

SPECIFICATIONS

**Fort Sam Houston National Cemetery
San Antonio, TX**

New Cremains Sections and Irrigation

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**Memorial Service Network III
Department of Veterans Affairs**

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LIST OF DRAWING SHEETS

The drawings listed below accompanying this specification form a part of
the contract.

<u>Drawing No.</u>	<u>Title</u>
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**SECTION 01 00 00
GENERAL REQUIREMENTS**

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**SECTION 01 00 00
GENERAL REQUIREMENTS**

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare the site for construction operations including demolition of the existing site; and furnish labor and materials to perform work for the proposed new cremains sections and irrigation system installation at Fort Sam Houston National Cemetery, San Antonio, TX as required by the contract drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Cemetery Director.
- C. Prior to commencing work, general contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- D. Training:
 - 1. All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and/or other relevant competency training.
 - 2. Submit training records of all such employees for approval before the start of work.

1.2 STATEMENT OF BID ITEM(S)

- A. ITEM I, GENERAL CONSTRUCTION: Work includes general construction, demolition (clearing and grubbing), grading, and extending the existing irrigation system for the development of three (3) new cremains burial sections at Fort Sam Houston National Cemetery in accordance with the contract drawings, specifications, applicable standards and requirements.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. AFTER AWARD OF CONTRACT, 1 set of electronic specifications and drawings will be furnished.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

- A. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 3 days notice to the COTR.
- B. No photography of Cemetery premises is allowed without written permission of the Contracting Officer.
- C. The Cemetery reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

1.5 FIRE SAFETY

- A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

- 1. American Society for Testing and Materials (ASTM):

E84-2009.....Surface Burning Characteristics of Building
Materials

- 2. National Fire Protection Association (NFPA):

10-2010.....Standard for Portable Fire Extinguishers

30-2008.....Flammable and Combustible Liquids Code

51B-2009.....Standard for Fire Prevention During Welding,
Cutting and Other Hot Work

70-2011.....National Electrical Code

241-2009.....Standard for Safeguarding Construction,
Alteration, and Demolition Operations

- 3. Occupational Safety and Health Administration (OSHA):

29 CFR 1926.....Safety and Health Regulations for Construction

- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to the Contracting Officer's Technical Representative (COTR) for review for compliance with contract

requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VA safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VA equipment, etc. Documentation shall be provided to the COTR that individuals have undergone contractor's safety briefing.

- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COTR.
- F. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COTR.
- G. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- H. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- I. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- J. Dispose of waste and debris in accordance with NFPA 241. Remove from construction site daily.

- K. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the COTR. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the COTR and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- D. Working space and space available for storing materials shall be as determined by the COTR.
- E. Workmen are subject to rules of Cemetery applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of Cemetery as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others.
 - 1. Do not store materials and equipment in other than assigned areas.

2. Schedule delivery of materials and equipment to immediate construction working areas in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Cemetery areas required to remain in operation.
- G. Utilities Services: Maintain existing utility services for Cemetery at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COTR.
1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COTR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Cemetery Director's prior knowledge and written approval.
 2. Contractor shall submit a request to interrupt any such services to COTR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
 3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Cemetery.
 4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COTR.
 5. In case of a contract construction emergency, service will be interrupted on approval of COTR. Such approval will be confirmed in writing as soon as practical.
 6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam,

payment of such fee shall be the responsibility of the Government and not the Contractor.

- H. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
- I. To minimize interference of construction activities with flow of Cemetery traffic, comply with the following:
 - 1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times.
 - 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COTR.
- J. Coordinate the work for this contract with other construction operations as directed by COTR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.
- K. Coordination of Construction with Cemetery Director: The burial activities at a National Cemetery shall take precedence over construction activities. The Contractor must cooperate and coordinate with the Cemetery Director, through the COTR, in arranging construction schedule to cause the least possible interference with cemetery activities in actual burial areas. Construction noise during the interment services shall not disturb the service. Trucks and workmen shall not pass through the service area during this period:
 - 1. The Contractor is required to discontinue his work sufficiently in advance of Easter Sunday, Mother's Day, Father's Day, Memorial Day, Veteran's Day and/or Federal holidays, to permit him to clean up all areas of operation adjacent to existing burial plots before these dates.

2. Cleaning up shall include the removal of all equipment, tools, materials and debris and leaving the areas in a clean, neat condition.

1.7 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COTR in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report:
 1. Shall note any discrepancies between drawings and existing conditions at site.
 2. Shall designate areas for working space, materials storage and routes of access to areas where alterations occur and which have been agreed upon by Contractor and COTR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COTR, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COTR together shall make a thorough re-survey of the areas involved. They shall furnish a report on conditions then existing, as compared with conditions of same as noted in first condition survey report:
 1. Re-survey report shall also list any damage caused by Contractor, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.
- D. Protection: Provide the following protective measures:
 1. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.

1.8 DISPOSAL AND RETENTION

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
1. Reserved items which are to remain property of the Government are identified by attached tags or noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COTR.
 2. Items not reserved shall become property of the Contractor and be removed by Contractor from Cemetery.

1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, that are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

1.10 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COTR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COTR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.11 LAYOUT OF WORK

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for

executing the work to the lines and grades that may be established or indicated by the COTR. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the COTR until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the COTR may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(FAR 52.236-17)

- B. Establish and plainly mark lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure are in accordance with lines and elevations shown on contract drawings.

1.12 AS-BUILT DRAWINGS

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the COTR's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the COTR within 15 calendar days after each completed phase and after the acceptance of the project by the COTR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.13 USE OF ROADWAYS

- A. For hauling, use only established public roads and roads on Cemetery property and, when authorized by the COTR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

1.14 TEMPORARY TOILETS

- A. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Cemetery. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.15 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the COTR, shall install and maintain all necessary temporary connections and distribution lines. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, and associated paraphernalia.
- C. Electricity (for Construction and Testing): Furnish all temporary electric services.
 - 1. Obtain electricity by connecting to the Cemetery electrical distribution system. Electricity is available at no cost to the Contractor.
- D. Water (for Construction and Testing): Furnish temporary water service.
 - 1. Obtain water by connecting to the Cemetery water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
 - 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COTR's discretion) of use of water from Cemetery's system.

1.16 HISTORIC PRESERVATION

Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the COTR verbally, and then with a written follow up.

SECTION 01 33 23
SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples (including laboratory samples to be tested), test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
 - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
 - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals (including any laboratory samples to be tested) will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Contracting Officer's Technical Representative, and action thereon will be taken by the COTR on behalf of the Contracting Officer.
- 1-6. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price

and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

- 1-7. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and COTRr. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and the COTR assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-8. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
 - A. Submit samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
 - B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of the Cemetery, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
 1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
 2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Cemetery, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
 3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
 - C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests (those preceded by symbol "LT" under the separate sections of the

specification shall be tested, at the expense of Contractor, in a commercial laboratory approved by Contracting Officer.

1. Laboratory shall furnish Contracting Officer with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
 2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past five years.
 3. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.
 4. Contractor shall send a copy of transmittal letter to both the COTR and to the Memorial Service Network III Engineer simultaneously with submission of material to a commercial testing laboratory.
 5. Laboratory test reports shall be sent directly to COTR Engineer for appropriate action.
 6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
 7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- E. Approved samples will be kept on file by the COTR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
- F. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission

by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.

1. For each drawing required, submit one legible photographic paper or vellum reproducible.
2. Reproducible shall be full size.
3. Each drawing shall have marked thereon, proper descriptive title, including the Cemetery location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
4. A space 4-3/4 by 5 inches shall be reserved on each drawing to accommodate approval or disapproval stamp.
5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
7. When work is directly related and involves more than one trade, shop drawings shall be submitted to the COTR and Memorial Service Network (MSN) III Engineer under one cover.
- 1-9. Samples (except laboratory samples), shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to the COTR at the Fort Bliss National Cemetery.
- 1-10. At the time of transmittal to the COTR, the Contractor shall also send a copy of the complete submittal directly to the Memorial Service Network (MSN) III Engineer.

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

EP-1. DESCRIPTION

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
 - 1. Adversely effect human health or welfare,
 - 2. Unfavorably alter ecological balances of importance to human life,
 - 3. Effect other species of importance to humankind, or;
 - 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
 - 1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
 - 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
 - 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
 - 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
 - 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
 - 6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

7. Sanitary Wastes:

- a. Sewage: Domestic sanitary sewage and human and animal waste.
- b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

EP-2. QUALITY CONTROL

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

EP-3. REFERENCES

- A. 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.
- B. U.S. National Archives and Records Administration (NARA):
33 CFR 328.....Definitions

EP-4. PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the COTR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
 - 1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
 - 2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be

- preserved by marking, fencing, or using any other approved techniques.
- a. Box and protect from damage existing trees and shrubs to remain on the construction site.
 - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
- a. Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local 25 (design year) storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.
 - b. Reuse or conserve the collected topsoil sediment as directed by the COTR. Topsoil use and requirements are specified in Section 31 20 11, EARTH MOVING.
 - c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features shown on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.

6. Manage borrow areas on and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
 7. Manage and control spoil areas on and off Government property to prevent erosion of soil or sediment from entering nearby water courses or lakes.
 8. Protect adjacent areas from despoilment by temporary excavations and embankments.
 9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
 10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 11. Handle discarded materials other than those included in the solid waste category as directed by the COTR.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
 2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
 3. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities,

equipment, processes, and work operated or performed, in strict accordance with the State of Missouri - Department of Natural Resources and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.

1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COTR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.

1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m. unless otherwise permitted by local ordinance or the COTR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:

- a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	--
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

- b. Use shields or other physical barriers to restrict noise transmission.
- c. Provide soundproof housings or enclosures for noise-producing machinery.
- d. Use efficient silencers on equipment air intakes.
- e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
- f. Line hoppers and storage bins with sound deadening material.
- g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 50 feet from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at three to six feet in front of any building face. Submit the recorded information to the COTR noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged

property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.

- H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the COTR. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
 - 1. Waste Management Plan development and implementation.
 - 2. Techniques to minimize waste generation.
 - 3. Sorting and separating of waste materials.
 - 4. Salvage of existing materials and items for reuse or resale.
 - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
 - 1. Soil.
 - 2. Inerts (eg, concrete, masonry and asphalt).
 - 3. Clean dimensional wood and palette wood.
 - 4. Green waste (biodegradable landscaping materials).
 - 5. Engineered wood products (plywood, particle board and I-joists, etc).
 - 6. Metal products (eg, steel, wire, beverage containers, etc).
 - 7. Cardboard, paper and packaging.
 - 8. Bitumen roofing materials.
 - 9. Plastics (eg, ABS, PVC).
 - 10. Carpet and/or pad.
 - 11. Gypsum board.
 - 12. Insulation.
 - 13. Paint.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
1. Excess or unusable construction materials.
 2. Packaging used for construction products.
 3. Poor planning and/or layout.
 4. Construction error.
 5. Over ordering.
 6. Weather damage.
 7. Contamination.
 8. Mishandling.
 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to reuse and recycle new materials to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
 2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:

- B. Prepare and submit to the COTR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
1. Procedures to be used for debris management.
 2. Techniques to be used to minimize waste generation.
 3. Analysis of the estimated job site waste to be generated:
 - a. List of each material and quantity to be salvaged, reused, recycled.
 - b. List of each material and quantity proposed to be taken to a landfill.
 4. Detailed description of the Means/Methods to be used for material handling.
 - a. On site: Material separation, storage, protection where applicable.
 - b. Off site: Transportation means and destination. Include list of materials.
 - 1) Description of materials to be site-separated and self-hauled to designated facilities.
 - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
 - c. The names and locations of mixed debris reuse and recycling facilities or sites.
 - d. The names and locations of trash disposal landfill facilities or sites.
 - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

1.6 APPLICABLE PUBLICATIONS

Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.

A. U.S. Green Building Council (USGBC):

LEED Green Building Rating System for New Construction

1.7 RECORDS

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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SECTION 31 20 11
EARTH MOVING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:
1. Site preparation.
 2. Excavation.
 3. Filling and backfilling.
 4. Grading.
 5. Soil Disposal.
 6. Clean Up.

1.2 DEFINITIONS:

- A. Unsuitable Materials:
1. Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 3 inches; organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D 698 for subgrade.
 2. Existing Subgrade: Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proofrolling, or similar methods.
- B. Trench Earthwork: Trenchwork required for utility lines.
- C. Site Earthwork: Earthwork operations required in area outside of a line located 1500 mm (5 feet) outside of principal building perimeter and within new construction area with exceptions noted above.
- D. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through use of data provided from results of field test procedures presented in ASTM D1556, ASTM D2167, and ASTM D2922.
- E. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.
- F. Backfill: Soil materials or controlled low strength material used to fill an excavation.

- G. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the COR. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- H. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.
- I. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- J. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course shall extend up to the springline of the pipe.
- K. Sub-base Course: Layer placed between the sub-grade and base course for asphalt paving or layer placed between the sub-grade and a concrete site pavement or walk.
- L. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- M. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.
- N. Contaminated soils: Soil that contains contaminants as defined and determined by the Resident Engineer or the Government's testing agency.

1.3 RELATED WORK:

- A. Safety requirements: Section 01 00 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- B. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.4 CLASSIFICATION OF EXCAVATION:

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Furnish to COR:
 - 1. Soil samples.
 - a. Classification in accordance with ASTM D2487 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
 - b. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - T180-01(2004).....Moisture-Density Relations of Soils using a 4.54 kg (10 lb) Rammer and a 457 mm (18 inch) Drop
- C. American Society for Testing and Materials (ASTM):
 - D698-00ae1.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft. lbf/ft³ (600 kN m/m³))
 - D1556-00.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - D1557-02e1.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN m/m³))
 - D2167-94 (2001).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
 - D2487-06.....Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)
 - D2922-05.....Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.
- B. Fills: Material in compliance with ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, AND ML, or any combination of these groups; free of rock or gavel larger than 75 mm (3 inches) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material approved from on site or offsite sources having a minimum dry density of 1760 kg/m³ (110 pcf). For "Building Earthwork", Fill shall have a maximum Plasticity Index of 15, and a maximum Liquid Limit of 40. This limitation for the liquid limit and plasticity index of the fill is not applicable for "Site earthwork" fill material.
- C. Engineered Fill: Naturally or artificially graded mixture of compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups, or as approved by the Engineer or material with at least 90 percent passing a 37.5-mm (1 1/2-inch) sieve and not more than 12 percent passing a 75-µm (No. 200) sieve, per ASTM D2940.
- D. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 25 mm (1 inch) sieve and not more than 8 percent passing a 75-µm (No. 200) sieve.
- E. Granular Fill: Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No 4), per ASTM D 2940.
- G. Bank sand as available from Osburn Sand Company, San Antonio, Texas (210) 626-2045 or approved equal.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

- A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Cemetery Property.
- B. Grubbing: Remove stumps and roots 75 mm (3 inch) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inch) diameter, and nonperishable solid objects a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left. Cemetery Projects: do not leave

material within burial profile up to 2400 mm (8 feet) below finished grade.

- C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from areas within 4500 mm (15 feet) of new construction and 2250 mm (7.5 feet) of utility lines when removal is approved in advance by Resident Engineer. Remove materials from Cemetery Property. Trees and shrubs, shown to be transplanted, shall be dug with a ball of earth and burlapped in accordance with latest issue of, "American Standard for Nursery Stock" of the American Association of Nurserymen, Inc. Transplant trees and shrubs to a permanent or temporary position within two hours after digging. Maintain trees and shrubs held in temporary locations by watering as necessary and feeding semiannually with liquid fertilizer with a minimum analysis of 5 percent nitrogen, 10 percent phosphorus, and 5 percent potash. Maintain plants moved to permanent positions as specified for plants in temporary locations until conclusion of contract. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in construction area. Immediately repair damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Do not store building materials closer to trees and shrubs, that are to remain, than farthest extension of their limbs.
- D. Stripping Topsoil: Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by Resident Engineer. Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 0.014 m³ (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work shall not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed. Cemetery Projects: Test the soil for chemicals, pesticides and fertilizers if topsoil is to be removed from lands formerly utilized as farmland, to verify suitability for use as topsoil in the cemetery where new lawn areas are to be established.

- E. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and grades.
1. Grades shall conform to elevations indicated on plans within the tolerances herein specified. Generally grades shall be established to provide a smooth surface, free from irregular surface changes. Grading shall comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade shall be established based on interpolation of the elevations between the spot grades while maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.
 2. Locations of existing and proposed elevations indicated on plans, except spot elevations, are approximate. from a site survey that measured spot elevations and subsequently generated existing contours and spot elevations. Proposed spot elevations and contour lines have been developed utilizing the existing conditions survey and developed contour lines and may be approximate. Contractor is responsible to notify Resident Engineer of any differences between existing elevations shown on plans and those encountered on site by Surveyor/Engineer described above. Notify Resident Engineer of any differences between existing or constructed grades, as compared to those shown on the plans.
 3. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that site is graded to conform to elevations indicated on plans.
 4. Finish grading is specified in Section 02480, LANDSCAPING.
- G. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

- A. Shoring, Sheet piling and Bracing: Shore, brace, or slope, its angle of repose or to an angle considered acceptable by the Resident Engineer, banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities.
1. Design of the temporary support of excavation system is the responsibility of the Contractor.

2. Construction of the support of excavation system shall not interfere with the permanent structure and may begin only after a review by the Resident Engineer.
 3. Extend shoring and bracing to a minimum of 1500 mm (5 feet) below the bottom of excavation. Shore excavations that are carried below elevations of adjacent existing foundations.
 4. If bearing material of any foundation is disturbed by excavating, improper shoring or removal of existing or temporary shoring, placing of backfill, and similar operations, the Contractor shall underpin the existing foundation, per Section 3.3 under disturbed foundations, as directed by Resident Engineer, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by Resident Engineer.
- B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from Resident Engineer. Approval by the Resident Engineer is also required before placement of the permanent work on all subgrades.
- C. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the Resident Engineer.
- D. Proofrolling:
1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building and pavements, proofroll exposed subgrade with a fully loaded dump truck to check for pockets of soft material.
 2. Proofrolling shall consist of at least two complete passes with one pass being in a direction perpendicular to preceding one. Remove any areas that deflect, rut, or pump excessively during proofrolling, or that fail to consolidate after successive passes to suitable soils and replaced with compacted fill. Maintain subgrade until succeeding operation has been accomplished.
- E. Trench Earthwork:
1. Utility trenches (except sanitary and storm sewer):

- a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work and as detailed in the drawings.
 - b. Grade bottom of trenches with bell holes scooped out to provide a uniform bearing.
 - c. Support piping on undisturbed earth unless a mechanical support is shown.
 - d. Length of open trench in advance of piping laying shall not be greater than is authorized by Resident Engineer.
- F. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation shall be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 25 mm (1 inch). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by Resident Engineer as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the contractor shall obtain samples of the material, under the direction of the Resident Engineer, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on volume in cut section only.
1. Site Grading:
- a. Provide a smooth transition between adjacent existing grades and new grades.
 - b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
 - c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:
 - 1) Lawn or Unpaved Areas: Plus or minus 25 mm (1 inch).
 - 2) Walks: Plus or minus 25 mm (1 inch).
 - 3) Pavements: Plus or minus 13 mm (1 inch).

- d. Grading Inside Building Lines: Finish subgrade to a tolerance of 13 mm (1/2 inch) when tested with a 3000 mm (10 foot) straightedge.

3.3 FILLING AND BACKFILLING:

- A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials and borrow meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and work inspected and approved by Resident Engineer.
- B. Placing: Place materials in horizontal layers not exceeding 230 mm (9 inches) in loose depth for material compacted by heavy compaction equipment and not more than 100 mm (4 inches) in loose depth for material compacted by hand-operated tampers and then compacted. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.
- C. Compaction: Compact with approved tamping rollers, sheepsfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without prior approval of Resident Engineer. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. Compact soil to not less than the following percentages of maximum dry density, according to ASTM D698 or ASTM D1557 as specified below:
 - 1. Fills, Embankments, and Backfill
 - a. Landscaped areas, top 400 mm (16 inches), ASTM D1557 85 percent.
 - b. Landscaped areas, below 400 mm (16 inches) of finished grade, ASTM D1557 90 percent.

3.4 GRADING:

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within

specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

- B. Cut rough or sloping rock to level beds for foundations. In pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.

3.5 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Cemetery property.
- B. Disposal: Transport surplus satisfactory soil to designated storage areas on Cemetery property. Stockpile or spread soil as directed by the COR.
 - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Cemetery property.
- C. Place excess excavated materials suitable for fill and/or backfill on site where directed.
- D. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- E. Segregate all excavated contaminated soil designated by the Resident Engineer from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.6 CLEAN UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove all debris, rubbish, and excess material from Cemetery Property.

----- E N D -----

SECTION 32 84 00
PLANTING IRRIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This project includes, but is not limited to, the extension of the existing irrigation system to include the installation piping, sprinkler heads, valves, control wiring, fittings, electrical connections, and necessary accessories. The project also includes new connections to the existing mainline and control wiring system within the previous developed portion of the cemetery.

1.2 RELATED WORK

- A. Maintenance of Existing Utilities: DIVISION 1 - GENERAL REQUIREMENTS.
- B. Site Work: DIVISION 2 - SITE WORK

1.3 GENERAL REQUIREMENTS

- A. The Contractor shall be responsible for the preparation of construction drawings for the new irrigation system. The shop drawings shall be in accordance with the general schematic information shown on the drawings and outlined in these specifications.
- B. The Contractor shall be responsible for the installation, testing, and initial maintenance of the irrigation system shown on the approved drawings, including the supply and installation of all incidental items and equipment not specified herein but required for the proper operation of the irrigation system in accordance with industry standards and/or in accordance with the irrigation equipment manufacturer's recommendations.

1.4 QUALITY ASSURANCE

- A. Criteria:
 - 1. Manufacturer regularly and presently manufactures the item submitted as one of their principal products.
 - 2. Installer, or supplier of a service, has technical qualifications, experience and trained personnel and facilities to perform the specified work.
- B. Products Criteria:
 - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units are products of one manufacturer.
 - 2. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

- a. All components of an assembled unit need not be products of the same manufacturer but component parts which are alike are the product of a single manufacturer.
 - b. Components are compatible with each other and with the total assembly for the intended service.
 - c. Nameplates: Nameplate bearing manufacturer's name or identification trademark securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
3. Compatibility with Reuse Water: All equipment utilized on the project shall be fully compatible with reuse water. Equipment shall be color coded or marked, where applicable, to comply with applicable codes.

C. System Requirements:

1. The extended irrigation system shall comply with the design criteria provided in the specifications and on the project plans. The system shall provide for the delivery of irrigation water throughout the project site, the uniform application of irrigation water using approved equipment, and the control of the irrigation system using remote control valves, existing field controller, and a central control panel (existing computer work station).
2. Full and complete coverage is required. Contractor shall, at no additional cost to the Government, make necessary adjustments to layout required to achieve full coverage of irrigated areas without overthrow on roadways, sidewalks, buildings, and other site features, and to protect trees from close-range high velocity spray.
3. Layout work as closely as possible to the shop drawings provided by the Contractor and approved by the COR. The irrigation drawings provided with the contract documents are diagrammatic and intended to show the approximate or typical layout of irrigation system features. Lines may be in common trench with the approval of the COR.
4. Locations of remote control valves, as shown on the contract documents, are schematic. Remote control valves shall be grouped wherever possible and aligned at a set dimension of 4 feet from back of curb along roads.
5. Irrigation lines and control wire shall run at boundaries of graves, thru designated utility lanes or beside roadways so that any gravesite may be opened in the future without disruption of the irrigation system.
6. Connect the new system to new mains installed as part of this project.

D. As-Built Record Drawings: Maintain a complete set of as-built drawings which shall be corrected daily to show the locations of all mainline and lateral line pipe, all remote control, quick coupling, and isolation valves, all control communications wiring, and other related irrigation equipment. All valves shall be shown with dimensions to fixed reference points such as fences, curbs, or monuments.

1. As-built drawings shall be turned over to the COR at the end of the project.

F. Controller Chart:

1. Prepare a map diagram showing location of all valves, mainlines, lateral lines, and route of the control wires. Identify all valves as to size, station, number and type of irrigation. "As-built" drawings must be approved before charts are prepared.
2. Provide one controller chart showing the area covered by controller for each automatic controller supplied at the maximum size controller door will allow.

G. Inspection:

1. The following inspections shall be the minimum required inspections during the course of construction. Additional inspections shall be made at any time at the discretion of the COR. It shall be the responsibility of the Contractor to notify the COR, in writing, 48 hours in advance of each required inspection. The sequence of required inspections shall not be changed from the sequence listed below. The Contractor shall not proceed with work of the next sequence without written approval of the work of previous sequence. The Contractor shall attach a copy of the written inspection approvals to all applications for payment.
 1. Inspect staked locations of mainline, valves, laterals and heads.
 2. Inspect and pressure test mainline installation.
 3. Inspect 24 volt control wire installation.
 4. Inspect and pressure test automatic valves and lateral irrigation installation.
 5. Inspect head placement, coverage and operating pressure prior to turnover to the cemetery staff.
 6. Inspect two week operational test.
 7. Inspect at end of maintenance period.

1.5 SUBMITTAL

- A. Submit as one package in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.

- B. Shop Drawings: Shop drawings shall be provided by the Contractor. Base information, including property lines, etc. will be provided to the Contractor by the COR. The shop drawings shall show:
1. The complete layout of the system including all mainline pipes, lateral line pipes, valves, sprinkler heads, bubblers, etc.
 2. The size of all valves, pipes, and other equipment.
 3. Installation details, if not shown on the RFP drawings.
 4. Control system diagrams, including information on how existing control system will be integrated with the new irrigation components.
 5. Do not start work before final shop drawing approval.
- C. Manufacturers' Literature and Data:
1. Piping (Mainline and Lateral Line).
 2. Pipe Fittings (For Mainlines, Lateral Lines, and other required installations).
 3. Jointing materials (Solvent Weld Primer, Solvent Weld Cement)
 4. Joint Restraint Materials
 5. Gate Valves
 6. Remote Control Valves
 7. Quick Coupling Valves
 8. Valve Access Boxes
 9. Control wire and communications cable
 10. Sprinkler Heads (all types)
 11. Swing-Joints for Sprinklers
 12. Valve Boxes (All Types)
 13. Detectable Marking Tape
 14. Mechanical Joint Restraint Devices
- D. After "as-built" drawings have been approved, submit print of controller chart.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
- RR-F-621E..... Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
- C. American National Standard Institute (ANSI):
- B40.1-91..... Gauges-Pressure Indicating Dial Type-Elastic Element
- D. American Society for Testing and Materials (ASTM):
- B61-93..... Steam or Valve Bronze Castings
- B62-93..... Composition Bronze or Ounce Metal Castings

- D1785-91..... Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120
- D2241-89..... Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
- D2287-81..... Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
- D2464-91..... Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
- D2466-90..... Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
- D2564-94..... Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- D2855-90..... Making Solvent Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
- F477-90..... Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- E. American Water Works Association (AWWA):
 - C110-93..... Ductile-Iron and Gray-Iron Fittings, 3-Inch Through 48-Inch for Water and Other Liquids
 - C111-90..... Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe Fittings.
 - C115-94..... Flanged and Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
 - C151-93..... Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
 - C153-94..... Ductile-Iron Compact Fittings, 3-Inch Through 12-Inch for Water and Other Liquids.
 - C500-93..... Gate Valves for Water and Sewerage Systems
 - C504-87..... Rubber Sealed Butterfly Valves
 - C600-93..... Installation for Ductile-Iron Water Mains and their Appurtenances
- F. Manufacturers Standardization Society (MSS):
 - SP70-90..... Cast Iron Gate Valves, Flanged and Thread Ends
- National Electrical Manufacturers Association (NEMA): 250-85 Enclosures for Electrical Equipment (1000 Volts Maximum); Revision 1- May 1986

PART 2 - PRODUCTS

2.1 PIPING

A. Irrigation Mains:

1. Provide one of the following materials:

- a. Ductile Iron, AWWA C151, minimum working pressure 1025 kPa (150 psi), cement lined, exterior bituminous coated.
 - b. Polyvinyl Chloride (PVC) Pressure Pipe, AWWA C900, PVC 1120, minimum working pressure 1025 kPa (150 psi). Pipe shall conform to outside diameters of AWWA C151 cast iron pressure pipe to accommodate cast iron fittings.
 - c. Polyvinyl Chloride (PVC) Pressure Pipe, Class 200, SDR-21, rated at 1375 kPa (200 psi), conforming to dimensions and tolerances established by ASTM Standard D2241.
2. Use rubber-gasketed pipe equipped with factory installed reinforced gaskets for mainline pipe. Gasketed pipe joints must conform to the "Laboratory Qualifying Tests" section of ASTM D3139. Gasket material must conform to ASTM F477. Use push-on rubber-gasketed ductile iron fittings according to 2.4.E.
 3. Mainline pipe within sleeves: Provide restrained casing spacers for gasketed joints that occur within sleeve and as necessary along pipe length.
- B. Irrigation Laterals: Polyvinyl Chloride, ASTM D2241, PVC 1120, SDR 21, solvent welded.
- C. Threaded Pipe: Polyvinyl Chloride, ASTM D1785, PVC 1120, Schedule 80, for threaded connections, risers and swing joints.
- D. Above-Grade and In-Concrete Pit: AWWA C115, flanged joints and fittings working pressure 1025 kPa (150 psi).
- E. Fittings:
1. Irrigation Mains (Ductile Iron and PVC Pipe): Ductile Iron, AWWA 110.
 2. Irrigation Laterals: PVC, Schedule 40, solvent welded socket type, ASTM D2466.
 3. Threaded Pipe: PVC, Schedule 80, ASTM D2464.
 4. Swing Joints: Threaded fittings with double elastomeric O-Ring seals that allow 360 degree rotation, and designed for minimum 1375 kPa (200 psig) working pressure.
- F. Jointing Materials:
1. Irrigation Mains: Rubber gaskets, AWWA C111.
 2. Irrigation Laterals: Solvent cement, ASTM D2564
- ## 2.2 VALVES (EXCEPT REMOTE CONTROL VALVES)
- A. Underground Shut-Off Valves: Provide One of the Following:
1. Gate valves 50 mm (Larger than 2 inches): Iron body, bronze mounted, double disc with parallel or inclined seats, non-rising stem turning clockwise to close, 1025 kPa (150 psi) minimum working pressure. AWWA C504.

2. Gate Valves (2" and Smaller): Bronze with FPT threaded ends. Valves shall be equipped with handwheel and shall have a clear waterway equal to the nominal diameter of the valve. Valves shall have a rated operating pressure of not less than 150 psi.
3. Butterfly valves 80 mm (3 inches) and larger: cast iron body with stainless steel shaft, ductile iron valve disc and resilient rubber coated, 1025 kPa (150 psi) minimum pressure. AWWA C504.

B. Valve Operation:

1. Underground: Furnish valves with 50 mm (2 inch) nut for T-Handle socket wrench operation.
2. Above ground and in pits: MSS SP70, with handwheels.
3. All butterfly valves 150 mm (6 inches) and above shall have enclosed gear drive operators.
4. Ends of valves shall accommodate the type of pipe installed.

C. Check: Swing.

1. Smaller than 100 mm (4 inches): Bronze body and bonnet, ASTM B61 or B62, 850 kPa (125 pound) WSP.
2. One hundred mm (4 inches) and larger: Iron body, bronze trim, vertical or horizontal installation, flange connection, 1375 kPa (200 pound) WOG.

- D. Pressure Reducing Valve: Cast steel body with renewable seats, with stainless steel trim. Flow passages and all parts designed to withstand high velocity applications, flanged connections.

2.3 VALVE BOX

- A. Gate and Butterfly Valve: Cast Iron extension box having screw or slide type adjustment and flared base. Minimum thickness of metal shall be 5 mm (3/16 inch). Box shall be of such length to be adapted, without full extension, to depth of cover required over pipe at valve location. Mark box cover to differentiate between lawn irrigation system and domestic water supply system and set flush with finished grade. Provide five (5) "T" handle socket wrenches of 15 mm (5/8 inch) round stock with sufficient length to extend 600 mm (2 feet) above top of deepest valve box cover.
- B. Remote Control Valves: Valve boxes shall be constructed of polyolefin and fibrous inorganic components. Box shall have a minimum clear top opening of 475 mm (19 inches) long by 330 mm (13 inches) wide and shall be 300 mm (12 inches) deep. The cover shall be constructed of the same material as the valve box. Larger size Valve Boxes or valve box extensions fabricated of the material specified shall be provided if required for the enclosure, operation, and maintenance of the equipment housed in the access box.

1. After installation, hot brand into lid of valve boxes two (2), 3 inch high, 3/16" wide and 3/16" deep labels designating the controller letter and station number. For quick coupler boxes brand in "QC"; for master valve boxes brand in "MV". If lid is metal, use welding to make labels 3 inch high, 3/16" wide and 3/16" raised letters directly on lid. Additionally, inside each valve box attach to each valve a 16 gauge aluminum sign 2 inches by 2 inches with 1 inch high 1/8" wide letter and number matching the valve box lid letter and number. Attach sign with a nylon cable tie through a 1/4" hole in the edge of the sign.
2. Valve Box Covers shall be color coded to indicate that the valves enclosed are part of a reclaimed water system. Color coding shall be in accordance with applicable codes and standards.
3. Furnish two (2) 30 inch long valve adjustment keys.

2.4 REMOTE CONTROL VALVES:

1. Each sprinkler section shall be automatically operated by a remote control valve installed underground and operated by a 24-volt AC electric solenoid. Valves shall be globe type of heavy duty construction and shall have manual shut-off and flow control adjustment and provide for manual operation. Install valves with unions on each side to allow for easy removal.
2. Valves shall have a minimum of 150 psi working pressure.
3. Valves shall be of all brass construction furnished as straight or angle pattern type.
4. Valves shall be diaphragm type designed to operate in water containing sand and debris and shall have a self cleaning type contamination filter to filter all water leading to the solenoid actuator and the diaphragm chamber. Valve shall incorporate a non-adjustable type opening and closing speed control for protection against surge pressures. Valve shall have color coded handles to indicate that they are part of a reuse water system.
5. Valves shall be completely serviceable from the top without removing valve body from the system. Furnish five (5), 30 inch long adjustment keys. Valves to operate at no more than 7 psi pressure loss at manufacturer's maximum recommended flow rate.
6. Separate remote control valves shall be provided for each type of sprinkler head and bubbler used. In no instance shall applicators of different types be installed downstream of a single remote control valve.

2.5 SPRINKLER HEADS

- A. Shall be of one manufacturer and, to the greatest extent possible, shall be of one type (model) throughout the job.
- B. The sprinklers shall have the following features:
 - 1. Heavy-duty plastic housing.
 - 2. Water lubricated, gear-drive mechanism.
 - 3. Stainless steel retract spring.
 - 4. Rubber cover color coded to indicate sprinklers are part of a reuse water system.
 - 5. Removable, color coded nozzles.
 - 6. Seal-a-Matic check device to prevent low-head drainage.
 - 7. Stainless steel riser.
 - 8. Fully compatible full and part circle units.
 - 9. Sprinklers shall be of the same make and model as the sprinklers most recently installed within the previously developed portion of the cemetery.
 - 10. To match the existing sprinkler heads used on the project, all new sprinkler heads shall be as manufactured by Rain Bird, Models F4-FC-SS-NP and F4-PC-SS-NP with ground-cover, shrub, turf, and MP Rotator nozzles.

2.6 LOW VOLTAGE CONTROL WIRE

- A. Wire: Solid copper wire, Underwriters Laboratories Inc. approved for direct burial in ground. Size of wire shall be in accordance with manufacturer's recommendations, but in no case less than Number 14.
- B. Splicing Materials: Epoxy waterproof sealing packet.

2.7 SLEEVE MATERIAL

- A. PVC-1120-SDR 21, larger than 4" size. Schedule 40, 4" and smaller.

2.8 DETECTABLE MARKING TAPE

- A. Detectable marking tape shall be a plastic enclosed metal foil tape specifically designed for the marking and surface identification of buried pipelines. The tape shall be a minimum of 3" wide and shall be purple in color. The tape shall have the words "Reclaimed Water" or "Reuse Water" imprinted on it at intervals not exceeding three feet.

2.9 MECHANICAL JOINT RESTRAINTS

- A. Mechanical joint restraints for mainline pipe shall be as specified in Section 02714, herein.

PART 3 - EXECUTION

3.1 PIPE LAYING - GENERAL

- A. Do not lay pipe on unstable material, in wet trench, or when in the opinion of COR, trench or weather conditions are unsuitable for the work.
- B. Mechanical Joint Restraints shall be installed where the irrigation main changes direction as at ells and tees and where the irrigation main terminates. Mechanical joint restraints shall be installed per Section 02714, herein. Pressure tests shall not be made until after all joint restraints have been installed. Concrete thrust blocks may be utilized for mainlines with a nominal pipe diameter of less than three inches (3"). Where utilized, concrete thrust blocks for supply mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications and shall be of an adequate size and so placed as to take all thrust created by the maximum internal water pressure.
- C. Allow a minimum of 3 inches between parallel pipes in the same trench.
- D. Hold pipe securely in place while joint is being made.
- E. Do not work over, or walk on, pipe in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
- F. Full length of each section of pipe shall rest upon the pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipe on wood blocking.
- G. Install sprinkler lines to avoid heating trenches, electric ducts, storm and sanitary sewer lines, and existing water and gas mains, all of which have right of way.
- H. Clean interior of pipe of foreign matter before installation. Keep pipe clean during laying operations by means of plugs or other methods. When work is not in progress, securely close open ends of pipe and fittings to prevent water, earth, or other substances from entering.
- I. Minimum cover over water mains shall be 24 inches. Control valves shall be as detailed. Except as may be approved by the COR, the cover on laterals and control wires shall be a minimum of 18 inches.
- J. Except as shown on the approved shop drawings, existing sidewalks and curbs shall not be cut during trenching and installation of pipe. Install pipe under sidewalks and curbs by jacking, auger boring, or by tunneling. Repair or replace any concrete that cracks, due to settling, during the guaranty period.
- K. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water and

chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

3.2 LAYING PLASTIC PIPE

- A. Pipe shall be snaked in trench at least 1 foot per 100 feet to allow for thermal construction and expansion and to reduce strain on connections.
- B. Solvent Welded Socket Type: ASTM D2855.
- C. Threaded Type: Apply Teflon thread tape. After joint is made hand tight (hard), a strap wrench should be used to make up to two additional full turns.
- D. Elastomeric Gasket: ASTM F477.

3.3 LAYING DUCTILE IRON PIPE

- A. Installation: AWWA C600.
- B. Joints:
 - 1. Mechanical: AWWA C111. Provide sufficient quantities of bolts, nuts, glands and gaskets for each socket opening on pipe and fittings.
 - 2. Push-on: Apply thin film of lubricant to gasket and place in proper position in contour of bell. Insert beveled end of joining pipe and make contact with gasket. Force beveled end of pipe to bottom of bell without displacing gasket. Do not caulk. Use only lubricant furnished by manufacturer of pipe.
 - 3. Flanges: AWWA C115. Install only in concrete pits. Make watertight and set not less than 6 inches from walls or floor.

3.4 INSTALLATION OF SPRINKLERS AND QUICK COUPLERS

- A. Sprinkler heads and quick couplers shall be temporarily placed at least 3 inches above finished grade. After turf is established, reset the sprinklers, quick couplers, and associated swing joints, ensuring that no dirt or foreign matter enters outlet, and install sprinkler heads and quick couplers at ground surface as detailed.
- B. Place part-circle sprinkler heads no more than 6 inches from edge of, and flush with top of adjacent walks, header boards, curbs, and mowing aprons, or paved areas at time of installation.
- C. Install concrete sprinkler head protection "donuts" around all sprinklers heads installed within six feet (6') of any roadway or parking area curb or pavement edge.
- D. Install all sprinklers and quick couplers on swing joints as detailed on plans.

3.5 INSTALLATION OF CONTROL WIRING

- A. Except as may be approved by the COR, wiring from CCU's to satellites and stub-cuts for future extension shall be located in trench with new mains or in separate trench at back of curb, unless cross-country route

is shown. Locate in trench with mains when possible on cross-country routes.

- B. Wiring bundles located with piping shall be set with top of the bundle below top of the pipe. No two wires in any bundle shall be of the same color. Wires shall be bundled, and tied or taped at 4.5 m (15 foot) intervals. A numbered tag shall be provided at each end of a wire, i.e., at valve, at field located controllers and at master controller. The number at each end of wire to be same.
- C. Splicing shall be held to a minimum. A pullbox shall be provided at each splice. No splices will be allowed between field located controllers and remote control valves.
- D. Provide 12 inch expansion loops in wiring at each wire connection or change in wire direction. Provide 24 inch loop at remote control valves.
- E. Power wiring for the operation of irrigation system shall not be run in same conduit as control wiring.

3.6 SETTING OF VALVES

- A. No valves shall be set under roads, pavement or walks.
- B. Clean interior of valves of foreign matter before installation.
- C. Set valve box cover flush with finished grade.

3.7 SLEEVING

- A. Except as shown on the approved shop drawings, furnish and install sleeves where pipe and control wires pass under walks, paving, walls, and other similar areas.
- B. Sleeving to be of adequate size to accommodate retrieval for repair of wiring or piping and shall extend 24 inches beyond edges of paving or construction.
- C. Bed sleeves with a minimum of 3 inches of sand backfill above top of pipe.

3.8 TEST AND FLUSHING

- A. Pressure Test: Pressure test lines before joint areas are backfilled. Backfill a minimum of 12 inches over the pipe to maintain pipe stability during test period. Test piping at hydraulic pressure of 150 psi for two hours. Maximum loss shall be 0.8 gallons/inch pipe diameter/1000-feet. Locate pump at low point in line and apply pressure gradually. Install pressure gauge shut-off valve and safety blow-off valve between pressure source and piping. Inspect each joint and repair leaks. Line shall be retested until satisfactory.
- B. Flushing: After testing, flush system with a minimum of 150 percent of operating flow passing through each pipe beginning with larger mains and

continuing through smaller mains in sequence. Flush lines before installing sprinkler heads and quick couplers.

- C. Operation Test: Upon completion of the final adjustment of the sprinkler heads to permanent level at ground surface, test each sprinkler section by the pan test and visual test to indicate 80% uniform distribution within any one sprinkler head area and over the entire area. When the system is operating properly, that it is balanced and adjusted, that all work and clean-up is completed and prior to the final inspection the contractor shall demonstrate, document and have witnessed by the COR the continuous fault free operation of the complete irrigation system for a period of two consecutive weeks. A fault is a cause to restart the test. Upon completion of this two week test the contractor shall request a final inspection. The COR will respond to the notice of completion by the Contractor and shall conduct an inspection of the project. At that time the Contractor shall demonstrate the operation of each system in its entirety.

3.9 INITIAL MAINTENANCE BY CONTRACTOR

- A. The Contractor shall be responsible for the initial maintenance of all irrigation systems installed as part of this project.

1. Maintenance work shall include, but not be limited to: daily inspection of the installed system, the as-needed re-programming of the control system, adjustments to system components, cleaning or replacement of clogged sprinkler nozzles and bubblers, repair or replacement of defective installations, immediate repair of all leaks, and the immediate repair of all damage to the site caused by irrigation system leaks.

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