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SECTION 02115

STORAGE TANK REMOVAL

PART 1 GENERAL

1.1 SCOPE

The work of this section includes:

- (1) 1000 gallon diesel storage tank in a concrete vault in the lock land wall to be removed and disposed of by the contractor;
- (2) Two propane tanks, 1 to be disposed, 1 to be relocated;
- (3) 300 gallon gasoline above ground storage tank to be relocated.

All tank removals shall include removal of associated and ancillary equipment. The Government will remove fuel contained in the tanks prior to start of work.

1.2 REFERENCES

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

AMERICAN PETROLEUM INSTITUTE (API)

API Publ 2217A	(1987) Guidelines for Work in Inert Confined Spaces in the Petroleum Industry
API RP 1604	(1996) Closure of Underground Petroleum Storage Tanks
API Std 2015	(1994) Safe Entry and Cleaning of Petroleum Storage Tanks

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Work Plan; FIO.

The Work Plan.

SD-08 Statements

Notification; FIO.

Proof of proper notification to MPCA, fire marshal, and appropriate local

officials shall be submitted prior to commencing site work.

1.4 NOTIFICATION

The Contractor shall notify the property owner and the Contracting Officer 30 days prior to tank removal. The Contractor shall also be responsible for properly notifying the local fire marshal and other agencies in accordance with the applicable reporting requirements.

1.5 PROJECT/SITE CONDITIONS

1.5.1 Work Plan

The Contractor shall develop, implement, maintain, and supervise as part of the work, a comprehensive plan for tank removal and related operations. The Work Plan shall be based on work experience, on the guidance provided in this specification, and on API references. At a minimum the Work Plan shall include:

- a. Scheduling and operational sequencing.
- b. Identification of applicable regulatory requirements and permits.
- c. Disposal facilities and means of disposal for the tank, ancillary equipment, Tank contents, and waste water resulting from Tank cleaning.
- d. Methods to be employed for product, sludge, vapor, and pumpable liquid removal; purging and inerting; and storage methods proposed for control of surface water.
- e. Spill prevention plan.
- f. Spill contingency plan.

1.6 DEFINITIONS

The definitions listed below form a part of this specification to the extent used. The definitions are included but not referenced in the text.

Ancillary Equipment: Ancillary equipment includes, but is not limited to existing Tanks, piping, valves, vent pipes, tank gage, and electric service wiring.

Inerting is the displacement of oxygen from the interior of a tank to deprive a potential fire from a source of oxygen.

Residue: Solid or semisolid material, sludge, or liquid remaining in the tank(s) following removal of water and the liquid phase the tank was designed to store.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 SAFETY GUIDELINES

Personnel working inside and in the general vicinity of the tank shall be trained and thoroughly familiar with the safety precautions, procedures, and equipment required for controlling the potential hazards associated with this work. Personnel shall use proper protection and safety equipment during work in and around the tank as specified in API Publ 2217, API RP 1604, and the contract clauses.

3.2 PURGING AND INERTING

After the tank and piping contents have been removed, the Contractor shall disconnect all the piping (except the piping needed to purge or inert the tank). Flammable and toxic vapors shall be purged from the tank or the tank made inert in accordance with API RP 1604, with the exceptions that filling with water shall not be used and, if dry ice is employed, the Contractor shall use a minimum of 3 pounds per 100 gallons of tank volume. The tank atmosphere shall be continuously monitored for combustible vapors if the tank is purged, or continuously monitored for oxygen if the tank is inerted.

3.3 ATMOSPHERE MONITORING

Within 30 minutes prior to initiating any activities (e.g., excavating, preparation, removal, opening, demolition, transportation, or other similar activities) involving a tank which has been inerted, oxygen levels shall be verified to be less than 8% by volume. Monitoring shall be performed at the top, bottom, and middle areas of the tank to ensure stratification has not occurred. Prior to tank decontamination, oxygen level monitoring shall be conducted at least hourly while activities involving the tanks are underway and at least daily during periods in which the tanks are stored above ground. Additional tank atmosphere monitoring shall be performed as directed by the Contracting Officer. If monitoring of tank interiors indicates that oxygen levels are not remaining below 8%, additional inert gas or dry ice shall be introduced.

3.4 TANK CLEANING

The tank interior shall be cleaned in accordance with API Publ 2015 and local, State, and Federal requirements. Cleaning shall be accomplished in a manner that eliminates the need for personnel to enter the tank to the greatest extent possible. Cleaning shall be done using specially designed tank cleaning equipment which allows the tank to be cleaned prior to cutting into sections without requiring personnel to enter the tank or, if less specialized equipment is used, the tank shall be partially dissected to overcome confined space entry hazards by removing the end walls. In either case, the cutting operation shall be accomplished using non-sparking or non-heat producing equipment.

3.5 SPILLS

3.5.1 Spill Responsibility

Immediate containment actions shall be taken as necessary to minimize effect of any spill or leak. Cleanup of spills or leaks which are caused by the Contractor in any aspect of the work for which he is responsible shall be in accordance with applicable Federal, State, and local laws and regulations at no additional cost to the Government. The Contractor will be fully liable for any and all releases he causes and shall indemnify the Government for any costs the Government incurs as a result of said releases.

3.5.2 Contractor Reporting Requirements

If a release of product, either above ground or below ground, occurs or has occurred on the site, the Contractor shall immediately notify the MPCA, the Contracting Officer, the property owner and if appropriate, the National Response Center (NRC). Off the site, the Contractor shall report spills related to project activities to the Contracting Officer immediately following discovery and shall also comply with applicable Federal and State requirements. A written follow-up shall be submitted to the Contracting Officer not later than 7 days after the initial report.

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SECTION 02220

DEMOLITION

PART 1 GENERAL

The demolition and disposal of existing buildings, pavements, curbs, fences, gate, utilities, buried foundations and other appurtenances as indicated shall be included under this section. This section also includes pavement sawcutting, lead abatement/disposal requirements, and testing of existing roofing materials for the central control station.

1.1 REFERENCES

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

ENGINEERING MANUALS (EM)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846 (n/a) Test Methods for Evaluating Solid Waste. Physical/Chemical Methods, (Vol IA, IB, IC, and II), 3rd Edition, Final Update I

1.2 GENERAL REQUIREMENTS

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of conservation, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as specified.

1.3 DEFINITIONS

The following definitions relate to the work of this section as specified herein and as shown on the drawings.

a. Abandoned: Items to be abandoned shall be removed to a limit at which they will not be visible or interfere with the new construction and left in place in a stable condition. Utilities to be abandoned shall be removed to two feet below grade. Ends of abandoned pipes shall be capped or plugged.

b. Removed: Items to be removed shall be detached, removed from the site, and disposed of by the Contractor. Unless otherwise specified,

cut off all protrusions such as anchor bolts or conduit and wire flush with the adjacent remaining surfaces. All other items to be removed shall be demolished.

c. Demolished: Items to be demolished shall be broken into pieces as required, removed from the site, and disposed of by the Contractor.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Work Plan; GA.

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, including careful removal and disposition of materials specified to be salvaged, 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 in accordance with EM 385-1-1.

Lead Abatement Plan; GA.

- a. Safety and Health Plan.
- b. Work Plan.
- c. TCLP test results shall be submitted prior to disposal of the waste.
- d. Wipe test results.
- e. Final disposition of wastes.
- f. Copies of final signed manifests if applicable.

SD-01 Data

Roofing Materials; FIO.

Reports on testing on existing roofing materials as required in Paragraph: ROOF TESTING.

1.5 DUST CONTROL

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

1.6 PROTECTION

1.6.1 Protection of Existing Work

Before beginning any demolition work, the Contractor shall carefully survey the existing work and examine the drawings and specifications to determine the extent of the work. The Contractor shall take all necessary precautions to ensure against damage to existing work to remain in place, to be reused, or to remain the property of the Government, and any damage

to such work shall be repaired or replaced as approved by the Contracting Officer at no additional cost to the Government. The Contractor shall carefully coordinate the work of this section with all other work and construct and maintain shoring, bracing and supports, as required. The Contractor shall insure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of the use of any equipment or any cutting, removal, or demolition work performed under any part of this Contract.

1.7 USE OF EXPLOSIVES

Use of explosives will not be permitted.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The work includes demolition or removal of all construction indicated or specified. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the limits of Government property. Rubbish and debris shall be removed from Government property daily unless otherwise directed by the Contracting Officer or his representative. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer or his representative. In no event shall rubbish and/or debris be allowed to accumulate either inside or outside of buildings.

3.2 UTILITIES

3.2.1 Utility Services

Disconnections of utility services, with related meters and equipment, shall be coordinated with utilities as specified in SECTION: GENERAL.

3.2.2 Removal of Utilities

Existing utilities including underground telephone, waterlines, irrigation lines, septic tanks and associated sewer lines, manholes, electrical lines, including power poles and outlets shall be removed as shown on the drawings. When utility lines are encountered that are not indicated on the drawings the Contracting Officer shall be notified.

3.2.3 Plugging Ends of Pipe

Where indicated on the drawings, pipes to be plugged shall be plugged as follows: End sections shall be removed and salvaged as necessary. Broken and deteriorated ends of pipe shall be removed to sound pipe. Pipe shall be thoroughly cleaned of foreign matter so as to assure good contact and bond with concrete. Concrete materials shall be as specified in SECTION: CONCRETE FOR BUILDING CONSTRUCTION, except that concrete shall be non-shrink, 3,000 psi strength, and shall fill not less than a 2-foot length of pipe. Plugs shall seal off the entire cross sections of the pipe and shall be watertight. At the Contractor's option, bulkheads may be used so as to require only a net 2-foot section of concrete, or end slopes at

natural repose of the concrete may be used provided that not less than a 2-foot section of pipe is completely filled with concrete.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Title to material and equipment to be demolished, except Government salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Government will not be responsible for the condition, loss or damage to such property after notice to proceed. The generator shall be retained by the Government.

3.3.2 Material for Contractor Salvage

Material for salvage shall be stored as approved by the Contracting Officer. Salvage materials shall be removed from Government property before completion of the Contract. Material for salvage shall not be sold on the site.

3.3.3 Unsalvageable Materials

Concrete, masonry, and other noncombustible materials shall be disposed off the site. Combustible materials shall be disposed off the site. Disposal off the site shall be in accordance with SECTION: GENERAL

3.3.4 Materials for Government Salvage

a. Property of the Government. Salvaged items shall be removed, handled and stored in a manner to prevent damage. Elements shall be properly identified. Salvage items shall include all air conditioners, air purifiers and drinking fountains, the generator, and items shown on the drawings.

b. Damaged Items. Items damaged during removal, handling or storage shall be repaired or replaced to match existing at no cost to the Government.

3.3.5 Fluorescent Lighting

The Contractor shall be responsible for properly disposing of any removed fluorescent light tubing in accordance with all applicable local, State and Federal regulations.

3.3.6 Existing Generator

The Contractor shall drain and properly dispose of anti-freeze (and oil if necessary) prior to removal of generator. The Contractor shall place the generator in a location on site as directed by the Contracting Officer.

3.4 ROOF TESTING

The existing roofing materials from the existing central control station shall be tested for the presence and quantification of PCB's and asbestos. Two samples for PCB testing and two samples for asbestos testing shall be obtained from the existing roofs as directed by the Contracting Officer. Sampling and testing for PCB's shall conform to the requirements of EPA SW-846, methods 3540/8081. Samples for asbestos testing shall be analyzed by Polarized Light Microscopy (PLM) in accordance with 40 CFR Part 763,

Appendix A to Subpart F. Test results shall be submitted before demolition of the roof begins. If test results indicate the presence of PCB's or asbestos, special demolition and disposal techniques will be required, and the contract will be modified under CONTRACT CLAUSE: DIFFERING SITE CONDITIONS.

3.5 LEAD

3.5.1 Locations

Lead Clad Cable has been identified in all Manholes and Pullboxes on the landwall, I-wall, riverwall and in the basement of the existing Central Control Station. There is also a possibility of asbestos-containing material in these cables.

3.5.2 Procedure

Unwatering will be required in all Manholes. Removal of cables shall be wall to wall with the cable duct entries sealed with concrete or other material, subject to the approval of the Contracting Officer. Remove dry and/or wet soil and dust, in the manholes and pullboxes, with shovels or other means. Avoid dust generation. Once gross dust/dirt has been removed, clean with HEPA vacuum cleaners. Following this step, all surfaces should be washed with a trisodium phosphate cleaner. A final dust clean shall then be performed with HEPA vacuum cleaners. Lead clearance will consist of one wipe test for each manhole or pullbox and two wipe tests in the CCS basement at locations selected by the Contracting Officer.

The clearance level is 500 micrograms of lead per square foot of surface. Each manhole/pullbox and the basement of the CCS will be accepted as abated when the area meets the clearance level stated above.

3.5.3 Disposal

Prior to disposal, the Contractor shall perform a Toxic Characteristic Leachate Procedure (TCLP) test on a representative sample of dirt and sediments removed from the manholes and pullboxes. If test results exceed 5 mg/l lead, the material shall be disposed of as a hazardous waste, and the contract modified under CONTRACT CLAUSE: DIFFERING SITE CONDITIONS.

3.5.4 Regulations

While performing the work under this contract, it shall be the Contractor's responsibility to properly remove, handle, store, transport, and dispose of all lead and lead containing materials encountered in accordance with all applicable Federal, State, and local regulations and statutes. Where specification requirements, referenced documents, and various agency's regulations and statutes conflict or vary, the most stringent requirement shall apply. As a minimum, the Contractor shall comply with the applicable provisions of the following requirements for lead abatement/disposal:

(1) As per OSHA Booklet 3126, requirements for worker protection shall be followed in accordance with 29 CFR 1926.62, and shall as a minimum contain the following where applicable:

a) Exposure monitoring of the level of airborne lead.

b) Employee training program, respiratory protection program, and medical surveillance program shall be in accordance with the requirements of 29 CFR 1910.62 and 29 CFR 1910.134.

c) Inform employees of the hazards on the project and their right of access to exposure and medical records in accordance with the requirements of 29 CFR 1910.1020.

d) Develop and implement a hazard communication program in accordance with the requirements of 29 CFR 1910.1200.

e) Posting of proper signs in and around lead work areas.

f) The Contractor shall comply with the requirements of 29 CFR 1926.59 Hazard Communication and 29 CFR 1926.21 Safety Training and Education.

(2) Handling and site storage shall be in accordance with the requirements of 40 CFR 262 and 40 CFR 265.

(3) Transportation shall be in accordance with the requirements of 40 CFR 263. Material shall be packed, loaded, transported and disposed of in a way that minimize exposure and contamination and meets all applicable regulations.

(4) Disposal shall be in accordance with the requirements of 40 CFR 264 and 40 CFR 268.

3.6 PAVEMENTS

Pavement removal shall include removal of existing aggregate base. Concrete and bituminous pavements shall include full depth saw cuts at the removal limits. Concrete pavements shall be removed to a construction joint where saw cuts will result in slab widths less than 2 feet, unless otherwise indicated on drawings.

3.7 FILLING

Holes, open basements and other hazardous openings or excavations created by this work shall be filled in accordance with SECTION 02300: EARTHWORK.

3.8 CLEAN UP

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

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SECTION 02300

EARTHWORK

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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1995) Materials Finer Than 75 Micrometers (No. 200 Sieve) in Mineral Aggregates by Washing
ASTM C 136	(1996) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 698	(1991) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³) (600 KN-m/m ³)
ASTM D 1556	(1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2488	(1993) Description and Identification of Soils
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1995a) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

WISCONSIN DEPARTMENT OF TRANSPORTATION (WIDOT)

WIDOT	(1996) Standard Specifications for Highway and Structure Construction
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1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL

PROCEDURES:

SD-09 Reports

Testing; FIO.

A summary of testing results indicated in PARAGRAPH: TESTING shall be submitted when the site work is substantially complete. See PARAGRAPH: TESTING for draft correspondence.

1.3 SUBSURFACE DATA

Subsurface soil boring logs are shown on the drawings. Variations may exist in the subsurface between boring locations. Existing backfill against the navigation lockwalls consists of hydraulically placed material obtained from the river channel. Reference the Physical Data clause in Section 00800.

PART 2 PRODUCTS

2.1 DEFINITIONS

2.1 Satisfactory Materials

Material placed as fill or backfill shall consist of material classified by ASTM D2487 as GW, GP, GC, GM, SP, SM, SC, CL AND SW. The material shall be free of ice, snow, frozen earth, trash, debris, sod, roots, organic matter, or stones larger than 3 inches in any dimension. All materials shall be of a character and quality satisfactory for the purpose intended.

2.2 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.

2.3 MATERIALS

2.3.1 Select Granular Fill

Select granular material shall be satisfactory material containing not more than 5 percent by weight of material passing the No. 200 sieve. The maximum allowable aggregate size shall be 1-1/2 inches.

2.3.2 Granular Fill

Select granular material shall be satisfactory material containing not more than 12 percent by weight of material passing the No. 200 sieve.

2.3.3 Topsoil

Topsoil shall be as specified in SECTION: PLANTING OF TREES, SHRUBS AND GROUND COVERS.

2.3.4 Sand Fill

Sand fill shall consist of satisfactory material with less than 12% passing

the No. 200 sieve.

2.3.5 Pea Gravel

Pea gravel shall consist of satisfactory material with 100% passing the ½ inch sieve and less than 5% passing the No. 4 sieve. The pea gravel shall be composed of sound and durable fine aggregate subject to the same aggregate durability requirements as the aggregate base given in SECTION: AGGREGATE BASE.

2.3.6 Granular Base

Granular base shall consist of Aggregate Base as defined in Section: Aggregate Base Course.

2.3.7 Drainage Aggregate

Drainage aggregate shall meet the requirements for WIDOT 304, Crushed Aggregate Base Course, Open Graded, Number 2.

PART 3 EXECUTION

3.1 CLASSIFICATION OF SOIL MATERIALS

Classification of soil materials shall be performed by the Contractor in accordance with ASTM D 2488. The Contracting Officer reserves the right to revise the Contractor classifications. In the case of disagreement, the Contracting Officer's classification will govern unless the soils are classified in accordance with ASTM D 2487. All testing completed by the Contractor in conjunction with soil material classification will be considered incidental to the contract work.

3.2 STOCKPILES

Stockpiles of satisfactory material shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed. Excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected 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, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government.

3.3 STRIPPING OF TOPSOIL

Where indicated or directed, topsoil shall be stripped to a depth of 6 inches. Topsoil shall be spread 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. Topsoil shall be kept 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. Any surplus of topsoil from excavations and grading shall be removed from the site.

3.4 GENERAL EXCAVATION

After topsoil removal has been completed, excavation of every description, regardless of material encountered, within the grading limits of the project shall be performed to the lines and grades indicated. Excavation material suitable for use as fill shall be transported to and placed in fill areas within the limits of the work. All unsatisfactory material, including any soil which is disturbed by the Contractor's operations or softened due to exposure to the elements and water, and surplus material shall be disposed of in areas approved for off site storage. In the event that it is necessary to remove unsatisfactory material to a depth greater than specified, the Contracting Officer shall be notified prior to removal of unsatisfactory material and an adjustment in the contract price will be considered in accordance with the contract. Excavations carried below the depths indicated shall be refilled to the proper grade with satisfactory material. Additional work not authorized by the Contracting Officer shall be at the Contractor's expense. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.5 DITCHES, GUTTERS, AND CHANNEL CHANGES

Ditches, gutters, and channel changes shall be cut accurately to the cross sections and grades indicated. Gutters and ditches shall be finished in a manner that will result in effective drainage. All roots, stumps, rock, and foreign matter in the sides and bottom of ditches, gutters, and channel changes shall be trimmed and dressed or removed to conform to the slope, grade, and shape of the section indicated. Care shall be taken not to excavate ditches and gutters below the grades indicated. Excessive ditch and gutter excavation shall be backfilled to grade with properly placed and compacted material. All ditches and gutters excavated under this section shall be maintained until final acceptance of the work. Satisfactory material excavated from ditches and channel changes shall be placed in fill areas. Unsatisfactory and excess excavated material shall be properly disposed of.

3.6 BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas shown or from other approved sources, either private or within the limits of the project site, selected by the Contractor. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

3.6.1 Excavation and Borrow Pits

Except as otherwise permitted, borrow pits and other excavation areas

shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of, or used for special purposes. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.6.2 Utilization of Excavated Materials

Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, subgrades, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Material authorized to be wasted shall be stored in designated areas approved for surplus material storage and disposed of offsite. No excavated material shall be disposed of in such a manner as to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.7 EMBANKMENTS

Fills and embankments shall be constructed at the locations and to lines and grades indicated. Fill shall be satisfactory material. The material shall be placed in successive horizontal layers for the full width of the cross section and shall be compacted as specified. Each layer shall be compacted before the overlaying lift is placed.

3.8 STRUCTURES

3.8.1 General

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing including necessary oversizing. Building excavation shall include trenching for utility and foundation drainage systems to a point 5 feet beyond the building line of each building and structure and all work incidental thereto. Excavations shall extend a sufficient distance from walls and footings to allow for placing and removal of forms.

3.8.2 Overdepth Excavation

Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed and replaced with satisfactory material. Satisfactory material removed below the depths indicated without the specific direction of the Contracting Officer shall be replaced with properly placed and compacted satisfactory fill at no additional cost to the Government, except that concrete footings shall be increased in thickness to the bottom of the overdepth excavation. All fill shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.8.3 Drainage

Surface water shall be directed away from excavation and construction sites

so as to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

3.8.4 Dewatering

See SECTION: GENERAL for dewatering requirements.

3.8.5 Footing Excavation

Excavation to final grade of all surfaces to support concrete shall not be made until just before concrete is to be placed. In building areas with shallow foundations, granular subgrades shall be surface compacted with at least two passes using a vibratory compactor.

3.8.5.1 Pile Foundations

The ground surface in the building area shall be prepared before driving piles to minimize grading requirements after pile installation. Isolated pits and vaults shall be excavated after all bearing piles are driven.

3.8.6 Backfill Material

Sand fill shall be used in bringing backfill for structures to the lines and grades indicated and for replacing unsatisfactory materials, unless otherwise indicated or directed.

3.8.7 Backfilling

Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved; concrete forms have been removed and the excavation cleaned of frost, trash and debris. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall. Trenches not immediately backfilled to grade shall be sloped to drain if practicable. Heavy equipment for spreading and compacting backfill shall not be operated closer to a foundation or other underground structural element than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted with power driven hand tampers suitable for the material being compacted.

3.9 SUBGRADE PREPARATION

All areas upon which fill is to be placed shall be stripped before the fill is started. Material shall not be placed on surfaces that are muddy, frozen, contain frost, or where unsatisfactory material remains in or under the fill. For cohesionless soils, the subgrade surface shall be compacted to at least 100 Percent of the Standard Proctor density. For cohesive soils, the subgrade shall be proof rolled with rubber tired equipment and any soft areas shall be brought to the Contracting Officer's attention.

3.9.1 Subgrade Correction

Soft or otherwise unsatisfactory material shall generally be removed and replaced with satisfactory excavated material or other approved material as

directed. Low areas resulting from removal of unsatisfactory material shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified.

3.10 FINISHING

All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified. Ditches and gutters shall be finished to permit adequate drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing.

3.10.1 Pavement Subgrade Tolerances

When the final layer of base has been completed, and at the time any additional construction is to be placed thereon, the finished surface of the base shall not vary more than 0.05 feet from the plan elevation.

3.11 PLACING TOPSOIL

Topsoil placement is covered in SECTION: ESTABLISHMENT OF TURF. The finished grade shall be such that after subsequent treatment (tillage, topsoiling and planting) the planted grade shall join 1 inch below adjoining surfaced grade of walks, curbs and drives and even with adjoining turfed areas.

3.12 COMPACTION

3.12.1 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 698. The maximum density is hereafter abbreviated as the "Standard Proctor" value.

3.12.2 Equipment

- a. Compaction equipment shall consist of sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil type being compacted. To avoid poor bonding between lifts, smooth drum rollers or manual vibrating plate tampers shall not be used on cohesive soils except in trenches and on finished subgrades. Water flooding or jetting methods of compaction will not be permitted.
- b. Sprinkling equipment shall consist of tank trucks, pressure distributors, or other equipment designed to apply water uniformly and in controlled quantities to variable width of surface.
- c. Miscellaneous equipment: Scarifiers, disks, spring tooth or spike tooth harrows, spreaders, mechanical tampers, and other equipment shall be of approved types suitable for construction of fills and embankments.

3.12.3 Moisture Control

Control of moisture in the fill shall be maintained to provide acceptable compaction. Dried or crusted cohesive soils shall be plowed, disked or otherwise broken up before compaction. If water is added to fills, the layer shall be spread in even lifts, moistened as necessary, thoroughly mixed, and compacted.

3.12.4 Placement And Compaction

Each layer shall be spread uniformly on an acceptable soil surface. The type of fill, its maximum uncompacted lift thickness, and the minimum compaction requirements (Percent of Standard Proctor density) to which each type of fill shall be compacted shall be as listed below.

<u>Fill Zone</u>	<u>Maximum Uncompacted Lift Thickness (inches)</u>	<u>Percent of Standard Proctor Density</u>
General Grading	12	95
Building Subgrades Floor Slabs and Steps	9	100
Building Backfill	12	95
Utility Backfill	Use specification for zone where utility is located.	

a. Satisfactory materials shall be place in horizontal layers not exceeding 6 inches loose depth when hand operated compactors are used.

b. Embankments and subgrade under pavements shall be compacted to at least the Percent of Standard Proctor density as follows:

(1) For fill sections the top 36 inches below the aggregate base course shall be placed in uncompacted lifts not exceeding 9 inches and compacted to at least 100 Percent of the Standard Proctor density.

(2) For cut sections in cohesionless soils the subgrade surface shall be compacted to at least 100 Percent of the Standard Proctor density. For cut sections in cohesive soils, the subgrade shall be proof rolled and any soft areas shall be brought to the Contracting Officer's attention.

3.13 TESTING

3.13.1 General

All testing expenses shall be the Contractor's responsibility. Testing shall be performed by a commercial testing laboratory selected by the Contractor and approved by the Contracting Officer or performed by the Contractor if approved by the Contracting Officer. The Contracting Officer reserves the right to direct the location and select the material for samples to be tested and to direct where and when moisture-density tests shall be performed.

3.13.2 Transmittal

The Contracting Officer shall be informed of test results daily for

direction on corrective action required. Draft copies of field testing results shall be submitted to the Contracting Officer on a frequent and regular basis, as directed.

3.13.3 Corrective Action

Tests of materials which do not meet the contract requirements (failing test) will not be counted as part of the required testing. Each such failing test must be retaken at the same location as the failing test was taken. If testing indicates material does not meet the contract requirements, the material represented by the failing test shall not be placed in the contract work or shall be recompacted or removed. The quantity of material represented by the failing test shall be determined by the Contracting Officer up to the quantity represented by the testing frequency. The Contractor may increase testing frequency in the vicinity of a failing test in order to reduce removal requirements, as approved by the Contracting Officer. Such increases in testing frequency shall be at the Contractor's expense and at no additional cost to the Government.

3.13.4 Testing Schedule

a. Moisture-Density Relations (ASTM D 698)

One test for each material variation, not less than 3 tests total.

b. In-Place Densities (ASTM D 1556 or ASTM D 2922)

(1) Typical, 1 test per 2500 CY of fill placed

(2) Structure foundations and floor slabs, not less than 1 test for each 2 vertical feet of fill

(3) Utility trench backfill below pavements and slabs, not less than 1 test per 2 vertical feet per 300 linear feet

(4) Segmental Concrete Retaining Walls over 5 feet in height, not less than 1 test for each 2 vertical feet per 300 linear feet along wall face

c. Percent Passing No. 200 sieve (ASTM C 117)

(1) Select Granular Fill, 1 test per 1000 CY of fill placed, not less than 1 test for each source placed

(2) Granular Fill, 1 test per 5000 CY of fill placed, not less than 1 test for each source

d. Sieve Analysis, (ASTM C 136)

(1) Select Granular Fill, 1 test for each source

e. Plasticity Index (ASTM D 4318)

(1) Cohesive soils, 1 test for each moisture density relation

3.14 NUCLEAR DENSITY TESTING EQUIPMENT

Nuclear density testing equipment shall be used in general accordance with ASTM D 2922 and ASTM D 3017. In addition, the following conditions shall

apply:

a. Prior to using the nuclear density testing equipment on the site, the Contractor shall submit to the Contracting Officer a certification that the operator has completed a training course approved by the nuclear density testing equipment manufacturer, the most recent data sheet from the manufacturer's calibration, and a copy of the most recent statistical check of the standard count precision.

b. The first test and every tenth test thereafter shall include a sand cone correlation test. The sand cone test shall be centered over the prepared surface for the nuclear test, shall include a nominal 6 inch diameter sand cone, and shall include a minimum wet soil weight of 6 pounds extracted from the hole. In addition, testing of aggregate base soils shall include a minimum of 3 sand cone correlations for each day of testing; and testing of bituminous shall include a minimum of 3 core densities for each day of testing. The density correlations shall be submitted with test results. Each transmittal including density test data shall include a summary of all density correlations for the job neatly prepared on a summary sheet including at a minimum:

- (1) meter serial number and operators initials.
- (2) standard count for each test.
- (3) material type.
- (4) probe depth.
- (5) moisture content by each test method and the deviation.
- (6) wet density by each test method and the deviation.

c. The nuclear density testing equipment shall be capable of extending a probe 6 inches minimum down into a hole.

d. Nuclear density testing equipment used within 2 vertical feet from the existing ground water level, 5 horizontal feet from a vertical wall or massive concrete structure, or in a trench shall have the standard count changed before and after each test.

e. Nuclear density testing equipment shall not be used during rain.

3.15 SUBGRADE AND EMBANKMENT PROTECTION

Compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein to the required density prior to further construction thereon. Subgrades not meeting the specifications for finish, material type and density at the time of surface material placement shall be corrected at the Contractor's expense. Cohesive embankments and subgrades shall be kept crowned or sloped for drainage. Newly graded areas shall be protected from traffic and erosion. Any settlement or washing away that may occur from any cause shall be repaired. No base course or pavement shall be laid until the subgrade has been checked and approved by the Contracting Officer. Ditches and drains along subgrade shall be maintained to provide effective drainage. All work shall implement best management practices for erosion control.

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SECTION 02316

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITY SYSTEMS

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 in the text by basic designation only.

ENGINEERING MANUALS (EM)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION(OSHA)

29 CFR 1926 Subpart P, Excavations

1.2 RELATED WORK OF OTHER SECTIONS

Dewatering is covered in SECTION 01000: GENERAL. Material definitions, backfill compaction and testing requirements are covered in SECTION 02300: EARTHWORK.

1.3 DEFINITIONS

Reference to pipes shall include conduits, cables, or other utility systems. Appurtenant structures include manholes, catch basins, inlets, outlets, energy dissipators, or similar structures.

PART 2 PRODUCTS

2.1 MATERIALS

In addition to the definitions below, material definitions shall be as specified in SECTION 02300: EARTHWORK.

2.1.1 Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 3 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.

2.1.2 Unstable Material

Unstable material shall consist of materials too soft and/or compressible to properly support the pipe or appurtenant structure.

2.1.3 Initial Backfill Material

Initial backfill shall consist of satisfactory materials free from rocks 3

inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

2.1.4 Granular Bedding Material

Granular embedment shall be crushed rock or pea gravel with not less than 95% passing the 3/4" sieve and not less than 95% retained on the No. 4 sieve.

2.2 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Blue:	Water Systems
Green:	Sewer Systems

PART 3 EXECUTION

3.1 EXCAVATION

Unless otherwise indicated, trench excavation shall be by open cut except that short sections may be jacked or bored if the utility can be safely and properly installed and ground loss can be properly controlled. All excavation shall be constructed in accordance with the Safety and Health Requirements Manual (EM 385-1-1) and/or OSHA Standards. Allowable trench widths, depths, side slopes, sheet and bracing requirements, and other considerations are given in the OSHA Standard; and an abbreviated version is given in the Safety and Health Requirements Manual.

3.1.1 Trench Excavation

Excavation shall be performed to the lines and grades indicated. During excavation, material satisfactory for backfilling shall be stockpiled in a neat and orderly manner at a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or caving. Topsoil shall be stockpiled separately from suitable backfill material. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized over excavation shall be backfilled at no additional cost to the Government.

3.1.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform

bearing and support for the bottom quadrant of each section of the pipe. Pipe shall rest on undisturbed or properly placed and compacted soil along its entire length. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.1.1.2 Unyielding Material

Where unyielding material is encountered in the bottom of the trench, such material shall be removed 8 inches below the required grade and replaced with select granular fill.

3.1.1.3 Unstable Material

Where wet, soft, unsuitable or otherwise unstable soil incapable of properly supporting pipe is encountered in the bottom of a trench or excavation, the Contractor shall immediately contact the Contracting Officer prior to proceeding with the associated work. When removal of unstable material is required due to inadequate shoring and sheeting, water removal, control of ground water or other similar operations, such unstable material shall be excavated and replaced with satisfactory material as directed at no additional cost to the Government.

3.1.1.4 Excavation for Appurtenances

Excavation for appurtenances shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.1.2 Stockpiles

Stockpiles of satisfactory material shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed. Excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected 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, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government.

3.2 BACKFILLING AND COMPACTION

Backfill shall consist of satisfactory material meeting the requirements shown and specified. Compaction and testing requirements for backfill shall be as stated in SECTION 02300: EARTHWORK.

3.2.1 Bedding and Initial Backfill

Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with manual tampers to a height above the pipe necessary to prevent damage, but not less than one foot.

The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

3.2.2 Backfill for Appurtenances

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

3.3 SPECIAL REQUIREMENTS

3.3.1 Burial Depth

Burial Depth of specific utilities is given below:

- a. Water lines. Trenches shall be of a depth to provide a minimum cover of 7 feet from the existing ground surface or from the indicated finished grade (whichever is lower) to the top of the pipe, unless otherwise indicated.
- b. Cables and Conduits. Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated.
- c. Underground Sprinkler System. Trenches shall be of a depth to provide a minimum cover of 2 feet from the indicated finished grade.
- d. Fuel Oil. Trenches shall be of a depth to provide a minimum of 6 inches of granular material under the pipe and 54 inches of cover.

3.3.2 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise shown.

3.4 DISPLACEMENT OF SEWERS

After other required tests have been performed and the trench backfill compacted to 2 feet above the top of the pipe, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 36 inches shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

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SECTION 02388

STONE PROTECTION (RIPRAP)

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 in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 288 (1996) Geotextile Specification for
Highway Applications

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33 (1999) Concrete Aggregates

ASTM C 127 (1988; R 1993) Specific Gravity and
Absorption of Coarse Aggregate

ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse
Aggregates

ASTM C 295 (1998) Petrographic Examination of
Aggregates for Concrete

ASTM D 75 (1997) Sampling Aggregates

ASTM D 4791 (1995) Flat Particles, Elongated
Particles, or Flat and Elongated Particles
in Coarse Aggregate

ASTM D 4992 (1994) Evaluation of Rock to be Used for
Erosion Control

ASTM D 5312 (1992) Evaluation of Durability of Rock
for Erosion Control Under Freezing and
Thawing Conditions

CORPS OF ENGINEERS (COE)

EM 1110-2-2302 (1990) Construction with Large Stone

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44 (1997) NIST Handbook 44: Specifications,
Tolerances, and Other Technical
Requirements for Weighing and Measuring
Devices

Wisconsin Department of Transportation (WIDOT) Standard
Specifications for Highway and Structure Construction

WIDOT 645

(1996) Geotextile Fabrics

1.2 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Geotextile Data; FIO.

Catalog cuts or technical data sheet shall be submitted for the geotextile showing that the product meet the specifications.

SD-08 Statements

Material Sources; GA.

The Contractor shall designate in writing only one source or one combination of sources from which he proposes to furnish stone. The Contractor shall state in writing methods of processing and handling riprap, and shall notify the Contracting Officer when production methods are changed.

PART 2 PRODUCTS

2.1 STONE SOURCES AND EVALUATION

Stone and aggregate materials shall be produced from the sources listed in SECTION 00830: ATTACHMENTS. If the Contractor proposes to furnish materials from a source not listed, the Government Geologist will make such investigations and evaluations as necessary to determine whether or not materials with acceptable durability can be produced from the proposed source. The rock supplied shall be produced from one rock formation to provide a product of uniform appearance. The Contractor shall not supply rock from various formations, or mix field stone with quarried rock, unless approved by the Contracting Officer. It is the Contractor's responsibility to determine that the stone source or combination of sources selected is capable of providing the quality, quantities and gradation needed and at the rate needed to maintain the scheduled progress of the work.

2.1.1 Alternate Sources

a. Evaluation by Site Inspection. If the Contractor proposes to furnish stone from an unlisted source, the Government will evaluate the alternate source and reply within 30 days. A quarry investigation shall be performed by a Government geologist or engineer. If the source is an undeveloped quarry or if the operation has been dormant for more than one year such that the quarry face is weathered, the Contractor shall expose fresh rock for 20 feet horizontally and for the full height of the face proposed for production, prior to the field evaluation. The Government will consider service records for stone of a similar size, placed in a similar thickness and exposed to weathering under similar conditions as are anticipated for

this contract. The Government may choose to accept the source based on rock classification, geologic evaluation, and service records show that the stone is durable to the satisfaction of the Government.

b. Evaluation by Test Data. If sufficient information is not available, the Government will reconsider the alternate source if evaluation is supplemented by sampling and testing. This will require an additional 60 day evaluation period. If the Contractor wishes to pursue the alternate source, the Government will notify the Contractor of required testing and evaluation criteria. Criteria for acceptance will consider criteria in EM 1110-2-2302, but will also consider characteristics of rock found in nearby quarries. Some common test procedures that may be considered include:

Unit Weight and Absorption (ASTM C 127).
Petrographic Examination (ASTM C 295 and ASTM D 4992).
Resistance to Freezing and Thawing (ASTM D 5312).

c. Sampling and Testing. Samples from alternate sources shall be taken by a representative of the quarry under the supervision of the Contracting Officer. Information provided with the samples shall include the location and stratigraphy within the quarry from which the sample was taken. The Contractor shall ship the samples to a laboratory identified by the Contracting Officer. The Government will be responsible for testing costs associated with one quarry per project; and the Contractor shall be responsible for testing costs for additional sources.

2.1.2 Acceptance of Materials

Acceptance of a source of stone is not to be construed as acceptance of all material from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for stone as determined by the Contracting Officer. The Contracting Officer also reserves the right to reject individual units of produced specified materials in stockpiles at the quarry, all transfer points, and at the project construction site when such materials are determined to be unsuitable.

2.2 RIPRAP

Riprap shall meet the gradation requirements of ASTM D 6092, gradation R-60. The stone shall be well graded within the limits specified.

2.2.1 General

All stone shall be durable material. Stone for riprap shall have a specific gravity not less than 2.55. Stone shall be of a suitable quality to ensure permanence in the structure and in the climate in which it is to be used. It shall be free from cracks, blast fractures, bedding, seams and other defects that would tend to increase its deterioration from natural causes. A hairline crack that is defined as being detrimental shall have a minimum width of 4 mil and shall be continuous for one-third the dimension of at least two sides of the stone. The stone shall be clean and reasonably free from soil, quarry fines, and shall contain no refuse. Any foreign material adhering to or combined with the stone as a result of stockpiling shall be removed prior to placement. The maximum aspect ratio (greatest dimension:least dimension) of any piece of stone for size ranges shall be not greater than 3:1 when measured across mutually perpendicular axis. ASTM D 4791 shall be used as a guide to perform the test.

2.2.2 Production

Riprap shall be handled and selectively loaded onto trucks in a manner to avoid segregation and provide a distribution of stone sizes consistent with the gradation band. Each truckload shall be representative of the gradation requirements.

2.3 GEOTEXTILE

Geotextile shall meet the requirements of WIDOT 645, Type HR.

2.4 SOURCE QUALITY CONTROL

The material shall be stockpiled at the quarry prior to shipment. The Contracting Officer shall approve the material gradation based on visual observation. If the Government chooses to test the material gradation, the quarry shall assist the Government, or its Contractors, to sample and test the material.

PART 3 EXECUTION

3.1 SURFACE TOLERANCES

The finished surface tolerance above the neatline shall generally not deviate from the lines and grades shown by more than half (1/2) the average stone dimension of the gradation range. Riprap that has a rough and uneven surface shall be reworked by hand to stabilize stones that wobble and are out of tolerance, except where the Contracting Officer approves use of equipment. Rearranging of individual stones shall be required to the extent necessary to obtain a well-graded distribution of stone sizes.

3.2 FOUNDATION PREPARATION

Turf and topsoil shall be stripped before placing the geotextile.

3.3 PLACEMENT OF GEOTEXTILE

Placement of geotextile shall be in accordance with WSDOT 645.3.

3.4 PLACEMENT OF RIPRAP

3.4.1 Layer Requirements

Riprap shall be placed in a manner which will produce a well-graded mass of rock with the minimum practicable percentage of voids. The large stones shall be well distributed. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones.

3.4.2 Construction Methods

Unsegregated stone shall be placed in a systematic manner. Riprap shall be placed to its full course thickness in one operation and in such manner as to avoid displacing underlying material. Placement shall typically begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. Final finish of slope shall be performed as the material is placed.

Placing riprap in layers will not be permitted. Placing riprap by dumping it into chutes, or by any method likely to cause segregation of the various sizes, shall not be permitted. Placing riprap by dumping it at the top of the slope and pushing it down the slope shall not be permitted. No equipment shall be operated directly on the completed stone protection system. Dump trucks shall be equipped with bottom hinged tailgates if rock is directly placed into position with the trucks.

3.4.3 Riprap Placement on Geotextile

Riprap shall be placed over the geotextile by methods that do not tear, puncture, or reposition the fabric. Equipment shall be operated so as to minimize the drop height of the stone without contacting and damaging the geotextile. Generally this will be about 1 foot of drop from the bucket to the placement surface. Riprap shall be placed so that stones do not roll downhill.

3.4.4 Riprap Placement in Water

Riprap to be placed under water shall be placed in a systematic manner so as to ensure a continuous uniform layer of well-graded stone of the required thickness. Stone to be placed under water shall not be cast across the surface of the water.

3.5 MAINTENANCE

The Contractor shall maintain the stone protection and underlying works until accepted by the Contracting Officer. When appropriate, the Contractor shall place stone protection in a timely manner to reduce risk of scour. Any material displaced prior to acceptance and due to the Contractor's negligence or neglect shall be replaced at the Contractor's expense.

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SECTION 02456

STEEL H-PILES

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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997) Carbon Structural Steel
ASTM A 572/A 572M	(1998) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(1997) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 690/A 690M	(1994) High-Strength Low-Alloy Steel H-Piles and Sheet Piling for Use in Marine Environments
ASTM D 1143	(1981; R 1994) Piles Under Static Axial Compressive Load

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1996) Structural Welding Code - Steel
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1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Pile Installation Plan; FIO.

The required set at refusal (in blows per inch) shall be submitted with calculations specific to the equipment and piles to be used. Descriptions of all pile driving equipment to be employed in the work, shall be submitted prior to commencement of pile installations, including details of the pile hammer, power plant, leads, cushion material, and helmet. Manufactures' literature and installation recommendations for the proposed

pile points shall be submitted.

SD-09 Reports

PDA Testing; FIO.

A written report presenting the results of the pile driving analyzer (PDA) tests shall be submitted. The report shall be prepared and signed by a Registered Professional Engineer licensed in Minnesota or Wisconsin.

SD-13 Certificates

Welder Qualifications; FIO.

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

Materials; FIO.

Certified copies of mill test reports for structural steel prior to commencement of pile installations.

SD-18 Records

Pile Driving; GA.

A complete and accurate record of each driven pile shall be submitted prior to demobilization. The record shall indicate the pile plan number (location), the HP section designation, driven length, final elevations of tip and top, number of splices and locations, driving resistance (blows per foot) required for the final 10 feet of penetration, penetration for last five blows with the hammer, and the total driving time. The records shall also include the type and size of the hammer used and the rate of operation. Any unusual conditions encountered during pile installation shall be recorded and immediately reported to the Contracting Officer.

Pile Survey; FIO.

Final pile locations shall be surveyed, and the deviations from plan dimension shall be submitted.

1.3 EXPERIENCE

The work shall be performed by a general contractor or a specialty subcontractor specializing in the specified foundation system and having experience installing the specified foundation system under similar subsurface conditions.

1.4 DELIVERY, STORAGE AND HANDLING

Piles shall not be subject to overstress or any other condition that may cause damage to the piles during storing and/or handling. Piles shall not be dragged along the ground. The maximum permissible camber and sweep shall be 2 inches over the length of the pile.

1.5 SUBSURFACE DATA

Subsurface soil boring logs are shown on the drawings. A driller's log for the water supply well constructed in 1939 is attached in SECTION 00830.

Field logs and complete testing data are available for examination at the Corps of Engineers, St. Paul District Office, 190 5th Street East, St. Paul, Minnesota, contact: District Engineer.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Piles

Steel for H-Piles and splice plates shall conform to the requirements of ASTM A 36. Pile tips as driven shall be square and blunt as received from the mill.

2.1.2 Pile Tips

The piles shall be fitted with low alloy cast steel pile tips. The pile tips shall be welded in accordance with the tip manufacturer's recommendations.

2.2 EQUIPMENT

2.2.1 Pile Hammers

The hammer used shall have a delivered energy suitable for the total weight of the pile, the character of subsurface material to be encountered, and the pile capacity to be developed. The driving energy of the hammer shall be not less than 24,000 foot-pounds.

2.2.2 Driving Helmets and Pile Cushions

A driving helmet or cap, including a pile cushion, shall be used between the top of the pile and the ram to prevent impact damage to the pile. The driving helmet, or cap and pile cushion combination, shall be capable of protecting the head of the pile, minimizing energy absorption and dissipation, and transmitting hammer energy uniformly over the top of the pile. The driving helmet or cap shall fit loosely around the top of the pile so that the pile is not restrained by the driving cap if the pile tends to rotate during driving. The pile cushion shall completely cover the top surface of the pile and shall be retained by the driving helmet. The cushion material thickness shall be suitable for the size and length of pile, character of subsurface material encountered, hammer characteristics, and required driving resistance.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

3.1.1 Driving Order

Unless otherwise directed by the Contracting Officer, piles nearest the existing lock wall shall be driven first, and subsequent piles shall be driven progressively away from the lock wall.

3.1.2 Grading

Rough grades throughout the building area shall be established prior to the

commencement of pile driving.

3.2 INSTALLATION

3.2.1 Pile Driving

Piles shall be driven to refusal.

3.2.2 Hammer Operation

Diesel-powered hammers shall be operated at the rate recommended by the manufacturer throughout the entire driving period. Sufficient pressure shall be maintained at the steam hammer so that: for a double-acting hammer, the number of blows per minute during and at the completion of driving of a pile is equal approximately to that at which the hammer is rated; for a single-acting hammer, there is full upward stroke of the ram; and for a differential type hammer, there is a slight rise of the hammer base during each upward stroke. The cushion shall be replaced whenever it has become highly compressed, charred, burned, or deteriorated.

3.2.3 Alignment

Pile shall be handled and driven carefully to prevent overstress or leaning from a true position. The pile-driving rig shall have sufficiently rigid supports so that the leads remain accurately aligned. Templates or guide frames shall be erected at or close to the ground or water surface.

3.2.4 Pre-Drilling

Pre-drilling of piles will not be permitted.

3.2.5 Jetting

Jetting of piles will not be permitted.

3.2.6 Splicing

Splices shall be of the full penetration butt-weld type. Splices shall be designed and constructed to maintain the true alignment and position of the pile sections. Splices shall develop the full strength of the pile in both bearing and bending. Proprietary prefabricated splicer sleeves may be used upon prior approval by the Contracting Officer.

3.2.7 Welding

Shop and field welding, qualification of welding procedures, welders, and welding operators shall be in accordance with AWS D1.1.

3.2.8 Tolerances in Driving

Piles shall not be located more than 3 inches horizontally from their position indicated on the Drawings. Top of pile at cut off shall be within ½ inches of the elevation indicated. Additionally, a variation from plumb, as measured on the driven pile, of not more than 1/4 inch per foot of longitudinal axis will be permitted. Piles will be checked for heave. Piles found to have heaved shall be redriven to the required point elevation. Piles damaged or driven outside the above tolerances shall be replaced or additional piles driven at locations specified by the Contracting Officer at no expense to the Government.

3.2.9 Pile Intersection

If pile driving conditions indicate that a driven pile may have intersected another pile or the lock structure, the Contracting Officer shall immediately be notified. If the Contracting Officer believes that an intersection may have occurred, he may at his option direct the Contractor to survey the location and alignment of the piles, pull the piles, furnish new piles, redrive the same piles or drive new piles. If a pulled pile was driven within tolerances, full payment will be made to the Contractor for pulling the pile, furnishing a new pile (if required) and re-driving the pile at the applicable unit prices for furnishing and driving piles as specified in SECTION 01270: MEASUREMENT AND PAYMENT.

3.2.9.1 Existing Sheet Pile Cutoff

The Contractor shall excavate a trench to verify the location of the existing sheet pile cutoff wall before driving any piles. Pile number 6 shall be offset or battered if necessary to avoid pile intersection with the sheetpile. The Contracting Officer shall be informed and approve of pile offset or batter.

3.3 PILE DRIVING ANALYZER

3.3.1 Test Piles

Two test piles shall be driven prior to driving other piles. The test piles shall be driven to refusal. Pile number 8 shall be a test pile, and one pile on grid line 1 shall be a test pile. The Contractor Officer shall approve of changes in test pile locations. In addition, the PDA shall be available on-site during driving of pile number 6.

3.3.2 Analysis

Pile Driving Analyzer testing shall be completed by an independent engineering/testing firm in accordance with ASTM D4945, measuring inputs from 2 strain transducers and 2 motion transducers on each pile. Preliminary results based on the CASE method with assumed values for damping and quake shall be reported to the Contracting officer. The report shall include an analysis of pile overstress, a CAPWAP analysis to refine wave theory variables, and updated pile capacities based on calculated values for damping and quake. The report shall be submitted within 48 hours after the field testing.

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SECTION 02533

SEWAGE LIFT STATION

PART 1 GENERAL

This section covers the installation of the sewage lift station including manhole, pumps, and discharge piping. Electrical requirements for the pumps are given in SECTION 16250: DUPLEX PUMP PANEL AND CONTROLS.

1.1 REFERENCES

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

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- | | |
|------------|---|
| ASME IX | (1992) Boiler and Pressure Vessel Code, Section IX: Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators |
| ASME B1.1 | (1989) Unified Inch Screw Threads (UN and UNR Thread Form) |
| ASME B16.5 | (1988) Pipe Flanges and Flanged Fittings |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------|---|
| ASTM A 47 | (1990) Ferritic Malleable Iron Castings |
| ASTM C 478 | (1996) Precast Reinforced Concrete Manhole Sections |
| ASTM D 1784 | (1996) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds |
| ASTM D 2241 | (1989) Specification for PVC Pressure Rated Pipe SDR Series |
| ASTM D 3139 | (1989) Specification for Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals |
| ASTM F 477 | (1995) Elastomeric Seals (Gaskets) for Joining Plastic Pipe |

AMERICAN WATER WORKS ASSOCIATION (AWWA)

- | | |
|-------|---|
| C 203 | (1986) Coal Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel & Tape-Hot Applied |
|-------|---|

C 206	(1991) Field Welding of Steel Water Pipe
C 207	(1986) Steel Pipe Flanges for Waterworks
C 208	(1983) Standard for Dimensions for Fabricated Steel Water Pipe Fittings
C 500	(1986) Gate Valves for Water and Sewage Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Materials and Equipment; GA.

Shop drawings shall be submitted for all materials and equipment. Components of the system shall be submitted together as a complete package. Shop drawings shall include: manufacturer's descriptive and technical literature, performance charts, and catalog cuts; complete piping diagrams; details and data on equipment layout and anchorage, valves, couplings, and supports; and other details necessary to demonstrate that each proposed system has been coordinated and will properly function as a unit. Shop drawings shall show clearances needed for maintenance and operation. The following shop drawings shall be submitted:

(1) Shop drawings on the proposed pumps. Include capacity head curves and material information. All support details shall be shown. Complete installation procedures shall be outlined.

(2) Data on the new piping and valves proposed for the lift station and manufacturer's standard coatings for new pipes and valves.

(3) Dimensional and material data on the pre-cast manhole. Include connection details between the manhole and the gravity sewer pipe and the forcemain pipe.

(4) A copy of the warranty for the pump, controls, and pre-cast manhole shall be submitted.

(5) Data on the pump controls, including control panel and floats, shall be submitted per Section 16250: DUPLEX PUMP PANEL AND CONTROLS.

(6) Complete wiring diagrams for the control system and pumps shall be submitted per Section 16250: DUPLEX PUMP PANEL AND CONTROLS.

(7) Certificates of compliance for the forcemain sewer, valves, lift station piping, and manhole shall be submitted.

SD-09 Reports

Performance Test Reports; FIO.

Upon completion, including testing, of each installed system, test reports shall be submitted in booklet form presenting all field tests performed. Performance test reports shall be included in the operation and maintenance manual.

SD-19 Operation and Maintenance Manuals

Operation And Maintenance Instructions; FIO.

The Contractor shall submit, prior to delivery of the sewage lift station to the project work site, five copies of an O & M manual. Manual shall contain complete information in connection with the operation, lubrication, adjustment, routine and special maintenance, disassembly, repair, and reassembly of the pumps and accessories. The manual shall also have a listing of special tools required for working on the pumps. The manual shall include operation and maintenance procedures, special features, and instructions for setting all adjustable controls and equipment. Comprehensive as-built drawings, photographs, factory test results, and sketches of the pumps shall be included. The manual shall include complete diagnostic information on the pumps and all approved shop drawing submittals on the pumps, controls, and pre-cast manhole.

Parts List; FIO.

The operation and maintenance manual shall have a complete parts list for the pumps and controls including spare parts. The list shall clearly show all details and parts, and all parts shall be adequately described and have identification markings and include sources for all parts.

Manuals shall be made up with hard cover post type binders and printed on 8-1/2 inch by 11 inch high quality paper with indexed, tabbed section dividers. Large sheets shall be neatly folded and installed with post hole reinforcements such that sheets can unfold without need to open binder posts. Drawings, sketches, and parts lists incorporated in the manual may be reduced to page size provided such reductions are clear and easily legible; otherwise they may be folded into the manual.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The sewage lift station shall be a packaged station consisting of submersible grinder pumps, pre-cast concrete manhole, sewer piping, and controls. Station shall be a duplex station. Influent and discharge pipe elevations shall be as indicated. Forcemain sewer layout shall be as indicated.

2.1.1 Standard Products

The pumps shall be the product of a pump manufacturer who has produced at least 200 units of the models required under this contract. 100 of these units shall have been operating in the United States for at least two years prior to the contract award date. Other materials and equipment shall be the standard products of manufacturers regularly engaged in the manufacture of such items. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to the contract award date. Pumps, discharge piping, and the guiderail system shall be standardized for installation in precast manholes.

2.1.2 Asbestos Prohibition

Asbestos and products containing asbestos shall not be used and will not be permitted in the contract work.

2.1.3 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type/style, model, serial number, and catalog number on a plate secured to the item of equipment. Nameplates shall be made of corrosion resisting metal with raised or depressed lettering on a contrasting colored background.

2.1.4 Instruction Plates

As necessary, each item of equipment shall be labeled with suitably installed instruction plates including warnings and cautions describing special and important procedures to be followed during starting, operating, and servicing of the equipment. The plates shall be made of corrosion resisting metal with raised or depressed lettering on a contrasting colored background.

2.2 Welding Procedures

Welding shall be performed in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME IX Boiler and Pressure Vessel Code, and AWS D1.1. The Contracting Officer shall be furnished with a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

2.3 Verification of Dimensions

The Contractor shall be familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy prior to performing the work. The Contractor shall be responsible for the coordination of his work with site conditions and with the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of work and working conditions.

2.4 MATERIALS

Materials not specifically described shall, as far as practicable, conform to the latest approved industry standard(s) covering the appropriate class or types of materials.

Designated items shall conform to the following:

Item	Requirements
Cast Iron	ASTM A 48, Class No. 30A, 30B and 30C
Cast Steel	ASTM A 27, Grade 65-35, annealed
Cold Rolled Steel Bars	ASTM A 108, Minimum Working Strength 65,000 pounds per square inch
Hot Rolled Steel Bars	ASTM A 576, Grades: G10200, G10450, G11410

Hot Rolled Stainless ASTM A 564, Grade 517/400

Bars and Shapes:

Steel Plates, Structural ASTM A 285, Grade B
Steel Plates, Pressure
 Vessel ASTM A 516, Grade 55
Steel Forgings ASTM A 668, Class F

2.4.1 Steel Pipe

Pipe within the limits of the sewage pumping station shall be galvanized steel, coated and lined in accordance with AWWA C 203. The pipe shall be suitable for use in pumping sewage after coating and lining, with no detrimental effects to the pipe. Either an epoxy coating system or a tape coating system shall be utilized. The size of the pipe shall be per pump manufacturer's recommendation with approval of the Contracting Officer. Pipe sizes shall be in accordance with ASTM A 53. The minimum wall thickness shall be schedule 40.

2.4.2 Fittings

Fittings within the limits of the pump station shall be flanged steel in accordance with AWWA C 208 and ASME B16.5. The pump manufacturer shall supply the hydraulic sealing flange and any other special fittings related to the pumps. Fittings shall be lined and coated as specified above for pipe.

2.4.3 Joints

Flanged joints shall be made using a full face gasket of rubber compound, suitable for use with raw sewage, 1/8 inch thick in accordance with AWWA C 207. Bolts shall be regular, unfinished square head, and nuts shall be American Standard heavy, unfinished hexagonal. Bolts, nuts, and stud bolts shall be standard size for the flanges bolted therewith. All threads shall be in accordance with ASME B1.1, Coarse-Thread Series, Class 2 fit, and shall be clean and true. Bolts and nuts shall be coated for installation in a sewage environment.

2.4.4 Insulating Joints

Insulating Joints shall be installed between non-threaded ferrous and non-ferrous metallic pipe, fittings and valves. Insulating joints shall consist of a sandwich-type flange insulating gasket of the dielectric type, insulating washers, and insulating sleeves for flange bolts. Insulating gaskets shall be full faced with outside diameter equal to the flange outside diameter. Bolt insulating sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

2.4.5 Flexible Coupling

The flexible coupling shall be a gasketed steel sleeve type. Couplings shall be coated and lined in accordance with AWWA C 203. Gaskets shall be composed of a synthetic rubber base and be made to withstand deterioration from exposure to raw sewage.

2.4.6 Pre-cast Manhole

Manhole shall be precast concrete of the diameter and length sized by the

pump manufacturer, as approved. Manhole shall be a packaged unit provided by the pump manufacturer. Manhole shall be constructed per ASTM C 478. Manhole base shall be precast concrete. Manhole cover shall be aluminum with a 300 lbs/sq foot load rating. A personnel access hatch and ladder shall be provided. Hatches shall be provided for removing the pumps from the manhole. Hatches and aluminum cover shall have diamond tread surfacing. Hatches shall be complete with hinges and flush locking mechanism.

2.4.7 Valves

Gate valves shall be cast iron, resilient type in accordance with AWWA C500.

2.4.8 Forcemain Sewer (Pressure Sewer)

Forcemain sewer shall be PVC in accordance with ASTM D 1784 and ASTM D 2241. Joints shall conform to ASTM D 3139 and ASTM F 477. Fittings shall be gasket push-on joints. Installation and testing of the forcemain sewer shall conform to Section: SANITARY SEWER.

2.5 PUMPS

2.5.1 Layout and Piping

The lift station shall be a duplex type station. The final layout of the lift station shall be coordinated with the pump manufacturer and approved by the Government. The final sizing of the lift station shall assume a maximum inflow of 60 gpm into the lift station. Float elevations shall be set so the pumps will start a maximum of 10 times per hour. The Contractor shall be responsible for investigating all site conditions affecting lift station installation. The Contractor shall design the lift station using the influent and discharge pipe elevations as indicated. The discharge piping shall include an integral ball check valve and hydraulically sealed discharge flange supplied by the pump manufacturer. The pumps shall mate with the discharge flange when the pumps are put into the well. Each pump discharge line shall be supplied with a gate valve in accordance with AWWA C500. The piping from each pump shall tee together and connect with a flexible coupling and new forcemain.

2.5.2 Pump Station Guide Rails

The Contractor shall provide and install guide rail(s) for each pump, to permit raising and lowering the pump. The guide rail(s) shall be stainless steel and sized as recommended by the pump manufacturer. They shall be of adequate length to extend from the lower guide holder on the pump discharge connections to the upper guide holders mounted on the access cover frame. Installation shall be in accordance with the manufacturer's instructions.

2.5.3 Other Pump Station Hardware

The Contractor shall provide and install other necessary station hardware as may be required for the complete construction. This hardware shall be, but not limited to, upper guide bracket, safety chain hook, cable holder, cable support grip, anchor bolts, and intermediate guide bar brackets to be installed at 8 foot maximum intervals.

2.6 PUMPING EQUIPMENT

2.6.1 Pumps

a. Three pumps total shall be provided. Two of the pumps will be for installation in the lift station and one pump will be used as a spare. Pumps shall be submersible grinder pumps capable of shearing and reducing commercial and residential sewage to a fine slurry. The pumps shall be easily removed from the wet-well without having operational personnel enter the wet-well. The individual design criteria shall be as follows:

GPM	TDH	Motor HP	RPM (max)
30	25	2	3450

b. The motor shall be three phase, 480 volt, and explosion proof designed for use in Class 1, Division 1, Environment. The grinder pump and motor are to be specially designed and manufactured so they can operate completely submerged in the liquid being pumped. Electrical power cord is to be sealed by use of a cord grip, with individual conductors additionally sealed into the cord cap assembly with epoxy sealing compound, thus eliminating liquid entering the motor by following individual conductors inside the insulation. The cord grip shall have a male taper pipe thread threaded into a female taper pipe thread in a cord cap. The cord cap shall be sealed into the motor housing with a Buna-N O-ring, or an epoxy seal providing an electrical connection which is completely water-tight, yet may be easily removed for service.

c. The combination centrifugal pump impeller and grinder unit shall be attached to a common motor and pump shaft made of 420 stainless steel. The grinder unit shall be on the suction side of the pump impeller, discharging directly into the impeller inlet leaving no exposed shaft to permit packing of ground solids. Both stationary and rotating cutters shall be made of hardened and ground stainless steel. Pump and motor housings are to be high quality grey iron castings. Impeller shall be bronze or cast iron. All fasteners shall be of AISI 316 stainless steel.

d. The pump-motor shall be sealed by two mechanical carbon and ceramic faced seals or an equivalent sealing system approved by the Contracting Officer, within an oil filled chamber to provide clean, constant lubrication. The shaft shall be supported by an upper ball radial and thrust bearing and a lower bronze radial sleeve bearing or lower single or double row ball bearing between the shaft seals to minimize overhang, both running in oil.

e. The motor winding and rotor are to be mounted in a sealed, submersible type housing which is air filled. Motor winding shall be securely held in the housing and it shall be removable in the field without the use of heat or a press. The impeller clearance shall be externally adjustable, without any pump disassembly, for most efficient operation.

2.6.2 Controls

Contractor shall design and provide a packaged control system for the lift station per SECTION 16250: DUPLEX PUMP PANEL AND CONTROLS. Controls shall be supplied by the pump manufacturer. Control system shall be a duplex, alternating, first on - first off, type system. A high alarm float, a first on, and second on float shall be provided. Control cabinet shall be stainless steel, NEMA 4X, and suitable for outdoor exposure. All control wiring shall conform to the NEC. Control cabinet shall be lockable. Alarms shall include the high alarm float and a leak detector for the seal oil chamber. Controls shall include a pump running light and pump run time meter.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 General

Unless otherwise required, materials and equipment shall be installed in accordance with the manufacturer's written recommendations. Alarms for the grinder pumps shall be installed inside the control station. Location shall be coordinated with the lockmaster.

3.1.2 Coordination

The Contractor shall be responsible for providing all required equipment and material for a complete installation, whether or not each and every item is shown on the drawings or specified herein.

3.2 START-UP AND TESTING

3.2.1 Start Up

A factory-trained service person shall be present at the time when the station is to be put into service and turned over to the Government. The Contractor shall allot 8 hours at the site for this service. The service person shall instruct the Government's personnel in the proper operation and maintenance of the equipment, and submit a written report to the Contracting Officer. The factory-trained service person shall return to the job site at least once after official start-up to renew instructions given previously. The time frame for this follow-up service shall be within 6 months of job completion.

3.2.2 Factory tests

The pump manufacturer shall perform the following inspections and tests on each submersible pump before shipment from factory.

(1) Impeller, motor rating, and electrical connections shall be checked for compliance to the specifications.

(2) A motor and cable insulation test for moisture content or insulation defects shall be performed.

(3) Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.

(4) The pump shall be run for 30 minutes submerged, a minimum of 6 feet under water.

(5) After operational test No. 4, the insulation test (No. 2) is to be performed again.

A factory certified written report, stating the foregoing have been done, shall be supplied with each pump at the time of shipment. An additional copy shall be forwarded to both the Contractor and Contracting Officer.

3.2.3 Site tests

Each pump shall be subjected to an operational test before acceptance as

follows:

- (1) Check discharge coupling for positive connection.
- (2) Check for proper service voltage.
- (3) Check for proper rotation of impeller.

(4) Perform a dry-run test allowing no liquid to enter inlet of pump. The exterior of the pump shall be dry and remain dry during test. The pumps shall be run dry for at least three 10 minutes periods and temperature readings shall be recorded and placed on file with the Contracting Officer and Contractor.

(5) Perform a "Snore test" (that is when the pump is alternately pumping liquid and air). The units shall be submerged with just enough liquid to accomplish "Snore test" and allowed to run for a 10 minute period.

(6) Perform an operational test on the station. Station shall run for 30 minutes to verify proper operation of controls and pumps.

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SECTION 02630

STORM-DRAINAGE SYSTEM

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 in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 105	(1994) Gray Iron Castings
AASHTO M 199	(1993) Precast Reinforced Concrete Manhole Sections
AASHTO M 198	(1994) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM C 76	(1995) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 270	(1996a) Mortar for Unit Masonry
ASTM C 443	(1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 478	(1994) Precast Reinforced Concrete Manhole Sections
ASTM C 506	(1998) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM D 4832	(1995) Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders
ASTM D 6023	(1996) Unit Weight, Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low Strength Material (CLSM)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL

PROCEDURES:

SD-01 Data

CLSM; GA.

A mix design shall be submitted for the CLSM mix to be used on the project. The design shall list the proportions by weight of cement, fly ash, weight or volume of water, weights of aggregates in a saturated surface-dry condition, and type, quantity, and name of admixtures per cubic yard of CLSM. All materials included in the mixture shall be of the same type and from the same source as will be used on the project. Each mix shall be accompanied by evidence that demonstrates the mix will produce CLSM having the characteristics and quality as specified.

SD-04 Drawings

Pipe Details; FIO.

Shop Drawings shall be submitted for each type of proposed pipe joint, for non-standard concrete items and for frames, covers, castings, and anchor bolting of manhole frames to structures.

SD-06 Instructions

Placing Pipe; FIO.

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-13 Certificates

Certificates for Pipeline; FIO.

Test reports demonstrating conformance of pipe to applicable pipe specifications shall be submitted to the Contracting Officer before delivery of pipe to work site. Strength tests for concrete pipe as required in applicable specifications shall be the three-edge bearing tests.

Certificates for Pipeline Joints; FIO.

Hydrostatic Test on Watertight Joints, and Frame and Cover for Gratings. Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed. Certification on the ability of frame and cover or gratings to carry the imposed live load.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Gasket materials and plastic materials shall be protected from exposure to the direct sunlight over extended periods.

1.3.2 Handling

Materials shall be handled in such a manner as to ensure delivery to the

trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

2.1.1 Concrete Pipe

Pipe for culverts and storm drains shall conform to ASTM C 76 for round pipe, and ASTM C 506 for arch pipe, class and size as shown.

2.1.2 Concrete Flared End Sections

Concrete flared end sections shall be of a standard design with pipe manufacturer and manufactured of the same materials as specified for the pipe to which the flared end section is to be jointed to.

2.1.3 Joints

The joint design and the physical requirements for gaskets shall conform to ASTM C 443. The gaskets shall meet the physical requirements for oil resistant rubber gaskets in ASTM C 443. Gaskets shall have not more than one factory-fabricated splice. Performance requirements for joints in concrete pipe shall conform to AASHTO M 198 or ASTM C 443. Alternate types of watertight joint may be furnished if specifically approved.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Concrete

Unless otherwise specified, concrete shall conform to the requirements under Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE, except that concrete for pipe bedding shall be a lean mix backfill (CLSM) proportioned for a 28-day strength between 75 and 400 psi as determined by ASTM D 4832. CLSM fill for the void between the new RCPA and existing box culvert shall have a density between 90 pcf and 130 pcf as determined by ASTM D 6023.

2.2.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except the maximum placement time shall be 1 hour.

2.2.3 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478 or AASHTO M 199. Joints between precast concrete riser and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure. Class of tee sections shall be the higher of the classes shown for adjoining pipe.

2.2.4 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron meeting ASTM A 48 Class 35B or AASHTO M 105 Class 35R; cast ductile iron meeting ASTM A 536 Grade 65-45-12; or cast aluminum meeting ASTM B 26 Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans. All castings and frames shall be capable of

withstanding a HS20 wheel load.

2.2.5 Tie Bolts

Tie bolts shall be steel and meet the requirements of the pipe manufacturer's recommendations.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches and for appurtenances and backfilling for culverts and storm drains shall be in accordance with the applicable portions of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITY SYSTEMS.

3.2 PLACING PIPE

Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper equipment shall be provided for lowering sections of pipe into trenches. Coated pipes shall be handled with straps rather than cables or chains. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. All pipe in place shall be inspected before backfilling, and those pipes damaged during placement shall be removed and replaced.

3.2.1 Concrete Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.2.2 Pipe Bedding

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe. When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making the particular type of joint.

3.3 JOINTS

Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made, the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

3.4 DRAINAGE STRUCTURES

3.4.1 Precast Reinforced Concrete Manholes and Catchbasins

Joints between precast concrete risers and tops shall be full-bedded in mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure, or joints shall be made with flexible, watertight, rubber-type gaskets meeting the requirements specified for concrete pipe joints in Paragraph: MATERIALS. Connections of pipes and risers to tee sections shall be made with rubber-type gaskets meeting the requirements specified.

Holes in precast risers for pipe connections shall be of the minimum dimensions necessary to install the pipe. The surfaces of the annular space between the pipe and riser wall shall be cleaned of loose material, filled with mortar, troweled smooth, and cured.

3.5 BACKFILLING

3.5.1 Backfilling Pipe in Trenches

Backfilling operations for pipes, culverts, storm drains and drainage structures shall be as specified in SECTION: EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITY SYSTEMS.

3.5.2 Backfilling Pipe in Fill Sections

No pipes shall be placed until rough grading is substantially complete.

3.5.2.1 Backfilling existing box culvert with CLSM

Backfilling with CLSM shall be placed in lifts not exceeding three feet. Each lift shall be allowed to harden before placing the next lift. CLSM shall be protected from freezing until it has hardened.

3.5.3 Movement of Construction Machinery

In compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any pipe damaged thereby shall be repaired or replaced at not cost to the Government.

3.5.4 Compaction and Testing

Compaction and testing requirements for backfill of pipes shall be as required in SECTION: GRADING.

3.5.5 Testing of CLSM

a. Strength Specimens. A set of Test cylinders shall be cast for compressive strength tests for each layer. A set of test specimens shall consist of three cylinders to be tested at 28 days.

b. Density Testing. Tests for unit weight shall be made for each layer placed.

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SECTION 02720

AGGREGATE BASE COURSE

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 in the text by basic designation only.

WISCONSIN DEPARTMENT OF TRANSPORTATION (WIDOT)

WIDOT 304 (1995)Crushed Aggregate Base, Standard Specifications for Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117 (1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse Aggregates

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Aggregate Sources; FIO.

Material sources as specified in Paragraph SOURCE AND SAMPLING.

SD-09 Reports

Testing; FIO.

Testing results as specified in Paragraph TESTING.

SD-14 Samples

Aggregate Samples; FIO.

Samples of aggregate as specified in Paragraph SOURCE AND SAMPLING.

PART 2 PRODUCTS

2.1 AGGREGATE BASE

WIDOT 304, Gradation No. 2.

2.2 MATERIAL SOURCES

It shall be the responsibility of the Contractor to make its own investigations for a source of suitable materials and to make its own arrangements with the owners of the pits for procuring the required quantity of suitable material. Aggregate sources on private lands shall be conditioned in agreement with local laws or authorities. The Contractor shall designate in writing only one source or one combination of sources from which it proposes to furnish aggregate. A 50 pound sample shall be provided to the Contracting Officer. Approval of samples from a source of aggregate is not to be construed as approval of all materials from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels when such materials are unsuitable for aggregate as determined by the Contracting Officer. Materials produced from an approved source shall meet all the requirements of this section.

PART 3 EXECUTION

3.1 GENERAL

Aggregate base course shall be constructed in accordance with the requirements of the referenced state standard specification sections unless specified otherwise.

3.1.1 Definitions

The term "Engineer" referenced in the state standard specifications shall mean the Contracting Officer.

3.2 EQUIPMENT

All plant, equipment, and tools used in the performance of the work will be subject to approval and shall be maintained in satisfactory working condition at all times. The equipment shall meet the requirements of the referenced state standard specification sections. The base course shall be compacted using a steel-wheeled roller, vibratory smooth drum roller, pneumatic-tired roller, unless other special compaction equipment is approved.

3.3 WEATHER LIMITATION

Base courses shall be placed when the atmospheric temperature is above 35 degrees F. Base shall not be constructed on subgrades that are frozen or contain frost. Areas of completed base course that are damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

3.4 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. Materials obtained from different sources shall be stockpiled separately.

3.5 PREPARATION OF SUBGRADE

Prior to constructing the aggregate base course, the subgrade shall be cleaned of all foreign substances. Ruts or soft, yielding spots in the subgrade, areas having inadequate compaction, and deviations of the surface from the requirements specified shall be corrected by loosening and removing soft or unsatisfactory material and by adding satisfactory material with a consistency and texture similar to the surrounding subgrade, reshaping to line and grade, and recompacting to specified density requirements. The finished subgrade shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the base course is placed.

3.6 PROOF-ROLLING

The subgrade shall be proof-rolled prior to placing aggregate base. Proof-rolling shall be scheduled at a time when the Contracting Officer can observe, unless waived. Proof-rolling shall be accomplished within the limits of the work by passing a loaded 25 ton dump truck or rubber tired heavy equipment over the entire subgrade at a slow rate of speed. Proof-rolling shall be observed by a qualified observer not riding in the vehicle. Soft or loose areas identified by the proof-rolling and occurring in previously placed fill shall be tested for compaction where directed by the Contracting Officer. Isolated areas of soft cohesive soils shall be subcut and replaced with satisfactory fill of a texture similar to surrounding subgrade soil. Loose zones of non-saturated granular soil shall be compacted. The Contracting officer has the option to direct subgrade correction. Payment will be authorized for subgrade correction of native soils identified as suitable subgrade material in the project documents. Such payment or schedule changes will be negotiated in accordance with CONTRACT CLAUSE: CHANGES. Correction of fill soils not meeting compaction specifications shall be corrected at the Contractor's expense.

3.7 GRADE CONTROL

During construction, the lines and grades, including crown and cross slope indicated for the base course, shall be maintained by means of line and grade stakes placed by the Contractor. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining. The Contractor may use an approved laser system in lieu of a grade stake system. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the area to be constructed.

3.7.1 Grade and Cross Section Tolerances

Subgrade. 0.05 foot above or below prescribed elevation.

Base Courses. 0.05 foot below prescribed elevation.

3.8 PLACING

The mixed material shall be placed on the prepared subgrade or subbase in loose lifts not exceeding 6 inches in thickness. The layers, when compacted, shall be true to the grades or levels required, with the least possible surface disturbance. If base course becomes contaminated by traffic or sedimentation, the surface shall be cleaned prior to completing subsequent work by sweeping with power sweepers, power brooms, or hand

brooms.

3.9 COMPACTION

3.9.1 Requirements

Each layer shall be compacted until there is no further evidence of consolidation. Water shall be applied to the base material during the mixing, spreading, and compacting operations when and in the quantities the Contracting Officer considers necessary for proper compaction.

3.9.2 Finishing

The surface of the top layer shall be finished to grade and cross section shown. Finished surface shall be of uniform texture. Light blading during compaction may be necessary for the finished surface to conform to the lines, grades, and cross sections. Should the surface for any reason become rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portion shall be scarified, reworked, or replaced as directed.

3.10 SMOOTHNESS TEST

The surface of the top layer shall not deviate more than 1/2 inch when tested with a 10 foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding 1/2 inch shall be corrected.

3.11 THICKNESS CONTROL

The thickness of the base course shall be measured at intervals of one measurement for at least each 500 square yards of base course. The depth measurement shall be made by test holes at least 3 inches in diameter. The work shall be scheduled when the Contracting Officer can observe the testing; and the Contracting Officer shall select the locations of the test holes, unless waived.

3.12 TESTING

The following tests shall be performed by and at the expense of the Contractor. Samples shall be taken when and where directed. Tests of materials not meeting the requirements specified will not be counted as part of the required tests. Copies of test results shall be submitted to the Contracting Officer.

3.12.1 Sieve Analysis (ASTM C117 and C136)

Aggregate Base. One test prior to placing or hauling and one test per 250 cy or fraction thereof (in place measure).

3.12.2 Correction

When any source of materials is changed or deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced.

3.13 MAINTENANCE

The base course shall be maintained in a condition that will meet specification requirements until accepted.

-- End of Section --

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SECTION 02740

BITUMINOUS PAVING

PART 1 GENERAL

Work under this section shall include all bituminous paving, including surface and base courses and tack coat, for paving of roads, parking lots, and isolated repairs over utility trenches.

1.1 REFERENCES

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

WISCONSIN DEPARTMENT OF TRANSPORTATION (WIDOT)

WIDOT 401	(1996) Plant-Mixed Bituminous Pavement, Standard Specifications for Highway and Structure Construction
WIDOT 402	(1996) Tack Coat, Standard Specifications for Highway and Structure Construction
WIDOT 405	(1996) Plant Mixed Asphaltic Bases and Pavements - General Requirements, Standard Specifications for Highway and Structure Construction
WIDOT 407	(1996) Asphaltic Concrete Pavement, Standard Specifications for Highway and Structure Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 2172	(1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

ASPHALT INSTITUTE

SP-1	() Superpave Series No. 1
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1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Mixture Data; FIO.

Mixture data for the bituminous pavement as specified in PARAGRAPH:
BITUMINOUS PAVEMENT MIXTURES.

SD-13 Certificates

Certificates of Compliance; FIO.

Certificates of compliance stating that materials incorporated in the work meet the requirements of these specifications.

SD-18 Records

Delivery Tickets; FIO.

Delivery tickets showing type of material and quantity of material incorporated in the work.

1.3 DEFINITIONS

Engineer: The term "Engineer" referenced in WIDOT Standard Specifications for Construction shall mean the Contracting Officer.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 Straightedge

The Contractor shall furnish and maintain at the site one 12-foot straightedge for each bituminous paver. Straightedge shall be made available for Government use.

1.5 WEATHER LIMITATIONS

Bituminous course or coat shall be applied only on a dry surface. No material shall be placed when the temperature of the substrate surface is below 40 degree F.

1.6 PROTECTION OF PAVEMENT

After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until the pavement has cooled to 140 degrees F.

1.7 GRADE AND SURFACE-SMOOTHNESS REQUIREMENTS

Finished surface of bituminous courses shall conform to gradeline and elevations shown and to surface-smoothness requirements specified.

1.7.1 Plan Grade

The grade of the completed surface shall not deviate more than 0.05 foot from the plan grade.

1.7.2 Surface Smoothness

When a 12-foot straightedge is laid on the surface parallel with the centerline of the paved area or transverse from crown to pavement edge, the surface shall vary not more than 1/4 inch from the straightedge.

1.8 AGGREGATE SOURCES AND SAMPLING

It shall be the responsibility of the Contractor to make its own investigations for sources of suitable aggregate for the bituminous mixture and to make its own arrangements with the owners of the pits for procuring the required quantity of suitable material. After the award of the contract and at least 30 calendar days prior to placing, the Contractor shall designate in writing only one source or one combination of sources from which it proposes to furnish aggregates. Samples shall be provided to the Contracting Officer at the construction site at the expense of the Contractor. Approval of samples from a source of aggregate is not to be construed as approval of all materials from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels when such materials are unsuitable for aggregate as determined by the Contracting Officer. Materials produced from an approved source shall meet all the requirements of this section.

1.9 ACCESS TO PLANT AND EQUIPMENT

The Contracting Officer shall have access at all times to all parts of the paving plant for checking adequacy of the equipment in use; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking temperatures maintained in preparation of the mixtures.

PART 2 PRODUCTS

2.1 TACK COAT

WIDOT 401.

2.2 BITUMINOUS MATERIAL

WIDOT 401, Asphalt Cement (AC), Penetration Grade 120/150, or the Asphalt Institute's performance graded asphalt PG 58-28 per Table 1 of the Superpave Series No. 1 (SP-1).

2.3 BITUMINOUS HOT MIX

- a. Bituminous Base Course. WIDOT 407, Gradation No. 2.
- b. Bituminous Wearing Course. WIDOT 407, Gradation No. 3.

2.4 JOB MIX FORMULA

Mixture for each bituminous course shall be determined by one of the following methods.

1. A mixture meeting the specified State specification may be used provided:
 - a. The mixture is currently approved by the State for use in a State paving project in the local area;
 - b. Evidence satisfactory to the Contracting Officer is submitted indicating such State approval;
 - c. The mixture uses the same aggregate source that is selected by

the Contractor, and
d. The mixture is approved by the Contracting Officer.

2. A written job-mix formula proposal by the Contractor, submitted to the Contracting Officer for approval setting forth:

- a. a specific source or combination of sources for aggregate
- b. a definite percentage of the aggregate passing each sieve;
- c. the percentage of bituminous material; and
- d. the temperature at which the mixture will be delivered to the worksite.

The proposal shall be accompanied by representative samples of aggregate to be used and shall be submitted to the Contracting Officer at least 15 calendar days prior to the beginning of bituminous pavement operations.

PART 3 EXECUTION

Bituminous pavement operations shall not begin until approval of the mixture for each course. Prior to paving operations, the lines and grades will be verified and/or corrected to be as indicated and within the tolerances specified in SECTION: AGGREGATE BASE COURSE.

3.1 PREPARATION

Prior to placing each bituminous course or coat, the underlying surface shall be cleared of all foreign and objectionable matter using power blowers, power brooms, or hand brooms. The Contracting Officer will inspect the underlying course or coat for conformance with the specifications and drawings. If the underlying course or coat is acceptable, work on the next bituminous course or coat may commence; if not acceptable, the Contractor shall take such corrective actions as directed to bring the underlying course or coat into conformance with the specifications and drawings before placing the next bituminous course or coat.

3.2 TRANSPORTATION OF BITUMINOUS MIXTURE

Each load of bituminous mixture having a temperature of less than 235 degrees F. when dumped into the bituminous paver, or when dumped for spreading when a bituminous paver is not used, will be rejected. Bituminous mixtures that are crusted or have become wet by precipitation shall be rejected.

3.3 TACK COATING

Prior to placing bituminous wear course over the base course, the entire surface shall be treated with a tack coat in conformance with WIDOT 402. Rate of application shall be 0.05 to 0.15 gallons per square yard as determined by the Contracting Officer to suit field conditions.

3.4 PLACING BITUMINOUS

Bituminous base course and wear course shall be placed in accordance with WIDOT 405.

3.5 COMPACTION OF MIXTURE

The compaction shall be monitored using the ordinary compaction procedure specified in WIDOT 405, except that initially a nuclear density meter shall be used to determine when no appreciable further consolidation occurs. The Contractor shall have on site a nuclear density meter that is designed for testing bituminous and/or concrete surfaces and an operator who is familiar with its use and certified to use nuclear gages. The specified density shall be obtained before the mat temperature drops below 185 degrees F.

3.5.1 Correcting Deficient Areas

Mixtures that become contaminated or are defective shall be removed to the full thickness of the course. Edges of the area to be removed shall be cut so that sides are perpendicular and parallel to the direction of traffic and so that the edges are vertical. Fresh paving mixture shall be placed in the excavated areas in sufficient quantity so that the finished surface will conform to grade and smoothness requirements. Paving mixture shall be compacted to the density specified herein. Skin patching of an area that has been rolled shall not be permitted.

3.6 TESTING

The following testing shall be performed by and at the expense of the Contractor. Samples shall be taken when and where directed by the Contracting Officer. Core samples shall be taken for the purposes of measuring course thickness and specific density. The Contractor shall fill core holes with bituminous mixture and compact. Tests of materials not meeting the requirements specified will not be counted as part of the required tests.

TABLE. BITUMINOUS TESTING

<u>Test</u>	<u>Material</u>	<u>Frequency</u>
Sieve Analysis ASTM C 136	Aggregates from Base and Surface Courses	One test per 125 cubic yards or fraction thereof for each type of material
Core Samples	Base Course and Surface Course	Two core samples of each course
Extraction of Bitumen ASTM D 2172	Base Course and Surface Course	One sample each course

-- End of Section --

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SECTION 02760

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SECTION 02760

PAVEMENT MARKINGS

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 in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 248 (1991I) Ready-Mixed White and Yellow
Traffic Paints

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment Lists; FIO.

Lists of proposed equipment to be used in performance of construction work, including descriptive data.

1.3 DELIVERY AND STORAGE

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.4 EQUIPMENT

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways will display low speed traffic markings and traffic warning lights. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces shall be acceptable for marking the parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

PART 2 PRODUCTS

2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paint shall conform to AASHTO M 248, color as indicated or selected. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface latence, and other marks on the pavement shall be completely removed with wire brushes or approved chemicals, or mechanical abrasion.

3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans. All pavement marking shall be paint.

3.2.1 Paint

Paint shall be applied evenly to the pavement surface to be coated at a rate of 105 plus or minus 5 square feet per gallon. Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically. The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

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SECTION 02770

CONCRETE SIDEWALKS AND CURBS

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 in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 182 (1991) Burlap Cloth Made from Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185 (1994) Steel Welded Wire Fabric, Plain,
for Concrete Reinforcement

ASTM A 615/A 615M (1996a) Deformed and Plain Billet-Steel
Bars for Concrete Reinforcement

ASTM A 616/A 616M (1996) Rail-Steel Deformed and Plain Bars
for Concrete Reinforcement

ASTM A 617/A 617M (1996a) Axle-Steel Deformed and Plain Bars
for Concrete Reinforcement

ASTM C 31/C 31M (1996) Making and Curing Concrete Test
Specimens in the Field

ASTM C 143 (1990a) Slump of Hydraulic Cement Concrete

ASTM C 171 (1997) Sheet Materials for Curing Concrete

ASTM C 172 (1990) Sampling Freshly Mixed Concrete

ASTM C 231 (1997) Air Content of Freshly Mixed
Concrete by the Pressure Method

ASTM C 309 (1997) Liquid Membrane-Forming Compounds
for Curing Concrete

ASTM C 920 (1995) Elastomeric Joint Sealants

ASTM D 1751 (1983; R 1991) Preformed Expansion Joint
Filler for Concrete Paving and Structural
Construction (Nonextruding and Resilient
Bituminous Types)

ASTM D 1752 (1984; R 1996) Preformed Sponge Rubber and

Cork Expansion Joint Fillers for Concrete
Paving and Structural Construction

ASTM D 3405

(1996) Joint Sealants, Hot-Applied, for
Concrete and Asphalt Pavements

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Technical Data; FIO.

Catalog cuts or material data sheets for the joint sealants shall be submitted.

SD-09 Reports

Field Quality Control; FIO.

Copies of all test reports shall be attached with daily quality control reports on the date of test completion.

SD-18 Records

Concrete; FIO.

Copies of delivery tickets for all concrete used in the construction shall be furnished to the Contracting Officer. Collection and transmittal of the tickets shall be arranged with the Contracting Officer.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Cold Weather

Concrete placement shall be discontinued when the air temperature reaches 40 degrees F and is falling. Placement may begin when the air temperature reaches 35 degrees F and is rising. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement shall be approved in writing. Approval will be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F. Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 95 degrees F.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

1.4.2 Slip Form Equipment

Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in 1 pass.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall conform to the applicable requirements of SECTION: CONCRETE FOR BUILDING CONSTRUCTION except as otherwise specified. Concrete shall have a minimum compressive strength of 4500 psi at 28 days. Maximum size of aggregate shall be 3/4 inches.

2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 4-1/2 to 7-1/2 percent, based on measurements made immediately after discharge from the mixer.

2.1.2 Slump

The concrete slump shall be 3 inches where determined in accordance with ASTM C 143.

2.1.3 Reinforcement Steel

Reinforcement bars shall conform to ASTM A 615/A 615M, ASTM A 616/A 616M, or ASTM A 617/A 617M, grade 60. Wire mesh reinforcement shall conform to ASTM A 185.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

2.4.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

2.4.2 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 3/8 inch thick, unless otherwise indicated.

2.5 JOINT SEALANTS

2.5.1 Joint Sealant, Cold-Applied

Joint sealant, cold-applied shall conform to ASTM C 920, Type S, Grade P, Class 25, Use T.

2.5.2 Joint Sealant, Hot-Poured

Joint sealant, hot-poured shall conform to ASTM D 3405.

2.6 FORM WORK

Form work shall be designed and constructed to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2-inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of 2 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

2.6.2 Curb Forms

Curb outside forms shall have a height equal to the full depth of the curb.

The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together.

2.6.3 Wheel Stops

Wheel stops shall be fabricated in general conformance with SECTION: PRECAST PRESTRESSED CONCRETE.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted to conform with applicable requirements of SECTION: EARTHWORK.

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Curb Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement and shall be placed and compacted to conform with applicable requirements of SECTION: EARTHWORK.

3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING

Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders,

and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10 foot long section. After forms are set, grade and alignment shall be checked with a 10 foot straightedge. Forms shall have a transverse slope of 1/4 inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

3.2.2 Curbs

Forms back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a wood float, bull float, or darby, edged and broom finished.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush. The brush shall be in a direction transverse to that of the traffic, unless otherwise shown on the drawings.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 5/16 inch from the testing edge

of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.4 CURB CONCRETE PLACEMENT AND FINISHING

3.4.1 Formed Curb

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using mechanical vibrators.

3.4.2 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges shall be rounded with an edging tool to a radius of 1/2 inch. Approved slipformed curb and gutter machines may be used in lieu of hand placement.

3.4.3 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers (whichever is less), unless the spacing is indicated on the drawings. Transverse contraction joints shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width.

Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

3.5.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.5.2 Sidewalk Expansion Joints

Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs on lockwalls. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed with 1/2 inch

joint filler strips. Joint filler shall be placed with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.5.3 Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length. Contraction joints shall be constructed by means of 1/8 inch thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

3.6.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement and lockwalls, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 1/2 inch in width shall be provided at intervals not exceeding 50 feet. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Expansion joints and the top 1 inch depth of curb and gutter contraction-joints shall be sealed with joint sealer. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.7 CURING AND PROTECTION

3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.7.1.1 Mat Method

The entire exposed surface shall be covered with 2 or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.7.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

3.7.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet per gallon for both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for

sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.7.4 Protective Coating

Protective coating of linseed oil mixture shall be applied to the exposed-to-view concrete surface.

3.7.4.1 Application

Curing and backfilling operation shall be completed prior to applying protective coating. Concrete shall be surface dry and clean before each application. Coverage shall be not more than 50 square yards per gallon for first application and not more than 70 square yards per gallon for second application, except that the number of applications and coverage for each application for commercially prepared mixture shall be in accordance with the manufacturer's instructions. Coated surfaces shall be protected from vehicular and pedestrian traffic until dry.

3.7.4.2 Precautions

Protective coating shall not be heated by direct application of flame or electrical heaters and shall be protected from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Material shall not be applied at temperatures lower than 50 degrees F.

3.8 FIELD QUALITY CONTROL

3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing.

Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.8.2 Concrete Testing

Concrete strength, air content, and slump shall be determined and evaluated in accordance with SECTION 03300: CONCRETE FOR BUILDING CONSTRUCTION.

3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine.

If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.9 SURFACE DEFICIENCIES AND CORRECTIONS

3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch.

Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

-- End of Section --

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SECTION 02795

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SECTION 02795

REINFORCED GRASS PAVERS

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Literature; FIO.

Descriptive technical data on the grass pavers shall be submitted. The submittal shall include all material properties and product characteristics as specified under PARAGRAPH: PRODUCTS.

SD-06 Instructions

Manufacturer's Instructions; FIO.

Instructions for installation of the grass pavers shall be submitted.

1.2 TIME RESTRICTIONS

Paving and concrete walks shall be completed prior to installation of the grass pavers. Pavers shall be installed concurrently with or immediately prior to sodding.

1.3 DELIVERY, STORAGE AND HANDLING

The pavers shall be protected from damage during shipping, delivery or placement. Cracked pavers shall be discarded and not placed in the work. The pavers shall be protected from sunlight until deployment, such as covering with a tarp.

PART 2 PRODUCTS

2.1 GRASS PAVERS

The grass pavers shall be manufactured from high density polyethylene (HDPE) with stabilizers for ultraviolet (UV) light. The pavers shall have bearing pads on the base to limit punching into the subgrade. The pavers shall be designed with a locking mechanism on the perimeter to fasten adjacent pavers. The pavers shall be manufactured to the following specifications:

- a. 1-3/4 inch nominal depth

- b. 2 to 3 inch nominal cell diameter
- c. color: dark green
- d. nominal wall thickness not less than 0.1 inches
- e. Strength: Demonstrated satisfactory performance with 18,000 pound axle loads.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

The bedding sand shall be spread evenly over the area to be paved and shall be screeded with a tolerance for grade and surface smoothness of plus or minus 1/4 inches. Immediately prior to placing the pavers, the surface shall be compacted with a smooth drum roller or plate tamper.

3.2 PLACEMENT OF PAVERS

Pavers shall be placed on smooth, level and compact sand bedding. Placement shall be coordinated to avoid traffic on the prepared surface. The pavers shall be placed and interlocked in accordance with the manufacturer's instructions.

3.3 FILLING PAVERS

Hauling material shall be staged so that equipment does not travel on pavers with unfilled voids. The fill material shall be spread manually with shovels, asphalt rakes or brooms. The fill material shall be compacted with water. After compaction, the cells shall be visible and the depth of unfilled cells shall not exceed the thickness of the sod to be placed.

3.4 INSTALLATION OF GRASS

Paver cells shall be filled uniformly prior to placing sod. Sod shall be placed over the pavers as specified in section 02930 SODDING. The sod shall be saturated and rolled to press it into the paver cells.

3.5 TOLERANCES

- a. Paver Height. The finished block surface shall be flush or up to 1/2 inch higher than drainage structures. The finished block surface shall be flush or up to 1/2 inch below edge restraints, curbs and pavements.
- b. Grade. The finished pavement shall be within 0.20 feet of planned grade shown on the plans.

-- End of Section --

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DIVISION 02 - SITE WORK

SECTION 02811

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SECTION 02811

UNDERGROUND SPRINKLER SYSTEM

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 in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------|--|
| ASTM D 2241 | (1994) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) |
| ASTM D 2239 | (1996) Polyethylene Pipe (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter |
| ASTM D 2466 | (1994a) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 |
| ASTM D 2564 | (1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- | | |
|------------|--|
| ASME B16.3 | (1992) Malleable Iron Threaded Fittings, Classes 150 and 300 |
|------------|--|

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

- | | |
|-----------|---|
| ASSE 1013 | (1993) Reduced Pressure Principle Backflow Preventers |
|-----------|---|

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- | | |
|------------|--|
| NEMA ICS 2 | (1993) Industrial Control and Systems, Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 DC |
| NEMA ICS 6 | (1993) Enclosures for Industrial Control and Systems, |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- | | |
|---------|---------------------------------|
| NFPA 70 | (1996) National Electrical Code |
|---------|---------------------------------|

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Sprinkler System Calculations; FIO.

Submit the following information with the sprinkler system drawings:

- a. For each type of head, the spray diameter shall be indicated at working pressure and the maximum head spacing shall be indicated.
- b. The discharge rate in gallons per minute (gpm) shall be listed for each zone operated by a separate valve.
- c. The maximum discharge rate (in gpm), the length of pipe run, the hose diameter, and the pressure drop shall be related as listed in design tables or manufacturer's literature. Design tables or other information shall be copied and included in the submittal, or calculations shall be provided.

Manufacturer's Data; FIO.

Submit a list of equipment and materials, and manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, installation instructions, and manufacturers standard warranty.

SD-04 Drawings

Sprinkler System; GA.

Submit shop drawings for underground irrigation system which include plan layout and details illustrating location and type of heads, valves, piping circuits, and controls. The irrigation plan shall be submitted on a full size drawing(s) and shall include the coverage area for each nozzle (circular lines with radius represented by the throw of the nozzle).

As-Built Drawings; FIO.

In addition to requirements in SECTION: SUBMITTAL PROCEDURES, as-built drawings shall provide current factual information showing locations of mains, heads, valves, and controllers, including changes in, deviations from, and amendments to, the original layout.

SD-19 Operation and Maintenance Manuals

Sprinkler System; FIO.

See Paragraph: OPERATION AND MAINTENANCE MANUALS and SECTION: SUBMITTAL PROCEDURES.

1.3 DESIGN AND LAYOUT

- a. Turfed areas, except for the I-wall, shall be irrigated with rotary type spray heads.
- b. Shrub beds and the I-wall shall be irrigated with stream spray or

flood bubbler type nozzles.

c. The nozzle spacing shall not exceed 50% of the spray diameter for single row spacing, 55% of the spray diameter for square spacing, and 60% of the spray diameter for triangular spacing.

d. The number of nozzles shall be limited in each zone to maintain a work pressure recommended by the manufacturer for optimum performance, or not less than 10 psig above the minimum operating pressure for the sprinkler head.

Pipe sizing shall be such that a water velocity of 4 feet per second will not be exceeded at any time.

1.4 IRRIGATION ROUTING TO INTERMEDIATE WALL

Piping to the lock I wall shall be routed through the crossover under the lock chamber.

PART 2 PRODUCTS

2.1 MANUFACTURER

The underground irrigation system shall be provided as a complete unit produced by a single acceptable manufacturer, including heads, valves, controls, and accessories. The sprinkler system shall include a standard manufacturer's warranty for a period of 2 years covering any and all parts which prove defective in material or workmanship. Each item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.2 PERFORMANCE STANDARDS

Minimum Water Coverage: 100% of indicated areas. Minimum Precipitation Rates:

- a. 1.5 inches/hr - spray head zones.
- b. 0.45 inches/hr - rotor head zones.

2.3 DESIGN STANDARDS AND CRITERIA

Design Pressures: Sprinkler heads shall be designed to open at 25 to 35 psig pressure.

Location of Heads: Shop drawing design location is approximate. Make minor adjustments in field as necessary to avoid plantings and other obstructions.

Matched Precipitation nozzles: uniform coverage.

Layout may be modified, to obtain coverage, to suit manufacturer's standard heads, this shall require approval of the Contracting Officer. Do not decrease number of heads indicated unless otherwise approved by the Contracting Officer.

2.4 CONNECTIONS TO WATER DISTRIBUTION SYSTEM

For service to the Intermediate Wall, the Contractor shall use the existing

electrical crossover for routing new piping.

2.5 IRRIGATION CABINET

The equipment enclosure shall be an open bottom cabinet constructed of 12 gauge steel. The cabinet shall incorporate a 4", 12 gauge steel open hinge and .375 diameter stainless steel pin hinge. A 2" x 2" angle iron frame shall be welded to the entire perimeter, bottom and top. The roof shall be hatched with 2" x 2" angle iron. Two (2) Powerise PNEN Spring Model EBB-10100 or approved equal opening assist mechanisms shall be used on either side of the cover. A Best 2B series padlock or approved equal shall be provided.

2.6 IRRIGATION PIPING AND FITTINGS

2.6.1 Pressure Pipe

Where pipe is exposed above grade. Galvanized steel schedule 40. Under 3" dia. PVC pipe: ASTM D-2241, SDR 21 (1120, 1220).

2.6.2 Circuit Pipe (downstream from circuit valves)

Polyethylene pipe: ASTM D 2239, SDR 11.5 minimum, 100 PSI rating.

2.6.3 Pipe Fittings

For PVC plastic pipe: ASTM D 2466 solvent-welded socket type fittings with ASTM D 2564 solvent cement.
For galvanized steel pipe, ANSI B16.3 galvanized malleable-iron screwed fittings.

2.7 VALVES

2.7.1 Valves

Manufacturer's standard, as follows:

Key Operated Valves: Manual valves, fitted for key operations.
Furnish 2 valve keys, 3-feet long with tee handles and key end to fit valves.

2.7.2 Automatic Circuit Valves

Globe valves operated by low-power solenoid, normally closed, manual flow adjustment.

2.7.3 Backflow Preventer

ASSE 1013, reduced pressure type installed in metal vault or cabinet. Unit must comply with all applicable City and State codes.

2.7.4 Valve Box

Ametek or equal 12" standard box locking cover.

2.7.5 Wire

Type UF 600 volt, 14 gauge min. Splice wire using 3M DB connector or approved equal. Splice in junction/pull boxes only.

2.8 SPRINKLER HEADS

Sprinkler heads shall be a manufacturer's standard unit designed to provide uniform coverage over entire area of spray shown on drawings as follows:

- a. Shrubbery: Fixed pattern, with screw-type flow adjustment. Pop up type.
- b. Pop-Up Spray: Fixed pattern, with screw-type flow adjustment and stainless steel reaction spring.
- c. Pop-Up Rotor: Gear drive, full circle and adjustable part circle type.
- d. Pop-Up Rotary Impact: Impact drive, full circle and part circle as indicated.

2.9 CONTROLLERS

Automatic Controllers, Electrical. Controllers shall conform to the requirements of NEMA ICS 2 with 120 volt single-phase service, operating with indicated stations, and grounded chassis. Controller outputs for remote control valves shall be 24 volts, 60 hertz. Enclosure shall conform to NEMA ICS 6 Type 3R, with locking hinged cover, wall-mounted. Controllers shall be programmed for various schedules by setting switches and dials equipped with the following features: A switch each day of the week for three schedules, allowing each station to be scheduled individually as to days of watering; a minute switch for each station with a positive increment range of 3 to 60 minutes, set time within 1 percent; a switch allowing selected schedules to be repeated after each completion of initial watering schedule and allowing each operation to be scheduled throughout a 24-hour day over a 14-day programming period; a circuit breaker for surge protection; and circuit for a 9 volt rechargeable NiCad battery.

2.10 SYSTEM DRAINAGE

Winter drainage shall be accomplished by replacing the standing water in the system with compressed air. Compressed air connector shall be located as indicated.

2.11 SPARE PARTS

Supply the following as part of this contract:

- a. Two keys for opening valve boxes.
- b. Two sprinkler heads of each size and type installed.
- c. Four keys for automatic controller housing.
- d. Two quick-coupler key and matching hose swivel.
- e. Two valves of each type installed.
- f. Two wrenches for removing and installing each type of head.

PART 3 EXECUTION

3.1 EXCAVATING, TRENCHING AND BACKFILLING

Sprinkler system shall be installed after site grading has been completed. Excavation, trenching, and backfilling for sprinkler system shall be in accordance with the applicable provisions of SECTION: EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITY SYSTEMS, except as modified herein.

PVC mains and wires must be trenched. PVC mains and wires must be installed together in single trench. Pulling by vibration plow will be accepted for circuit pipe only. Allow 18" extra wire slack at each splice point including controller and valve splice.

3.1.1 Minimum Cover

Provide following minimum cover over top of installed piping:

PVC piping: 20".

Poly piping: 12".

3.1.2 Backfill

Backfill with clean material from excavation. Remove organic material as well as rocks and debris larger than 1" diameter. Place acceptable backfill material in 6" lifts, compacting each lift. A 6" pea gravel base shall be installed under all valve boxes.

3.1.3 Existing Lawns

Where trenching is required across existing lawns, uniformly cut strips of sod 6" wider than trench. Remove sod in rolls of suitable size for handling and keep moistened until replanted. Backfill trench to within 6" of finished grade. Continue fill with acceptable topsoil and compact to bring sod even with existing lawn. Replant sod within 2 days after removal in accordance with SECTION: ESTABLISHMENT OF TURF. Remove and replant as necessary to complete installation. Replace damaged lawn areas and plants with new to match existing in accordance with SECTIONS: ESTABLISHMENT OF TURF and SECTION: TREES, SHRUBS AND GROUND COVERS.

3.1.4 Pavements

At walkways and drives, jack piping under paving material. Provide P.V.C. conduit 2 pipe sizes greater than the pipe passing through at areas marked Irrigation Sleeving on plans and any other areas required as determined by irrigation design.

3.2 INSTALLATION AND FABRICATION

Unless otherwise indicated, comply with requirements of Uniform Plumbing Code.

3.2.1 Connection to Water Distribution System

Connect to water distribution system in location indicated. All applicable state codes shall be complied with. Maintain uninterrupted water service during normal working hours. Arrange for temporary water shut-off with Contracting Officer, if necessary.

3.2.2 Backflow Preventer

Provide union on downstream side.

3.2.3 Circuit Valves

Install in valve box, arranged for easy adjustment and removal. Provide union on downstream side. Adjust automatic control valves to provide flow rate required for each sprinkler circuit.

3.2.4 Piping

Lay pipe on solid subbase, uniformly sloped without humps or depressions. Install PVC pipe in dry weather when temperature is above 40 F in strict accordance with manufacturer's instructions. Allow joints to cure at least 24 hours at temperature above 40 F before testing, unless otherwise recommended by manufacturer. Install lawn heads at manufacturer's recommended heights. Readjust all heads for proper height after sod, seed or mulch is installed. Locate part-circle heads to maintain a minimum distance of 4" from walls and 2" from other boundaries, unless otherwise directed.

3.2.5 Dielectric Protection

Use dielectric fittings at connections where pipes of dissimilar metal are joined.

3.2.6 Adjustments

After completion of grading, seeding or sodding, and rolling of grass areas, carefully adjust lawn sprinkler heads so they will be flush with or not more than 1/2" above finish grade. All sprinkler heads shall be set perpendicular to finished grades unless otherwise designated on the plans and at height and distance from walks, buildings, etc., and noted. The Contractor shall adjust all sprinkler heads and valves for optimum performance and to prevent as much as possible any overspray onto walks and roadways. No spray is permitted on buildings. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may include changes in nozzle sizes or degrees of, as required.

3.2.7 Cleaning and Disinfection of Piping

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by the Contracting Officer. Sprinkler system fed from a potable water system shall be disinfected upstream of backflow preventer in accordance with SECTION: WATERLINES.

3.3 INSPECTIONS AND TESTS

Notify Contracting Office in writing when testing will be conducted. Conduct tests in presence of Contracting Officer.

3.3.1 Hydrostatic Pressure Test

Piping and valves shall be tested hydrostatically before backfilling trenches, and proved tight to a hydrostatic pressure of not less than 100 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi. If hydrostatic pressure cannot be held for a minimum of four hours, the Contractor shall make adjustments or equipment replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer. Piping may be tested in sections to expedite work.

3.3.2 Operational Testing

At the conclusion of the pressure test, sprinkler heads, quick coupling assemblies, and hose valve shall be installed and the entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be irrigated. Demonstrate to Contracting Officer that system meets coverage requirements and that automatic controls function properly. Coverage requirements are based on operation of one circuit at a time.

3.4 OPERATION AND MAINTENANCE MANUALS

Six copies of operation and six copies of maintenance manuals shall be submitted for the equipment furnished; one complete set prior to field testing and the remainder upon acceptance. Manuals shall be approved prior to the field training course required below. Manuals shall be submitted in labelled, hard-covered, three-ringed binders. Manuals shall have an index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturer's representatives and a copy of the guarantee statement. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and drainage shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and trouble-shooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

3.5 FIELD TRAINING

Provide the Government's maintenance personnel with written and verbal instructions. The Contractor shall drain the system (for winter and shall put the system back into operation without cost to the Owner.

-- End of Section --

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SECTION 02821

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PART 3 EXECUTION

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- 3.7 GATES
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-- End of Section Table of Contents --

SECTION 02821

CHAIN LINK FENCE

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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 121	(1992a) Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A 153	(1996) Zinc-Coated (Hot Dip) on Iron and Steel Hardware
ASTM A 392	(1996) Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A 491	(1996) Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A 824	(1992) Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
ASTM F 626	(1996) Fence Fittings
ASTM F 668	(1996) Poly(Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric
ASTM F 883	(1997) Padlocks
ASTM F 900	(1994) Industrial and Commercial Swing Gates
ASTM F 1043	(1995) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
ASTM F 1184	(1994) Industrial and Commercial Horizontal Slide Gates
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL

PROCEDURES:

SD-04 Drawings

Chain Link Fence; GA.

Chain-link fence drawings shall show layout, post sizes and sections; post setting and bracing, gate details; details of attachment of fabric to support members; and any other details required to erect the fence along the lines indicated. Drawings shall also include a wiring diagram for the slide gate operator and layout drawings for the operator system components.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the following:

2.1.1 Chain Link Fence Fabric

The fence shall have black polyvinyl chloride-coated steel fabric with 0.3 ounces of zinc coating per square foot in accordance with ASTM F 668. Fence fabric shall have 9 gauge wire woven in 2 inch mesh. The wire for securing the fabric to the post shall be 9 gauge for round posts and 11 gauge for all other sections. Tension wire shall meet requirements of ASTM A 824. Selvage for the 5 foot fence fabric shall be knuckled on top and bottom. Selvages for the 7 foot fence shall be twisted and barbed on the top and knuckled on the bottom.

2.1.2 Swing Gates

Swing gates shall be the type and swing shown, and shall meet the requirements of ASTM F 900. Gate frames shall conform to strength and coating requirements of ASTM F 1043, for steel pipe with external coating Type A or Type B, and nominal pipe size 1-1/2 inches. Gate fabric shall match the remainder of the fence. Vertical members of gate leaves shall be spaced so that no members are more than 8 feet apart. Gates over 10 feet wide shall be additionally braced with a 5/16 inch, minimum thickness, diagonal truss rod. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged for padlocking so that padlock will be accessible from both sides of the gate.

2.1.3 Slide Gates

Aluminum cantilever slide gates, in openings as shown on drawings, shall conform to the following specifications:

A. Gate frames shall be made of 2" square black PVC-coated aluminum tubing, alloy 6063-T6, weighing .94 pounds per lineal foot and shall be welded at all corners so as to form a rigid one-piece unit. Fabric shall be securely stretched and held on all four sides in the 2" square tubing by use of hook bolts and tension rods. Fabric filler shall be black. Gate shall have a cantilever overhang of 12'-0".

B. One additional 2" square lateral support rail shall be welded

adjacent to top horizontal rail. The bottom rail will be 2" x 4" tubing weighing 1.71 pounds per foot.

C. All cantilever overhang frames shall have 3/8" galvanized steel brace rods.

D. The enclosed track shall be combined track and rail one piece extruded aluminum having a total weight of 3.72 pounds per foot and designed to withstand a reaction load of 2,000 pounds.

E. Two swivel type zinc die cast trucks having four sealed lubricant ball-bearing wheels, 2" in diameter by 9/16" in width, with two side rolling wheels to insure alignment of truck in track shall be provided for each gate leaf. Trucks shall be held to post brackets by 7/8" diameter ball bolts with 1/2" shank. Truck assembly shall be designed to take the same reaction load as the track.

F. All gate hangers, latches, brackets, guide assemblies, and stops shall be malleable iron or steel galvanized after fabrication. A positive latch shall be provided with provisions for padlocking.

G. Gates and gate posts can be coated by the thermal fusion process with PVC, 10 to 15 mils thick, to match the fence.

H. Gates shall be installed on 4" OD Schedule 40 galvanized posts weighing 9.1 pounds per foot. Three posts are to be used for single slide gate.

I. Guide wheel assemblies shall be provided for each supporting post. Each assembly shall consist of two rubber wheels 4" in diameter and shall be attached to post so that the bottom horizontal member will roll between the wheels which can be adjusted to maintain plumb gate frames and proper alignment.

2.1.4 Posts

Gate posts shall be either round or square formed steel sections, and shall meet the strength and coating requirements of ASTM F 1043. Sizes shall be as shown on the drawings. Line posts and terminal posts (corner, gate, and pull) shall be of the same class throughout the fence, unless shown or specified otherwise. All posts shall be black PVC-coated above concrete bases.

2.1.5 Braces and Rails

Braces and top rails shall be selected to match the rail pattern of existing fence. Sizes shall be as shown on the drawings. Braces and top rails shall be formed steel sections meeting the strength and coating requirements of ASTM F 1043. All braces and top rails shall be black PVC-coated.

2.1.6 Tension Wire

Tension wire shall be Type I or Type II, Class 2 coating, in accordance with ASTM A 824.

2.1.7 Accessories

Fence fittings shall meet the requirements of ASTM 626. Ferrous

accessories shall be zinc- or aluminum-coated meeting the requirements of ASTM A 121 (for wire) or ASTM A 153 (for hardware). All accessories shall be black PVC-coated. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment.

2.1.8 Concrete

Concrete shall meet the requirements of SECTION: CONCRETE FOR BUILDING CONSTRUCTION, using 3/4 inch maximum-size aggregate, and having minimum compressive strength of 4000 psi at 28 days.

2.1.9 Padlocks

ASTM F 883, Type P01, Grade 2, corrosion resistant, size 1-3/4 inch. Two complete sets of padlocks, keyed differently, shall be furnished. Padlocks, within each set, shall be keyed alike and each lock shall be furnished with two keys. Each chain link fence swing gate shall be furnished with two locks.

2.1.10 Slide Gate Operator

The operator shall be a torque-controlled motorized gate actuator with electronic controls. Hydraulically operated actuators shall not be permitted. Operator shall have minimum 1 horsepower motor rated 460 volt, 3-phase, 60 hertz. It shall be provided with a step-down transformer for any required control voltage and a 3-phase reversing starter NEMA size 1 minimum. Power wiring (480 volt) will be 12 AWG minimum. Control wiring shall be 14 AWG minimum. All enclosures shall be weatherproof NEMA 4. The operator shall include magnetic key switch, magnetic push button, pavement pad sensor, and timed closing with photocell features. A cutoff switch shall be provided in the control cabinet to disable the pavement pad sensor.

PART 3 EXECUTION

3.1 GENERAL

Fence shall be installed to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line posts shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet.

3.2 POSTS

Posts shall be set plumb and in alignment. Concrete shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete shall be allowed to cure for 72 hours prior to attachment of any item to the posts. These provisions apply to all posts unless otherwise noted on the drawings.

3.3 TOP RAIL

Top rail shall be supported at each post to form a continuous brace between terminal posts. Where required, sections of top rail shall be joined using sleeves or couplings that will allow expansion or contraction of the rail.

3.4 BRACES AND TRUSS RODS

Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal (compression) braces and diagonal truss (tension) rods shall be installed on fences over 6 feet in height. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal. No bracing is required on fences 6 feet high or less if a top rail is installed.

3.5 TENSION WIRES

Tension wires shall be installed along the bottom of the fence line and attached to the terminal posts of each stretch of the fence. Bottom tension wire shall be installed within the bottom 6 inches of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

3.6 CHAIN LINK FABRIC

Chain-link fabric shall be installed on the side of the post furthest from the new Central Control Station Building. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15 inch intervals. Fabric shall be pulled taut to provide a smooth uniform appearance free from sag. Fabric shall be fastened to line posts at approximately 15 inch intervals and fastened to top rails and tension wires at approximately 24 inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 2 inches (plus or minus ½ inch) above the concrete pad.

3.7 GATES

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Slide gates, gate operators, and accessories shall be installed as recommended by the manufacturer. Padlocks shall be attached to gates or gate posts with chains to prevent padlock removal. The Contractor shall provide all wiring and connections between the components of the slide gate operator in accordance with the requirements of SECTION: LOCK ELECTRICAL WORK.

3.8 MOWING STRIP

The concrete mowing strip shall be centered on the fence line, continuous under all fencing.

3.9 GROUNDING

Fences crossed by powerlines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be 3/4 inch by 10 foot long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable electrodes shall be buried a minimum of 12 inches deep and radially from the fence. Top of electrode shall be not less than 2 feet

nor more than 8 feet from the fence. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps so as to create electrical continuity between fence posts, fence fabric, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.

-- End of Section --

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SECTION 02832

SEGMENTAL CONCRETE BLOCK RETAINING WALL

PART 1 GENERAL

This work element includes engineering services in addition to the construction requirements. The Contractor is responsible for engineering services that include design of SCRW No. 1 in accordance with the National Concrete Masonry Association design method, and providing shop drawings indicating all features of the complete design. SCRW No. 2 is Government designed and does not required engineering by the Contractor.

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 252 (1996) Corrugated Polyethylene Drainage Tubing

AASHTO M 288 (1996) Geotextiles Used for Subsurface Drainage Purposes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse Aggregates

ASTM C 140 (1997) Sampling and Testing Concrete Masonry Units

ASTM C 920 (1998) Elastomeric Joint Sealants

ASTM C 1262 (1997) Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units

ASTM C 1372 (1997) Segmental Retaining Wall Units

ASTM D 448 (1986; R 1993) Sizes of Aggregate for Road and Bridge Construction

ASTM D 698 (1998) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

ASTM D 1241 (1968; R 1994) Materials for Soil-Aggregate Subbase, Base, and Surface Courses

ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2488	(1993) Description and Identification of Soils (Visual-Manual Procedure)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 4355	(1992) Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	(1996) Water Permeability of Geotextiles by Permittivity
ASTM D 4595	(1986; R 1994) Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D 4873	(1997) Identification, Storage, and Handling of Geosynthetic Rolls
ASTM D 5321	(1992) Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method

FEDERAL HIGHWAY ADMINISTRATION (FHWA)

FHWA SA-96-071	(1997) Mechanically Stabilized Earth Walls and Reinforced Soil Slopes: Design and Construction Guidelines
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GEOSYNTHETIC INSTITUTE (GSI)

GSI GRI GG1	(1988) Geogrid Rib Tensile Strength
GSI GRI GG5	(1991) Geogrid Pullout
GSI GRI GG6	(1992) Grip Types for Use in the Wide Width Testing of Geotextiles and Geogrids
GSI GRI GT6	(1992) Geotextile Pullout

WISCONSIN DEPARTMENT OF TRANSPORTATION (WIDOT)

WIDOT	(1996) Standard Specifications for Highway and Structure Construction
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NATIONAL CONCRETE MASONRY ASSOCIATION (NCMA)

NCMA SRWU-1	(1997) Determination of Connection Strength between Geosynthetics and Segmental Concrete Units
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NCMA SRWU-2	(1997) Determination of Shear Strength between Segmental Concrete Units
NCMA SRW Manual	(1997) Design Manual for Segmental Retaining Walls, 2nd Edition
NCMA Seismic Manual	(1998) Segmental Retaining Walls - Seismic Design Manual, 1st Edition

1.2 MEASUREMENT AND PAYMENT

Measurement of segmental retaining wall for payment will be made on the basis of the face area in the vertical plane of segmental concrete units. The pay lines of the structure will be neat lines taken off the approved shop drawings; and will extend from the block-leveling pad interface to the top of wall, excluding any fencing or barrier. Payment will be made at the respective unit price per square foot (SF) listed on the Bidding Schedule. Payment will be full compensation for engineering services, excavation and preparatory work, and furnishing all material, labor and equipment to complete the work.

1.3 DEFINITIONS

- a. Blocks. Segmental concrete retaining wall units will be referred to as blocks.
- b. Drainage Aggregate. Granular soil or aggregate which is placed within, between, and/or immediately behind segmental concrete units.
- c. Fill. Soil or aggregate placed in, behind, or below the wall will be referred to as fill.
- d. Reinforced Fill. Soil which is placed and compacted within the neat line volume of reinforcement as outlined on the plans.
- e. Retained Fill. Soil which is placed and compacted behind the reinforced fill.
- f. Reinforcement. Reinforcement shall consist of a geogrid or a geotextile product manufactured for use as reinforcing. Reinforcement shall not include steel products.
- g. Long Term Design Strength. The long term design strength (LTDS) is:

$$LTDS = T_{ult} / (RF_D * RF_{ID} * RF_{CR})$$

where:

T_{ult} is the ultimate strength
 RF_D is the reduction factor for chemical and biological durability
 RF_{ID} is the reduction factor for installation damage
 RF_{CR} is the reduction factor for creep

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Data; FIO.

The Contractor shall submit descriptive technical data on the blocks, wall caps, masonry adhesive, reinforcement and geotextile filter materials. The submittal shall include all material properties specified under paragraph PRODUCTS. The submittal shall also include a copy of any standard manufacturer's warranties for the products.

Test Data; FIO.

The Contractor shall submit testing data specific to the blocks and reinforcement to be supplied.

- a. The shear strength between blocks shall be established in accordance with NCMA SRWU-2.
- b. The connection strength between the blocks and the reinforcement shall be established in accordance with NCMA SRWU-1. If the FHWA design method is used, the modifications in FHWA SA-96-071 shall be implemented.
- c. The coefficient for direct shear of the reinforcement on a soil similar in gradation and texture to the material that will be used for fill in the reinforced zone shall be established in accordance with ASTM D 5321.
- d. The coefficient of interaction for pull-out resistance of the reinforcement in a soil similar in gradation and texture to the material that will be used for fill in the reinforced zone shall be established in accordance with GSI GRI GG5 or GSI GRI GT6.

Calculations; GA.

The Contractor shall submit a calculation of the long term design strength for the reinforcement in accordance with the NCMA or FHWA design method. The ultimate strength or index strength shall be based on the minimum average roll value tensile strength of the product using the wide width strength test in ASTM D 4595 or the single rib test in GSI GRI GG1. The calculation shall itemize each reduction factor and include backup data to justify each reduction factor.

The Contractor shall submit design calculations, including computer output data and program documentation. The calculations shall include all items described under PARAGRAPH: SEGMENTAL RETAINING WALL DESIGN.

SD-04 Drawings

Shop Drawings; GA.

The fabrication and installation drawings shall be submitted for both walls. The shop drawings shall include all items described under paragraph SEGMENTAL RETAINING WALL DESIGN.

SD-08 Statements

Qualifications; FIO.

The Contractor shall provide documentation showing that the installer and supplier meet the qualifications listed.

Permits; GA.

A permit from the state highway department is required for the wall within the highway right of way, as indicated in Section 01000. The Contractor shall provide copies of submittals for permit application to the state highway department, a copy of the permit, and any other written correspondence related to the permit.

SD-13 Certificates

Certificate of Compliance; FIO.

The Contractor shall submit an affidavit certifying that the reinforcement meets the project specifications. The affidavit shall be signed by an official authorized to certify on behalf of the manufacturer and shall be accompanied by a mill certificate that verifies physical properties were tested during manufacturing and lists the manufacturer's quality control testing. If the affidavit is dated after award of the contract and/or is not specific to the project, the supplier shall attach a statement certifying that the affidavit addressed to the wholesale company is representative of the material supplied. The documents shall include a statement confirming that all purchased resin used to produce reinforcement is virgin resin. The mill certificate shall include the tensile strength tested in accordance with either ASTM D 4595 or GSI GRI GG1.

1.5 SEGMENTAL RETAINING WALL DESIGN

The Contractor shall complete all stability analyses for SCRW No. 1 in accordance with the Federal Highway Administration/AASHTO method detailed in FHWA SA-96-071. The segmental retaining wall system shall be designed under the direction of, and be signed by, a professional engineer. The engineer shall visit the job at least once during the construction.

1.5.1 Design

Calculations shall include determination of long term design strength of reinforcement specific to this project in accordance with FHWA SA-96-071. Calculations shall include analysis of all failure modes listed in the NCMA SRW Manual. Design calculations shall include a clear outline of material properties and assumptions. The Contractor shall use the following soil parameters and water elevation for stability analysis, and shall select additional soil parameters as required to complete the analysis.

Moist Unit Weight of reinforced fill, 112 pcf
Saturated Unit Weight of reinforced fill, 128 pcf
Internal Friction Angle of reinforced fill, 32 degrees
Cohesion of reinforced fill, 0 psf
Water Elevation in reinforced fill, not less than 1 foot over top of rock, and not less than the top of drain pipe.

1.5.1.1 External Stability Design Requirements

As a minimum requirement, the length of the reinforcing at the base of the wall shall not be less than 0.7 times the total height of the blocks.

1.5.1.2 Seismic Design Requirements

The Contractor shall complete the seismic stability analysis in accordance with FHWA SA-96-071. The pseudo-acceleration value with a 10 percent probability of exceedance in 50 years (referred to as the A value by NCMA and FHWA) shall be assumed as 0.02.

1.5.2 Layout

Shop drawings shall reflect all information needed to fabricate and erect the walls including the leveling pad elevations; the shape and dimensions of wall elements; the number, size, type, and details of the soil reinforcing system and anchorage; and identification of areas requiring coping. The design and layout of the internal reinforcement shall be subject to the following:

- a. All features indicated in the contract documents shall be incorporated in the final design and construction.
- b. The leveling pad elevations may vary, but shall be no higher than the embedment depth profile shown.
- c. Each reinforcement level shall run as continuous as practical throughout the profile. If a geotextile filter is present, the reinforcement shall be laid out so that interference with the geotextile is minimized.
- d. Any reinforcement not placed with the machine direction as the design reinforcement direction shall be identified on the shop drawings.
- e. Reinforcement attached to the wall facing shall not combine geogrid and geotextile, nor products from different manufacturers, within one wall. The number of reinforcement products shall be limited to avoid confusion in placement. For walls under 12 feet high, all reinforcement shall be the same grade and strength (i.e. design with one reinforcement strength).

1.6 CONTRACTOR QUALIFICATIONS

The job foreman or the company directly responsible for the wall installation shall have completed a minimum of 10 segmental concrete retaining wall projects and have at least 2 years experience.

1.7 SUPPLIER QUALIFICATIONS

Suppliers of segmental retaining wall system components shall have demonstrated experience in the supply of similar size and types of segmental retaining walls on previous projects.

1.8 MANUFACTURER'S REPRESENTATIVE

The Contractor shall have a qualified and experienced representative from the block or reinforcement manufacturer available on an as-needed basis during the wall construction. The representative shall visit the site for consultation at least once during construction.

1.9 DELIVERY, STORAGE AND HANDLING

The Contractor shall check products upon delivery to assure that the proper

material has been received and is undamaged. For geosynthetics, the guidelines presented in ASTM D 4873 shall be followed.

1.9.1 Segmental Concrete Units and Wall Caps

The Contractor shall protect blocks from damage and exposure to cement, paint, excessive mud, and like materials. The Contractor shall check materials upon delivery to assure that the block dimensions are within the tolerances specified.

1.9.2 Geosynthetic Labeling

Each roll shall be labeled with the manufacturer's name, product identification, roll dimensions, lot number, and date manufactured.

1.9.3 Geosynthetic Handling

Geosynthetic rolls shall be handled and unloaded by hand, or with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Geosynthetic rolls shall not be dragged, lifted by one end, lifted by cables or chains, or dropped to the ground.

1.9.4 Geosynthetic Storage

Geosynthetics shall be protected from cement, paint, excessive mud, chemicals, sparks and flames, temperatures in excess of 160 degrees F, and any other environmental condition that may degrade the physical properties. If stored outdoors, the rolls shall be elevated from the ground surface. Geosynthetics, except for extruded grids, shall be protected with an opaque waterproof cover. Geosynthetics shall be delivered to the site in a dry and undamaged condition. Geotextiles shall not be exposed to direct sunlight for more than 7 days.

PART 2 PRODUCTS

2.1 SEGMENTAL CONCRETE UNITS

2.1.1 Architectural requirements

- a. Face color - Natural Limestone.
- b. Face Texture - split face typical of broken mortar.
- c. Face Appearance - straight, single-surface face.
- d. Batter - Blocks shall be engaged to the block below by use of keys, lips, pins, clips, or other reliable mechanism to provide a consistent wall batter between 1H:6V and 1H:16V.
- e. Block Size - a minimum of 2/3 square feet of face area, minimum 6 inch height, maximum 12 inch height.

2.1.2 Structural requirements

The blocks shall be manufactured to the requirements of ASTM C 1372, except for the following modifications:

- a. Minimum 28-day compressive strength of 4500 psi, based on net area in accordance with ASTM C 140.

- b. A maximum moisture absorption rate of 9 pcf, in accordance with ASTM C 140.
- c. The minimum oven dry density of concrete shall be 125 pcf.
- d. The blocks shall provide a minimum of 80 pounds per square foot of wall face area (determined without void filling).
- e. For freeze-thaw durability tested in accordance with ASTM C 1262, specimens shall comply with either of the following when tested in a 3 percent saline solution: (1) the weight loss of each of 5 specimens after 40 cycles shall not exceed 1 percent; or (2) the weight loss of 4 out of 5 specimens after 50 cycles shall not exceed 1.5 percent.

2.1.3 Wall Caps

Segmental concrete block units shall be placed as caps on top of all segmental concrete retaining walls. The cap blocks shall have a color and texture on exposed faces to match that of the other blocks and meet the requirements for the other blocks except that the minimum height shall be 3 inches. Each cap block shall have abutting edges saw cut or formed to provide tight, flush abutting joints with no gaps in the joints when placed end to end in the alignment shown on the drawings.

2.2 REINFORCEMENT

Geogrid shall be a geosynthetic manufactured for reinforcement applications. The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil, aggregate, or other fill materials. The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. The geogrid shall be manufactured with 100 percent virgin resin consisting of polyethylene, polypropylene, or polyester, and with a maximum of 5 percent in-plant regrind material. Polyester resin shall have a minimum molecular weight of 25,000 and a carboxyl end group number less than 30. Polyethylene and polypropylene shall be stabilized with long term antioxidants.

2.2.1 Reinforcement Properties

The reinforcement shown in the approved shop drawing submittal shall meet the long term design strength requirements used in the design, and shall meet the properties listed in Table 1. Reinforcement for SCRW No. 2 shall also meet the properties listed in Table 1A. Reinforcement strength requirements represent minimum average roll values in the machine direction.

TABLE 1. REINFORCEMENT PROPERTIES

PROPERTY	REQUIREMENT	TEST DESIGNATION
UV Resistance	70 percent after 500 hours	ASTM D 4355

TABLE 1A. REINFORCEMENT PROPERTIES FOR SCRW NO. 2

PROPERTY	REQUIREMENT	TEST DESIGNATION
Long Term Design Strength	100 lb/inch	NCMA SRW Manual, Method A
Coefficient of Interaction for Pullout	0.85	GSI GRI GG5 or GSI GRI GT6
Coefficient for Direct Shear	35 degrees	ASTM D 5321

2.2.1.1 Long Term Design Strength

The long term design strength shall be based on reduction factors for installation damage and durability that are applicable to the fill that will be used. Minimum reduction factors for durability include: 1.1 for polyethylene and polypropylene geosynthetics, 1.15 for coated polyester geogrids, and 1.6 for polyester geotextiles. The creep reduction factor must be consistent with the test procedure used for determining the ultimate strength.

2.3 SOILS AND AGGREGATES

All material placed as fill shall consist of material classified by ASTM D 2487 as GW, GP, GC, GM, SP, SM, SC, CL, ML, or SW. The material shall be free of ice; snow; frozen earth; trash; debris; sod; roots; organic matter; contamination from hazardous, toxic or radiological substances; or stones larger than 3 inches in any dimension. Each material shall be obtained entirely from one borrow source, unless the Contracting Officer determines that quality control is adequate and the alternate source produces material that is similar in gradation, texture, and interaction with the reinforcement. The Contractor shall supply any testing required by the Contracting Officer to evaluate alternate sources. All materials shall be of a character and quality satisfactory for the purpose intended.

- a. Drainage Aggregate shall meet specificaton requirements for soundness, durability and shape for concrete aggregates in Section 03300 ; and shall meet the following gradation requirements:

<u>Sieve</u>	<u>Percent Passing</u>
1"	100
3/4"	90 - 100
3/8"	20 - 55
#4	0 - 30
#10	0 - 5

- b. Aggregate Base material for the wall leveling pads shall meet the requirements of WIDOT 304, Gradation No. 2.

- c. Reinforced Fill. Soil placed in the reinforced fill zone shall consist of granular material with less than 5 percent passing the No. 200 sieve.

- c. Retained Fill. Soil placed in the retained fill zone shall meet

the minimum requirements above.

2.4 MASONRY ADHESIVE

The masonry adhesive shall meet the following requirements:

- a. ASTM C 920, Type S, Grade NS, Class 25
- b. expected 30 year life
- c. meet the recommendations of the block manufacturer

2.6 DRAINAGE PIPE

The drainage pipe shall be corrugated polyethylene pipe meeting requirements of AASHTO M 252.

PART 3 EXECUTION

3.1 CLASSIFICATION OF SOIL MATERIALS

Classification of soil materials shall be performed by the Contractor in accordance with ASTM D 2488. The Contracting Officer reserves the right to revise the Contractor classifications. In the case of disagreement, the Contracting Officer's classification will govern unless the soils are classified in accordance with ASTM D 2487. All testing completed by the Contractor in conjunction with soil material classification will be considered incidental to the contract work.

3.2 EARTHWORK

The leveling pad and reinforced fill zone shall bear on undisturbed native soils, or acceptably placed and compacted fill. In the event that it is necessary to remove material to a depth greater than specified or to place fill below the leveling pad not otherwise provided for in the contract, the Contracting Officer shall be notified prior to work and an adjustment in the contract price will be considered in accordance with the contract. Additional work not authorized by the Contracting Officer shall be at the Contractor's expense.

3.2.1 Excavation

Foundation soil shall be excavated as required for leveling pad dimensions and reinforcement placement shown on the construction drawings. Material for backfilling shall be stockpiled in a neat and orderly manner at a sufficient distance from the banks of the excavation to avoid overloading and to prevent slides or caving. Excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. The Contractor is responsible for disposal of surplus material, waste material, and material that does not meet specifications, including any soil which is disturbed by the Contractor's operations or softened due to exposure to the elements and water.

3.2.2 Stockpiles

Stockpiles of all material to be incorporated into the work shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed. Topsoil shall be stockpiled separately from suitable backfill material. Stockpiles of aggregates and granular soils shall be protected 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 frozen, saturated, intermixed with other materials, or otherwise out of specification or unsatisfactory for the use intended, such material shall be removed and replaced with new material from approved sources at no additional cost to the Government.

3.3 LEVELING PAD

3.3.1 Concrete Leveling Pad

Tolerances in screeding shall be sufficient to place the blocks directly on the leveling pad without mortar, pointing, or leveling course between the blocks and leveling pad.

3.4 BLOCK INSTALLATION

The wall system components shall be constructed in accordance with the wall supplier's recommendations and construction manual. Damaged blocks shall not be incorporated in the retaining wall.

a. Block placement shall begin at the lowest leveling pad elevation. The blocks shall be in full contact with the leveling pad. Each course of block shall be placed sequentially for the entire wall alignment to maintain a level working platform for layout of reinforcement and placement of fill.

b. The grade and alignment of the first course shall be surveyed and the results furnished to the Contracting Officer prior to placing the second course. Survey control for alignment shall include a string line, offset from a base line, or suitable provisions that can be reproduced for quality assurance.

c. The blocks shall be placed with the edges in tight contact. No gap shall be allowed for wall batter and curvature. The vertical joints shall be maintained with a minimum 4 inch overlap on the underlying block. Coping required to keep block alignment shall be done with a full depth saw cut. No splitting shall be allowed.

d. Stacking of blocks prior to filling any lower course of block with drainage aggregate will not be allowed.

e. Cap units and the top two course of blocks shall be joined using masonry adhesive. Care shall be taken to keep adhesive from coming into contact with the face of wall units.

3.5 REINFORCEMENT INSTALLATION

a. Before placing reinforcement, the subgrade or subsequent lift of fill shall be compacted and graded level with the top of the blocks. The surface shall be smooth and free of windrows, sheepfoot impressions, and rocks.

b. Reinforcement shall be placed at the elevations and to the extent shown on the construction drawings and the approved shop drawing submittal. Reinforcement shall be oriented with the design strength axis perpendicular to the wall face. Each segment of reinforcement shall be continuous. Spliced connections between shorter pieces of reinforcement will not be allowed. Reinforcement strips shall be placed immediately next to adjacent strips to provide 100 percent

coverage.

c. The reinforcement shall be installed in tension. The reinforcement shall be pulled taut and anchored with staples or stakes prior to placing the overlying lift of fill. The tension shall be uniform along the length of the wall and consistent between layers.

d. All reinforcement shall be 100% covered by soil so that reinforcement panels do not contact in overlaps. Where the wall bends, a veneer of fill shall be placed to a nominal thickness of 3 inches to separate overlapping reinforcement.

3.6 FILL PLACEMENT

a. Fill placement, including drainage aggregate, shall be completed to the top of each course of facing blocks prior to stacking the subsequent course of blocks.

b. Reinforced fill shall be placed from the wall back toward the fill area to ensure that the reinforcement remains taut. Fill shall be placed, spread, and compacted in such manner that minimizes the development of wrinkles in or movement of the reinforcement.

c. A minimum fill thickness of 6 inches is required prior to operation of vehicles over the reinforcement. Sudden braking and sharp turning shall be avoided. Tracked equipment shall not turn within the reinforced fill zone to prevent tracks from displacing the fill and damaging the reinforcement. Construction equipment shall not be operated directly upon the reinforcement as part of the planned construction sequence. Rubber tired equipment may operate directly on the reinforcement if: the Contractor submits information documenting testing of equipment operating on a similar geogrid product on similar soils, the travel is infrequent, equipment travels slow, turning is minimized, and no damage or displacement to the reinforcement is observed.

d. Drainage aggregate shall be placed and tamped directly behind, between, and within the cells of the facing units. Compaction of the drainage aggregate shall be achieved by at least two passes on each lift with a vibratory plate compactor. Care shall be taken not to contact or chip the blocks with the compactor. Aggregate placed within the block cores and recesses shall be compacted by hand tamping and rodding.

e. At the end of each day, the Contractor shall slope the last lift of fill away from the wall in a manner that will allow drainage and direct runoff away from the wall face.

3.7 COMPACTION

Fill shall not be placed on surfaces that contain mud, frost, organic soils, fill soils that have not met compaction requirements, or where the Contracting Officer determines that unsatisfactory material remains in or under the fill. Fill shall be spread and compacted in lifts not exceeding the height of one course of blocks.

3.7.1 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum

density obtained by the test procedure presented in ASTM D 698. The maximum density is hereafter abbreviated as the "Standard Proctor" value.

3.7.2 Moisture Control

Control of moisture in the fill shall be maintained to provide acceptable compaction. Disking and plowing will not be allowed in the reinforced fill zone. Moisture content of cohesive soils shall be adjusted at the borrow source before placement. Adding water directly to the reinforced fill zone shall only be conducted under conditions where the soil has sufficient porosity and capillarity to provide uniform moisture throughout the fill during compaction.

3.7.3 Compaction

Reinforced and retained fill shall be compacted to 95 percent of the Standard Proctor Density. Care shall be exercised in the compaction process to avoid misalignment of the facing blocks. Heavy compaction equipment (including vibratory drum rollers) shall not be used within 3 feet from the wall face.

3.8 SOIL TESTING

3.8.1 General

All testing expenses shall be the Contractor's responsibility. Prior to sampling and testing the work, testing laboratories shall be inspected and approved in accordance with Section 01451, CONTRACTOR QUALITY CONTROL. The Contracting Officer reserves the right to direct the location and select the material for samples to be tested and to direct where and when moisture-density tests shall be performed. Nuclear density testing equipment shall be used in general accordance with ASTM D 2922.

3.8.2 Transmittal

The Contracting Officer shall be informed of test results daily for direction on corrective action required. Draft copies of field testing results shall be furnished to the Contracting Officer on a frequent and regular basis, as directed.

3.8.3 Corrective Action.

Tests of materials which do not meet the contract requirements (failing test) will not be counted as part of the required testing. Each such failing test must be retaken at the same location as the failing test was taken. If testing indicates material does not meet the contract requirements, the material represented by the failing test shall not be placed in the contract work or shall be recompacted or removed. The quantity of material represented by the failing test shall be determined by the Contracting Officer up to the quantity represented by the testing frequency. The Contractor may increase testing frequency in the vicinity of a failing test in order to reduce removal requirements, as approved by the Contracting Officer. Such increases in testing frequency shall be at the Contractor's expense and at no additional cost to the Government.

3.8.4 Testing Schedule

Moisture-Density Relations (ASTM D 698)

One test for each material variation, not less than 1 test.

In-Place Densities (ASTM D 1556 or ASTM D 2922)

Not less than 1 test for each 2 vertical feet for each wall.

Sieve Analysis, (ASTM C 136)

(1) Drainage Aggregate, 1 test for each source.

3.9 [Enter Appropriate Subpart Title Here]

All testing expenses shall be the Contractor's responsibility. Testing shall be performed by a commercial testing laboratory selected by the Contractor and approved by the Contracting Officer or performed by the Contractor if approved by the Contracting Officer. The Contracting Officer reserves the right to direct the location and select the material for samples.

TABLE 3. REINFORCEMENT TESTING

PROPERTY	TEST DESIGNATION	FREQUENCY
Wide Width Strip Tensile Strength or Single Rib Tensile Strength	ASTM D 4595 GSI GRI GG1	1 test 1 test

ASTM D 4595 shall be modified for geogrids considering recommendations in GSI GRI GG6; and the tensile strength shall be expressed on a unit length basis by substituting $n \cdot a$ for W_s , where:

- W_s = specimen width, (inches)
- n = number of ribs in the sample (must be a whole number)
- a = nominal rib spacing for the product tested, (inches)

3.10 DRAINAGE PIPE

Drain pipe shall be placed as indicated on the drawings. Drain lines shall be laid to true grades and alignment with a continuous fall in the direction of flow. The interior of the pipe shall be kept clean from soil and debris; and open ends shall be temporarily capped as necessary.

3.11 CONSTRUCTION TOLERANCES

- a. Horizontal: The front toe of wall shall be within 3 inches of the plan location.
- b. Vertical: The top of wall elevations shall be 1/2 to 1-1/2 block courses above the neat line slope.
- c. Plumbness and Alignment: The wall batter and alignment offset measured as deviation from a straight edge shall be within plus or minus 1.25 inches per 10 feet section. The batter measured from vertical shall be within 2 degrees of the plan dimension.
- d. Block Defects: The blocks will be accepted on the basis of tolerances specified in ASTM C 1372.

e. Block Gaps: Gaps between adjacent blocks shall not exceed 1/8 inches.

3.12 PROTECTION OF WORK

Work shall be protected against damage from subsequent operations. Disturbed or displaced blocks shall be removed and replaced to conform to all requirements of this section. Damaged material shall not be incorporated into the wall. Upon completion of wall erection, the Contractor shall clean the wall face to remove any loose soil deposits or stains.

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SECTION 02870

SITE FURNISHINGS

PART 1 GENERAL

This section covers furnishment and installation of 6 park benches and 6 trash receptacles.

1.1 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Park bench and trash receptacle data; GA.

Manufacturer's descriptive data and catalog cuts. The submittal shall include drawings for each product showing details on material descriptions, layout, fabrication, field assembly, and ground anchorage.

1.2 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered, handled, and stored in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. Each type of site furniture shall be the same: materials, color and model number. Additionally, the picnic tables and benches shall be of the same manufacturer, style, material and color. Trash receptacles shall match the other furniture in style, color and materials. Review for approval of the equipment models proposed by the Contractor will be based on complete product data submitted by the Contractor to the Contracting Officer.

2.1.1 Finish

All site furniture shall be brown Plastisol or equivalent. The furniture is intended to roughly match existing furnishings at Locks 2, 3, 4, 5 and 6.

2.1.2 Park Benches

Functional stationary bench with a minimum length of 6 feet and a minimum width of 1.5 feet. Benches shall be furnished with no sharp edges or protruding hardware. The height above finished grade or specified surface shall be between 18-20 inches.

2.1.3 Trash Receptacles

Trash Receptacles shall have a minimum capacity of 30 gallons and a maximum capacity of 50 gallons..

2.2 ANCHORS

Anchors shall be provided, where necessary, for fastening site furnishings securely in place and in accordance with approved manufacturer's instructions. Anchors shall be vandal-resistant and corrosion-resistant steel.

PART 3 EXECUTION

3.1 INSTALLATION

The benches and trash receptacles shall be installed in the quantity indicated and at locations directed by the Contracting Officer. Field assembling and anchoring to the ground for each piece of equipment shall be performed by the Contractor in accordance with the contract requirements and the manufacturer's written recommendations, as approved.

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SECTION 02920

SODDING AND TOPSOIL

PART 1 GENERAL

Existing turf areas which have been damaged during the contract operations, and which are outside of the limits designated to be sodded, shall be restored following the requirements in this section, at no additional cost to the Government.

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4972 (1995a) pH of Soils

ASTM D 5268 (1992; R 1996) Topsoil Used for Landscaping Purposes

AMERICAN SOD PRODUCERS ASSOCIATION, INC. (ASPA)

ASPA (1988) Guideline Specifications to Sodding

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Literature; FIO.

The Contractor shall submit manufacturer's literature discussing physical characteristics, applications, guarantees, and installation of the mulch, and fertilizer.

SD-13 Certificates

Certificates of Compliance; FIO.

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

- a. Topsoil. Gradation, pH, organic matter content, textural class, soluble salts.
- b. Fertilizer. Chemical analysis and composition percent.

- c. Organic Material: Composition and source.
- d. Mulch: Composition and source.

SD-14 Samples

Samples; FIO.

Samples shall be provided for the following:

- a. A 5 pound sample for each source of topsoil.
- b. A 2 pound sample for each type of soil amendment proposed for use.
- c. A 2 pound sample for each type of mulch proposed for use.

1.3 SOURCE INSPECTION

The source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Inspection

Sod shall be inspected for conformity to species and quality. Other materials shall be inspected for compliance with specified requirements. The following shall be rejected: open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter; and topsoil that contains viable plants and plant parts. Unacceptable materials shall be removed from the job site.

1.4.2 Storage

Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment materials shall be stored according to manufacturer's instructions and not with seed.

1.4.3 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

PART 2 PRODUCTS

2.1 SOD

Sod shall be nursery grown as classified in the ASPA Guideline Specifications to Sodding. Sod shall be 100% mineral sod. Sod grown in peat soils will not be accepted. Sod shall be used in all areas designated on the drawings. Sod shall consist of at least 75% Kentucky Blue Grass (*Poa pratensis*). Acceptable varieties include park, newport, glade, nugget, touch down, rugby, and parade.

2.1.1 Quality

Sod shall be machine cut at a uniform soil thickness of 5/8 inch, plus or minus 1/4 inch, at the time of cutting. Measurement of thickness shall exclude top growth and thatch. Standard size sections of sod shall be strong enough that when grasped at one end, can be picked up and handled without damage. Sod shall not be harvested or transplanted when moisture content, either excessively dry or wet, may adversely affect its survival. Broken pads and pads with torn or uneven ends will not be accepted. The pieces of sod shall not vary more than 1/2 inch in width.

2.1.2 Harvesting

Before harvesting, the turf shall be mowed uniformly at a height of 1 to 1-1/2 inches. Sod shall be harvested, delivered and transplanted within a period of 36 hours. Sod not transplanted within this time period shall not be installed without the inspection and approval of the Contracting Officer.

2.1.3 Delivery

Sod Pallets shall be sprinkled with water and covered with moist burlap, straw, or other approved covering and protected from exposure to wind and direct sunlight. Covering shall be such that air can circulate and heating will not develop.

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

2.3 SOIL AMENDMENTS

Soil amendments required under this contract consist of fertilizer. Soil amendments consisting of pH adjuster, organic material and soil conditioners may be added at the Contractors option if approved by the Contracting Officer, or shall be added if directed by the Contracting Officer and will be negotiated in accordance with contract clause: CHANGES.

2.3.1 Fertilizer

The nutrients ratio shall be 12 percent nitrogen, 12 percent phosphorus, and 12 percent potassium. Fertilizer shall be controlled release commercial grade, free flowing, and uniform in composition.

2.3.2 Organic Material

Organic material shall consist of either rotted manure, recycled compost, or worm castings. Bonemeal and decomposed wood derivatives shall not be used.

2.3.2.1 Rotted Manure

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones,

sticks, and soil.

2.3.2.2 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be derived from vegetable food products; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 3/8 inch screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 2 inches in length.

2.4 WATER

Water shall be the responsibility of the Contractor, unless otherwise noted. Water shall not contain elements toxic to plant life.

2.5 PESTICIDE

Pesticide shall not be applied without written approval of the Contracting Officer.

2.6 HERBICIDE

Herbicide shall be broad spectrum that leaves no lasting harmful residues and allows planting within 10 to 14 days after application. The herbicide shall be glyphosate based. Herbicide shall be applied per manufacturer's recommendations.

PART 3 EXECUTION

3.1 Time Restrictions

Planting shall not be done when the ground is frozen, snow covered, or in unsatisfactory condition for planting. Sod shall be laid from April 1 to June 15 for spring planting and from August 10 to November 1 for fall planting.

3.2 SITE PREPARATION

3.2.1 Finished Grade and Topsoil

The Contractor shall verify that finished grades are as indicated on drawings, and the placing of topsoil, smooth grading, and compaction requirements have been completed prior to the commencement of the sodding operation. All vegetation, including live roots, shall be completely removed or treated with herbicide prior to spreading topsoil or placing sod.

3.2.2 Spreading Topsoil

Topsoil shall be distributed and spread uniformly to one half the thickness shown on the plans and tilled to a depth of 4 inches into the subgrade. The remaining half of the topsoil shall then be placed. Surface irregularities resulting from topsoiling or other operations shall be

leveled to prevent depressions.

3.2.2.1 Equipment

Topsoil shall be spread using a bladed dozer having ground pressure less than 4.5 psi and operating weight less than 35,000 pounds, or with rubber tired equipment having operating weight less than 10,000 pounds. The work shall be coordinated such that equipment for hauling the topsoil does not travel over the topsoil in place. Areas compacted by construction operations shall be completely pulverized by tillage.

3.2.2.2 Stripped Materials.

Topsoil obtained from stripping operations shall be kept separate from other unusable excavated materials, brush, litter, objectionable weeds, roots, stones, and other materials that would interfere with planting and maintenance operations. Unusable material shall be removed and properly disposed of.

3.2.3 Tillage

Topsoil on slopes up to a maximum 3H:1V slope shall be tilled to a nominal 4 inch depth by plowing, disking, harrowing, rototilling or other approved method. On slopes between 3H:1V and 1:1, the soil shall be tilled to a minimum 2 inch depth by scarifying with heavy rakes, or other method. On slopes 1:1 and steeper, no tillage is required.

3.2.4 Treatments

Fertilizers shall be applied per manufacturer's directions. The fertilizer shall be applied at the rate recommended by the soil test. Fertilizer may be incorporated as part of the tillage operation. The Contractor shall assume full responsibility for any loss or damage to seed or sod arising from improper use of herbicides or other chemicals or due to his failure to allow sufficient time to permit dissipation of toxic residues, whether or not such materials are specified herein.

3.2.5 Prepared Surface

The prepared surface shall be 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove debris. Debris and stones over a minimum 3 inch in any dimension shall be removed from the surface. Drainage patterns shall be maintained as indicated on drawings. Tolerance for drainage ditches and swales shall be within 1 inch of the plan elevation. The prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

3.3 SODDING

3.3.1 Placement

Sod shall be carefully placed with the first row laid in a straight line and subsequent rows placed parallel to and abutted tightly against each other. Sod shall be placed with staggered end joints and without stretching or overlapping. On slope areas sodding shall be started at the bottom of the slope. On 1:3 or greater slopes, sod shall be laid across the angle of the slope and secured by tamping, pegging or other approved methods of temporarily securing each piece. In areas where concentrated

flow of water is expected, sod shall be laid at right angles to the flow. After the sodding operation has been completed, the edges of the sodded area shall blend smoothly into the surrounding area.

3.3.2 Rolling and Watering

After completion of the sod placement in each area, the Contractor shall water the sod immediately, and the entire area shall be lightly rolled. The sod shall be watered to a depth sufficient such that the underside of the sod pad and the soil immediately below the pad are thoroughly wet. Watering operations shall be properly supervised to prevent run-off. The Contractor shall arrange for an adequate water supply and all equipment necessary for water application shall be supplied including all pumps, hoses, pipelines, and sprinkling equipment until final acceptance is made.

3.4 RESTORATION AND CLEAN UP

Immediately upon completion of the sodding operation in an area, the area shall be protected against traffic or other use by erecting barricades, providing signage, or as directed. Existing turf areas, pavements, and facilities that have been damaged from the sodding operation shall be restored to original condition at Contractor's expense. Excess and waste material shall be removed from the seeded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

3.5 MAINTENANCE

3.5.1 Maintenance Watering

During the first week after placement of the sod, the soil on the sod pads shall be kept moist at all times. In the absence of adequate rainfall watering shall be performed daily or as often as necessary and in sufficient amounts to maintain moist soil to a depth of at least 4 inches. Watering shall be done during the heat of the day to prevent wilting, and at such a rate that puddling and run-off do not occur. During the second and subsequent weeks, the sod shall be watered as required to maintain adequate moisture in the upper four inches of soil.

3.5.2 Mowing

Bluegrass predominant seed mixes: The first mowing shall not be attempted until the sod is firmly rooted and securely in place. Mowing shall be done as needed to maintain lawn areas at a nominal height of 3 inches until final acceptance, except not more than 1/3 of the grass leaf shall be removed by the initial cutting. Clippings shall be removed when the amount of cut turf is heavy enough to damage the turfed areas. Areas shall be mowed immediately prior to final inspection.

3.5.3 General Maintenance

Maintenance of the turfed areas shall include eradicating weeds, protecting embankments and ditches from surface erosion, protecting installed areas from traffic, mowing, watering, and post-fertilization. If any portion of the surface becomes rilled, gullied, damaged, or destroyed, that portion shall be repaired to re-establish the area without additional cost to the government. The Contractor shall control erosion during the maintenance period by using ditch checks, sod swales, silt fences or other methods until a proper stand of turf is established.

3.5.4 Maintenance Record

A record of each site visit shall be furnished, describing the maintenance work performed; areas repaired or reinstalled; and diagnosis for unsatisfactory stand of grass plants.

3.6 ACCEPTANCE

A proper stand of turf is defined as having sufficient density such that no surface soil is visible when mowed to a height of 1-1/2 inches, and shall contain no more than one percent undesirable grasses or clover and not more than two weeds per 50 square yards.

3.7 SURFACE EROSION CONTROL

Where indicated or as directed, surface erosion control material shall be installed in accordance with manufacturer's instructions. Placement of the material shall be accomplished without damage to installed material or without deviation to finished grade. When directed during contract delays affecting turf establishment or when a quick cover is required to prevent surface erosion, the areas designated shall be sodded or seeded with a temporary seed crop.

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SECTION 02930

EXTERIOR PLANTING

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 in the text by basic designation only.

AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)

ANLA ANSI/ANLA Z60.1 (1996) American Standard for Nursery Stock

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300 (1995) Tree Care Operations - Trees, Shrubs and other Woody Plant Maintenance

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4972 (1995a) pH of Soils

ASTM D 5268 (1992; R1996) Topsoil Used for Landscaping Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Schedules

Plant Installation Schedule; GA.

Plant installation schedule shall be submitted a minimum of 30 days before beginning plant installation. Schedule shall specify planting season (spring or fall), dates, locations, and plant materials to be installed.

SD-08 Statements

Plant Establishment Period; FIO

Upon completion of the last day of the planting operation, the plant establishment period for maintaining installed plant material in a healthy growing condition shall commence and shall be in effect for the remaining contract time period, not to exceed 12 months. Written calendar time period shall be furnished for the plant establishment period. When there is more than one plant establishment period, the boundaries of the planted area covered for each period shall be described.

SD-18 Records

Maintenance Record; FIO.

A record shall be furnished describing the maintenance work performed, the quantity of plant losses, diagnosis of the plant loss, the quantity and date of replacements made, and pesticide application.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

1.3.1.1 Plant Material Identification

Plant material shall be identified with attached, durable, waterproof labels and weather-resistant ink, stating the common name, correct botanical plant name and size.

1.3.1.2 Protection During Delivery

Plant material shall be protected during delivery to prevent desiccation and damage to the branches, trunk, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport.

1.3.1.3 Conditioners and Amendments

Soil conditioners and amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis and name. In lieu of containers, soil conditioners and amendments may be furnished in bulk and a certificate from the manufacturer indicating the above information shall accompany each delivery.

1.3.1.4 Pesticide Material

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration number and the manufacturer's registered uses.

1.3.2 Storage

Plants stored on the work site shall be protected from any drying at all times by covering the balls or roots with moist sawdust, wood chips, shredded bark, peat moss, or other similar mulching material. Plants, including those in containers, shall be kept in a moist condition by watering with a fine mist spray until planted.

Storage of other material shall be in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with plants or other materials.

1.3.3 Handling

Plant material shall not be injured in handling. Cracking or breaking the earth ball of balled and burlapped plant material shall be avoided. Plant material shall not be handled by the trunk or stems. Materials shall not be dropped from vehicles.

1.4 SCHEDULE

Planting shall be scheduled within the dates in the Optimal Planting Date table shown on the drawings. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted for approval. Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, frozen ground or other unsatisfactory conditions prevail, the work shall be stopped when directed.

1.5 INSPECTION

Plants shall be subject to inspection at any time prior to planting. Plants may be inspected at the nursery prior to shipment, but such inspection shall not be considered as acceptance. Upon request of the Contracting Officer, the contractor shall accompany the government inspector to the nursery and identify plant material to be furnished. Unacceptable material shall be promptly removed from the job site.

PART 2 PRODUCTS

2.1 PLANT MATERIAL

Trees shall be delivered to the jobsite without wrapping (bark shall be visible for inspection).

2.1.1 Quality

Well shaped, well grown, vigorous plant material having healthy and well branched root systems in accordance with ANLA ANSI/ANLA Z60.1 shall be provided. Plant material shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems, which may occur from the digging and preparation for shipment. Plant material shall be well shaped, vigorous and healthy with a healthy, well branched root system. Plant material shall be checked for unauthorized substitution and to establish nursery grown status. The plant material shall exhibit typical form of branch to height ratio; and meet the caliper and height measurements specified. Plant material that measures less than specified, or has been poled, topped off or headed back, shall be rejected. Container-grown plant material shall show new fibrous roots and the root mass shall contain its shape when removed from the container.

2.1.2 Method of Shipment to Maintain Health of Root System

2.1.2.1 Balled and Burlapped (BB) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with biodegradable twine. Plant material with broken or cracked balls; or broken containers

shall be rejected.

2.1.2.2 Bare-Root (BR) Plant Material

Minimum root spread shall be in accordance with ANLA ANSI/ANLA Z60.1. A well branched root system characteristic of the species specified shall be provided. Roots shall not be pulled from the ground. Bare-root plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. Bare-root plant material shall be dormant. The root system shall be protected from drying out.

2.1.2.3 Container-Grown (C) Plant Material

Container size shall be in accordance with ANLA ANSI/ANLA Z60.1. Plant material shall be grown in a container over a duration of time for new fibrous roots to have developed and for the root mass to retain its shape and hold together when removed from the container. Container-grown plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. The container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

2.1.3 Growth of Trunk and Crown

2.1.3.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANLA ANSI/ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

- a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 6 inches from ground level.
- c. Specimen: The tree provided shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

2.1.3.2 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANLA ANSI/ANLA Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

2.1.3.3 Coniferous Evergreen Plant Material

Coniferous Evergreen plant material shall have the height-to-spread ratio recommended by ANLA ANSI/ANLA Z60.1. The coniferous evergreen trees shall not be "poled". The leader shall be whole and unpruned, including the tip.

2.1.3.4 Ground Cover and Vine Plant Material

Ground cover and vine plant material shall have the minimum number of runners and length of runner recommended by ANLA ANSI/ANLA Z60.1. Plant material shall have heavy, well developed and balanced crown with vigorous, well developed root system and shall be furnished in containers.

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. Additional topsoil required beyond that available from stripping operations shall be imported. Topsoil shall meet the physical requirements of, and shall be tested, amended, fertilized and treated in accordance with Section 02920.

2.3 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Rotted manure and recycled mulch including compost, plastics, or pine needles is not acceptable. Wood chips and shredded or ground bark shall be treated to retard the growth of mold and fungi.

2.4 WEED BARRIERS

Weed barrier shall be an inert membrane specifically manufactured and marketed for landscaping. Weed barrier shall consist of a heat bonded non-woven geotextile composed of fiberglass, polyester, or polypropylene fibers. Polymers shall be stabilized for ultraviolet light degradation.

2.5 TREE ROOT BARRIERS

Tree root barriers shall be metal or plastic consisting of recycled content. Barriers shall utilize vertical stabilizing members to encourage downward tree root growth. Barriers shall limit, by a minimum 90 percent, the occurrence of surface roots. Tree root barriers which are designed to be used as plant pit liners will be rejected.

2.6 MYCORRHIZAL FUNGI INOCULUM

Mycorrhizal fungi inoculum shall be composed of multiple-fungus inoculum as recommended by the manufacturer for the plant material specified.

2.7 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

2.8 TRUNK WRAPPING MATERIAL

Tree wrap shall be two thicknesses of crinkled paper cemented together with a layer of bituminous material. Wrapping material shall be a minimum of 4 inches in width and shall stretch 33 percent without breakage. Waterproof tape shall be used to bind wrapping to tree.

PART 3 EXECUTION

3.1 PROTECTION OF EXISTING VEGETATION

If turf areas have been established prior to planting operations, the surrounding turf shall be covered before excavations are made in a manner that will protect turf areas. Existing trees, shrubbery, and beds that are to be preserved shall be protected in accordance with the approved Environmental Protection Plan and SECTION: GENERAL.

3.2 SITE PREPARATION

The Contractor shall verify that finished grades are as indicated on drawings, and that the placing of topsoil, the smooth grading, and the compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the planting operation. The location of underground utilities and facilities in the area of the planting operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.2.1 Layout

Tree locations and bed outlines shall be staked by the Contractor on the project site and approved by the Contracting Officer before any plant pits or beds are dug.

3.3 INSTALLATION

3.3.1 Setting Plant Material

Plant material shall be set plumb and held in position until sufficient soil has been firmly placed around root system or ball. Balled and burlapped and container grown plants shall be handled and moved only by the ball or container. Plastic wrap and metal baskets shall be completely removed before the placement of backfill. Container grown stock shall be removed from containers without damaging plant or root systems. After centering the plant in pit, all ropes secured to the trunk shall be removed and burlap opened on the top 1/3 of the root ball.

3.3.2 Backfill Soil Mixture

The backfill soil mixture may be a mix of topsoil and soil amendments suitable for the plant material specified. When practical, the excavated soil from the plant pit that is not amended provides the best backfill and shall be used. Mycorrhizal fungi inoculum shall be added as recommended by the manufacturer for the plant material specified.

3.3.3 Backfill Procedure

Prior to backfilling, all metal, wood, synthetic products, or treated burlap devices shall be removed from the ball or root system avoiding damage to the root system. The backfill procedure shall remove air pockets from around the root system. Plant pits and plant beds shall be watered immediately after backfilling, until completely saturated.

3.3.3.1 Bare-Root Plant Material

The root system shall be spread out and arranged in its natural position. Damaged roots shall be removed with a clean cut. The backfill soil mixture shall be carefully worked in amongst the roots and watered to form a soupy mixture. Air pockets shall be removed from around the root system, and root to soil contact shall be provided.

3.3.4 Staking and Guying

Staking will be required when trees are unstable or will not remain set due to their size, shape, or exposure to high wind velocity. Trees that are staked and guyed shall be completed as shown.

3.4 FINISHING

3.4.1 Placing Mulch

Care shall be taken to avoid contaminating the mulch with the planting soil. Mulch shall be kept out of the crowns of shrubs, and shall be kept off buildings, sidewalks, fences, and other facilities.

3.4.2 Pruning

New plant material shall be pruned in accordance with recommended dates for each species in the following manner: prune dead and broken branches, cross branches, weak branches, and for shape. Typical growth habit of individual plants shall be retained with as much height and spread as is practicable. The pruning of trees shall be in accordance with ANSI A300. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off". Trimmings shall be disposed of as specified for clearing and grubbing debris in SECTION: 01000 GENERAL.

3.4.3 Wrapping

The trunks of deciduous trees, planted during the fall, shall be wrapped within 24 hours after planting. Trees planted during the spring shall not be wrapped until October of the year when planted. Wrap shall be removed in the following spring. The wrapping shall be securely tied at the top and bottom and at 18-inch maximum intervals with waterproof tape.

3.5 MAINTENANCE DURING PLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the plant establishment period commences. Installed areas shall be kept free of weeds, grass, and other undesired vegetation. The maintenance includes maintaining the mulch, watering, and adjusting settling.

3.6 APPLICATION OF PESTICIDE

Herbicides, insecticides, and fungicides shall be applied as needed and in accordance with approved written manufacturer's recommendations. When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted. A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. The pesticide shall be prevented from coming into contact with the applicator or other persons.

3.7 RESTORATION AND CLEAN UP

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense. Excess and waste material shall be removed from the installed area and shall be disposed offsite. Adjacent paved areas shall be cleared.

3.8 MAINTENANCE

Maintenance of plant material shall include straightening plant material, straightening stakes; tightening guying material; correcting girdling; supplementing mulch; pruning dead or broken branch tips; maintaining plant material labels; watering; eradicating weeds, insects and disease; post-fertilization; and removing and replacing unhealthy plants.

a. Watering Plant Material. The plant material shall be watered as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. All watering shall be done in a manner which will provide uniform coverage but which will not cause erosion or damage to the finished surface. Water shall not be applied with a force sufficient to displace mulch and shall not be applied at such a rate that it cannot be absorbed by the mulch and plants.

b. Weeding. Grass and weeds in the installed areas shall not be allowed to reach a maximum 3 inches height before being completely removed, including the root system.

c. Post-Fertilization. The plant material shall be topdressed at least once during the period of establishment with controlled release fertilizer. Apply at the rate of 2 pounds per 100 square feet of plant pit or bed area. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy. Fertilizer in packet or tablet form shall be placed prior to backfilling and in accordance with the approved manufacturer's written recommendations.

d. Unhealthy Plant Material. A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement. Unhealthy or dead plant material shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

-- End of Section --