Construction Specifications

Issued for Construction

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Lake Marblehead Dam Repairs

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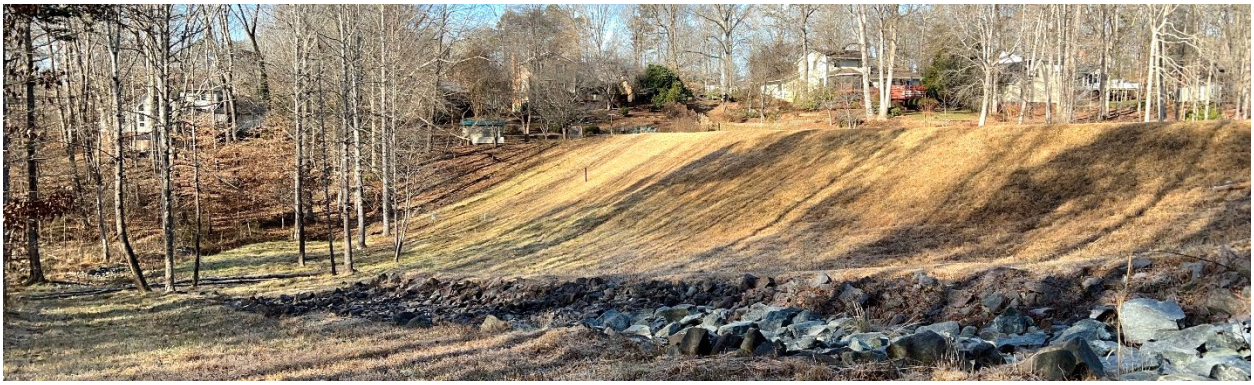

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TECHNICAL SPECIFICATIONS
SECTION 02200 – CLEARING, GRADING, AND EXCAVATION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Specifications, and Division 1 Specification Sections, apply to this section.

B. This section covers the furnishing of materials, labor, and equipment necessary to perform clearing, grading, excavation, and associated work on the project or projects covered by these Construction Specifications.

C. This item shall consist of the removal and satisfactory disposal of all materials cleared, grubbed, and/or excavated within the proposed clearing and grubbing limits indicated on the Plans and/or specified by the Engineer, including unsuitable subgrade materials and the replacement with satisfactory materials.

D. This item shall consist of such clearing, grading, and excavation as is necessary for berms, inlets, outlets, and lateral drainage ditches and for the formation, compaction, and the shaping of all embankments, fills, subgrade, shoulders, slopes and roadways to conform to the lines and grades of typical cross sections and contours shown on the Plans and/or specified by the Engineer.

E. This item shall include the removal and proper disposal of all stripping, fences, trees, hedgerows, pipes, walls, steps, masonry, rock and existing asphalt and concrete surfaces, as required. It shall also include removal of abandoned underground piping or conduit interfacing with construction.

F. This item shall include the lengthening and/or relocating of any surface and sub-surface drainage pipes and the raising, lengthening, and/or relocating of any existing spillways and/or appurtenances, as required.

1.02 RELATED WORK IN OTHER SECTIONS:

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Specifications, and Division 1 Specification Sections, apply to this Section.

B. Related Work in Other Sections:

1.	Clearing, Grading, and Excavation	Section 02200
2.	Control of Erosion, Siltation, and Pollution:	Section 02476
3.	Seeding and Mulching:	Section 02480
4.	Storm Drains and Appurtenances:	Section 02721
5.	Supplementary Specifications	Section SS
6.	Control of Water	Section 01 57 60

1.03 DEFINITIONS:

A. Geotechnical Engineer (also referred to as Soils Engineer) is a qualified Professional Engineer who is employed by a qualified geotechnical firm, which is representing the Owner to identify soils, rock formations, check soil moistures and densities, classify materials, and perform other related functions.

B. Unsuitable material includes soils that, for any reason, will not place and compact satisfactorily. Unsuitable material shall include, but not be limited to, soils high in organic content, soft soils, spongy or frozen soils, topsoil, and sod. Unless specifically approved for their intended use by the Owner's Geotechnical Engineer, soils classified as OH, OL, and PT by the Unified Soil Classification shall be considered unsuitable.

C. Benching shall mean the excavation of material in the existing ground adjacent to the proposed embankment in order to increase the bond between the existing ground and the proposed embankment.

1.04 SITE EXAMINATION AND SUPERVISION:

A. Contractor shall visit the site, familiarize himself with actual conditions, and shall verify existing conditions in the field. Promptly report in writing to the Engineer, discrepancies and conditions that vary from information shown and/or specified that could adversely affect the performance of the work required.

B. It shall be the Contractor's responsibility to verify all existing underground utility locations either shown or not shown on the Plans. Contractor shall also visibly mark and identify all underground utilities and shall immediately inform the Engineer, the same working day, of their location.

C. Contractor shall perform work to conform to applicable federal, state, county, and city laws, codes and regulations, and with Contract requirements.

D. Contractor shall notify utility companies, Engineer, and Owner at least three days before starting clearing and grubbing. Request identification or action on hidden lines in the work areas.

1. Protect known utilities to remain from damage. Use precautions to prevent damage to overhead lines.

2. If existing utility lines not shown or not known by the Contractor are encountered and exposed or damaged, immediately notify the Engineer and Owner.

1.05 PROTECTION:

A. Contractor shall maintain carefully all benchmarks, monuments, and other reference points. If disturbed or destroyed, replace as directed. If found at variance with the Plans, notify Engineer before proceeding to lay out work. A minimum of two benchmarks are required.

B. Protection of Existing Work Remaining:

1. All existing curbs, sidewalks, gates, signs, fences, pastures, fields, roads, trails, and paving damaged in performance of this work shall be restored in manner prescribed by authorities having jurisdiction and to the complete satisfaction of the Engineer and Owner.

2. Existing utility services shall not be interrupted, except as authorized in writing by Owner; and only after temporary services have been installed by Contractor and approved by Owner and Engineer, or applicable utility company.

3. Provide barricades, coverings, and other type of protectors necessary to prevent damage to existing piping and structures to be left in place at the project site.

C. Contractor shall provide barricades and other types of safeguards for protection of Owner's property, adjacent property, and public.

1.06 QUALITY ASSURANCE:

A. Contractor shall consult with the Owner and the Engineer prior to beginning clearing and grubbing. A full understanding shall be reached as to procedure. The Contractor shall then conduct clearing and grubbing operations in strict accordance with these agreements.

B. Compaction shall be completed in accordance with the standards of ASTM D-698 as amended.

C. The Owner shall retain the services of an engineering firm to monitor construction. The field observations of construction shall be provided on a part-time basis to identify any potential problem areas and to confirm that the specifications are met.

1.07 CLASSIFICATION OF EXCAVATION:

A. Common excavation shall include all materials excavated within the designated limits, removal and disposal of vegetation, topsoil, ornamental work, pipes, fences, masonry, concrete slabs, asphalt, pavement, debris, unsuitable materials, and all other surplus materials.

B. Rock Excavation:

1. Mass rock excavation shall be defined as the removal of a formation that cannot be excavated without systematic drilling and blasting which does not occur in a confined space. The Contractor shall demonstrate that the material cannot be ripped with a D-8 dozer or equivalent, pulling a single-tooth ripper. The Contractor shall be required to provide equipment specification data verifying the above-required minimum capacity for the equipment used for demonstration purposes. The equipment is to be in good repair and in proper working condition.

2. Trench rock excavation shall be defined as the removal of a formation that cannot be excavated without systematic drilling and blasting. Boulders larger than 1/2 cubic yard shall be classified as rock. The Contractor shall demonstrate that the material cannot be removed with a backhoe equipped with a maximum 1/2 cubic yard heavy duty trenching bucket with rock teeth placed on a CAT 325 or equivalent. The Contractor shall be required to provide equipment specification data verifying the above required minimum capacity for the equipment used for demonstration purposes. The equipment is to be in good repair and in proper working condition.

a. Typical of materials classified as rock are boulders one-half (1/2) cubic yard or more in volume, solid rock, rock in ledges, and rock hard cementitious aggregate deposits.

b. Intermittent drilling, blasting, or ripping performed to increase production and not necessary to permit excavation of material encountered shall be classified as common excavation.

c. Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by the Contractor, and such information provided to the Engineer for approval. Such excavation shall be paid on basis of Contract Conditions relative to changes in work.

d. Rock payment lines are limited to the following:

(1) Two (2) feet outside of concrete work, for which forms are required, except foundations.

(2) One (1) foot outside perimeter of foundations.

(3) In pipe trenches, six (6) inches below invert elevation of pipe and two (2) feet wider than nominal diameter of pipe. Trench width shall be a minimum of three (3) feet wide.

(4) Outside dimensions of concrete work where no forms are required.

(5) Under slabs on grade, six inches below bottom of concrete slab.

e. Blasting will not be allowed in the footprint of the dam or within 500 feet of the dam and if rock is encountered, it must be removed by use of pneumatic tools or other means approved by the engineers.

C. Undercut excavation shall consist of the excavation and disposal of unsuitable materials below the proposed subgrade, as directed by the Engineer, and the proper disposal of the material off-site or at designated areas on-site.

D. Off-site select material shall consist of excavation, hauling, placement, and compaction of the select material, only for the replacement of undercut areas, as directed by the Engineer, from a location off the project site as arranged by the Contractor.

E. On-site select material shall consist of excavation, movement, placement, and compaction of the select material, only for the replacement of undercut areas, as directed by the Engineer. On-site select material shall consist of select material from the project site.

PART 2 - PRODUCTS

2.01 DAMAGED TREE MATERIALS:

A. Burlap AASHTO M182, Class 2-9 ounces, Class 3-10 ounces, Class 4-12 ounces.

B. Tree-Wound-Paint: Bituminous-based paint, standard manufacture, specially formulated for use on damaged plant tissues.

2.02 EXCAVATION AND COMPACTION EQUIPMENT:

A. The Contractor shall select the excavation equipment to excavate the various materials in conformance with this Specification section. However, any equipment that results in waste of material, or results in inaccurate work, or is otherwise objectionable, shall be replaced promptly as directed by the Engineer.

B. Compaction equipment shall be adequate in number and types of units, and in capacity, to secure continuously the density requirements of this section for each layer of fill. Selection of equipment shall be left to the Contractor, and it shall be his responsibility to provide equipment that shall produce the required density. In event of failure to reach the required density due to equipment, the Contractor shall substitute more effective equipment, add more compaction units, or reduce the rate of fill placement to permit available equipment to produce the required density. Appropriate equipment shall be required to keep each layer of the fill properly shaped and with proper moisture content.

2.03 BORROW MATERIAL:

A. Borrow material shall consist of soils which shall be free from trash, debris, stone, vegetable matter, organic matter, or other indigenous material. Other soils may be used only if prior written approval is obtained from the Engineer.

B. The Contractor shall submit Proctor density curves for potential new sources of borrow material for approval by the Engineer prior to use.

C. Off-site borrow material shall consist of the excavation, hauling, placement, and compaction of approved borrow material from a location off the project site as arranged by the Contractor.

D. On-site borrow material shall consist of excavation, movement, placement, and compaction of approved borrow material from approved areas of the project site.

E. The Contractor will be responsible to moisture condition the soils as necessary to meet technical specifications at no additional cost to the Owner.

F. On-site borrow material shall only be obtained from the suitable excavated soil within the property boundary or as otherwise approved by the Engineer and the property owner.

G. A borrow source has not been identified on the site, and it is anticipated that some off-site borrow will have to be imported to fill stump holes and other noted areas.

2.04 TOPSOIL:

A. Topsoil shall consist of natural loamy soil suitable as surfacing for lawns, occurring usually in a surface layer of 6” to 18” thick.

B. Topsoil shall be removed from the work sites and shall be stockpiled for subsequent reuse.

EXECUTION

2.05 PRELIMINARY WORK:

A. Key sedimentation and soil erosion control measures shall be installed prior to beginning significant clearing operations.

B. After construction lines and sitework features, including project boundaries, benchmarks, slopes, utilities, spillways, and seepage control drains have been located and staked accurately on the site, clearly mark all trees, tree groups and plants to be removed.

2.06 GENERAL:

A. Except as otherwise permitted by the Engineer, areas shall be graded and/or excavated so as to provide adequate continuous drainage. The Contractor shall install ditches supplementary to those indicated on the Plans, as required; to initially achieve and subsequently maintain adequate drainage of both cut and fill areas. If required, such ditches shall be installed before commencing earth moving operations into or out of moist areas.

B. The Contractor shall be responsible for the accommodation and the maintenance of base and storm flows in all areas of the project site (including any borrow areas) throughout the construction period.

C. Where springs or other seeping water is encountered, the Contractor shall make adequate provisions for collecting and disposing of this water. If seeping water is encountered, the engineer will be notified of the proposed measures for handling it. French drains are not permitted except where drainage measures are called for on the project.

2.07 CLEARING, GRUBBING, AND STRIPPING:

A. Where trees or brush exist at the site of the work, the construction areas shall be cleared and trees, stumps, and roots grubbed. All areas shall be stripped to such depth as to remove all vegetation, topsoil, turf, roots, organic matter, and other objectionable materials.

B. Use equipment and methods for clearing and grubbing in a manner to prevent damage to trees and plants which are to remain within and adjacent to contract limits and to avoid hazard to public and property.

C. The operations of the Contractor shall be conducted with full consideration of all the proper and legal rights of the Owner, and of adjacent property owners and the public, and with the least possible amount of inconvenience to them.

D. Avoid unnecessary skinning and bruising of bark and cutting, breaking or skinning of roots. Do not tie cables or chains around trunks of remaining trees.

E. All brush, stumps, laps, roots, and logs shall be removed from the entire construction area and disposed of off-site or on-site to the Engineer's satisfaction.

F. Do not operate heavy vehicles over the root zones of trees to remain.

G. No open burning shall be allowed, unless prior written approval is obtained from the property owner and the Engineer.

H. The Contractor shall reflect any existing drainage pipes on the "Record Drawings" (also referred to as "As-Built Drawings").

I. Any new pipe joints (including connection joints for existing and new pipes) located in soil fill shall be wrapped with non-woven geotextile fabric (see Section 02721 for specifications). All new pipe joints shall be sealed watertight.

J. If abandoned foundations, pipes, drainage structures or other obstructions are encountered that are not shown on the Plans, the Contractor shall notify the Engineer immediately, and adjustments shall be made only as directed by the Engineer before proceeding with the work.

K. Minor debris, trash, fences, waste concrete, waste metal, and pipes that may be on the site shall be removed and disposed of to the satisfaction of the Engineer and Owner.

L. All pollutable waste material shall be properly disposed in the nearest landfill unless otherwise approved by the Engineer. Other wastes shall be legally disposed of at a convenient site located by the Contractor, subject to the approval of the Engineer and Owner.

2.08 DISPOSAL OF WASTE MATERIAL:

A. Except for items to be retained by Owner, trees and plant materials and waste material, rubble and debris removed during site clearing operations shall be removed from the site and legally disposed of off the Owner's property.

B. Burning of debris at the site shall NOT be allowed.

2.09 REMOVAL OF EXISTING STRUCTURES:

A. This work shall consist of the complete removal and satisfactory disposal of all structures, old pavements, abandoned pipelines and utilities, and any other obstructions within the limits of the earthwork, unless otherwise indicated on the Plans or directed by the Engineer.

B. Structure foundations within the limits of the earthwork shall be completely removed, unless otherwise indicated on the Plans or directed by the Engineer. Any and all buried tanks, pits or cisterns within said area shall be completely removed.

2.10 PROTECTION AND REPAIR:

A. Where roots 1 1/2" diameter or larger of retained trees are cut during excavation, coat the cut faces with an emulsified asphalt or other acceptable coating. Temporarily cover exposed roots with wet burlap to prevent roots from drying out. Cover with earth as soon as possible.

B. Observe restrictions to parking and storage of building materials over tree root zones.

C. Repair satisfactorily the construction damage to remaining trees and shrubs.

D. Where excavation or stripping is required within the drip line of trees to be saved, use a narrow trenching machine to cut roots at limit of excavation. Avoid ripping tree roots. If root trimming is necessary, make clean, sharp cuts.

2.11 GRADING PREPARATION:

A. Grade stakes shall be maintained as required. Layout work shall be referenced to benchmarks, base lines, property lines, easements, and/or rights-of-way as indicated.

B. Where new grades tie into existing grades, existing grades shall be verified. If existing conditions are at variance with the Plans, the Engineer shall be notified before proceeding with the work, and adjustments shall be made only as directed by the Engineer.

2.12 EXCAVATION AND GRADING:

A. Excavation and grading shall include all site grading, roadway and driveway, trench and structure, excavation, backfill, dike and embankment construction. Excavation and grading shall also include borrow, disposal of excess material off-site (or on-site as approved by the Engineer), procuring and placing topsoil, cleanup, and dressing off. This item shall also include all necessary dewatering, soil aeration (drying), soil wetting, sheathing, bracing, cofferdam work, pumping, blasting, and protection.

B. All excavation and grading shall be confined to the construction area, as shown on the Plans, and shall be done in an approved manner, with proper equipment.

C. All construction operations shall comply with local codes, ordinances, and requirements of agencies having jurisdiction.

D. All construction operations shall be accomplished in accordance with applicable regulations of the North Carolina Department of Labor, Occupational Safety and Health Administration (OSHA).

E. Slope sides of excavations are to comply with codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions and stability of material excavated. Maintain side slopes of excavations in a safe condition until completion of backfilling.

F. The Contractor shall be responsible for any dewatering required for construction of the dam. The Contractor shall provide and maintain whatever means required for dewatering including ditching, drains, pumping, bailing, and well pointing. Installation of permanent drainage measures, any drainage measure not completely removed after it is no longer needed, is not permitted unless approved by the Engineer.

G. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, and soil changes detrimental to stability of subgrades and foundations. Also, remove water to prevent contaminating foundation areas cleaned and prepared for grouting or concrete placement. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations as necessary. Remove and restore areas where temporary drainage measures have been implemented once those measures are no longer needed. Restoration is to be to the satisfaction of the engineer.

2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations prior to collecting in runoff areas. Do not use trench excavations as temporary drainage ditches.

H. Site grading shall conform to the grades indicated by finish contours, cross sections, and/or spot elevations on the Plans. Accuracy of finished grades shall be +/- 0.1 feet. Where topsoil, sand base, or other items are shown or called for, the rough grade shall accommodate these items. Excavation shall be made to the elevations, slopes, and limits called for on the Plans or as directed by the Engineer.

I. All cuts, fills, and slopes shall be neatly dressed off to the required grade or subgrade as indicated on the Plans.

J. At locations designated on the Plans and/or as designated by the Engineer, the Contractor shall remove unsuitable material within the limits of construction as directed and backfill with suitable material properly compacted to the finished subgrade. Undercut material may be used elsewhere on the project if the Engineer determines that it is suitable for the purpose. If it cannot be used, the Contractor shall dispose of it as directed herein before.

K. Foundation excavations shall be made at the locations shown on the Plans and to the exact subgrade required and/or as directed by the Engineer. Bottoms of excavations are to be in firm, solid, material, with soft material or voids treated as specified on the plans and the specifications. Excavated areas shall be kept free of water during construction period.

L. Where necessary, the sides of excavation shall be shored and sheathed, or cofferdams built, as required for protection of the work and employees.

M. Engineered Fills:

1. Remove all debris subject to termite attack, rot, or corrosion; remove all other deleterious materials from areas to be filled.

2. Where soft surface soils have been undercut, and where unsuitable material is required to be removed, replace with approved fill material.

3. Do not deposit any fill on a subgrade that is frozen or that contains frost. Do not deposit any fill on a subgrade that is muddy, unless otherwise indicated on the Plans, specified in the attached geotechnical engineering report, or directed by the Engineer.

N. Should soft or unsuitable material be encountered at subgrade elevation, such material shall be removed and replaced with acceptable compacted select material, obtained on-site or off-site at the direction of the Engineer. Any other excavation below grade shall be replaced with good material, without additional compensation therefore.

2.13 ROCK:

A. When rock is encountered, the Contractor shall notify the Engineer immediately.

B. Where rock is excavated along with other material, it may not be incorporated in soil fill sections. Rock fragments larger than 4 inches in greatest dimension shall not be allowed in any portion of fills or slopes, unless specified otherwise. Voids between rock material are to be completely filled with good material, and all rock shall be covered with at least 12 inches of earth, unless indicated otherwise on the plans or directed by the Engineer.

C. Blasting shall NOT be permitted.

2.14 BACKFILLING: (These specifications for backfill shall also apply for areas considered fill, unless directed otherwise by the Engineer and/or Geotechnical Engineer.)

A. As far as practicable, backfill shall be brought up evenly on each side of conduits, structures, and other facilities.

B. Preparation:

1. Before placing backfill, remove all debris subject to termite attack, rot, or corrosion, and all other deleterious materials from areas to be backfilled.

2. Remove and dispose of rock in excess of 4" diameter.

3. All backfill material shall be as specified herein for fill material.

C. Backfill adjacent to conduits, structures, and other facilities shall be completed as soon as possible, in conformance with the following:

1. Backfill shall consist of clean acceptable earth, free from trash, wood, large rocks, vegetable matter, organic matter, and other injurious material. Suitable fill shall meet the placement moisture and compaction requirements as noted on the Plans.

2. Backfill shall be placed in 4” (max.) loose lifts where manual, hand-held, or light compaction equipment is used.

3. Backfill shall be thoroughly compacted by rolling or pneumatic tamping after a light sprinkling with water (if required) to 95% of the Standard Proctor Maximum Dry Density as defined by ASTM D-698 as amended, with any subsequent settlement being refilled.

4. Backfill shall be placed at moisture contents specified for each class of material. Moisture conditioning is to be performed at no additional cost to the Owner.

5. Care shall be taken to protect piping and other utilities during backfill operations.

6. Excessively wet, soupy or mucky material shall be removed from the area around structures prior to backfill.

7. Backfill around non-waterholding structures shall be completed upon completion of the structure above finish grade, and all piping has been properly installed and tested. Backfill shall NOT be placed against any portion of *concrete* structures until the concrete has reached at least 70% of its design strength unless otherwise directed by the engineer.

8. Unless approved by the Engineer, structures that are to contain or transport liquids shall not be backfilled until successfully inspected and tested for leakage. It shall be the responsibility of the Contractor to protect all structures from damage due to flotation prior to backfill being placed.

2.15 TOLERANCES:

A. Surface of finished grade generally shall be not more than 0.1 feet above or below established grade or approved cross section.

B. All ditches and swales shall be finished to drain readily. Unless otherwise indicated, subgrade piping shall be sloped evenly to provide drainage at a grade not less than 1/4" per foot (2.0 percent).

2.16 FINE GRADING, PLACEMENT OF TOPSOIL, AND CLEANUP:

A. Upon completion of excavation, grading, and backfill, the entire work area shall be fine graded and dressed off to the indicated grades. If necessary to establish proper grass cover as specified on the Plans and/or in Section 02480 - Seeding and Mulching of these Construction Specifications, at least 4" of topsoil shall be placed on all disturbed non-paved areas, except for roadways and the areas of the reservoir below the normal water level, with the final level of topsoil conforming to the design finished elevations. Topsoil shall be free of debris, sticks, excessive amounts of weeds, and other deleterious substances.

B. Upon completion of the fine grading and placement of topsoil (if topsoil is required), the entire site shall be cleaned up and dressed off and all excess material and debris disposed of to the Owner's and to the Engineer's satisfaction.

END OF SECTION 02200

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TECHNICAL SPECIFICATIONS
SECTION 02476 – CONTROL OF EROSION, SILTATION, AND POLLUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Specifications, and Division 1 Specification Sections, apply to this Section.

B. Related Work in Other Sections:

1.	Clearing, Grading, and Excavation	Section 02200
2.	Control of Erosion, Siltation, and Pollution:	Section 02476
3.	Seeding and Mulching:	Section 02480
4.	Storm Drains and Appurtenances:	Section 02721
5.	Supplementary Specifications	Section SS
6.	Control of Water	Section 01 57 60

1.02 SUMMARY:

A. This section covers the furnishing of materials, labor, and equipment necessary to minimize erosion, siltation, and pollution on the project or projects covered by these Construction Specifications.

B. The Contractor shall take whatever measures are necessary to minimize soil erosion and siltation, water pollution, and air pollution. The Contractor shall also comply with the applicable regulations of all legally constituted authorities relating to pollution prevention and control. The Contractor shall keep himself fully informed of all such regulations that in any way affect the conduct of the work. In the event of conflict between such regulations and the requirements of these Construction Specifications, the more restrictive requirements shall apply.

C. Failure on the part of the Contractor to perform the necessary measures to control erosion, siltation and pollution will result in the Engineer notifying the Contractor to take such measures. In the event that the Contractor fails to perform such measures within 24 hours after receipt of such notice, the Engineer may suspend the work with no extension of contract time, or may proceed to have such measures performed by others at the Contractor's expense, or both.

1.03 QUALITY ASSURANCE:

Erosion and sedimentation control shall conform to the requirements of the North Carolina Sedimentation Pollution Control Act of 1973.

PART 2 - PRODUCTS

2.01 Seeding and mulching materials shall conform to the requirements of Section 02480 – Seeding and Mulching of these Construction Specifications.

2.02 Riprap, washed stone and geotextile filter fabric shall conform to the requirements of the Plans and Section 02721 – Storm Drains and Appurtenances of these Construction Specifications.

2.03 Sediment fencing, temporary stone check dams and other erosion control measures shall conform to the details in the latest edition of the Erosion Sedimentation Control Planning and Design Manual by the NC Department of Environment and Natural Resources.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS FOR EXECUTION:

A. Existing Structures and Facilities:

1. Existing structures and facilities shall be protected from sedimentation.

2. Items to be protected from sedimentation deposits shall include, but are not limited to, all downstream property, natural waterways, streams, catch basins, drainage ditches, roads, gutters, and natural buffer zones.

B. Control measures such as erection of sediment fences, barriers, traps, or other structures shall begin prior to any land disturbing activity. Additional measures shall be constructed as required during construction.

C. All facilities installed shall be maintained continuously during construction until disturbed areas are stabilized.

3.02 PROTECTIVE MEASURES:

A. The following measures are listed as a guide for the protection of existing structures and facilities. Design and construction of the measures shall be in accordance with the plans for the project site.

1. Sediment Fence: Sediment fence shall be as detailed on the plans unless otherwise directed by the Engineer.

2. Gravel Construction Entrance: Gravel construction entrances shall be as detailed on the plans and at all construction entrances for a minimum length of 50 feet, unless otherwise directed by the Engineer.

3. Berms and Diversion Ditches: These shall be graded channels with a supporting ridge on lower side as detailed on the Plans, constructed across sloping land surface. Diversion ditches and berms shall be planted in vegetative cover as soon as completed.

4. Mulching: Mulching shall be used to prevent erosion and to hold soil and seed in place during establishment of vegetation.

5. Matting: Jute matting shall be used for temporary stabilization during establishment of permanent cover on problem areas such as future grassed ditches, channels, slopes 2-H:1-V or steeper, long slopes, and steep banks.

6. Other Measures: Other methods of protecting existing structures and facilities (such as vegetative filter strips, diversions, riprap, baffle boards, and ditch check dams used for reduction of sediment movement and erosion) may be used at option of Contractor when approved by appropriate state or local authorities.

3.03 REMOVAL OF SEDIMENTATION ACCUMULATION:

A. Accumulated sediments shall be removed when control device is one-half capacity, unless indicated otherwise on the plans or directed by the Engineer.

B. All sediment control measures shall be inspected and maintained after each storm.

3.04 STABILIZATION:

A. Protected areas shall be stabilized permanently prior to removal of protective devices.

B. After final establishment of permanent stabilization, existing sediment control measures shall be removed and accumulated sediments, if any, shall be removed as required herein.

C. All areas disturbed by removal and re-spreading operations shall be permanently stabilized immediately.

D. After rough grading has been completed and before topsoil is spread, apply soil conditioning materials as specified in Section 02480 - Seeding and Mulching of these Construction Specifications.

E. Thoroughly scarify ground to a minimum depth of 6". Mix materials thoroughly with roto-tiller in two directions and at right angles.

F. Sow seed evenly with mechanical spreader at rates specified in Section 02480 - Seeding and Mulching of these Construction Specifications. Roll with culti-packer to cover seed and water with fine spray.

G. Apply mulch and/or matting as required to retain soil and grass. See Section 02480 - Seeding and Mulching of these Construction Specifications.

3.05 MISCELLANEOUS ITEMS:

A. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent the eroding of soil and the siltation of rivers, streams, lakes, reservoirs, ditches, ground surfaces, or other property. Should any erosion or siltation occur, the Contractor shall take immediate action to correct the situation. The Contractor shall remove and properly dispose of any material washed into rivers, streams, lakes, reservoirs, ditches, storm sewers, or other property. The Contractor shall be liable for any damage to private or public property resulting from insufficient erosion and siltation control measures.

B. Construction operations in rivers, streams ditches and water impoundments shall be restricted to those areas which must be entered for the performance of work shown on the Plans. Excavated materials shall not be deposited in rivers, streams, ditches, or impoundments except that temporary earth dikes and/or cofferdams may be used when approved by the Engineer, but such dikes and/or cofferdams shall be completely removed in such manner as to prevent siltation. Frequent fording of flowing streams with equipment shall not be permitted. Temporary bridges or other structures shall be used whenever frequent stream crossings are necessary.

C. Temporary and permanent erosion control measures shall be provided as shown on the plans or as directed by the Engineer. Temporary sediment control devices must be installed to the extent possible prior to initiation of grading and excavation. The devices must be maintained at a minimum of 50% of the original sediment storage capacity and may not be removed until the areas they serve have been stabilized. Temporary erosion control measures shall include, but not be limited to, the use of temporary berms, dikes, drainage ditches, silt basins, silt ditches, slope drains, structures, stone check dams, vegetation, mulches, mats, netting, gravel, or other necessary methods. Temporary erosion control may include work outside the construction limits.

D. The Engineer may limit the area over which excavation, embankment, and grading operations are performed whenever the Contractor's operations are not effectively minimizing erosion and/or siltation.

E. All disturbed, non-paved areas shall be seeded and fertilized, mulched, and tacked as soon as practical after clean up in accordance with the Construction Specifications therefor. In no case shall disturbed areas be left unstabilized more than fifteen (15) working days or ninety (90) calendar days, whichever is shorter.

F. The Contractor shall take every precaution throughout the life of the project to prevent the pollution of rivers, streams, and water impoundments. Pollutants such as chemicals, fuels, lubricants, bitumens, sewage, and other harmful waste shall not be discharged into or alongside rivers, streams, or impoundments, or into natural or manmade channels leading thereto. The Contractor shall also comply with all Federal, State and local water and air pollution laws.

G. The Contractor shall prevent live or fresh concrete from coming into contact with surface waters until the concrete has hardened.

H. The Contractor shall have full responsibility for construction and maintenance of all erosion control measures. The Contractor shall maintain all erosion control measures until such time as the appropriate State authority approves and releases the site at which time the Contractor shall remove all erosion control measures as directed by the Engineer.

END OF SECTION 02476

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TECHNICAL SPECIFICATIONS
SECTION 02480 – SEEDING AND MULCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Specifications, and Division 1 Specification Sections, apply to this Section.

B. Related Work in Other Sections:

1.	Clearing, Grading, and Excavation	Section 02200
2.	Control of Erosion, Siltation, and Pollution:	Section 02476
3.	Seeding and Mulching:	Section 02480
4.	Storm Drains and Appurtenances:	Section 02721
5.	Supplementary Specifications	Section SS
6.	Control of Water	Section 01 57 60

1.02 SUMMARY:

C. This section covers the furnishing of materials, labor, and equipment necessary to perform the seeding and mulching work on the project or projects covered by these Construction Specifications.

D. The work of seeding and mulching shall be performed immediately upon completion of grading.

E. The Contractor shall adapt his operations to variations in weather or soil conditions as necessary for the establishment and growth of the grasses or legumes.

F. In all operations, care shall be taken to preserve the required line, grade, and cross-section of the area.

PRODUCT HANDLING:

A. The Contractor shall store lime, fertilizer, soil conditioners, and seed in a dry area, free from physical abuse of any kind. Store on pallets off of ground.

B. During handling, the Contractor shall protect lime, fertilizer, soil conditioners, and seed from damage of any cause.

PART 2 - PRODUCTS

2.01 SEED:

A. Seed shall be certified by and comply with the rules and regulations of the N.C. Department of Agriculture.

B. Only high quality seed shall be used. Wet, moldy, or otherwise damaged seed or seed containing excess of noxious weeds shall not be acceptable.

C. Each variety of seed shall be furnished and delivered in separate bags.

D. If seed is to be mixed before sowing, it shall be mixed by methods that shall mix the seed thoroughly and uniformly without causing damage to the seed.

E. Seed shall be clean; delivered in original unopened packages; and bearing an analysis of contents.

F. Seed shall be guaranteed 95 percent pure; and shall have a minimum germination rate of 85 percent (within 1 year of test).

2.02 FERTILIZER:

A. Fertilizer shall comply with the rules and regulations of the N.C. Department of Agriculture.

B. Fertilizer shall be manufactured from cured stock and have an analysis of 10-10-10.

C. During handling and storage, the fertilizer shall be protected against hardening, caking, or loss of plant food values. Any hardened or caked fertilizer shall be pulverized to its original condition before being used.

1. Fertilizer shall conform to applicable State fertilizer laws; with availability of plant nutrients conforming to standards of AOAC. Fertilizer shall be uniform in composition, dry, and free-flowing.

2. Fertilizer shall be delivered in original, unopened containers bearing manufacturer's guaranteed analysis.

2.03 LIME:

A. Lime shall comply with the rules and regulations of the N.C. Department of Agriculture.

B. Lime shall be agricultural grade ground dolomitic limestone containing not less than 85% of combined calcium and magnesium carbonates.

C. Lime shall be so graded that 100% shall pass a No. 10 sieve and 40% shall pass a No. 100 sieve.

D. During handling and storage, lime shall be protected against hardening and caking. Any hardened or caked lime shall be pulverized to its original condition before being used.

2.04 MULCH AND MATTING:

A. Mulch shall consist of clean grain straw reasonably free from mature seedbearing stalks, roots, or bulblets of Johnson Grass, Nutgrass, Sanbur, Wild Garlic, Wild Onion, Bermuda Grass, Crotalaria, Witchweed, and restricted noxious weeds as defined by the N.C. Department of Agriculture at the time of use.

B. Mulch that is matted or lumpy shall be loosened and separated before being used.

C. Matting shall be heavy twisted jute mesh. Openings between strands shall be approximately 1" square.

2.05 SEDIMENT FENCE: (See Section 02476 – Control of Erosion, Siltation, and Pollution of these Construction Specifications)

2.06 WASHED STONE: (See Section 02721 – Storm Drains and Appurtenances of these Construction Specifications)

2.07 RIPRAP: (See Section 02721 – Storm Drains and Appurtenances of these Construction Specifications)

EXECUTION

2.08 The seedbed shall be properly prepared and true to line and grade with lime and fertilizer worked into the soil 4” to 6” deep. All weeds and other unacceptable growth shall be cut and disposed of properly. Uneven and rough areas shall be smoothed to provide a uniform surface. The soil shall be loosened to a minimum depth of 5” and all clods shall be broken up. The top 2” or 3” of soil shall be worked into an acceptable seedbed by the use of approved methods. On cut slopes steeper than 2-H:1-V, the Engineer may permit the depth of preparation to be reduced, but in all cases the slope surface shall be scarified, grooved, trenched, or punctured so as to provide places in which the seeding materials can lodge.

2.09 Lime and fertilizer shall be distributed uniformly over the prepared seedbed at the specified rates and then harrowed, raked, or otherwise thoroughly worked or mixed into seedbed. Seed shall be distributed uniformly over the prepared seedbed at the specified rate and immediately harrowed, dragged, raked, or otherwise worked so as to cover the seed with a layer of soil. Immediately after seed has been properly covered, the seedbed shall be compacted by means approved by the Engineer.

2.10 Within 24 hours after completion of seeding, all areas shall be mulched. Mulch shall be spread uniformly by hand or by approved mechanical spreaders, which shall provide an acceptable application. An acceptable application shall be that which shall allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion, and conserve soil moisture.

2.11 Mulch and/or matting shall be applied as required to retain soil and grass.

A. Mulch areas (slopes flatter than 2.0-H:1-V) by spreading light cover of mulch over seeded area at rate of not less than 2.0 tons per acre.

B. On slopes 2.0-H:1-V or steeper, mulch with matting. Pin matting to ground with 6" long wire staples at 5 ft. intervals (both ways) immediately after seeding.

2.12 Mulch shall be held in place by applying a sufficient amount of asphalt emulsion or other approved bind material. The rate and method of application shall meet the approval of the Engineer. When the binding material is not applied directly with the mulch, it shall be applied immediately following the mulch application. During the application of the binding material, adequate precautions shall be taken to prevent damage to traffic, structures, traffic control devices, and other appurtenances. When any damage does occur, the Contractor shall repair it, including any necessary cleaning. The Contractor shall take precautions to prevent mulch from entering drainage structures and shall promptly remove any blockages, which may occur.

2.13 SEEDING MIXTURES:

Note: <u>Lespedeza, Weeping Lovegrass, or Crown Vetch shall NOT be used</u> on any portion of the dam embankment or within 500' of the dam. Any such grasses shall be completely removed and replaced with the approved permanent seeding mixture at the contractor's expense.

A. Permanent Seeding:

Permanent Seed Mixture "A"

Note: Lespedeza, Weeping Lovegrass, or Crown Vetch shall NOT be used on any portion of the dam embankment or within 500 feet of the dam.

Table 6.11s
Seeding No. 4CP for:
Well-Drained Sandy Loams to Dry Sands, Coastal Plain and Eastern Edge of Piedmont; Low- to Medium-Care Lawns

Seeding mixture

Species[1]	Rate
Centipedegrass	10-20 lb/acre (seed) or 33 bu/acre (sprigs)

Seeding dates
Mar. - June

(Sprigging can be done through July where water is available for irrigation.)

Soil amendments
Apply lime and fertilizer according to soil tests, or apply 300 lb/acre 10-10-10 fertilizer.

Sprigging
Plant sprigs in furrows with a tractor-drawn transplanter, or broadcast by hand.

Furrows should be 4-6 inches deep and 2 feet apart. Place sprigs about 2 feet apart in the row with one end at or above ground level (Figure 6.11d).

Broadcast at rates shown above, and press sprigs into the top 1/2-2 inches of soil with a disk set straight so that sprigs are not brought back toward the surface.

Mulch
Do not mulch.

Maintenance
Fertilize very sparingly—20 lb/acre nitrogen in spring with **no phosphorus**. Centipedegrass cannot tolerate high pH or excess fertilizer.

[1]Refer to *Appendix 8.02* for botanical names.

Reference:
Detail from Erosion and Sediment Control Planning and Design Manual
June 1, 2006
NCDENR, Division of Land Resources, Land Quality Section

B. Permanent Seeding:

Permanent Seed Mixture "B"

Note: Lespedeza, Weeping Lovegrass, or Crown Vetch shall NOT be used on any portion of the dam embankment or within 500 feet of the dam.

Table 6.11t
Seeding No. 5CP for: Well-Drained Sandy Loams to Dry Sands; Low Maintenance

Seeding mixture

Species[1]	Rate (lb/acre)
Pensacola Bahiagrass	50
~~Sericea lespedeza~~	~~30~~ NO
Common Bermudagrass	~~10~~ 40
German millet	10

Seeding notes
1. Where a neat appearance is desired, omit sericea.
2. Use a common Bermudagrass only on isolated sites where it cannot become a pest. Bermudagrass may be replaced with 5 lb/acre centipedegrass.

Seeding dates
Apr.1 - July 15

Soil amendments
Apply lime and fertilizer according to soil tests, or apply 3,000 lb/acre ground agricultural limestone and 500 lb/acre 10-10-10 fertilizer.

Mulch
Apply 4,000 lb/acre grain straw or equivalent cover of another suitable mulch. Anchor by tacking with asphalt, roving, netting, or by crimping with a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance
Refertilize the following Apr. with 50 lb/acre nitrogen. Repeat as growth requires. May be mowed only once a year. Where a neat appearance is desired, omit sericea and mow as often as needed.

[1]Refer to *Appendix 8.02* for botanical names.

Reference:
Detail from Erosion and Sediment Control Planning and Design Manual
June 1, 2006
NCDENR, Division of Land Resources, Land Quality Section

C. Temporary Seeding (Winter & Early Spring):

Temporary Seeding (Winter & Early Spring)

Note: Lespedeza, Weeping Lovegrass, or Crown Vetch shall NOT be used on any portion of the dam embankment or within 500 feet of the dam.

Table 6.10a Temporary Seeding Recommendations for Late Winter and Early Spring

Seeding mixture

Species	Rate (lb/acre)
Rye (grain)	120
~~Annual lespedeza (Kobe in Piedmont and Coastal Plain, Korean in Mountains)~~	~~50~~ No

Omit annual lespedeza when duration of temporary cover is not to extend beyond June.

Seeding dates
Mountains—Above 2500 feet: Feb. 15 - May 15
Below 2500 feet: Feb. 1- May 1
Piedmont—Jan. 1 - May 1
Coastal Plain—Dec. 1 - Apr. 15

Soil amendments
Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 750 lb/acre 10-10-10 fertilizer.

Mulch
Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance
Refertilize if growth is not fully adequate. Reseed, refertilize and mulch immediately following erosion or other damage.

Reference:
Detail from Erosion and Sediment Control Planning and Design Manual
June 1, 2006
NCDENR, Division of Land Resources, Land Quality Section

D. Temporary Seeding (Summer):

Temporary Seeding (Summer)

Note: Lespedeza, Weeping Lovegrass, or Crown Vetch shall NOT be used on any portion of the dam embankment or within 500 feet of the dam.

Table 6.10b Temporary Seeding Recommendations for Summer

Seeding mixture

Species	Rate (lb/acre)
German millet	40

In the Piedmont and Mountains, a small-stemmed Sudangrass may be substituted at a rate of 50 lb/acre.

Seeding dates
Mountains—May 15 - Aug. 15
Piedmont—May 1 - Aug. 15
Coastal Plain—Apr. 15 - Aug. 15

Soil amendments
Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 750 lb/acre 10-10-10 fertilizer.

Mulch
Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance
Refertilize if growth is not fully adequate. Reseed, refertilize and mulch immediately following erosion or other damage.

Reference:
Detail from Erosion and Sediment Control Planning and Design Manual
June 1, 2006
NCDENR, Division of Land Resources, Land Quality Section

E. Temporary Seeding (Fall):

Temporary Seeding (Fall)

Note: Lespedeza, Weeping Lovegrass, or Crown Vetch shall NOT be used on any portion of the dam embankment or within 500 feet of the dam.

Table 6.10c
Temporary Seeding Recommendations for Fall

Seeding mixture

Species	Rate (lb/acre)
Rye (grain)	120

Seeding dates
Mountains—Aug. 15 - Dec. 15
Coastal Plain and Piedmont—Aug. 15 - Dec. 30

Soil amendments
Follow soil tests or apply 2,000 lb/acre ground agricultural limestone and 1,000 lb/acre 10-10-10 fertilizer.

Mulch
Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance
Repair and refertilize damaged areas immediately. Topdress with 50 lb/acre of nitrogen in March. ~~If it is necessary to extent temporary cover beyond June 15, overseed with 50 lb/acre Kobe (Piedmont and Coastal Plain) or Korean (Mountains) lespedeza in late February or early March.~~

Reference:
Detail from Erosion and Sediment Control Planning and Design Manual
June 1, 2006
NCDENR, Division of Land Resources, Land Quality Section

2.14 SEEDBED PREPARATION:

A. Chisel compacted areas and spread topsoil 3” deep over adverse soil conditions, if available

B. Rip the entire area to 6” depth.

C. Remove all loose rock, roots, and other obstructions leaving surface reasonably smooth and uniform.

D. Apply agricultural lime, fertilizer, and superphosphate uniformly and mix with soil (see below*).

E. Continue tillage until a wet-pulverized, firm, reasonably uniform seedbed is prepared 4” to 6” deep.

F. Seed on a freshly prepared seedbed and cover seed lightly with seeding equipment or cultipack after seeding.

G. Mulch immediately after seeding and anchor mulch.

H. Inspect all seeded areas and make necessary repairs and re-seed within the planting season, if possible. If stand should be over 60% damaged reestablish following original lime, fertilizer and seeding rates.

I. *Apply:

1. Agricultural Limestone – 4,000 lbs./acre (6,000 lbs./acre in clay soils)
2. Fertilizer – 1,200 lbs./acre (10-10-10)
3. Superphosphate – 200 lbs./acre (0-49-0)
4. Mulch – 4,000 lbs./acre (small grain straw)
5. Anchor – asphalt emulsion at 400 gal./acre

J. Consult the State Erosion Control Engineer or the Natural Resources Conservation Service for additional information concerning other alternatives for vegetation of denuded areas. The vegetation rates listed on these Construction Specifications are those which do well under local conditions, other seeding rate combinations are possible; however, only with prior written approval obtained from the Engineer.

K. ***Temporary – Reseed according to optimum season for desired permanent vegetation. Do not allow temporary cover to grow over 12" in height before mowing, otherwise fescue may be shaded out.

L. The Contractor shall maintain seeded areas in a satisfactory condition until final acceptance of the project. Areas of damage or failure due to any cause shall be corrected by being repaired or by being completely redone as may be directed by the Engineer. Damage or failure resulting from poor seed, the Contractor's operation, or his failure to provide erosion control shall be repaired or replaced at the Contractor's expense.

M. The Contractor shall maintain adequate drainage on the project at all times. In the event water pockets are formed, they shall be drained by the Contractor and all wet and unstable material shall be removed and disposed of and the area backfilled and compacted with suitable material. Such remedial work caused by the failure of the Contractor to keep the area adequately drained shall be performed at his expense.

2.15 Judgement by the Engineer of satisfactory turf establishment shall be made on the basis that a vegetative cover in accordance with the permanent seeding specifications shall be established on all disturbed areas sufficient to restrain accelerated erosion.

END OF SECTION 02480

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TECHNICAL SPECIFICATIONS
SECTION 02721 – STORM DRAINS AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Work under this section consists of furnishing all labor, materials, and equipment for the installation of piping, pipe fittings, seepage control devices, flow measuring devices, gate valves, sluice gates, and intake structures.

B. Work under this section consists of furnishing all labor, materials, and equipment for the installation of surface drainage systems, including but not limited to drain lines, catch basins, manholes, and other drainage appurtenances as required to properly convey surface runoff throughout the project site.

1.02 RELATED WORK IN OTHER SECTIONS:

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Specifications, and Division 1 Specification Sections, apply to this Section.

B. Related Work in Other Sections:

1.	Clearing, Grading, and Excavation	Section 02200
2.	Control of Erosion, Siltation, and Pollution:	Section 02476
3.	Seeding and Mulching:	Section 02480
4.	Storm Drains and Appurtenances:	Section 02721
5.	Supplementary Specifications	Section SS
6.	Control of Water	Section 01 57 60

1.03 QUALITY ASSURANCE:

A. Reference:

1. Some products and execution are specified in this section by reference to published specifications or standards of the following (with respective abbreviations used):

a. American Society for Testing and Materials (ASTM)
b. North Carolina Department of Transportation (NCDOT)

2. Standard References:

a. As published by NCDOT: "Standard Specifications for Roads and Structures," dated July 1995, referred to hereinafter on the Plans and these Construction Specifications as "NCDOT specs."

b. As published by NCDOT: "Roadway Standard Drawings," dated January 1998, referred to hereinafter on the Plans and these Construction Specifications as "NCDOT Std. No(s)."

B. Manufacturers:

1. Standard: For purposes of designating type and quality for the work under this section, Plans and Specifications are based on products manufactured or furnished by manufacturers listed.

2. Source: Products for use on this project shall be of one manufacturer for each function, unless noted specifically otherwise herein or approved in writing by the Engineer.

C. Soil Testing: (See Section 02200 – Clearing, Grading, and Excavation of these Construction Specifications)

D. Soil Erosion Control: Siltation, sedimentation, and erosion shall be kept to a minimum at all times during construction. Sedimentation and erosion control methods shall be employed by the Contractor during construction in order to comply with the requirements of the N.C. Sedimentation Pollution Control Act of 1973, and to plan requirements (See Section 02476 – Control of Erosion, Siltation, and Pollution of these Construction Specifications).

E. Material Testing: Material shall be tested in accordance with the conditions of the Plans, the Construction Specifications and the following:

1. Pipe: Ductile iron pipe and PVC pipe shall be subject to inspection and testing in accordance with standard manufacturing practice.

2. Pipe Fittings: Pipe fittings shall be subject to inspection and testing in accordance with standard manufacturing practice.

3. Gaskets: Gaskets shall be durable continuous rubber "O"-ring gaskets. Gaskets shall be subject to inspection and testing in accordance with standard manufacturing practice.

4. Other Material: Other material shall be subject to such inspection and testing as the Engineer may require should its acceptability be questioned.

F. Field Quality Control: **Contractor shall notify Engineer in ample time (at least 3 days prior to such work) to permit inspection of undercut, fill placement, completed underground piping before backfilling and/or placing of concrete is commenced**, unless otherwise noted on the plans and specifications. Any areas backfilled and/or cast prior to inspection by the Engineer shall be uncovered for inspection and subsequently backfilled and/or re-cast at the Contractor's expense.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE:

A. Ductile iron pipe shall be centrifugally cast in metal molds in accordance with ANSI/AWWA C151/A21.51. *NOTE: Some portions of this project require Flanged ductile iron pipe and fittings*

B. Gaskets for ductile iron pipe and fittings shall be furnished in accordance with ANSI/AWWA C111/A21.11 *"Rubber-Gasket Joints for Ductile-Iron Pipe, Centrifugally Cast for Water"* for pipe and ANSI/AWWA C110/A21.10 *"Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., For Water and Other Liquids."*

C. Asphaltic outside coating and inside lining and coating shall be in accordance with ANSI/AWWA C151/A21.51 *"Ductile-Iron Pipe, Centrifugally Cast for Water"* for pipe and ANSI/AWWA C110/A21.10 *"Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., For Water and Other Liquids."*

D. Ductile iron pipe and fittings shall be minimum Pressure Class 250 for spillway piping and other drains, unless otherwise specified on the plans.

E. Sizes 4" through 42" shall be furnished in nominal 18-foot laying lengths. Sizes 48" and 64" shall be furnished in nominal 20-foot laying lengths.

F. All ductile iron pipe and fittings shall be installed in accordance with manufacturer recommendations and industry standards, subject to Engineer approval.

G. All pipe shall be tested at the factory in accordance with AWWA requirements. Weight, nominal thickness, sampling period, and class of pipe shall be shown on each pipe. The manufacturer's year of production and the letters DI or Ductile shall also be cast or stamped on the pipe. All markings shall be clear and legible and on, or near, the bell end.

H. All ductile iron fittings shall be asphaltic coated as required for pipe.

I. All ductile cast iron fittings shall be bituminous coated and cement lined as required for pipe. Where flanged ends are required, flanges shall conform to applicable requirements of ANSI B16.1 and ANSI B16b, unless specified otherwise by the Engineer.

J. All pipe and/or concrete construction joints to be in contact with soil shall be completely wrapped with non-woven geotextile fabric in accordance with manufacturer's specifications and recommendations with 12" minimum overlap at all seams in all directions. The ends of the geotextile fabric shall extend over each pipe joints at least 18" in each direction (36" minimum total). (See the Pipe Joint Detail on the Plans)

2.02 POLYVINYL CHLORIDE (PVC) PIPE:

A. Where Schedule 40 and/or Schedule 80 PVC pipe are indicated on the Plans, the pipe shall be installed according to all specifications and recommendations of the manufacturer, subject to Engineer approval. Cellular core type pipe shall NOT be allowed.

B. PVC fittings and adapters shall conform to the same requirements as for pipe and shall be the same class as pipe, except where indicated otherwise on the Plans, subject to Engineer approval.

C. All PVC pipe shall be installed according to all specifications and recommendations of the manufacturer, subject to Engineer approval.

D. All pipe joints shall be watertight sealed.

E. All pipe joints to be in contact with soil shall be completely wrapped with non-woven geotextile fabric in accordance with manufacturer's specifications and recommendations with 12" minimum overlap at all seams in all directions. The ends of the geotextile fabric shall extend over each pipe joint at least 18" in each direction (36" minimum total).

2.03 JOINT MATERIAL:

A. Except where specified otherwise on the Plans or in these Construction Specifications, gaskets for pipe and fittings shall be a continuous ring of rubber material compounded to resist deterioration and of a texture to assure a permanent and watertight seal. They shall have smooth surfaces, free from pitting, blisters, porosity or any other defects. Gaskets shall conform to the requirements of AWWA Specification C301 and Federal Specification WW-P4211.

B. Gasket lubricant shall be a potable hydrogenated vegetable oil, insoluble in cold water, non-toxic, shall not support the growth of bacteria, and shall not impart taste or odor to the water. It shall not contain detergents, organic solvents, or other deleterious ingredients and shall have no deterioration effects on the gaskets. The lubricant shall be semi-paste, easily applicable, and readily adherent to the inside of the bell and shall remain in a usable state throughout the range of temperature in which the pipe is normally installed. Lubricant shall be delivered to the job site in unopened containers bearing the manufacturer's name and trade name or trademark.

2.04 CONCRETE: (See the Plans and Specifications)

2.05 WASHED STONE:

A. Washed stone (also referred to as crushed stone) for foundation preparation, seepage control devices, erosion control devices, pipe bedding, or for use as a bedding for riprap, shall be uniform, clean and shall conform to ASTM C-33, NCDOT size No. 78, No. 57, or size No. 67.

B. Other more readily available washed stone may be used only if prior written approval is obtained from the Engineer.

C. Washed stone shall not be used as foundation preparation, pipe bedding, or seepage control devices, unless specifically shown on the Plans; otherwise, prior written approval must be obtained from the Engineer.

D. Washed stone shall not be used for backfill in the event of over excavation unless prior written approval is obtained from the Engineer.

2.06 RIPRAP: (Referenced from Section 1042 RIPRAP MATERIALS of the "Standard Specifications for Roads and Structures," dated July 1995, and published by the N.C. Department of Transportation)

A. Stone for plain riprap shall consist of field stone or rough unhewn quarry stone. The stone shall be sound, tough, dense, resistant to the action of air and water, and suitable in all other respects for the purpose intended. Where broken concrete from demolished structures or pavement is available, it may used in place of stone provided that such use is approved in writing by the Engineer prior to use. However, the use of broken concrete which contains reinforcing steel will not be permitted.

B. All stone shall meet the approval of the Engineer. While no specific gradation is required, the various sizes of the stone shall be equally distributed within the required size range. The size of an individual stone particle will be determined by measuring its long dimension.

C. Stone or broken concrete for Riprap shall meet the requirements of Table 1042-1 for class and size distribution.

Table 1042-1
Acceptance Criteria for Riprap and Stone

REQUIRED STONE SIZES - INCHES			
CLASS	MINIMUM	MIDRANGE	MAXIMUM
A	2	4	6
B	5	8	12
1	5	10	17
2	9	14	23

D. No more than 5.0% of the material furnished can be less than the minimum size specified nor more than 10.0% of the material can exceed the maximum size specified.

E. Should testing of riprap materials be necessary or requested by the Engineer, the riprap materials shall be tested in accordance with Section 1042-3 TESTING of the "Standard Specifications for Roads and Structures," dated July 1995, and published by the N.C. Department of Transportation.

2.07 NON-WOVEN GEOTEXTILE FILTER FABRIC: Non-woven geotextile filter fabric for use beneath all riprap stabilization (and for all other general project uses) shall meet the minimum requirements:

Fabric Property	Unit	Test Method
Fabric Weight	10 oz per s.y.	ASTM D-4533
Grab Tensile Strength	250 lbs.	ASTM D-4632
Grab Elongation	50 %	ASTM D-4632
CBR Puncture Strength	700 lbs.	ASTM D-6241
Trapezoid Tear Strength	100 lbs.	ASTM D-4533
Water Flow rate	80 gpm per s.f.	ASTM D-4491

2.08 VARMINT GUARDS:

A. Varmint guards shall be stainless steel, hot-dipped galvanized, or Engineer approved equal.

B. Varmint guards shall be sturdy, removable, yet not easily removed.

C. A varmint guard shall be installed on all seepage collection discharge pipes; see the Plans for locations.

PART 3 - EXECUTION

3.01 LOCATIONS:

A. Pipe shall be installed at the locations shown on the Plans and to the position, alignment and grade shown thereon.

B. Prior to beginning work at any location, the Contractor shall consult with the Engineer and the Owner to determine that permits, or other legalities are in order.

C. The Contractor shall familiarize himself with all conditions and/or limitations of such permits and shall fully comply with all such requirements.

D. All work shall be confined to rights-of-way or permit limits and any encroachment beyond such limits shall be the Contractor's liability.

3.02 CLEARING AND GRUBBING:

A. The Contractor shall consult with the Owner and the Engineer prior to starting clearing and a full understanding is to be reached as to procedure. The Contractor shall then conduct clearing and grubbing operations in strict accordance with these agreements.

B. Clearing and grubbing shall be performed in accordance with Section 02200 – Clearing, Grading, and Excavation of these Construction Specifications.

3.03 PIPE INSTALLATION:

A. Pipe shall be protected during handling from impact shocks and free fall. On the subgrade prepared as above described, the pipe shall be laid so as to produce a straight line of pipe on a uniform grade, each pipe laid to form a watertight joint with the preceding pipe and so as to form a smooth inside flow line. Pipe jointing shall be in strict accordance with the manufacturer's written specifications and recommendations.

B. Ductile iron pipe and all other pipe types shall be installed in accordance with manufacturer's directions and as shown on the Plans. (NOTE: No stone or any other granular material shall be used as a bedding for pipe, unless specifically shown on the Plans or prior written approval is obtained from the Engineer.)

C. All pipe joints (for all pipe types) shall be wrapped with geotextile filter fabric as indicated on the Plans and/or specified herein, where respective pipe joints are in direct contact with soil.

D. All joints in manholes and junction boxes shall be wrapped with geotextile filter fabric as indicated on the Plans and/or specified herein, where respective joints are in direct contact with soil.

E. The Contractor shall haul the pipe and appurtenances to the site of the work. The pipe shall be carefully handled to prevent damage. Mechanical hoists or other approved methods shall be used in handling.

F. Pipe and appurtenances shall be thoroughly inspected and cleaned prior to the installation and care shall be exercised after the pipe is in place to prevent dirt of other extraneous material from getting into the pipe or bells and into the spigot.

G. Spigots shall be fully seated in the bells and the pipe shall be uniformly bedded on the bottom of the trench for its entire length with bells lying in previously dug bell holes sufficiently large to allow proper bedding and jointing. Fittings, valves, and other appurtenances shall be located where shown on the Plans or directed by the Engineer, with the pipe being cut where necessary. After joining, a reasonable amount of deflection may be made in the joining. Such deflection shall not exceed the allowable amount specified by the manufacturer for each size of pipe.

H. **The bells of each individual piece of pipe shall be located on the upstream side of the respective pipe segment (spigots on the downstream end)**, unless specifically shown on the Plans or prior written approval is obtained from the Engineer.)

3.04 SLIP LINING PREPARATION: (Not Applicable)

3.05 BACKFILLING OF TRENCHES: (See Section 02200 – Clearing, Grading, and Excavation of these Construction Specifications)

3.06 REPAIRS TO DAMAGED SERVICES AND UTILITIES:

A. Repairs to damaged services and utilities shall be promptly made at the Contractor's expense.

B. The Contractor shall use every effort to avoid damaging or breaking water, sewer, gas, power, telephone, or other utility services.

C. Should damage occur, immediate action shall be initiated to effect satisfactory repairs.

D. All repair work shall be satisfactory to the Engineer and the Owner of the damaged utility.

3.07 MISCELLANEOUS ITEMS:

A. The entire length of the inside of the pipes to be used and/or re-used for drainage purposes shall be thoroughly cleaned out, whether entirely or partly filled during construction operations, so that the pipes shall drain properly.

B. The Contractor shall determine the condition of all existing lines prior to the Contractor's beginning work, and notify the Engineer of any existing conditions to which he takes exception.

C. The Contractor shall be responsible for removing and replacing miscellaneous items in conflict with the storm drainage work such as signs, fences, gates, walls, shrubbery, private ornamental items, etc.

D. Shrubbery and plantings shall be preserved by proper root protection and watering until replanted; however, the Contractor shall not be required to guarantee replanted items.

E. No additional payment shall be made for removing and replacing miscellaneous items.

3.08 SEEDING AND MULCHING:

A. The work of seeding and mulching shall be performed immediately upon completion of the dam construction.

B. The Contractor shall adapt his operations to variations in weather or soil conditions as necessary for the establishment and growth of the grasses or legumes. In all operations, care shall be taken to preserve the required line, grade, and cross-section of the area.

C. All disturbed areas shall be seeded and mulched in accordance with Section 02480 – Seeding and Mulching of these Construction Specifications.

3.09 FINAL CLEAN-UP:

A. Final clean-up shall meet the approval of the Engineer, the Owner, and the Property owner, where applicable, with all defects in embankment settlement, grading, seeding, or other deficiencies being promptly corrected.

B. Dam construction shall be stopped at any time that clean-up work lags and shall not be resumed until clean-up progress is satisfactory to the Engineer.

PART 4 - METHOD OF MEASUREMENT: (Not Applicable)

PART 5 - PAYMENT

5.01 GENERAL:

A. The various items of construction of the dam shall be paid for at the respective contract prices to be negotiated between the Owner and the Contractor, which shall include the cost of all equipment, labor, material, and other items required to complete them as specified.

B. No additional compensation shall be considered, unless the cost is negotiated between the Owner and the Contractor prior to such work.

END OF SECTION 02721

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SUPPLEMENTARY SPECIFICATIONS

1. The Contractor shall visit the site, familiarize himself with actual conditions, and shall verify existing conditions in the field. The Contractor shall promptly report in writing to the Engineer, discrepancies or conditions that vary from information shown on the Plans and specified in the Construction Specifications that could adversely affect the performance of the work required. The Contractor and the Engineer shall review and resolve the matter prior to performance of any such work.

2. The Contractor shall be responsible for contacting the proper utility companies and field locating all utilities prior to construction.

3. The Contractor shall be responsible for the accommodation and the maintenance of base and storm flows in all areas of the project site throughout the construction period. The Contractor shall also be responsible for the control of groundwater and seepage in all excavated areas of the project site throughout the construction period.

4. Submittals and/or shop drawings shall be required for all specified construction materials to be used. **The Contractor shall provide submittals and/or shop drawings for review and written approval by the Engineer.** The submittals and/or shop drawings shall be submitted to the Engineer **at least 3 weeks** prior to the use of the respective materials.

5. All areas to receive fill shall be evaluated and approved by the Engineer (or Engineer's representative) after preparation and prior to fill placement. Any areas of fill installed prior to Engineer approval shall be subject to removal of the fill and re-installation at the Contractor's expense.

6. The Engineer (or Engineer's representative) shall approve all installation of pipes prior to covering with soil, sand, or stone. Any pipe covered with soil, sand, or stone prior to Engineer approval shall be subject to uncovering and re-installation at the Contractor's expense.

7. All pipe joints to be in contact with soil (not washed stone) shall be completely wrapped with 10.0 oz./sy non-woven geotextile fabric in accordance with manufacturer's specifications and recommendations with 18" minimum overlap at all seams in all directions. The ends of the geotextile fabric shall extend over each pipe joint at least 18" in each direction (36" minimum total).

8. The Contractor shall take appropriate measures to ensure that no "green" (non-hardened) concrete or grout comes in contact with live streams or ponds.

9. **Every day** of construction, **the Contractor shall email and/or digitally text a few digital photos of the construction progress to the Engineer.** The Contractor shall submit additional digital photos upon the Engineer's request. All such construction photos shall be of sufficient resolution and construction content to the Engineer's satisfaction. In the event that the photos are not to the Engineer's satisfaction, the Contractor shall take appropriate measures (such as upgrading digital photo and/or delivery equipment, etc.) to bring this construction requirement into compliance.

10. The Contractor shall maintain a complete set of record drawings of the construction as the work progresses. The record drawings shall provide "as-built" elevations and dimensions for the respective data indicated on the plans, and reflect all field modifications to the proposed repairs.

11. The Contractor shall provide a complete set of "final" record drawings to the Engineer no later than **3 weeks** after completion of construction.

END OF SUPPLEMENTARY SPECIFICATIONS

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SECTION 01 57 60

CONTROL OF WATER

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the control of surface and ground water as needed to perform the required construction, including:

1. Maintaining the reservoir in a lowered condition.
2. Coordinating the construction operations to ensure that, in the event of a storm large enough to fill the reservoir and cause the water to flow through the spillway, the water is controlled and does not damage the existing structure, proposed structure, or the contractor's equipment.
3. Designing, building, and maintaining all the necessary temporary and permanent diversion works required.
4. Removing all temporary works and equipment after they have served their purposes.

1.02 SUBMITTALS – (Not Applicable)

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

3.01 PROTECTION

A. The Contractor shall be solely responsible for control of water.

B. The Contractor shall take the necessary precautions to ensure that water does not flow through excavations and work areas that result in damage to the existing dam or work in progress on the proposed dam. Precautions shall include but not limited to:

1. Sequencing work to minimize exposure.

2. Tracking weather conditions and the potential for large storm or thunder storms to occur during the work.

3. Observe reservoir and stream conditions as needed during working and non-work hours to allow crews to be mobilized to initiate emergency water control plans, as needed.

4. The Contractor shall be responsible for developing plans to stabilize vulnerable work in the event of a large rainfall event. For example, be capable of backfilling excavations quickly to prevent excessive erosion or damage to completed work.

C. The Contractor shall be responsible to repair to the satisfaction of the Engineer any damages caused to the Work or adjacent property resulting from Contractor's failure to provide adequate control of water.

D. The Contractor shall provide and operate excavation dewatering systems if needed.

3.02 SEQUENCING OF WORK

A. The Contractor is solely responsible to sequence his work and minimize his risk.

END OF SECTION - 01 57 60

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APPENDIX - A

Construction Materials / Product Data

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TENCATE GEOSYNTHETICS
Americas

Mirafi® 160N

Drainage

Mirafi® 160N is a nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Mirafi® 160N is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids. Mirafi® 160N meets AASHTO M288-15 Class 2 for Elongation > 50%.

TenCate Geosynthetics Americas Laboratories are accredited by Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP). NTPEP Listed

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D4632	lbs (N)	160 (712)	160 (712)
Grab Tensile Elongation	ASTM D4632	%	50	50
Trapezoid Tear Strength	ASTM D4533	lbs (N)	60 (267)	60 (267)
CBR Puncture Strength	ASTM D6241	lbs (N)	410 (1825)	
			Maximum Opening Size	
Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve (mm)	70 (0.212)	
			Minimum Roll Value	
Permittivity	ASTM D4491	sec^{-1}	1.5	
Flow Rate	ASTM D4491	$gal/min/ft^2$ ($l/min/m^2$)	110 (4481)	
			Minimum Test Value	
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70	

Physical Properties	Unit	Roll Size
Roll Dimensions (width x length)	ft (m)	15 x 300 (4.5 x 91)
Roll Area	yd^2 (m^2)	500 (418)

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