist of installing baskets to the lines and grades shown on the Drawings. Gabions and revet mattresses shall be securely fastened to each adjoining unit along the vertical and top reinforced edges of all contact surfaces. Overlying rows of baskets shall be staggered appropriately. Empty sections stacked on a filled line of gabions and revet mattresses shall be securely fastened to the bottom unit along the front, back and ends.

Prior to the placement of rock, the baskets used in the front vertical exposed faces of retaining walls shall be aligned. To facilitate alignment, tension may be applied to empty units at the direction of the Engineer or designated representative.

3.3 Filling of Gabions and Revet Mattresses

The gabions and revet mattresses may be filled by machine, in maximum lifts of 12 inches (300 mm). The machine work shall be supplemented with handwork to avoid bulges and provide a compact mass with a minimum of voids. Care will be exercised so as not to damage the gabion/revet mattress elements or wire coating by limiting height of drop during filling to 3.0 feet (0.9 meter) for Gabions and 1.5 feet (0.5 meter) for revet mattresses. Undue deformation or bulging of the mesh shall be corrected prior to further stone filling. Where specified on the Drawings, select large stone shall be hand placed on vertical outside faces to achieve a desired neat appearance.

During placement, the depth of stone in any cell shall not exceed the depth in an adjoining cell by more than one foot (300 mm). Stone smaller than the mesh opening found against vertical faces shall be removed.

Two connecting wires in each direction for end units and two parallel connecting wires perpendicular to the exposed face for exposed face units shall be installed at every 12 inch (300 mm) lift. The connecting wires shall loop around two mesh openings, and the ends of wires shall be securely twisted with a minimum of three twists after looping. Prefabricated connecting wire may be used in lieu of connecting wire.

Connecting wires associated with 18 inch (450 mm) gabions shall be installed when and as specified on the Drawings or as recommended by the gabion/revet mattress manufacturer.

The gabion or revet mattress unit shall be overfilled by 1½ to 2 inches (37.5 to 50 mm) and the lid shall be bent and stretched until it meets the perimeter edges of the front and end panels. The stretching shall be accomplished using an approved lid closing tool in order to prevent damage to the PVC coating. Crow bars or similar single point leverage devices will not be allowed. The lid shall then be securely tied with lacing wire, spirals or approved fasteners to the fronts, ends and diaphragms. Excessive deformation of the lid panel to facilitate closing of a bulging gabion or revet mattress will not be permitted.

All backfill shall be placed and compacted in sequence with the filling of the baskets; however, care shall be exercised in compacting the fill behind a single row of baskets since excessive compaction effort can displace the gabions/revet mattresses from the desired alignment.
GABIONS AND REVET MATTRESSES
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PART 1  GENERAL

1.1  REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)


ASTM D5851  (1995; R 2015) Planning and Implementing a Water Monitoring Program

TREE CARE INDUSTRY ASSOCIATION (TCIA)


U.S. GREEN BUILDING COUNCIL (USGBC)


1.2  DEFINITIONS

1.2.1  Pesticide

Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and are specifically labeled for use by the U.S. Environmental Protection Agency (EPA). Also, any substance used as a plant regulator, defoliant, disinfectant, or biocide. Examples of pesticides include fumigants, herbicides, insecticides, fungicides, nematicides, molluscicides and rodenticides.

1.2.2  Stand of Turf

95 percent ground cover of the established species.

1.2.3  Planter Beds

A planter bed is defined as an area containing one or a combination of the following plant types: shrubs, vines, wildflowers, annuals, perennials, ground cover, excluding turf. Trees may also be found in planter beds.
1.3 RELATED REQUIREMENTS

Section 32 92 19 SEEDING applies to this section for installation of seed requirements, with additions and modifications herein.

1.4 SUBMITTALS

Submittals will be handled in accordance with the TPWD UGC.

Maintenance inspection report

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Delivery

Deliver fertilizer, gypsum, iron to the site in original containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, gypsum may be furnished in bulk with a certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Fertilizer, Lime, Iron, Mulch Storage

Material shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations away from contaminants.

1.5.2.2 Antidessicants Storage

Do not store with fertilizers or other landscape maintenance materials.

1.5.3 Handling

Do not drop or dump materials from vehicles.

PART 2 PRODUCTS

2.1 POST-PLANT FERTILIZER

Fertilizer for groundcover, wildflowers, and grasses is not permitted.

2.2 WATER

Source of water shall be approved by the Contracting Officer, and be of suitable quality for irrigation.

2.3 MULCHES TOPDRESSING

Free from noxious weeds, mold, pesticides, or other deleterious materials.

2.3.1 Organic Mulch Materials

Biobased content shall be a minimum of 100 percent. Wood cellulose fiber shall be processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application. Paper-based hydraulic mulch shall contain a minimum of
2.4 PESTICIDES

Pesticides and herbicides are not permitted.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide landscape construction maintenance to include irrigation equipment cleaning and adjustments, mowing, fertilizing, watering, weeding, for all newly installed landscape areas, unless indicated otherwise, and at all areas inside or outside the limits of the construction that are disturbed by the Contractor's operations.

3.1.1 Policing

The Contractor shall police all landscaped areas. Policing includes removal of leaves, branches and limbs regardless of length or diameter, dead vegetation, paper, trash, cigarette butts, garbage, rocks or other debris. Policing shall extend to both sides of fencing or walls. Collected debris shall be promptly removed and disposed of at an approved disposal site.

3.2 IRRIGATION ESTABLISHMENT PERIOD

The irrigation establishment period will commence on the date that inspection by the Contracting Officer shows that the temporary irrigation equipment furnished under this contract have been satisfactorily installed and is functional and shall continue for a period of 365 days.

3.2.1 Maintenance During the Irrigation Establishment Period

Begin maintenance immediately after irrigation equipment has been installed and is functional. Inspect irrigation equipment at least once a week during the installation and establishment period and perform needed maintenance promptly. Automatic controllers not equipped with rain shut-off sensors shall be turned off during periods of rain that exceed twelve hours of continuous rainfall in one day or during rain storms of one day or more. Once the rain has subsided timers shall be reactivated. Irrigation controllers shall be inspected and reprogrammed after power outages. Contractor shall be responsible for winterization and startup. Sprinkler heads shall direct water away from buildings and hard surfaced areas.

3.2.2 Water Restrictions

The Contractor shall abide by state, local or other water conservation regulations in force during the establishment period. Automatic controller shall be adjusted to comply with the water conservation regulations schedule.

3.2.3 Final Acceptance

Upon completion of the irrigation establishment period and final acceptance of groundcover and exterior plants, irrigation equipment shall be removed.

3.3 GROUNDCOVER ESTABLISHMENT PERIOD

Groundcover establishment period will commence on the date that inspection by the TPWD ODR shows that the new turf furnished under this contract has been satisfactorily installed to a 95 percent stand of coverage. The establishment period shall continue for a period of 730 days.
3.3.1 Frequency of Maintenance

Begin maintenance immediately after turf has been installed. Inspect areas once a week during the installation and establishment period and perform needed maintenance promptly.

3.3.2 Promotion of Growth

Groundcover shall be maintained in a manner that promotes proper health, growth, natural color. Turf shall have a neat uniform manicured appearance, free of bare areas, ruts, holes, weeds, pests, dead vegetation, debris, and unwanted vegetation that present an unsightly appearance. Mow, remove excess clippings, eradicatce weeds, water, fertilize, overseed, and perform other operations necessary to promote growth, as approved by TPWD ODR and consistent with approved Integrated Pest Management Plan. Remove noxious weeds common to the area from planting areas by mechanical means.

3.3.3 Mowing

3.3.3.1 Turf

Turf shall be mowed at a uniform finished height. Mowing of turf shall be performed in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Prior to mowing, all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on a turf area shall be picked up and disposed. Adjacent paved areas shall be swept/vacuumed clean.

3.3.3.2 Native Grasses

Mow above height of native grass seedlings (approximately 3.5 to 4 inches). Mow during spring or early summer. Do not mow after early summer during the second growing season.

3.3.3.3 Wildflowers

Mow three times per season above height of the wildflowers (approximately 12 to 15 inches).

3.3.4 Post-Fertilizer Application

Apply turf fertilizer in a manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. The method of application, fertilizer type and frequencies shall be determined by the laboratory soil analysis results the requirements of the particular turf species. Fertilizer shall be applied by approved methods in accordance with the manufacturer’s recommendations.

3.3.5 Turf Watering

The Contractor shall perform irrigation in a manner that promotes the health, growth, color and appearance of cultivated vegetation and that complies with all Federal, State, and local water agencies and authorities directives. The Contractor shall be responsible to prevent over watering, water run-off, erosion, and ponding due to excessive quantities or rate of application. The Contractor shall abide by state, local or other water conservation regulations or restrictions in force during the establishment period.

3.3.6 Replanting

Replant in accordance with Secton 32 92 19 SEEDING and within specified planting dates areas which do not have a satisfactory stand of turf. Replant areas which do not have a satisfactory stand of other groundcover and grasses.

3.3.7 Final Inspection and Acceptance

Final inspection will be make upon written request from the Contractor at least 10 days prior to the last day
of the turf establishment period. Final turf acceptance will be based upon a satisfactory stand of turf. Final acceptance of wildflower and grass areas will be based upon a stand of 95 percent groundcover of established species.

3.3.8 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the TPWD until work has been completed, inspected and accepted by TPWD ODR.

3.3.9 Slope Erosion Control Maintenance

The Contractor shall provide slope erosion control maintenance to prevent undermining of all slopes in newly natural growth areas. Maintenance tasks include immediate repairs to weak spots in sloped areas to intercept and direct water flow to prevent development of large gullies and slope erosion and during periods of extended rainfall, irrigation systems shall be secured. Eroded areas shall be filled with amended topsoil and replanted with the same plant species. Erosion control blankets damaged due to slope erosion shall be reinstalled.

3.3.10 Final Inspection

Final inspection will be made upon written request from the Contractor at least 10 days prior to the last day of the establishment period. Final inspection will be based upon satisfactory health and growth of plants and on the following:

3.3.10.1 Remedial Work

Remedial measures directed by the TPWD ODR to ensure plant material survival and promote healthy growth have been completed.

3.3.11 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the TPWD until work has been completed, inspected and accepted by TPWD ODR.

3.4 FIELD QUALITY CONTROL

3.4.1 Maintenance Inspection Report

Provide maintenance inspection report to assure that landscape maintenance is being performed in accordance with the specifications and in the best interest of plant growth and survivability. Site observations shall be documented at the start of the establishment period, then quarterly following the start, and at the end of establishment period. Results of site observation visits shall be submitted to the TPWD ODR within 7 calendar days of each site observation visit.
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SEEDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)


ASTM D 4427 (2007) Peat Samples by Laboratory Testing

ASTM D 4972 (2001; R 2007) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act (1940; R 1988; R 1998) Federal Seed Act


1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Submittals will be handled in accordance with the TPWD UGC.

Submittals shall include:

Wood cellulose fiber mulch

Fertilizer

Include physical characteristics, and recommendations.

Topsoil composition tests (reports and recommendations).

State certification and approval for seed
Erosion Control Materials

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer Gypsum Sulfur Iron and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer’s chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer gypsum sulphur iron and lime may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season’s crop delivered in original sealed packages, bearing producer’s guaranteed analysis for percentages of mixtures, purity, germination, weed seed content, and inert material.
Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected.

2.1.2 Seed Mixture by Weight
Areas disturbed by construction shall be seed with seed mix and application rate as shown on plan.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

On site topsoil material shall not be used.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil as needed shall be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the following limits:

<table>
<thead>
<tr>
<th>Component</th>
<th>Limits</th>
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</thead>
<tbody>
<tr>
<td>Silt</td>
<td>25-50 percent</td>
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<tr>
<td>Clay</td>
<td>10-30 percent</td>
</tr>
<tr>
<td>Sand</td>
<td>20-35 percent</td>
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<tr>
<td>pH</td>
<td>5.5 to 7.0</td>
</tr>
<tr>
<td>Soluble Salts</td>
<td>600 ppm maximum</td>
</tr>
</tbody>
</table>

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade hydrate or burnt limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C 602 of not less than 110 percent for hydrate or 140 percent for burnt limestone.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental
2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D 4427. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.3.6 Sand

Clean and free of materials harmful to plants.

2.3.7 Perlite

Horticultural grade.

2.3.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.8.1 Particle Size

Minimum percent by weight passing:

- No. 4 mesh screen: 95
- No. 8 mesh screen: 80

2.3.8.2 Nitrogen Content

Minimum percent based on dry weight:

- Fir Sawdust: 0.7
- Fir or Pine Bark: 1.0

2.3.9 Gypsum

Coarsely ground gypsum comprised of calcium sulfate dihydrate 61 percent, calcium 22 percent, sulfur 17 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

2.3.10 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following ratios, by weight, of plant food nutrients:

- 1 parts nitrogen
- 0 part phosphorus
0 parts potassium
traces of iron

In addition fertilizer shall contain 50 percent slow-release nitrogen.

2.4.2 Hydroteeing Fertilizer

Controlled release fertilizer, to use with hydroteening and composed of pills coated with plastic resin to provide a continuous release of nutrients for at least 6 months and containing the minimum ratios, by weight, of plant food nutrients as listed above in Section 2.4.1.

18 percent available nitrogen
18 percent available phosphorus
18 percent available potassium

2.5 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

2.5.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

2.5.2 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

2.5.3 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent) or wood-based (100 percent) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2. Use with hydraulic application of grass seed and fertilizer.

2.6 WATER

Source of water shall be approved by TPWD ODR and of suitable quality for irrigation, containing no elements toxic to plant life.

2.7 EROSION CONTROL MATERIALS

Erosion control material shall conform to the following:

2.7.1 Erosion Control Blanket

70 percent agricultural straw/30 percent coconut fiber matrix stitched with degradable nettings designed to degrade within 18 months.

2.7.2 Erosion Control Fabric
Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

2.7.3 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of off-site topsoil topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer, pH adjusters and/or soil conditioners into soil a minimum depth of 4 inches by disk, harrowing, tilling or other method approved by the TPWD ODR. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Finished topsoil areas must be protected from damage by vehicular or pedestrian traffic. No on site topsoil shall be used.

3.1.1.2 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site. For bidding purposes only apply at rates for the following:

Organic Granular Fertilizer 10 pounds per 1000 square feet.

Hydroseeding Fertilizer 10 pounds per 1000 square feet.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy, frozen, snow covered or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the TPWD's ODR stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half of the seed in one direction, and sow remainder at right angles to the first sowing direction.

3.2.2 Seed Application Method

Seeding method shall be hydroseeding.

3.2.2.1 Hydroseeding
First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. Fiber shall be added at 1,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed shall be mixed to ensure broadcasting at the rates listed in Section 2.1.2. When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.2.3 Mulching

3.2.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.2.3.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

3.2.3.3 Asphalt Adhesive Tackifier

Asphalt adhesive tackifier shall be sprayed at a rate between 10 to 13 gallons per 1000 square feet. Sunlight shall not be completely excluded from penetrating to the ground surface.

3.2.3.4 Asphalt Adhesive Coated Mulch

Hay or straw mulch may be spread simultaneously with asphalt adhesive applied at a rate between 10 to 13 gallons per 1000 square feet, using power mulch equipment which shall be equipped with suitable asphalt pump and nozzle. The adhesive-coated mulch shall be applied evenly over the surface. Sunlight shall not be completely excluded from penetrating to the ground surface.

3.2.4 Erosion Control Material

Install in accordance with manufacturer’s instructions, where indicated or as directed by the TPWD ODR.

3.2.5 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF SEEDED/GRASSED

Immediately after seeding and/or grass establishment, the seeding area against traffic and other use must be protected.

3.4 RESTORATION
Buescher State Park – Spillway Repair

Restore to original condition existing turf/grassed areas which have been damaged during seeding operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

END OF SECTION 32 92 19
The Geotech Report included is for reference only. The drawings and technical specifications shall dictate the design requirements for this project. Where conflicts may exist within the contract documents, the documents shall govern in the following order: a) change orders, addenda, and written amendments to the contract; b) the contract; c) drawings; d) technical specifications (but specifications shall control over drawings as to quality of materials); and e) other contract documents.
GEOTECHNICAL ENGINEERING REPORT

Proposed Dam Spillway Rehabilitation
Phase I
Buescher State Park
Smithville, Texas

PSI Project No. 0312-1564

PREPARED FOR:

Halff Associates, Inc.
9500 Amberglen Blvd., Bldg. F, Ste. 125
Austin, Texas 78729

November 7, 2017

BY:

PROFESSIONAL SERVICE INDUSTRIES, INC.
Three Burwood Lane
San Antonio, Texas 78216
Phone: (210) 342-9377
Fax: (210) 342-9401
November 7, 2017

Halff Associates, Inc.
9500 Amberglen Blvd., Bldg. F, Ste. 125
Austin, Texas 78729

Attn: Mr. Paul Morales, P.E.

RE: PHASE I GEOFTECHNICAL ASSESSMENT
PROPOSED DAM SPILLWAY REHABILITATION
BUESCHER STATE PARK
100 PARK ROAD 1-C
SMITHVILLE, TEXAS
PSI Project No. 0312-1664

Dear Mr. Morales:

Professional Service Industries, Inc. (PSI), an Intertek Company, is pleased to submit this Phase I Geotechnical Assessment for the Buescher State Park Dam. This report includes a review of the existing site conditions at the dam spillway, recommendations for short-term repairs and a preliminary discussion for long-term remediation. This report is the first phase of a two-phase study for the dam spillway remediation. The second phase will include subsurface exploration and laboratory tests for the long-term remediation.

PSI appreciates the opportunity to provide this Geotechnical Assessment and looks forward to continuing participation during the design and construction phases of this project. If there are any questions pertaining to this report, or if PSI may be of further service, please contact the PSI office.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.
Texas Board of Professional Engineers Certificate of Registration # F003307

Luis Perez-Milicia, P.E.
Project Engineer
Geotechnical Services

Kevin C. Miller, P.E.
Chief Engineer

PSI Project No. 0312-1664
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Short Term Conceptual Remediation
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1.0 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

Professional Service Industries, Inc. (PSI) has completed the Phase I Geotechnical Assessment for the proposed Buescher State Park Dam Spillway rehabilitation. Mr. Paul Morales, representing Halff Associates, Inc. (Halff), authorized PSI’s services on October 3, 2017 through a subconsultant agreement for Halff’s Project Number 33245. The subconsultant agreement includes PSI’s scope of work from PSI Proposal No. 223857 Rev. 1 dated September 29, 2017.

1.2 PROJECT DESCRIPTION

PSI understands that the existing Buescher State Park Dam has experienced significant scour at two primary locations of the downstream portion of the spillway with a third area developing in-between the two primary scour. The dam was constructed in 1936 as an earthen dam with a puddled clay core. The spillway structure is located directly east of the existing dam and is separated from the earthen dam with a retaining wall. PSI also understands that a breach occurred on the earthen dam immediately west of the spillway which was repaired in 1993.

Halff Associates, Inc. (Halff) has provided PSI with the following documents:

- As-Built documents of the existing dam dated 1936.
- As-Built documents for the dam repair performed in 1993.
- A TCEQ inspection report on the dam dated April 8, 2016.

Based on information provided by Halff, PSI understands that scouring was present at the spillway downstream area at the time of the 2016 TCEQ report and recent rain events, including Hurricane Harvey in August, have enlarged the scour fractures and initiated partial failure of the spillway structure. The major scour consists of stair-stepped failures of approximately 7 feet depth, and the onsite materials have washed away creating two erosion channels to the south of the spillway.

It appears that ongoing maintenance of the spillway channel did not include removal of trees from the spillway. Several large trees are in the spillway channel immediately below the crest of the spillway. PSI believes these trees have formed constrictions which increased the velocity of water between the trees and contributed to the scour that is observed today.

Halff is working in coordination with the Texas Parks and Wildlife Department (TPWD) on the existing spillway remediation. PSI understands that the immediate need for the project is to provide a temporary solution to mitigate further scour of the spillway channel and stabilize the downstream slope of the spillway. A long-term remediation of the spillway will be designed after short-term repairs are implemented. PSI has been contacted to provide geotechnical engineering recommendations for the short-term and long-term spillway rehabilitation.

The geotechnical recommendations presented in this report are based on the available project information, structure locations, and the subsurface materials described in this report. If any of the noted information or assumptions made are incorrect, please inform PSI so that the recommendations presented in this report can be amended as necessary. PSI will not be responsible for the implementation of provided recommendations if not notified of changes in the project.
1.3 **PURPOSE AND SCOPE OF SERVICES**

It is understood that a short-term repair solution to stabilize the downstream slope and protect against further scour is desired and to develop a long-term solution to follow the temporary stabilization. PSI proposes to perform a geotechnical study in two phases. **Phase I** includes a site assessment and recommendations for short-term temporary repair/stabilization of the spillway downstream slope and preliminary discussion on long-term solutions. **Phase II** includes a subsurface exploration near the spillway area and geotechnical recommendations for a long-term solution. The scope of work for the proposed Phase I study is outlined below.

**Phase I – Geotechnical Site Assessment for Short-Term Repairs**

- Compile and review the existing dam documents provided to PSI by Halff including the existing structure components and available boring log data.
- Perform a site visit in conjunction with Halff and/or a Texas Parks and Wildlife Representative to observe the existing failure conditions.
- Coordinate closely with Halff to assist in the development of short-term remediation for the observed issues at the spillway.
- Provide a brief letter report outlining the recommended Short-Term repairs to the dam spillway. The letter report will also include a preliminary discussion on Long-Term repairs.
- Develop a conceptual drawing showing the short-term remediation and construction limits.
- Follow-up meeting with Halff to discuss potential long-term solutions to the dam.

The Phase I study will not include any soil borings or laboratory testing. PSI should be provided with available survey data to better assess the geometry and extent of the existing scour failure.
2.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

2.1 SITE ASSESSMENT

Mr. Kevin Miller, with PSI, performed a site visit on October 19, 2017 in conjunction with Mr. Paul Morales and Mr. Dan Yates, with Halff, to observe and document the existing failure conditions at the Buescher State Park dam spillway. An earlier visit by Mr. Richard Webb of PSI Was performed to provide an initial site review.

It appears that the spillway was initially constructed primarily on a ridge of rock protruding southerly into the creek valley. Therefore, the spillway was constructed on what appears to have been primarily rock or weathered rock.

The spillway area consists of a reinforced concrete slab with a turndown beam on the upstream side, grouted rip-rap stone placed directly to the downstream, a concrete beam, and finally scattered cobbles further downstream. Two scour failure areas were identified during the site visit. The primary scour failure is located at about Sta. 1+82.5 (as shown in Figure 2.1, about 20 feet northeast of the retaining wall). The primary scour consists of a failure at the grouted rip rap zone that has resulted in about a 7 foot scour and portions of the rip rap have washed downhill. Additionally, the flow after the failure appears to have caused erosion and formed a channel south of the rip rap zone and concrete beam. There is an approximate 7 foot drop from the concrete beam to the scour channel. The secondary scour is located at approximately Sta. 1+09.3 (about 90 feet northeast of the retaining wall) and features minor erosion in the grouted rip rap zone and about a 6 foot drop south of the rip rap zone.

Visual examination of the damage to the spillway structure itself included a large amount of tree roots growing in what appeared to be irregularities in the rock formation and between spillway concrete and original ground. Visual observations of water flowing from the exposed substrate below the spillway was documented. Site photographs showing the existing conditions are included in the Appendix.

Halff performed a topographic survey of the existing conditions and included the location of large trees in the channel after PSI's initial site visit. PSI has utilized the elevation information obtained by Halff for the spillway repair recommendations. The following figures display a plan view and profile views of the existing elevations at the spillway area.
The downstream portion of the spillway, including the cemented rip-rap zone, is heavily vegetated with trees and brush. A large tree has fallen over the primary scour channel. At the scour failure locations within the rip-rap zone, root systems can be observed that extend below the existing spillway slab. Water seepage was observed below the cemented rip rap in the scour areas. At the time of our initial site visit, the lake pool was being drawn down by pumping at an apparent rate of 3-inches per day. During the second site visit, while the area was being surveyed a 3-inch diameter siphon was placed to lower the lake level.

2.2 **Subsurface Information**

The historical construction plans of the dam show a plan view with geotechnical borings that were performed for the original dam design. Specific soil testing information or boring logs are not available. Based on the review of the historical plans, the subsurface conditions for the dam consisted primarily of Clay. The plans show that three (3) borings were performed near the spillway area. The deep boring (approximately 30 feet depth) that is shown to be over the existing spillway structure displayed a Sandstone profile. The 1993 dam repair plans (failure location shown on Figure 2.7) did not show any additional geotechnical borings performed. The following figures display the dam and spillway cross-sections obtained from the original plans, along with the original borings performed in the spillway area.

**Figure 2.3: Dam Cross-Section (1936)**

**Figure 2.4: Spillway Cross-Section (1936)**
PSI’s scope of work for the Phase II study included performing two (2) geotechnical borings to a depth of 50 feet. Due to accessibility issues in the failure area, the borings were placed at the crest of the earthen dam. At the time of this Phase I report, the borings have been sampled and initial laboratory test results are available. One boring was performed on top of the dam near the existing retaining wall and another boring was performed further away from the spillway on the dam to document the original dam construction. Preliminary results for the boring near the existing retaining wall show subsurface conditions primarily consisting of dense to very dense Clayey Sand (SC) below the spillway elevation.

2.3 Geotechnical Recommendations for Short-Term Remediation

The existing vegetation on the downstream slope is detrimental to the integrity and functionality of the spillway. Roots can creep below the spillway slab and create pathways for water to seep through. PSI recommends that the spillway downstream area be cleared of vegetation to a minimum of 50 feet away from the edge of the downstream concrete beam and the entire length of the spillway. Vegetation on and close to the rip-rap zone should be removed carefully to prevent further erosion of the spillway downstream slope. PSI understands that temporary repairs may be concentrated on the two erosion failures and not on the entire length of the spillway. Consideration should be given to clearing out as much as possible to prepare for the eventual long-term spillway modification. It is also understood that the larger trees may not be removed until final modifications. PSI believes it would be advantageous to provide as clear of flow channel and consistent of spillway grade as possible for the short-term modification.

PSI, along with Halff, have participated in conference call discussions for the repair options. PSI recommends the following two options for the short-term erosion repair:

- Option 1: Preplaced-Aggregate Concrete (PAC) (in scour locations)
- Option 2: Revetment Mats (for first 50 feet of spillway from the spillway crest)
The following includes the geotechnical recommendations for each of the two options. An option to place rock was explored, but PSI does not recommend placing loose rock due to the potential for washing away in a future rain event. Option 1 includes placing grouted rock that can be excavated in re-used in the future; this option is provided as a cost-effective repair. Option 2 includes revetment mats (gabion mattresses) that are held down with helical or rock anchors; this option would result in a more stable system, but likely has a higher cost than Option 1.

It should be noted that the repair options contained herein are intended to stabilize the slope, but will not prevent seepage from the existing failures. At this moment, PSI does not recommend a temporary system that would impede the seepage because it can divert the water pressure elsewhere and potentially cause further damage to the structure.

![Recommended Repair Zones - Options 1 & 2](image)

### 2.3.1 OPTION 1 – PREPLACED-AGGREGATE CONCRETE

PSI recommends that the existing erosion areas be filled and re-graded using Preplaced-Aggregate Concrete (PAC). PAC is commonly utilized for resurfacing dams and repairing spillways. Construction often involves placing formwork and utilizing coarse aggregate within the formwork. In this case, we recommend filling scoured areas with large aggregate (3-inches to 6-inches) and place most of grout tubes at roughly 4-foot centers to grout scour areas from the bottom up. Grout is then injected through the aggregate from the bottom-up. This installation method helps prevent voids and will bind the material together to resist erosion from future spillway overflow events.

PSI recommends a lower strength grout with a high percentage of fly-ash mix to be utilized in the PAC. A compressive strength of 500 to 1,000 psi is recommended for the grout mix. This material strength will allow future excavation of the material for long-term repairs.

The PAC should be installed in the scour zones at a minimum 4:1 slope. The report appendix includes a generalized sketch of the repair option as a guidance (final repair design by Halff may
vary). The PAC should have a minimum thickness of 2 feet. PSI understands that Halfp may increase the PAC layer thickness in order to provide additional cover along the existing concrete beam directly south of the grouted rip rap zone. The gravel size utilized for the PAC installation should have a diameter from 3-inches to 6-inches.

PSI recommends that drainage pipes, or an aggregate drainage layer, be provided at the base of the PAC to provide a flow-path that prevents the accumulation of water. A 2-inch diameter perforated pipe is recommended for drainage and installed near the base of the PAC. The drainage pipe should daylight at the downstream end of the PAC. Alternatively, a minimum 6-inch lift of Sand or Gravel can be installed beneath the PAC for drainage. A non-woven geotextile should be installed above and below the drainage layer to provide separation between the materials. In areas where only a perforated pipe will be utilized, PSI recommends that a non-woven geotextile be installed below the PAC layer.

**Figure 2.9: Short-Term Repair Concept – Option 1 - Preplaced Aggregate Concrete**

2.3.2 **Option 2 – Revetment Mats**

Revetment mats are typically used for slope stabilization and erosion control. A revetment mat is a wire-mesh gabion cage with a rectangular mattress shape. The general dimensions for the revetment mat is 12-inch thick by 6-ft width by 9 to 12-ft length. A gravel with a 3-inch to 5-inch diameter should be utilized to fill the revetment mats.

PSI recommends that helical or rock anchors be installed to anchor the initial mat in place. The helical anchors should be installed to a depth of 10 feet and be placed every 6 feet. The revetment mats should be installed at a minimum 4:1 slope. The scour voids can be backfilled with a Sandy Lean Clay material compacted to 95% of ASTM D698 with -2% to +2% from optimum moisture content. A 6-inch lift of Sand or Gravel can be installed beneath the sandy lean clay material to provide a drainage pathway. A non-woven geotextile should be utilized to separate the drainage layer and also at the base of the revetment mats.
Upon further discussions, this option was considered limited in the effectiveness. The maximum expected velocity that this option would remain functional is in the 6 m/sec range (20 ft/sec) with the spillway being approximately 125 feet wide and 1 feet of flow over the weir would only provide 2,500 cfs capacity per feet of overflow.
2.3.3 CONSTRUCTION ACCESS

PSI understands that three main construction access routes are currently being considered:

- Path 1: Access by driving on top of the existing earthen dam, and clear vegetation to access through the downstream slope
- Path 2: Access by driving on the dirt road northeast of the spillway, clearing vegetation, looping through the north-side of the spill, and drive across the spillway.
- Path 3: Access by driving on the first road northeast of the spillway, clearing vegetation, and access east of the spillway.

A generalized path of the three access options is displayed in the figure below.

**Figure 2.11: Short-Term Repair Concept**

PSI recommends the following for each access path option:

**Path 1:** PSI does not recommend any cuts to the existing dam performed for access. Driving heavy equipment on the dam can lead to heavy ruts and potential damage of the dam crest and slopes. If equipment needs to be driven across the dam, PSI recommends that 18 inches of crushed stone or 12 inches with a geogrid reinforcement layer be provided as a driving path for construction equipment. In addition, if this path is selected care to avoid disturbing the downstream face and particularly where the 1993 repair was performed will need to be provided.

**Path 2:** Path 2 involves driving across the existing lake bed or building a roadway in that portion of the pool and crossing the existing spillway. Based on PSI's experience with similar projects, the lake bottom material is typically very weak and over-excavation until reaching competent material would be required to provide enough support for vehicles. Furthermore, driving across the spillway can potentially cause damage to the existing structure. PSI does not recommend this construction access option.
Path 3: Path 3 involves clearing vegetation and accessing through a downward slope to the spillway area. This option could require more vegetation clearing than the previous 2 options, but PSI believes this would be the simplest and most direct option to provide an access. Upon vegetation clearing, PSI recommends that the bearing conditions of the soils be verified for the proposed equipment. If the soils are weak, a 12-inches of crushed rock can be provided as a temporary access pathway.

2.4 Long-Term Remediation Considerations

PSI understands that a long-term solution has not been established at this point. PSI has participated in conference calls with Haifff and the following options have been discussed for the long-term repair:

- Slurry-Trench Cut-Off Wall at existing spillway
- Spillway hydrological improvements for a primary discharge area
- Spillway Replacement to meet updated criteria

Establishing the design spillway capacity will likely be the first step for a long-term solution. If the solution requires greater head in the pool to drive the spillway options, the freeboard of the existing dam will need to be increased. Likely a downstream raising of the embankment would be necessary. While this would provide for the installation of internal drainage to the dam, it would likely be a very expensive undertaking. Depending on the spillway design requirements it may be possible to provide a modified spillway structure to provide the anticipated increase in spillway requirements.

Figure 2.12: Dam Improvement Consideration

Regardless of spillway revision, it may be required to provide some form of toe berm to meet current stability design criteria. The spillway channel for the long-term spillway design will need to safely convey the design storm flows past the toe of the dam, through a curve in the channel and safely to a low gradient portion of the downstream channel.

Throughout the design flow schemes, we will need to verify the structural integrity of the embankment during the passage of these events. The existing embankment is reported to have a puddled clay core. The integrity of the puddled clay core may need verification consistent with the long-term head requirements for the normal pool and design storm pools.
3.0 REPORT LIMITATIONS

The recommendations submitted in this report are based on the available information obtained by PSI and design details furnished by the client for the proposed project. If there are any revisions to the plans for this project, or if deviations are encountered during construction, PSI should be notified immediately to determine if changes in the recommendations are required. If PSI is not notified of such changes, PSI will not be responsible for the impact of those changes on the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional Geotechnical Engineering practices in the local area. No other warranties are implied or expressed. This report may not be copied without the expressed written permission of PSI.

After the plans and specifications are more complete, the Geotechnical Engineer should be retained and provided the opportunity to review the final design plans and specifications to check that the engineering recommendations have been properly incorporated in the design documents. At this time, it may be necessary to submit supplementary recommendations. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the project.

This report has been prepared for the exclusive use of Halff Associates, Inc. for specific application to the proposed Phase I Spillway Short-Term Rehabilitation at Buescher State Park.
APPENDIX