



TOWN OF
NAGS HEAD

TOWN OF NAGS HEAD WATER DISTRIBUTION SYSTEM

Standard Technical Specifications and Construction Details

Town of Nags Head
Nags Head, NC

SEPTEMBER 17, 2021

NCDEQ Serial # 21-00672

PUBLIC WATER SYSTEM PLANS AND SPECIFICATIONS	
APPROVED BY N.C. DEPARTMENT OF ENVIRONMENTAL QUALITY DIVISION OF WATER RESOURCES PUBLIC WATER SUPPLY SECTION	
Serial No.	<u>21-00672</u>
Date	<u>9/21/21</u>
By	<u>SB</u>

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Introduction:

The Town of Nags Head Water Distribution System Standard Technical Specifications and Construction Details was created and organized to assist planning, design, engineering, contractor and construction professionals for development activities in the Town of Nags Head. The Town of Nags Head “Water Distribution System Standard Technical Specifications and Construction Details”, latest revision, is established to serve as a reference manual and guide to design professionals and contractors to ensure compliance with the Town Code of Ordinances. The information contained herein are minimum requirements for design and construction within the Town and referenced from adopted policies, standards, details and established practices.

This document will be amended periodically to include supplemental development details and/or changes in materials, methods and procedures.

Copies of this manual may be downloaded from the Town of Nags Head web site, (www.nagsheadnc.gov). Hard copies of the information can be supplied upon request

Manual Provision

The authors of this manual, to the best of their ability, have insured that the information presented here is correct and reliable. The execution of design and construction, however, involves professional judgment and only the design professional/contractor can ascertain whether a technique, method or material can be applied to a given situation. It is the sole responsibility of the design professional/contractor to ensure the standards, methods and practices utilized are accurate and correct.

Variance or Modification

Any variances, alternate design, construction methods and materials, not specifically prescribed herein, shall be subject to the approval of the Public Services Director, Town Engineer or his/her designee.

Applicability

On or after July 7, 2021 this “Water Distribution System Standard Technical Specifications and Construction Details,” latest revision, shall be applicable to all new improvements, alterations and additions located within the jurisdiction of the Town of Nags Head.



September 17, 2021

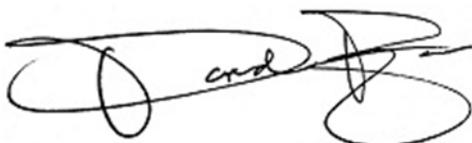
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Requirements of Layout and Design for Town of Nags Head Water Mains:

- a) All mains be a minimum of 6 inches in diameter and shall meet the size requirement of the latest Nags Head Engineering Report “Improvements of the Water Distribution System”. The only exception to this standard is for work undertaken by the Town as authorized by the Town Manager.
- b) Dead-end lines shall exist only with approval from The Town of Nags Head.
- c) Butterfly valves are not to be used in distribution system piping.
- d) Butterfly valves may be used, with approval from Town of Nags Head, in process piping at water treatment or pumping facilities.
- e) Fire prevention sprinkler systems shall be designed to allow the entire piping system to be flushed once a year. Flushing capabilities shall be provided by means of a blow-off valve at the farthest point on the piping system. If the system is looped, isolation valves shall be installed to allow blow-off of one half of the loop.
- f) At least one sample tap and valve shall be installed to allow the Public Works Department, Water Division, to sample the water standing in the sprinkler of the system. The sample tap shall be located near the farthest point on the system and shall be easily accessible.
- g) There shall be a double check valve, or other approval devise, on service line to sprinkler system.

Submittals:

- a) Prior to actual construction of water lines, the developer must submit the following for approval by the Town of Nags Head.
 1. Certificates of Conformance for each lot of pipe supplied verifying that the pipe meets the specifications.
 2. Engineering data covering all equipment and materials which will become a permanent part of the work. This data should include drawings and descriptive information insufficient detail to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorages, and supports required; and dimensions needed for installation and correlation with other material and equipment.
 3. Written approval of shop drawings by the Town of Nags Head is required prior to installation.
 4. Three (3) sets of drawings and specifications which include, as a minimum:
 - a. Plan view draw to 1 Inch equals 50 feet scale, submitted on 22 inch x 36 inch paper.
 - b. All existing topography within rights-of way, plus all permanent building structures outside of right-of-way, within 200 feet of centerline.
 - c. All proposed work including streets and underground utilities.
 - i. Water line, valves, hydrants, and miscellaneous fittings dimensioned to existing topography or centerline of right-of-way.
 - ii. All water line crossings of culverts shall indicate size and invert of existing pipe line and ground elevation.

- iii. Location of all proposed water services.
 - iv. Location and method of connection to existing water system.
5. All other information required by this ordinance and the specifications dealing with actual construction of water lines:
- b) Thirty (30) days shall be allowed for approval by the Town of Nags Head.
 - c) Following approval of the drawings and specifications by the Town of Nags Head, the developer is required to submit a letter of approval for the water system from the North Carolina Department of Environmental Quality, Division of Water Quality.
 - d) Following actual construction of the water lines, the contractor shall furnish a copy of the bacteriological test for total coliform analysis. The test must be done by a State certified laboratory and the certification number must be on the copy of the bacteriological test.

Job Conditions:

- (a) **Laws to be observed.** The developer and/or contractor must keep fully informed of all Federal and State laws, all local laws, ordinances, and regulations and all orders and decrees of bodies having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect conduct of the work. He shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the Town and its representatives against any claim or liability arising from or based on the violation of any such law, ordinance, order or decree whether by himself or his employees.
- (b) **Permits, Licenses and Taxes.** The developer and/or contractor must procure all permits and licenses, pay all charges, fees, and taxes, and give notices necessary and incidental to the due and lawful prosecution of the work.
- (c) **Protection and Restoration of Property and Landscape.** The developer shall be responsible for the preservation of all public and private property and shall protect carefully from disturbance or damage all property markers.
- (d) **Developer's Responsibility for Damage.** The developer shall be responsible for all damage or injury to property of any character, during the prosecution of the work, resulting from any act, omission, neglect, or misconduct in this manner or method of executing the responsibility.
- (e) **Developer's Responsibility for Work.** Until final written acceptance of the project by the Town of Nags Head, the developer shall have the responsibility to protect against injury or damage to any part thereof arising directly or indirectly from any cause, whether from the execution or from the non-execution of the work. The developer shall, at his expense, rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any above causes before final acceptance.
- (f) **Developer's Responsibility During Suspension of Work.** In case of suspension of work for any cause, the developer shall be responsible for the project and shall take such precautions as may be necessary to prevent damage to the project. The developer shall provide for normal drainage and shall erect any necessary temporary structures, signs or other facilities at his expense.
- (g) **Shutting off for Connections.** The existing water supply and fire protection systems shall not be disturbed, except as absolutely necessary, by the developer's operations.

Special care shall be exercised where pipes are being removed and replaced with new lines. The developer shall carefully plan his work in order to avoid contamination and lengthy shut downs of existing water lines.

- (h) **Notification of Affected Parties.** The contractor shall notify the affected property owners and the Fire Department at least 24 hours prior to shutting off water.
- (i) **Contractor's Responsibility Prior to Work.** Prior to commencing work on any existing water line, the contractor shall assist the Town with men and tools to enable the Town of Nags Head to shut off the water for making connections. Existing valves shall be operated by the Town's employees only.
- (j) **Review of Procedures Prior to Work.** A preconstruction meeting will be held to review the progress schedules, to establish procedures for handling shop drawings and other submissions and to establish a working understanding between the parties as to the project. Attendance will include the Town of Nags Head, Developer, Contractor, utility companies and other interested parties.
- (k) **Access to Work.** The Town of Nags Head and its representatives shall at all times have access to the work. The contractor shall provide facilities for such access and observation of the work and also for any inspections or testing thereof by others.
- (l) **Contractor's Responsibility Prior to Work.** The contractor shall furnish all labor, materials, and equipment required to construct the water line, appurtenances and other miscellaneous items. The contractor shall excavate the trench, maintain the backfield trench until final acceptance, replace pavement, sidewalks, curb and gutter and any permanent structures where required.
- (m) **Town May Stop the Work.** If the work is defective, or the developer fails to supply sufficient skilled workmen or suitable materials or equipment, the Town of Nags Head may order developer to stop the work, or any portion thereof, until the cause for such order has been eliminated, however, this right of the Town of Nags Head to stop the work shall not give rise to any duty on part of the Town to exercise the right for the benefit of the developer or any other part.
- (n) **Correction or Removal of Defective Work.** If the work has been rejected by the Town of Nags Head, the developer must remove it from the site and replace it with non-defective work. If the developer does not correct such defective work or remove and replace such rejected work, all as specified in written notice from the Town of Nags Head, the Town may have the deficiency corrected or the rejected removed and replaced. All direct or indirect costs of such correction or removal and replacement, including compensation for additional professional service, shall be paid by the developer. Developer shall also bear the expenses of making good all work of others destroyed or damages by the defective work.
- (o) **Clean-Up.** Following construction of water lines, all surplus material shall be removed from the site by the contractor. Clean-upwork, including complete trench backfill, may be delayed for testing purposes, but shall be limited to single sections of pipe that can be valved off. Clean-up must be done prior to or concurrent with pipe laying operations for the next valved section.
- (p) **Two-year Warranty Period.** If construction meets the requirements of this ordinance and the specifications, final approval will be credited to the developer by the Town of Nags Head. If, after the final approval and prior to the expiration of one year after the date of final approval, any work is found to be defective, the developer will correct such a

defective work, without cost to the Town of Nags Head, or, if it has been rejected by the Town, remove it from the site and replace it with non-defective work. If the developer does not promptly comply with the terms of such instructions, the Town may have the defective work corrected or the rejected work removed and replaced, and all direct and indirect costs of such removal and replacement, including compensation for additional professional services, shall be paid by the developer. Repair or replacements made under the guarantee shall bear an additional 12-month guarantee dated from the acceptance of repair or replacement.

Materials:

- a) All water line materials furnished shall conform in all respects to the Town of Nags Head Water Distribution System Standard Technical Specifications and Construction Details. The standards are maintained by the Public Works Department, Water Division, and the Town Clerk's office for viewing by the affected parties.
 1. Saddles shall be double strap brass with "CC" threads.
 2. Corporation stops will be brass with "CC" threads to minimum 1" CTS.
 3. Meter setters will be copper, with a brass oval flanges angle check valve outlet, 1 inch bypass line at its base, with a inch ball valve installed in the bypass. The bypass valve shall be a Ford "B" series ball valve equipped with padlock wings, Mueller, or approved equal.
 4. Water meter shall be Master Meter, 5/8x3/4 inch with serial number on lid and stamped on meter body or approved equal.
 5. Meter box shall be a heavy-duty plastic box with a cast iron lid which includes a meter reading lid.
 6. Service lines will be 1" CTS tubing 200 psi, SDR-9.
 7. All water distribution mains will be Class 200 PVC, SDR-21 gasketed bell and spigot pipe.
 8. All street or road crossing with water mains 2 inches and larger will be encased in Class 200 PVC, SDR-21 pipe or restrained joint ductile iron pipe.
 9. All tees will have at least two valves.
 10. All valves will be electroplated resilient wedge type.
 11. Hydrant valves will be bolted to a hydrant tee whenever possible.
 12. Fire Hydrants shall be Waterous traffic model, 5 1/4" valve opening equipped with 2-1/2 hose nozzles, and (1) 4-1/2 inch pumper nozzle with a minimum bury depth of 3'-0". NO SUBSTITUTIONS PERMITTED.
 13. Pre-approval by the Water Department representative is required for materials to be used.
 14. All changes in piping direction require a restraint.

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other sections of this Division, apply to this Section.
- B. Standards set forth by the North Carolina Department of Environmental Quality (NCDEQ) Division of Energy, Mineral and Land Resources.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Removal of trees and other vegetation.
 - 2. Clearing and grubbing.
 - 3. Removing above-grade improvements.
 - 4. Removing below-grade improvements.
- B. Related Sections:
 - 1. Division 31 Section "Trenching, Backfilling & Compaction for Utility Systems".
 - 2. Division 31 Section "Earth Moving".
 - 3. Division 31 Section "Erosion Controls".

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with with North Carolina Department of Transportation Standard Specifications for Roads and Structures, latest edition.

1.4 PROJECT CONDITIONS

- A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.
- B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
 - 1. Protect improvements on adjoining properties and on Owner's property.
 - 2. Restore damaged improvements to their original condition, as acceptable to property owners.
 - 3. All erosion control measures shall be in place prior to commencement of clearing operations.
- C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
2. Provide protection for roots over 1-1/2 inch (38 mm) in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
3. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in a manner acceptable to Owner.
4. Replace trees that cannot be repaired and restored to full-growth status, as determined by arborist.

- D. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated or directed.
- E. Existing Conditions: It is recommended, but not required, the Contractor video-tapes existing conditions of the right-of-way and adjacent properties prior to the commencement of work.

1.4 EXISTING SERVICES

- A. General: Indicated locations are approximate; determine exact locations before commencing Work.
- B. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Notify affected utility companies in advance and obtain approval before starting this Work.
- C. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

PART 2 – PRODUCTS

- A. Temporary Barricades: Employ temporary barricades to surround objects selected for protection, unless otherwise directed by the Town of Nags Head before commencing Work.
- B. Pruning Paint: To treat cut or damaged plant tissue.
- C. Other Materials: Any other materials required for completion of the work this Section shall be selected by the contractor and subject to approval by the Town of Nags Head.

PART 3 – EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Notification: The Town of Nags Head shall be notified at least forty-eight (48) hours prior to beginning the work of this section.
- B. Contact NC One Call service not less than seven working days before performing the work.
1. Request underground utilities to be located and marked within and surrounding construction areas.
- C. Verify the existing plant life designated to remain is tagged or identified.
- D. Identify stockpile locations for placing removed materials.

3.2 PROTECTION

- A. Ensure that utilities indicated to remain are located, identified, and protected from damage.

- B. Protect benchmarkes, survey control points, and existing structures from damage or displacement.
- C. Heavy equipment and traffic shall be restricted from travelling over any infiltration areas except as necessary to perform clearing operations.

3.3 SITE CLEARING

- A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site removal of stumps and roots.
 - 1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 2. Existing trees within clearing limits may be chipped and stockpiled on-site but NOT respread as landscape mulch.
- B. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
 - 1. Completely remove stumps, roots, and other debris protruding through ground surface.
 - 2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
 - 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 6 inches (150 mm) loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.
- C. Topsoil Stripping: Strip and stockpile existing topsoil within construction limits for re-spreading. Should the Contractor elect to remove topsoil from the site, suitable topsoil from off-site sources shall be provided for re-spreading at no additional cost.
 - 1. Remove sod and grass before stripping topsoil.
 - 2. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. All surface topsoil, regardless of thickness encountered, shall not be considered Unsuitable Soil.
 - 3. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
 - 4. Stockpile topsoil materials within construction limits and away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 5. Do not stockpile topsoil within tree protection zones.
 - 6. Dispose of excess topsoil off-site as approved by the Town of Nags Head.
- D. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.
 - 1. Abandonment or removal of certain underground pipe or conduits may be necessary.

3.4 DEMOLITION PREPARATION

- A. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations or as shown on the drawings.
- B. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective site demolition area.
 - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction or as shown on the plans.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 - 4. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.
- C. Provide and maintain exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- D. Protect trees, fences, poles, mailboxes, and all other property unless their removal is authorized. Any property damaged, that is not authorized for removal, shall be restored or replaced to the Owner's satisfaction.

3.5 UTILITY SERVICES

- A. Maintain existing utilities indicated to remain in service and protect them against damage during selective site demolition operations.
 - 1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
 - a. Provide not less than 72 hours notice to Owner if shutdown of service is required during changeover.
- B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
- C. Utility Requirements: Contact the Owner for additional requirements for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective site

demolition work until utility disconnecting and sealing have been completed and verified in writing.

- D. Utility Adjustments and Relocations: Adjust locations, elevations and routes of existing utility lines, poles, guys, vaults, handholes, boxes, and other related appurtenances as required to facilitate new construction. Coordinate adjustments and relocations with utility companies.

3.6 POLLUTION CONTROLS

- A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
 - 1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective site demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.7 SELECTIVE SITE DEMOLITION

- A. Demolish and remove existing construction only to the extent required by new construction and as indicated on the drawings. Use methods required to complete Work within limitations of governing regulations.
 - 1. Dispose of demolished items and materials promptly. Prolonged On-site storage or sale of removed items is prohibited.
 - 2. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.
- B. Demolish asphalt, concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.
- C. Remove sawcut concrete and asphalt, including aggregate base, to a depth of 12-inches below existing, adjacent grade, or as indicated. Provide neat sawcut at limits of pavement removal as indicated.

3.8 PATCHING AND REPAIRS

- A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective site demolition operations.
- B. Where repairs to existing surfaces are required, match previous work as closely as possible.
 - 1. Completely fill holes and depressions.
- C. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

3.9 CLEANING

- A. Keep the site free from debris and hazards and inspect the site at the end of each day for trash. All adjacent roads and drives outside of the construction fencing shall remain in operation during construction and shall remain free of all construction materials and debris.

3.10 DISPOSAL OF WASTE MATERIALS

- A. General: Promptly and dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning on Owner's Property: Burning is not permitted on Owner's property.
- C. Removal from Owner's Property: Remove waste materials and unsuitable or excess soils and mulch from Owner's property. Transport demolished materials off Owner's property and legally dispose of them.
- D. Recycling: Contractor shall not dispose of excess soil and land clearing debris in landfills. 100% of soil and land clearing debris shall be recycled.

END OF SECTION 31 10 00

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. Subsurface Exploration Report.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing and grading subgrades.
 - 2. Excavating and backfilling for structures.
 - 3. Base course for walks and pavements.
 - 4. Subsurface drainage backfill for trenches.
 - 5. Excavating and backfilling trenches.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. General and Supplementary Conditions for allowances, definitions and procedures.
 - 2. Division 31 Section 311000 "Site Clearing" for site stripping, grubbing, topsoil removal, and tree protection.
 - 3. Division 31 "Erosion Controls", for all areas of the site that are graded or disturbed by any construction operations.
 - 4. Division 31 Section 312333 "Trenching, Backfilling and Compacting for Utility Systems"

1.3 DEFINITIONS

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed. Refer to the following section for additional definitions of classified excavations.
- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base course, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Surface Course: The top layer of the pavement structure placed on base course or subgrade.
- E. Base Course: Layer placed between the subgrade elevation and asphalt paving courses.
- F. Bedding Course: Layer placed over excavated subgrade in a trench before laying pipe.
- G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.

- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.5 EXCAVATION CLASSIFICATIONS

- A. Excavation Classifications: All excavation is classified as General Excavation except for Rock and Unsuitable Soil Materials as defined in this section.
 - 1. General Excavation: Excavation, removal and/or disposal of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and/or removed; together with soil, boulders, and other materials encountered that are not classified as rock, unsuitable soil, or unauthorized excavation.
 - a. Intermittent drilling, blasting, or ripping to increase production and not necessary to permit excavation of material encountered will be considered general excavation.
 - b. Soil (irregardless of nature) or other debris encountered above proposed subgrade elevations shall be considered general excavation unless determined by the Engineer to meet the definition of rock.
 - 2. Unsuitable Soil Excavation: Removal and disposal of soil materials or other debris encountered at or below proposed subgrade elevations which is deemed unsuitable to remain in place by the Engineer or Owner's Independent Testing Agency.
 - a. Soil and/or other debris encountered above proposed subgrade elevations shall be considered general excavation.
 - b. Soil material which, in the opinion of the Engineer or Owner's independent testing agency, can be repaired by scarifying, drying and recompacting or material which is made unsuitable by delay of work, lack of protection or other actions of the Contractor or his Sub-Contractors shall not be considered as unsuitable soil and shall be repaired or replaced by the Contractor at no additional cost to the Owner.
 - c. Any material moved or removed without the measurement by the Owner's independent testing agency and approval by the Engineer will be considered as general excavation.
 - d. Surface topsoil, regardless of thickness encountered, shall not be considered unsuitable soil.
 - e. Stones, rocks and boulders not meeting classifications of rock shall not be considered unsuitable soil. Stones, rocks and boulders shall be removed from soil as necessary if soil is to be used as fill or backfill. Removed stones, rocks and boulders shall be removed from the site.
 - 5. Classified excavation requirements:
 - a. Excavations more than 10 feet in width and pits more than 30 feet in either length or width are defined as open excavations. Excavations less than 10 feet in width

and pits less than 30 feet in both length and width are defined as trench excavations.

- b. Contractor shall expose and clean the rock material for inspection and measurement by the Engineer.
- c. Do not excavate rock or unsuitable soil until it has been classified and cross-sectioned by the Owner's independent testing agency or Engineer. Any material moved or removed without the measurement by the Owner's independent testing agency and approval by the Engineer will be considered as unclassified excavation.
- d. The Engineer shall be the final judge on what is classified as unsuitable or rock excavation.
- e. The contractor may be required to provide equipment specification data verifying that the above minimum-rated equipment will be used for demonstration purposes. The equipment shall be in good repair and in proper working condition.
- f. Rippable rock, weathered rock or overburden which is not classified as rock according to the above definitions shall be considered General Excavation.

1.6 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and General and Supplementary Conditions.
- B. Material Test Reports: Interpreted test results from a qualified testing agency shall be submitted indicating compliance of test results with the following indicated requirements:
 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 2. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
- C. Report of unsuitable soil removal with quantities confirmed in writing by the Engineer or Owner's independent testing agency.

1.7 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction. Any earthwork required for preparation of parking areas and drives shall comply with current NCDOT Standard Specifications as per the North Carolina Construction Manual.
- B. Comply with applicable requirements of North Carolina Erosion and Sediment Control Planning and Design Manual.
- C. Testing and Inspection Service: Qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.
 1. Off-site borrow material, if any, shall be tested and inspected prior to its use. All soil tests done to qualify off-site fill material for use on-site shall be paid by the Contractor as well as compaction retests required due to failure of the original tests.
- D. Pre-construction Conference: Conduct conference at Project site.

1. Before commencing earthwork, meet with representatives of the governing authorities, Owner, Design Engineer, consultants, Geotechnical Engineer, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

1.8 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Design Engineer and/or Town of Nags Head and then only after acceptable temporary utility services have been provided.
 1. Provide a minimum 72-hours' notice to the Engineer and receive written notice to proceed before interrupting any utility.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.
- B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GC, GP, GM, ML, CL, SW, SP, SC, and SM; free of rock or gravel larger than 2 inches (50 mm) in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter; with a Plasticity Index less than 20 and a Liquid Limit less than 50.
 1. Soils free of organics and having a plasticity index greater than 20 and a liquid limit greater than 50 may be used as fill in approved non-structural areas.
 2. CH and MH soils having plasticity indices great than 20 may also be used as fill in deep fill sections placed at -1% to +3% of optimum and at least 3-ft below planned subgrade elevations in pavement, building or other structural areas.
 3. Satisfactory soil materials obtained from off-site borrow sources shall meet all requirements listed above, however Plasticity Index shall be less than 20.
- C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups MH, CH, OL, OH, and PT. Soils having a Plasticity Index greater than 20 and a Liquid Limit greater than 50 are also unsatisfactory within structural (building and pavement) areas except if placed as specified above.
- D. Unsuitable Soil: Existing, in-place soil, materials or other debris encountered at or below proposed subgrade elevations deemed unsuitable by the Engineer or the Owner's independent testing agency to remain in place and/or for use as fill or backfill material or subgrade. Soil material which, in the opinion of the Engineer or Owner's independent testing agency, can be repaired by scarifying, drying and recompacting and/or material which is made unsuitable by delay of work, lack of protection or other actions of the Contractor or his Sub-Contractors shall not be considered as unsuitable material and shall be repaired or replaced by the Contractor at no additional cost to the Owner. Moisture content alone shall not be the determining factor as to the presence of unsuitable soil. Topsoil shall not be considered unsuitable regardless of thickness from the existing ground surface.

- F. Backfill and Fill Materials: Satisfactory soil materials.
- G. Base Course Material: Type A, B or C aggregate base course meeting the requirements of NCDOT “Standard Specifications for Roads and Structures.”
- H. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- I. Bedding Material: #57 washed stone.
- J. Drainage Fill: #57 washed stone.
- K. Filtering Material/Stone: #57 washed stone.
- L. Filter Sand: Washed, coarse to very coarse sand, 1.0 mm to 2.0 mm particles.
- M. Impervious Fill and Clay Liner: Clayey or silty soil mixtures capable of compacting to a dense state with an maximum permeability of 0.01-in/hr compacted to at least 95% of the maximum dry density per ASTM D-698. ASTM D 2487 soil classification groups CH, CL, SC, MH, and ML; free of rock, brush, roots, and other organic material subject to decomposition.

2.2 PROCESSED AGGREGATE MATERIALS

- A. Base Course Material: Type A aggregate base course meeting the requirements of Section 520 of NCDOT “Standard Specifications for Roads and Structures.”
- B. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- C. Bedding Material: #57 washed stone.
- D. Drainage Fill: #57 washed stone.
- E. Filtering Material: #57 washed stone.
- F. Coarse Sand: Grain Size Distribution (ASTM C136-95A):

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8”	100
#4	95-100
#8	85-97
#16	60-80
#30	10-20
#50	5-15
#100	0-5

2.3 ACCESSORIES

- A. Drainage (Filter) Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
 - 1. Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.
 - 2. Tear Strength: 40 lbf (178 N); ASTM D 4533.
 - 3. Puncture Resistance: 50 lbf (222 N); ASTM D 4833.

4. Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.
 5. Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.
- B. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
1. Grab Tensile Strength: 200 lbf (890 N); ASTM D 4632.
 2. Tear Strength: 75 lbf (333 N); ASTM D 4533.
 3. Puncture Resistance: 90 lbf (400 N); ASTM D 4833.
 4. Water Flow Rate: 4 gpm per sq. ft. (2.7 L/s per sq. m); ASTM D 4491.
 5. Apparent Opening Size: No. 30 (0.6 mm); ASTM D 4751.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- D. Site Maintenance: The Contractor shall be responsible to take whatever measures are necessary to insure reasonable accessibility to and on the construction site so that undue delays are avoided under normal weather conditions. These measures shall include, but not be limited to, the following:
1. Maintaining the surface of the soils in a manner to promote drainage runoff and avoid ponding of water, especially prior to predicted rain events.
 2. Avoiding operation of temporary water sources or hoses in a manner which will cause unnecessary and repeated wetting of the site.
 3. Fill in severely rutted areas which are ponding water during the construction activities or after rain events with drainage fill material to assist drying and allow construction activities to continue.
 4. Provide drying of surface soils and soils intended for filling or backfilling as required to promote accelerated drying of those materials.
 5. After successful drying efforts or prior to predicted rain events, grade the areas back to a smooth condition to promote drainage runoff.
 6. Controlling vehicular traffic, both construction and personal on the site in a manner to prevent undue damage to soils whenever possible and practical.
 7. Providing temporary staging areas of crushed stone or other materials around the construction site which will better withstand the weather and traffic and keep the site accessible immediately or shortly after rain events.
 8. Provide de-watering equipment for any areas collecting water which may affect construction or soil densities under built areas.

3.2 DEWATERING

- A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system to keep subgrades dry and convey groundwater away from excavations. Maintain until dewatering is no longer required.
- C. Soft wet soils, if present at the surface, shall be dried in place by the Contractor prior to placing fill. Drying shall be accomplished by discing, plowing or other means necessary and shall be included in the Contractor's bid. Site soils are typical of the area and susceptible to loss of strength if they become wet, resulting in softening and rutting during construction. Site soils are extremely moisture sensitive, therefore, the Contractor shall take active and aggressive steps to dry soil materials wet of optimum to maintain construction progress through the work and to maintain access to and around the construction. The Contractor, at his option and cost may remove unstable, wet materials and replace with available fill materials in lieu of accomplishing soil drying procedures.

3.3 STABILITY OF EXCAVATIONS

- A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations. Contractor is responsible for ensuring all excavation operations and other construction comply with applicable OSHA requirements. Contractor shall provide temporary shoring and bracing as needed to construct the proposed improvements and comply with the above requirements.

3.4 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- B. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.6 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: Bell diameter + 12” (minimum)- 6” minimum clearance each side.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.
 - 1. For pipes or conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches (150 mm) below invert elevation to receive bedding course.

3.7 APPROVAL OF SUBGRADE PRIOR TO PLACING FILL OR OTHER IMPROVEMENTS

- A. Notify Design Engineer or Town Project Representative when excavations have reached required subgrade.
- B. After stripping is complete the exposed subgrade shall be proofrolled with a fully loaded dual wheel tandem axial dump truck or similar construction equipment. Four passes shall be made in each orthogonal direction. The proofrolling operation shall be observed by the Design Engineer or Town Project Representative. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the soil shall be scarified and moistened or aerated and recompacted. Repeat proofrolling operations.
- C. When independent testing agency, Design Engineer or Town Project Representative determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Unforeseen additional excavation and replacement with suitable material approved by the Engineer will be considered unsuitable material and will be paid by unit prices included in the Contract Documents.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer. Install french drains at design subgrade if directed by the independent testing agency, Design Engineer or Town Project Representative.

3.8 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Design Engineer or Town Project Representative.

1. Fill unauthorized excavations under other construction as directed by the Design Engineer, independent testing agency or Town Project Representative.
- B. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Design Engineer or Town Project Representative.

3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

- A. Backfill excavations promptly, but not before completing the following:
 1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for record documents.
 3. Testing, inspecting, and approval of underground utilities.
 4. Concrete formwork removal.
 5. Removal of trash and debris from excavation.
 6. Removal of temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
 8. Removal of objectionable materials, including rocks larger than acceptable size, from backfill soils.

3.11 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on rock and other unyielding bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Place and compact initial backfill of satisfactory soil material or base course material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit.
 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- C. Coordinate backfilling with utilities testing.
- D. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.
- E. Place and compact final backfill of satisfactory soil material to final subgrade.
- F. Install detectable warning tape and copper wire directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.12 FILL

- A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.
 - 1. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.
- B. Obtain approval of subgrade as specified prior to placing fill.
- C. Place fill material in layers to required subgrade elevations for each location listed below.
 - 1. Under grass, use satisfactory excavated or borrow soil material.
 - 2. Under walks, pavements, buildings and other structural areas use base course material, or satisfactory excavated or borrow soil material.
- D. Following placement of fill the subgrade of building and pavement areas shall be proofrolled. The proofrolling operation shall be observed by the independent testing agency, Design Engineer or Town Project Representative. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the soil shall be scarified and moistened or aerated and recompacted. Repeat proofrolling operations.

3.13 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 3 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.
 - a. Stockpile or spread and dry removed wet satisfactory soil material.

3.14 COMPACTION

- A. Place backfill and fill materials in layers not more than 6-8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
- C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D698 Standard Proctor:
 - 1. Under structures, steps, walks, courts, tracts, and pavements, compact the top 24 inches below subgrade at 98% and each layer of backfill or fill material at 95% of the standard Proctor Density (ASTM D-698). Moisture content of the fill during placement shall be kept within 3% from the optimum moisture.
 - a. Under pavements within NCDOT rights-of-way or new pavement to be constructed to NCDOT standards compact the top 8 inches below pavement subgrade to at least 100% density in accordance with AASHTO T-99 as modified by NCDOT.
 - 2. Under lawn or unpaved areas, compact the top 6 inches below subgrade and each layer of backfill or fill material at 90 percent maximum dry density.

3. In pond embankments, compact each layer of backfill or fill material at 95% of the standard Proctor Density (ASTM D-698). Moisture content of the fill during placement shall be kept within 3% of optimum.
4. Compact each layer of aggregate base material under pavement to 100% density in accordance with AASHTO T-180 as modified by NCDOT.

3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between existing adjacent grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1.2 inches (0.10 foot).
 2. Walks: Plus or minus 1.2 inches (0.10 foot).
 3. Pavements: Plus or minus 1/2 inch (0.05 foot).

3.16 BASE COURSES

- A. Under pavements, walks, courts and tracks, place base course material on prepared subgrades.
 1. Compact base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 100 percent density in accordance with AASHTO T-180 as modified by NCDOT.
 2. Shape base course to required crown elevations and cross-slope grades.
 3. When thickness of compacted base course is 6 inches or less, place materials in a single layer.
 4. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.
 5. Following compaction testing and within 48 hours prior to the application of asphalt or concrete pavement, the aggregate base course shall be proofrolled with a fully loaded dual wheel tandem axial dump truck or similar construction equipment. Four passes shall be made in each orthogonal direction. The proofrolling operation shall be observed by the Engineer. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the base course shall be scarified and moistened or aerated and recompacted. Repeat proofroll testing.
- B. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders at least 12 inches (300 mm) wide of acceptable soil materials and compact simultaneously with each base course layer.

3.17 FIELD QUALITY CONTROL

- A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Perform field in-place density tests according to ASTM D 1556 (sand cone method), or ASTM D2922 (nuclear) as applicable.
2. Paved Areas : At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 5000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests. Observe proofrolling of finished subgrade and aggregate base course.
 1. Trench Backfill : In paved areas, test as noted above. Perform at least one field in-place density test per 2 feet of backfill per 250 linear feet or less of trench.
 2. Non-Structural Areas: Field density and moisture content tests shall be performed on the fill and backfill at a rate of one test per every 10,000 square yards of fill per lift, per day
- B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.
- C. Proofrolling: Subgrade to receive fill, finish subgrade of building or pavement areas, and aggregate base courses shall be proofrolled with a fully loaded dual wheel tandem axial dump truck or similar construction equipment. Four passes shall be made in each orthogonal direction. The proofrolling operation shall be observed by the independent testing agency, design engineer or authorized Town representative. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the soil shall be scarified and moistened or aerated and recompact. Repeat proofrolling operations.

3.18 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
 1. Scarify or remove and replace material to depth directed by the Design Engineer or Town Project Representative; reshape and recompact at optimum moisture content to the required density.
- C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus soil and waste material, including unsatisfactory soil, excess topsoil, trash, and debris, and legally dispose of it off the Project work area.

END OF SECTION 31 20 00

SECTION 312333 - TRENCHING, BACKFILLING AND COMPACTING FOR UTILITY SYSTEMS**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Material Classification
- B. Excavation
- C. Dewatering
- D. Backfilling and Compaction
- E. Testing

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D422 Particle - size Analysis of Soils
 - 2. ASTM D698 Moisture - Density Relations of Soils and Soil - Aggregate mixtures using 5.5 lb. Rammer and 12 inch Drop.
 - 3. ASTM D1556 Density of soil in place by the Sand - Cone Method
 - 4. ASTM D2167 Density and Unit Weight of soil in place by the Rubber Balloon Method.
 - 5. ASTM D2487 Classification of soils for engineering purposes.
 - 6. ASTM D2488 Description of soils (visual - manual Procedure).
 - 7. ASTM D2922 Density of soil and soil - aggregate in place by nuclear methods.
 - 8. ASTM D3017 Moisture content of soil and soil - aggregate in place by Nuclear Methods.
 - 9. ASTM D4318 Liquid limit of soils.

1.3 JOB CONDITIONS

- A. Existing Utilities:
 - 1. Locate existing underground utilities in areas of work.
 - 2. Provide adequate means of support and protection during earthwork operations.
 - 3. Utilities encountered during excavation, uncharted or incorrectly charted shall be kept in operation. Consult Engineer about utility locations.
 - 4. Repair damaged utilities to satisfaction of Design Engineer and Town of Nags Head.
 - 5. Do not interrupt existing utilities serving facilities occupied and used, during occupied hours, unless acceptable temporary utility services have been provided.
 - 6. Provide minimum of 72-hour notice to Town of Nags Head Project Representative, and receive notice to proceed before interrupting any utility.
- B. Protection of Persons and Property:
 - 1. Provide adequate barricades, construction signs, and warning lights as required.
 - 2. Protection shall be placed and maintained by the Contractor at his expense during the progress of the construction.

3. Obstructions to traffic, material piles, equipment and pipe, shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor.
4. The rules and regulations of O.S.H.A. and appropriate authorities safety provisions shall be observed.
5. Shoring and Sheeting shall be used if the soil conditions are not substantial to:
 - a. Prevent undermining of pavements and slabs.
 - b. Prevent movement in bank or slopes.
 - c. Prevent movement in vertical wall trenches.
6. Protect satisfactory material from becoming spoiled by water, debris, organic material.
7. A temporary surface shall be placed over the trench top as soon as possible after compaction in traveled areas. The temporary surface shall:
 - a. Maintain a smooth surface
 - b. Meet grade of adjacent undisturbed surface
 - c. Be maintained at Contractor's expense until final restoration

1.4 DEFINITIONS

- A. Absorption - The attachment of water molecules to the surfaces of soil particles.
- B. Aggregate - Relatively inert granular mineral material such as sand, gravel, slag, crush stone, etc.
 1. Fine aggregate - material that will pass a No. 4 screen.
 2. Coarse aggregate - material that will not pass a No. 4 screen.
- C. Angular aggregate - aggregate that possesses well - defined edges formed at the intersection of roughly planar faces.
- D. Base coarse - a layer of specified or selected material of planned thickness constructed in the subgrade or subbase for the purpose of serving one or more functions such as distributing load, providing drainage, minimizing frost action, etc.
- E. Backfill - The area above the initial backfill to finish grade or grade specified.
- F. Bedding - The section from the top of the foundation to the bottom of the pipe.
- G. Clay - fine grained soil or the fine grained portion of soil that can be made to exhibit plasticity (putty like) within a range of water contents, and that exhibits considerable strength when air dry.
- H. Cohesionless soils - a soil that when unconfined has little or no strength when air dried and that has little or no cohesion when submerged.
- I. Cohesive soils - a soil that when unconfined has considerable strength when air dried and that has significant cohesion when submerged.
- J. Compaction - The densification of a soil by means of mechanical manipulation.
- K. Differential Settlement - settlement that varies in rate or amount, or both, from place across a structure.
- L. Displacement - a change in position of a material point.
- M. Ductility - condition in which material can sustain permanent deformation without losing its ability to resist load.

- N. Elasticity - property of material that returns to its original form or condition after the applied force is removed.
- O. Fineness - a measure of particle size.
- P. Fines - portion of soil that passes through a No. 200 U.S. Standard sieve.
- Q. Foundation - material below bedding that represents the bottom of trench.
- R. Water Table - elevations at which the pressure of the water is zero (0) with respect to the atmospheric pressure.
- S. Ground - Water Level - - the level below which the rock and subsoil, to unknown depths, are saturated.
- T. Hardpan - a hard impervious layer, composed chiefly of clay, cemented by relatively insoluble materials, that does not become plastic when mixed with water and definitely limits the downward movement of water and roots.
- U. Haunching - from the bottom of the pipe to 1/4 of pipe outside diameter above the spring line (3/4 of pipe outside diameter above the pipe bottom).
- V. Initial Backfill - from top of haunching section to the bottom of the final backfill.
- W. Liquid Limit - the water content corresponding to the arbitrary limit between the liquid and plastic states of consistency of a soil.
- X. Moisture Content - the percentage by weight of water contained in the pore space of a rock or soil.
- Y. Muck - stone, dirt, debris, or useless material or an organic soil of very soft consistency.
- Z. Mud - a mixture of soil and water in a fluid or weakly solid state.
- AA. Optimum moisture content - the water content at which a soil can be compacted to a maximum dry unit weight by a given compactive effort.
- BB. Plasticity - the property of a soil or rock that allows it to be deformed beyond the point of recovery without cracking or appreciable volume change.
- CC. Rock – see definition in Earth Moving Section.

1.5 SUBMITTALS

- A. Copies of laboratory and field test reports

PART 2 PRODUCTS

2.1 SATISFACTORY MATERIALS

- A. Satisfactory materials are materials designated as such in the Earth Moving section.

2.2 UNSATISFACTORY MATERIALS

- A. Unsatisfactory materials shall be materials that are unsatisfactory for their intended use and as designated by soil technicians.
- B. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than 3 inches and materials classified in USCS as OH, OL, CH, and MH.

- C. Unsatisfactory materials also include man-made fills, refuse, or backfill from previous construction.
- D. Satisfactory materials, which are classified as wet or saturated by ASTM D2488, shall be considered unsatisfactory material unless dried to optimum moisture content.

2.3 UNYIELDING MATERIAL

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

2.4 UNSTABLE MATERIAL

- A. Unstable material shall consist of materials unable to properly support the utility pipe, conduit, or appurtenance structure.

2.5 DEGREE OF COMPACTION

- A. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D-698.

2.6 EMBEDMENT MATERIALS

- A. Embedment materials listed herein include a number of processed materials plus the soil classifications listed under the Unified Soil Classification System (USCS) (Method D 2487 and Practice D 2488). These materials are grouped into four broad categories according to their suitability for this application.
 1. Class I - Angular, 6 to 40 mm (1/4 to 1-1/2 inch), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
 2. Class II - Coarse sands and gravels with maximum particle size of 40 mm (1-1/2 inch), including variously graded sands and gravels containing small percentage of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class.
 3. Class III - Fine sand and clay gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil Types GM, GC, SM and SC are included in this class.
 4. Class IV - Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH and CL are included in this class.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. Construction on site:
 1. Confine all operations to the limits of construction.
 2. Take precautions to prevent any cave-in of disturbance beyond the construction limits or damage to improvements within the site.

3. Restore damage areas outside of the construction limits to original condition.
 4. Fences, shrubbery or other type of surface improvements located in the construction area will require protection during construction or removal and replacement as necessary for trench construction.
 5. Organize operations to perform within the construction limits.
- B. Protection of Property and Surface Structures:
1. Protect property and surface structures during construction operations. Provide appropriate barricades in any traffic areas to deter traffic from construction areas.
 2. Restore fences, poles or other man-made surface improvements that are disturbed to the original conditions. Expense for restoration shall be borne by the Contractor and shall not be an additional cost to Owner.
 3. The Contractor at no cost to Owner shall restore damage caused by construction operations to landscape improvements that were not authorized for removal.

3.2 EXCAVATION

- A. Excavation shall be performed to the lines and grades indicated.
- B. Stockpile:
1. Stockpile material satisfactory for backfilling at a sufficient distance from the trench to avoid overloading and to prevent slides or cave-ins.
 2. If construction limits prevent the stockpiling of excavated material adjacent to the banks of the trench transport immediately excavated material to its ultimate destination (backfill or off-site).
 3. Provide adequate drainage for the stockpiles and surrounding areas, by means of ditches, dikes, or other approved methods.
 4. Grade to prevent surface water from flowing into the excavation.
 5. Remove accumulating water from trenches.
 6. Protect stockpiles from contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material.
 7. Satisfactory material that becomes contaminated shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Owner.
 8. Excavated material not required or unsatisfactory for backfill shall be completely removed from the site.
 9. Avoid obstructing sidewalks and driveways.
 10. Leave fire hydrants, valve pit covers, valve boxes, curb stop boxes, or other utility controls unobstructed and accessible.

11. Provide adequate erosion control devices to prevent damage to surrounding construction areas.
- C. Excavation for Appurtenances:
1. Leave 12 inches clear between the outer structure surfaces and the face of the excavation or support members.
 2. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated.
 3. Remove loose disintegrated rock and thin strata.
 4. Take care not to disturb the bottom (foundation) of the excavation when placing concrete or masonry.
 5. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.
- D. Trench Excavation:
1. Excavate to the dimension and depth shown in the plans.
 2. Slope or brace trench walls, above the area designated as "initial backfill", to meet OSHA requirements. Vertical side wall shall be maintained below the area designated as "initial backfill".
- E. Sheeting, Shoring and Bracing:
1. Open-cut trenches shall be sheeted and braced or otherwise protected as required to protect life, property, or the work and as required by Federal, State, or municipal ordinances.
 2. The minimum protection shall conform to the recommendations in O.S.H.A. Safety and Health Standards for Construction.
 3. A sand box or trench shield may be used in lieu of sheeting as permitted by O.S.H.A.
 4. When close sheeting is used, it shall be so driven as to prevent adjacent soil from entering the trench either below or through such sheeting.
 5. Where shoring and bracing are used, the trench width shall be increased accordingly.
 6. Sheeting and bracing which have been ordered left in place shall be cut off 18-inches below grade.
 7. Trench bracing, except when ordered left in place, may be removed when the backfilling has reached the respective levels of such bracing.
 8. Sheeting, except that ordered left in place, may be removed after the backfilling has been completed or has been brought to such an elevation as to permit its safe removal.
- F. Trenches With Sloping Sides, Limited:

1. When working conditions and right-of-way permit allow, excavate pipe line trenches with sloping sides, but with the following exceptions:
 - a. To save site improvements.
 - b. Adjacent to a structure or building.
 - c. Violates easement or right-of-way permit.
- G. Bottom Preparation:
1. Accurately grade the bottom to provide uniform bearing and bottom quadrant support of each pipe section and to avoid differential settlement.
 2. When unstable material is encountered in the bottom of the trench, such material shall be removed to the depth as required to provide acceptable pipe foundation and replaced to the proper grade with Class I material.
 3. Over excavation of trench bottom - fill over excavation with an acceptable class of embedment material to at least 12 inch below pipe and compact to a minimum of 98% Standard Proctor Density, ASTM D 698.

3.3 DEWATERING

- A. Trenches shall be kept dewatered at all times by bailing sump pumps at the lower end of the trench, by well-pointing or other approved means.
- B. Surface water shall be prevented from flowing into trenches by diking, ditching or otherwise directing the flow of surface water.
- C. Disposal of water shall be in accordance with local erosion and sediment control regulations. Silty or muddy water shall not be permitted to enter a watercourse, open ditch or storm drain until after flowing through a sediment trap or basin.
- D. Running Water:
 1. Remove running water from trench before laying pipe.
 2. Select the method of water removal.
 - a. Use Class I material for pipe bedding which will serve as a trench drain and/or under drain from which the excess water will be pumped via trench side pumps.
 - b. Well points.
 3. Take necessary precautions to insure that the trench wall will not be removed as a result of the running water.

3.4 BACKFILL AND COMPACTION

- A. Backfill shall be placed in layers not exceeding 6 inches loose thickness for hand operated machine compaction, and 8" loose thickness for other than hand operated machines, unless otherwise specified.
 1. Each layer shall be compacted to at least 95% maximum density, unless otherwise specified.
 2. Compaction shall be tested by ASTM D698.

- B. Replacement of Unyielding Material: Unyielding material removed from the bottom of the trench shall be replaced with satisfactory material of class specified for that trench section (Haunching, Initial Backfill, etc.).
- C. Replacement of Unstable Material: Unstable material removed from the bottom of the trench or excavated shall be replaced with the specified class of material for that trench section (Haunching, Initial Backfill, etc.).
- D. Foundation: Take care to undercut only what is required for bedding and leave foundation undisturbed. In situations where unstable material is encountered below the bedding, it shall be removed to the depth required, replaced with Class I material in 6" layers and compacted to 98% of maximum density.
- E. Bedding: shall consist of Class I or Class II materials.
- F. Haunching: place in layers of a maximum of 6 inches loose thickness. The haunching shall be brought up evenly on both sides of the pipe for the full length of the pipe. Compaction rates for materials used in Haunching area are as follows:
 - 1. Class I: Requires hand tamped compaction
 - a. Care shall be taken to ensure proper pipe support under pipe in haunching areas.
 - 2. Class II and III: 95% maximum density
 - 3. For PVC pipe use Class 1.
- G. Initial Backfill:
 - 1. Place in layers of a maximum of 6 inches loose thickness and compacted.
 - 2. When using ductile iron pipe use Class I, Class II, or Class III materials,
 - a. At a moisture content that will facilitate compaction,
 - b. Be free from stones larger than 2 inches in any dimension or as recommended by pipe manufacturer, whichever is smaller.
 - c. If the pipe is coated or wrapped for protection against corrosion, the backfill material shall be free of stones larger than 1 inch in any direction or as recommended by the pipe manufacturer whichever is smaller.
 - d. PVC pipe use Class I only
 - 3. Compaction rates
 - a. Class I material: hand tamped.
 - b. Class II and Class III: 95% maximum density.
 - c. Class IV material shall not be used in initial backfill area.
- H. Final Backfill: Class II, Class III, or Class IV material. Final backfill shall contain no unsuitable material that includes organic matter, trash, debris, frozen materials and stones larger than 1.5 inches.
 - 1. Turfed or Sodded Areas and Miscellaneous Areas:
 - a. Deposit in layers of a maximum of 12-inch loose thickness.
 - b. Compact to 90% maximum density.

2. Backfill for Manholes, Catch Basins and other Appurtenances:
 - a. Carefully place backfill so that the structure will not be damaged by the shock of falling earth.
 - b. Deposit and compact as specified for initial backfill above.
 - c. Place as to prevent eccentric loading and excess stress on the pipe or structure.
3. Roadways, Walks, and Parking Areas:
 - a. Deposit on lifts not exceeding 6" loose thickness.
 - b. Compacted to 98% maximum density.

3.5 TESTING

- A. Testing and inspection services: An independent geotechnical service may be engaged for quality control testing during trenching and backfilling operation.
- B. Determination of Density:
 1. Testing facility: an approved qualified testing laboratory shall perform density tests. Approval of testing facilities shall be based on compliance with ASTM E 548.
 2. Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained.
 3. Field moisture-density relation testing and compaction testing shall be performed at the direction and discretion of the Engineer, but shall not exceed two test locations per week.
 4. Laboratory tests for moisture-density relations shall be determined in accordance with ASTM D 698 or ASTM D 1557, as specified in these specifications.
 5. Characteristics of backfill material shall be determined in accordance with particle size analysis of soils in accordance with ASTM D 422.
 6. Field in-place density shall be determined in accordance with ASTM D 2167.
 7. Trenches improperly compacted shall be reopened to the necessary depth, then refilled and compacted to the density specified at no additional cost to the Owner.

3.6 RESTORATION OF PRE-EXISTING CONDITIONS

- A. Areas disturbed by operations required under this Section shall be restored as indicated on the Drawings or specified herein and at no cost to Owner.
- B. Any disturbance outside the construction area shall be restored to the original condition or satisfaction of Engineer at no cost to the Owner.
- C. Paved Areas: Restore to the original conditions conforming to these specifications and drawings.

- D. Lawns and Yards: Established greenways on site; sod lawn and replant scrubs.
- E. Surfaces Structures: Trees, shrubbery, fences, poles and all other surface structures shall be protected during construction operations unless the Engineer authorizes the removal. Any fences, poles or other manmade surface improvements which are moved or disturbed by the Contractor shall be restored to their original condition at the Contractor's expense. Any trees, shrubbery or other vegetation which are approved or ordered for removal by the Engineer shall be removed completely, including stumps and roots, by the Contractor. The Contractor shall be responsible for damage or claims of damage caused by construction operations to shrubbery or other landscape improvements.

END OF SECTION 31 23 33

SECTION 31 25 00 - EROSION CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other specifications, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following: Soil erosion and sedimentation control for all areas of the site that are graded or disturbed by any construction operations and elsewhere as indicated on the Drawings or specified herein. Erosion control shall be as specified herein and as may be required by actual conditions and governing authorities.
- B. The Contractor is fully responsible for all applicable permits and approvals for off-site borrow and waste areas.
- C. The Contractor shall have full responsibility for the construction and maintenance of erosion control and sedimentation control facilities as shown on the Drawings and as specified herein. The Contractor shall at all times provide the operation and maintenance necessary to operate the permitted sediment and erosion controls at optimum efficiency.
- D. The Contractor shall provide permanent or temporary ground cover as soon as possible over disturbed areas of the site, and shall provide permanent or temporary ground cover in no more than 30 days after construction activities have permanently or temporarily ceased over the disturbed area. Temporary or permanent ground cover shall be provided on slopes within 15 days after construction activities have permanently or temporarily ceased.
- E. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 31 Section "Site Clearing."
 - 2. Division 31 Section "Earth Moving."
 - 3. Division 31 Section Trench, Backfilling and Compacting for Utility Systems

1.3 PRODUCT HANDLING

- A. Deliver seed, fertilizer and other packaged materials in unopened original packages with labels legible and intact. Seed packages shall bear a guaranteed analysis by a recognized authority.
- B. On-site storage of materials shall be kept to a minimum. Wet or damaged seed or other material shall be removed from the project site immediately.

1.4 MONITORING AND RECORD KEEPING

- A. Contractor shall abide by all conditions of the General Permit to Discharge Stormwater under the National Pollutant Discharge Elimination System (NPDES), and the general requirements listed below.

- B. All sediment and erosion control devices and facilities shall be inspected at least once every seven (7) calendar days and within 24 hours after any storm event of greater than 0.5 inches of rain per 24 hour period.
- C. Stormwater discharges shall be inspected by observation for stormwater discharge characteristics (as listed below) at the above frequency to evaluate the effectiveness of the sediment control facilities, devices or practices. Observations shall be made at all stormwater discharge outfalls and other locations where concentrated stormwater discharges from the site. Observations shall be qualitative, no analytical testing or sampling is required. If any visible off-site sedimentation is leaving the site, corrective action shall be taken to reduce the discharge of sediments.
 - 1. Color.
 - 2. Odor.
 - 3. Clarity.
 - 4. Floating solids.
 - 5. Suspended solids.
 - 6. Foam.
 - 7. Oil sheen.
 - 8. Other obvious indicators of stormwater pollution.
- D. The contractor shall perform and keep records of the above inspections. Visible sedimentation found off the site shall be recorded with a brief explanation as the measures taken to prevent future releases as well as any measures taken to clean up the sediment that has left the site. This record shall be made available to the Owner, Architect and governmental authorities.

PART 2 - PRODUCTS

2.1 SOIL AMENDMENTS AND SEED

- A. Refer to instructions as detailed on the drawings.

2.2 MISCELLANEOUS

- A. Gravel for Stone Filters: Washed No. 57 stone or as indicated on the drawings.
- B. Silt Fabric: A synthetic filter fabric or a pervious sheet of polypropylene, nylon, polyester, or polyethylene yarn, which is certified by the manufacturer or supplier as conforming to the following requirements.
 - 1. Filtering efficiency: 85% min.
 - 2. Tensile Strength at 20% (max) elongation: 30 lb/lin in (min).
 - 3. Slurry Flow Rate: 0.3 gal/sq-ft/min (min)
 - 4. Fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected useable construction life.
- C. Filter Fabric (for installation under riprap): Woven geotextile fabric, apparent opening size no larger than US Standard Sieve no. 70, min. grab strength of 120-lbs.
- D. Temporary Inlet Sediment Control Device: Storm drainage inlet sediment control device shall be a weather resistant tape that fully encompasses the inlet slots of the drain until the surrounding drainage area has been stabilized. The tape shall be a weather resistant adhesive tape of adequate

width to prohibit inflow until the surrounding parking area and driveway are paved. Remove shortly thereafter.

- E. Polyacrylamide (PAM) Turbidity Control Log: Soil specific tailored, solid form PAM product containing blends of water treatment components and polyacrylamide co-polymer for water clarification (25 NTU max. at outlet of sediment basin) and erosion control. Product shall be designed for site specific soil and water conditions. APS-700 Series Flocc Log by Applied Polymer Systems, Inc. or approved equal.
- F. Dewatering Silt Bag: Permeable, non-woven geotextile bag manufactured to accept and filter pumped, sediment-laden water from dewatering activities. Silt bag shall be sized as appropriate for the dewatering pump discharge rate and shall be fitted with a fill spout large enough to accommodate the discharge piping of the dewatering pump. Silt bag shall be Dirtbag as manufactured by ACF Environmental, Inc., US Filter Bags as manufactured by US Fabrics, Inc., Dandy Dewatering Bag as manufactured by Dandy Products, Inc. or approved equal.
- G. Compost Filter Sock: Three-dimensional tubular sediment control device comprised of an organic compost filter media contained in a tubular knitted mesh sock.
 - 1. Filter media shall be mature compost that has been certified by the US Composting Council's Seal of Testing Assurance Program and meeting the following specifications:
 - a. pH: 5.0 – 8.5.
 - b. Moisture Content: < 60%.
 - c. Organic Matter: >25%, dry weight.
 - d. Particle Size: 99% passing 2-in sieve, 30-50% passing 3/8-in sieve.
 - 2. Filter sock netting shall be 5-mm thick continuous HDPE filament, tubular knitted mesh with 3/8-in openings. Filled sock shall be a minimum of 12-in in diameter.
 - 3. Stakes shall be 2x2-in x 3-ft wooden stakes.

2.3 CHANNEL AND SLOPE MATTING

- A. Slope and Channel Matting: Erosion Control blankets shall be a machine-produced mat of curled wood fiber (excelsior) or synthetic polypropylene fiber as specified below. The blanket shall be of consistent thickness with the fiber evenly distributed over the entire area of the mat. The blanket shall be covered with a photo degradable plastic netting secured to the fiber mat. Slope matting and channel liners shall be excelsior mat unless otherwise indicated on the drawings.
 - 1. Excelsior Mat (Turf Reinforcement Mat):
 - a. Fiber: Curled wood excelsior of 80% six inch or longer fiber length with a consistent width of fibers evenly distributed throughout the mat. Mat shall be smolder resistant with no chemical additives.
 - b. Top and Bottom Netting: Photo degradable extruded plastic netting with maximum mesh size of 3/4" x 3/4".
 - 2. Coconut Mat (Turf Reinforcement Mat):
 - a. Fiber: 100% coconut fiber (0.5-lbs./sq.yd.)

- b. Top Netting: 100% biodegradable jute (9.3-lbs/1000-sq.ft. approx. weight.)
- c. Bottom Netting: 100% biodegradable jute (7.7-lbs/1000-sq.ft. approx. weight.)
- d. C125BN by North American Green, ECC-2B by East Coast Erosion Blankets, C4000BD by Enviroscap ECM,Ltd. or approved equal.

3. Synthetic Mat:

- a. Fiber: UV stabilized polypropylene fiber matrix (0.7-lbs./sq.yd.)
- b. Top Netting: Extra heavyweight UV stabilized polypropylene (5-lbs/1000-sq.ft. approx. weight.)
- c. Bottom Netting: Heavyweight UV stabilized polypropylene (3-lbs/1000-sq.ft. approx. weight.)
- d. P300 by North American Green, ECP-3 by East Coast Erosion Blankets, PP5-10 by ADS Geosynthetics or approved equal.

- 4. Wire Staples: 16 gauge steel wire, with minimum of 3" top and 6" long legs. 1.75 staples per square yard of matting minimum.

2.4 RIPRAP

- A. Riprap: Provide riprap of the class and quantity indicated on the Drawings. While no specific gradation is required, the various sizes of the stone shall be equally distributed within the required size range. The size of an individual stone shall be determined by measuring its long dimension. Stone shall meet the requirements of the following table for class and size distribution. No more than 5% of the material furnished can be less than the minimum size specified nor no more than 10% of the material can exceed the maximum size specified.

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

PART 3 - EXECUTION

3.1 GENERAL

A. Existing Structures and Facilities

- 1. Existing structures, facilities, and water courses shall be protected from sedimentation.
- 2. The Contractor shall be responsible for the construction of necessary measures, and all costs shall be at the expense of the Contractor.
- 3. Items to be protected from sedimentation deposits shall include, but are not limited to, all down stream property, natural waterways, streams, lakes and ponds, catch basins, drainage ditches, road gutters, and natural buffer zones.
- 4. Control measures such as the erection of silt fences, barriers, dams, or other structures shall begin prior to any land disturbing activity. Additional measures shall be constructed as required during the construction.
- 5. All facilities installed shall be maintained continuously during construction until the disturbed areas are stabilized. Contractor shall remove all erosion control measures at the

end of the project at his expense unless otherwise directed by the Owner or his representative.

6. Perform monitoring and record keeping as specified in this section.

3.2 PROTECTIVE MEASURES

- A. Protective measures shall conform to all State and Local requirements.
- B. Construction and maintenance of sediment and erosion control measures shall be in accordance with all applicable laws, codes, ordinances, rules and regulations.
 1. Silt Fence: Hog wire or wire mesh fastened to posts as recommended by the Manufacturer, and covered with silt fabric.
 2. Berms and Diversion Ditches: These shall be graded channels with a supporting ridge on the lower side constructed across a sloping land surface. Diversion ditches and berms shall be planted in vegetative cover as soon as completed.
 3. Mulching: Mulching shall be used to prevent erosion and to hold soil and seed in place during the establishment of vegetation.
 4. Matting: Temporary slope and channel matting shall be used for temporary stabilization during the establishment of seeded cover in all grassed ditches, channels, long slopes, and steep banks (6:1 or steeper) and additional areas as indicated on plans. Matting shall be installed on any area on site as needed to provide temporary stabilization whether or not matting is indicated on the plan. Install as indicated or per manufacturer's instructions. The installation of matting may be waived by the Architect if surface stabilization is obtained by other methods within the appropriate and agreed time frames. If adequate stabilization is not obtained, the Contractor shall install matting where required at no additional cost to the Owner. Allowances in the contract for Turf-Reinforcement Mat shall be considered to be in addition to the matting indicated on the plan and required by this Section.
 5. Build Berm, Pits and Gravel Filter as shown on Drawings. Maintain during construction to keep erosion and sedimentation to a minimum. When it is necessary to remove berm, pits, and gravel, return area to required profiles and condition.
 6. Construction Entrances: Construct all entrances in accordance with plans. Maintain all ingress/egress points to prevent tracking of soil onto the Owner's, public or private roads. Any soil that is tracked onto the roads shall be removed immediately.
 7. Riprap: Stone shall be graded so that the smaller stones are uniformly distributed throughout the mass. Stone may be placed by mechanical methods, augmented by hand placing where necessary, provided that when the riprap is completed it forms a properly graded, dense, neat layer of stone.
 8. Other Measures: Other methods of protecting existing structures and facilities, such as vegetative filter strips, diversions, rip-rap, baffle boards, and ditch checks used for reduction of sediment movement and erosion, may be used at the option of the Contractor when approved by the appropriate State or local authorities.
 9. Manufactured Inlet Sediment Control Device: Install device in accordance with manufacturer's instructions and install a curb deflector if appropriate. Inspect device after each rain event and at intervals not exceeding two weeks during construction. Remove, empty, clean, and replace the device as needed during construction. Empty collected sediment in approved, protected location. Remove and dispose of device following full and permanent stabilization of the contributing drainage area.
 10. PAM Turbidity Logs: At a minimum, install logs in drainage structures located immediately upstream of sediment basins and traps. Install additional logs in any other locations indicated on the drawings. Install per manufacturer's instructions. Check logs regularly and after every runoff producing rainfall and replace as needed throughout the duration of construction.

11. Dewatering Silt Bag: Install silt bag on an undisturbed slope so incoming water flows downhill through the bag without causing erosion. Remove and replace silt bag when device no longer drains efficiently due to accumulated sediment in bag. Empty bag within disturbed limits of the site protected by other sediment control measures.
 12. Compost Filter Socks: Stake filter sock every 10-ft. Drive stakes through the center of the sock and 1-ft into the ground. If sock netting must be joined, fit beginning of the new sock over the end of the old sock, overlapping by 1-2 ft. Fill with compost and stake the joint.
- C. Provide the following, at a minimum, to prevent windblown dust.
1. Apply straw mulch and establish temporary or permanent ground cover on exposed soil where work is not being actively performed.
 2. Cover or establish vegetative cover on stockpiles.
 3. Apply water or other approved dust suppressant as needed to soil surfaces before they become excessively dry.
 4. Sweep and collect soil that has been tracked onto paved surfaces.
- 3.3 STABILIZATION
- A. Permanently protect stabilized areas prior to the removal of protective devices.
 - B. After the final establishment of permanent stabilization, remove temporary sediment control measures. Re-spread accumulated sediments as specified.
 - C. Permanently stabilize all areas disturbed by the removal and re-spreading operations immediately.
- 3.4 TEMPORARY SEEDING
- A. In accordance with the schedule as detailed in Section on the drawings.
- 3.5 PERMANENT SEEDING
- A. In accordance with the schedule as detailed on the drawings.
- 3.6 MULCHING AND MATTING
- A. Apply mulch or matting to retain soil and grass.
 - B. Mulch areas with slope greater than 5% by spreading a light cover of mulch over seeded area at the rate of not less than 95 lbs. per 1000 sq. ft.
 - C. Install temporary matting in all grassed ditches, channels, long slopes, and steep banks (6:1 or steeper) and additional areas indicated on plans or where extra protection from erosion is needed.
- 3.7 TACKIFIER
- A. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
 - B. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors. (9 gals/1,000 SF).

END OF SECTION 31 25 00

SECTION 32 92 19 – SEEDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. North Carolina Erosions and Sediment Control Planning and Design Manual.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fertilizing.
 - 2. Seeding.
 - 3. Hydroseeding.
 - 4. Mulching.
 - 5. Maintenance.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. General and Supplementary Conditions for allowances, definitions and procedures.
 - 2. Division 31 Section 311000 "Site Clearing" for site stripping, grubbing, topsoil removal, and tree protection.
 - 3. Division 31 Section 312513 "Erosion Controls", for all areas of the site that are graded or disturbed by any construction operations
 - 4. Division 31 Section 312317 "Trenching, Backfilling & Compaction for Utility Systems"
 - 5. Division 31 Section 312000 "Earth Moving"

1.3 MEASUREMENT AND PAYMENT

- A. Grassed Areas:
 - 1. Basis of Measurement: Per Acre of disturbed area to be seeded, measured to the nearest one-quarter acre.
 - 2. Basis of Payment: Includes seeding, watering, mowing and maintenance until the end of Contract time.

1.4 REFERENCES

- A. ASTM International:
 - 1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

1.5 DEFINITIONS

- A. Finished Grade: Elevation of finished surface of planting soil.
- B. Subgrade: Surface or elevation of subsoil remaining after excavation is complete or top surface of a fill or backfill before planting soil is placed.
- C. Subsoil: All soil beneath the topsoil layer of the soil profile, typified by the lack of organic matter and soil organisms.

- D. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Projects site. In undisturbed areas, the surface soil is typically topsoil, and in disturbed areas the surface soil is typically subsoil.
- E. Weeds: Vegetative species other than specified species to be established in given area.

1.6 SUBMITTALS

- A. Product Data: For all pesticides and herbicides used on this project, submit product label and manufacturer's application instructions.
- B. Certification of Grass Seed: Submit data from seed vendor for each seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination and weed seed. Include the year of production and date of packaging.
- C. Product Certificates: From Manufacturer, for all fertilizers, limes, and other soil amendments.

1.7 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.
- B. Perform work in accordance with North Carolina Department of Transportation Standard Specifications for Roads and Structures, latest edition.
- C. Submit the following test reports to the Owner for each soil type to be amended.
 - 1. Soil Analysis including:
 - a. pH factor.
 - b. Composition of soil.
 - c. Percentage of organic content.
 - d. Recommendation of type and quantity of additives required to establish satisfactory pH and bring the supply of nutrients to a satisfactory level for planting.
 - 2. Testing shall be conducted by a soil testing laboratory in compliance with USDA Handbook No. 60.
 - 3. Recommendations shall be reported in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- C. Store seed, fertilizer, lime, and mulch in a manner which prevents wetting and deterioration.

1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed with beneficial and optimum results. Apply products during favorable weather conditions according to manufacturer's instructions.
- B. The contractor shall field check the location of utilities before any ground disturbance associated with seeding, fertilizing, liming or mulching. The contractor shall be responsible for all damage resulting from neglect or failure to comply with this requirement.

- C. Work shall only take place on-site under the direct supervision of a competent, experienced landscape personnel.

1.10 MAINTENANCE SERVICE

- A. Maintain seeded areas for 45 days from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

- A. Grass Seed: Provide seed conforming to all statutory requirements and all rules and regulations adopted by the North Carolina Board of Agriculture. Deliver to site in original containers, labeled to show that the requirements of the N.C. Seed Law are met.
- B. No seed will be accepted with a date of test more than 8 months prior to the date of sowing, excluding the month in which the test was completed.
- C. When a low percentage of germination causes the quality of the seed to fall below the minimum pure live seed specified, the contractor may elect to increase the rate of application sufficiently to obtain the minimum pure live seed content specified, provided that such an increase in the rate of application does not cause the quantity of noxious weed seed per area to exceed the quantity that would be allowable at the regular rate of application.
- D. Seed: Seed of grass species as follows, with not less than 95 percent germination. Not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. Temporary Seeding:

Seed	Quantity	Planting Season
Rye (Grain)	120 lbs /AC.	Dec 1 – Apr 15
Annual Lespedeza	50 lbs / AC	Dec 1 – Apr 15
German Millet	40 lbc/ AC	Apr 15 – Aug 15
Rye (Grain)	120 lbs /AC.	Aug 15 – Dec 30

2. Permanent Seeding:

Seed	Quantity	Planting Season
Bermudagrass	2 lbs /1,000 SF	Apr 1 – Aug 31
Tall Fescue Blend	6 lbs/1,000 SF	Sept 1 – Mar 31

2.2 SOIL MATERIALS

- A. Topsoil: Excavated from site and free of weeds.

2.3 ACCESSORIES

- A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

- B. Fertilizer: Commercial grade fertilizer recommended for grass; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis of topsoil, to the following proportions: Nitrogen 10] percent, phosphoric acid [10], soluble potash [10] percent
- C. Lime: Ground dolomitic limestone, ASTM C602, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent. Minimum 99 percent passing through a No. 8 sieve and a minimum 75 percent passing through a No. 60 sieve.
- D. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of grass.
- E. Erosion Fabric: Jute matting, open weave.
- F. Herbicide: Round-Up by Monsanto or approved equal.
- G. Stakes: Softwood lumber, chisel pointed.
- H. String: Inorganic fiber.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify prepared soil base is ready to receive the work of this Section.
- B. Do not place or mix soils or soil amendments in frozen, wet, or muddy conditions.
- C. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture.
- D. Uniformly moisten any soil which is excessively dry or dusty to the extent of being unworkable.

3.2 FERTILIZING

- A. Apply lime at application rate as recommended by soil analysis or at 40 lbs per 1000 sq.ft.
- B. Apply fertilizer at application rate as recommended by soil analysis.
- C. Do not apply fertilizer at same time or with same machine used to apply seed.
- D. Mix fertilizer thoroughly into upper 3 inches of topsoil.
- E. Lightly water soil to aid in dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 SEEDING

- A. Seed at the rates in accordance with 32 92 19 Seeding Part 2.1 D.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.
- D. Immediately following seeding, apply mulch to thickness of 1/8 – 1/4 inches. Maintain clear of shrubs and trees.
- E. Apply water with fine spray immediately after each area has been mulched. Saturate to 2 inches of soil.

3.4 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, fertilizer and fiber mulch in water, utilizing equipment specifically designed for hydroseeding operations. Continue mixing until uniformly blended into a homogeneous slurry suitable for hydraulic application.
- B. Paper mulch material is not allowed.

- C. Mix slurry with a nonasphaltic tackifier.
- D. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch is deposited at not less than 500 lbs per acre dry weight and the seed component is deposited at not less than the specified seed sowing rate.
- E. Apply slurry coat of fiber mulch at a rate of 1000 lbs per acre.
- F. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 2 inches of soil and maintain moisture levels 2 – 4 inches.

3.5 MAINTENANCE

A. General Care

- 1. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf:
- 2. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation identical to those used in the original installation.
- 3. As necessary, fill in any soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
- 4. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
- 5. Apply treatments as required to keep turf and soil free of pests, pathogens, and disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering

- 1. Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
- 2. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
- 3. Water turf with fine spray at a minimum rate of one inch per week unless rainfall precipitation is adequate.

C. Mowing

- 1. Mow grass as soon as top growth is tall enough to cut. Continue mowing without cutting more than 1/3 of grass height. Do not cut more than 1/3 of grass blade at each mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Maintain the following heights:
 - a. Bermuda: 1”
 - b. All other grasses: 2-1/2”

- D. Apply herbicides to control growth of weeds. Remedy damage resulting from improper use of herbicides.
- E. Immediately reseed areas showing bare spots.

- F. Repair washouts or gullies.

3.6 ACCEPTABLE TURF CONDITIONS

- A. Satisfactorily Seeded Turf: At end of maintenance period a healthy, uniform, close stand of grass should be established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

3.7 CLEANUP

- A. Perform cleanup during the installation and upon completion of the work. Remove soil and debris created during seeding operation from paved areas.
- B. Remove from site all excess material, debris, and equipment.

END OF SECTION 32 92 19

SECTION 33 05 23 - TRENCHLESS UTILITY INSTALLATION – JACK AND BORE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Proposal-Agreement Section of the Contract and other sections of this Division apply to the work in this Section.

1.2 SUMMARY

- A. Section Includes:
1. Excavation for approach trenches and pits.
 2. Casing pipe.
 3. Carrier pipe.

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Jacked Pipe:
1. Basis of Measurement: By linear foot measured on invert of jacked pipe from face to face of jacked pipe.
 2. Basis of Payment: Includes excavation, jacked pipe, grout, accessories, tests, and backfill.

1.4 REFERENCES

- A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. American Railway Engineering and Maintenance-of-Way Association:
1. AREMA - Manual for Railway Engineering.
- C. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 4. ASTM A449 - Standard Specification for Quenched and Tempered Steel Bolts and Studs.
 5. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 6. ASTM C33 - Standard Specification for Concrete Aggregates.
 7. ASTM C150 - Standard Specification for Portland Cement.
 8. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
 9. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 10. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 11. ASTM D1557 - Standard Test Method for Laboratory Compaction

Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).

12. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
13. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

E. National Utility Contractors Association:

1. NUCA - Pipe Jacking & Micro Tunneling Design Guide.
2. NUCA - Trenchless Excavation Construction Equipment & Methods Manual.

1.5 SUBMITTALS

- A. Product data for steel casing pipe and pipe supports.
- B. Project Record Documents: Record actual locations of casing, carrier pipe, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with NUCA Trenchless Excavation Construction Equipment & Methods Manual and NUCA Pipe Jacking & Micro Tunneling Design Guide.
- B. Perform work and provide materials in accordance with North Carolina Department of Transportation Standard Specifications for Roads and Structures, latest edition.

1.7 QUALIFICATIONS

- A. Use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Use a sufficient number of equipment of adequate size and capacity to accomplish the work in a timely manner.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- B. Protect piping from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.
- C. Accept system components on site in manufacturer's original containers or configuration. Inspect for damage.
- D. Use wooden shipping braces between layers of stacked pipe. Stack piping lengths no more than 3 layers high.
- E. Store field joint materials indoors in dry area in original shipping containers.
- F. Support casing and carrier pipes with nylon slings during handling.

1.9 FIELD MEASUREMENTS

- A. Verify invert elevations of existing work prior to excavation and installation of casing pipe.

PART 2 PRODUCTS

2.1 CASING AND JACKING PIPE MATERIALS

- A. Steel Casing Pipe: All encasement pipe shall be smooth wall welded steel conforming to ASTM Designation A139, Grade B. The outside of the pipe shall be coated in accordance with AWWA Standard C203.

2.2 CARRIER PIPE MATERIALS

- A. Water Distribution: As specified in Section 33 11 00 Water Utility Distribution.

2.3 ACCESSORIES

- A. Supports and Insulators:
 - 1. Spiders: Bituminous coated steel spiders.
- B. Steel Strapping: ASTM A36/A36M.
- C. Grout: 1 part Portland cement, 3 parts mortar sand, and water.

PART 3 EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect from damage any utilities indicated to remain.
- C. Notify utility company to remove and relocate utilities.
- D. Protect plant life, lawns and other features remaining as portion of final landscaping.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- F. Establish elevations of casing with not less than three feet of cover.

3.2 DEWATERING

- A. Intercept and divert surface drainage precipitation and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps, or other means.
- B. Develop substantially dry subgrade for prosecution of subsequent operations.

3.3 PITS OR APPROACH TRENCHES

- A. Excavate approach trenches or pits as site conditions require.
- B. Ensure casing entrance face as near perpendicular to alignment as conditions permit.
- C. Establish vertical entrance face at least 1 foot above top of casing.
- D. Install dewatering measures and excavation supports as specified in Section 31 23 23 Trenching and Backfilling and Compacting for Utility Systems.

3.4 CASING PIPE INSTALLATION

- A. Boring:
1. Push pipe into ground with boring auger rotating within pipe to remove spoil. Do not advance cutting head ahead of casing pipe except for distance necessary to permit cutting teeth to cut clearance for pipe. Arrange machine bore and cutting head to be removable from within pipe. Arrange face of cutting head to provide barrier to free flow of soft material.
 2. When unstable soil is encountered during boring, retract cutting head into casing to permit balance between pushing pressure and ratio of pipe advancement to quantity of soil.
 3. When voids develop greater than outside diameter of pipe by approximately one inch, grout to fill voids.
 4. When boring is obstructed, relocate, jack, or tunnel as directed by Town of Nags Head project Representative.
- B. Jacking
1. Construct adequate thrust wall normal to proposed line of thrust.
 2. Impart thrust load to pipe through suitable thrust ring sufficiently rigid to ensure uniform distribution of thrust load on full pipe circumference.

3.5 PRESSURE GROUTING

- A. Pressure grout annular space between casing pipe and surrounding earth.

3.6 CARRIER PIPE INSTALLATION

- A. Clean, inspect, and handle pipe in accordance with Sections 33 11 00 Water Utility Distribution.
- B. Pipeline Installation: After completion of the boring and encasement, insert the pipeline in pre-jointed segments. A galvanized steel spider shall be installed behind each carrier pipe bell in the encasement pipe, as shown on the drawings and details.
- C. Place carrier pipe in accordance with Sections 33 11 00 Water Utility Distribution. Exercise care to prevent damage to pipe joints when carrier pipe is placed in casing.
- D. Support pipeline within casing so no external loads are transmitted to carrier pipe. Attach supports to barrel of carrier pipe; do not rest carrier pipe on bells.
- E. Pressure test line prior to grouting ends of casing pipe.
- F. Grout ends of casing to seal.

3.7 TOLERANCES

- A. Do not over-cut excavation by more than 1 inch greater than outside diameter of casing pipe.
- B. Install casing pipe to vertical and horizontal alignment on drawings within plus or minus 3 inches prior to installation of carrier pipe.
- C. Install pipe bells with minimum 1/2 inch clearance to casing.

END OF SECTION 33 05 23

SECTION 33 05 24 - HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Proposal-Agreement Section of the Contract and other sections of this Division apply to the work in this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Excavation for approach trenches and pits.
 - 2. Horizontal directional drilling.
 - 3. Pipe.

1.3 MEASUREMENT AND PAYMENT

- A. Horizontal Directional Drilling:
 - 1. Basis of Measurement: By linear foot.
 - 2. Basis of Payment: Includes:
 - a. Excavation
 - b. Fusing
 - c. Drilling
 - d. Pipe
 - e. Accessories
 - f. HDPE Mechanical Joint Adapter
 - g. Backfilling
 - h. Testing.

1.4 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ANSI/AWWA www.awwa.org:
 - 1. AWWA M55 Manual of Water Supply Practices, PE Pipe-Design and Installation
 - 2. ANSI/AWWA C111/A21.11-12 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 - 3. AWWA C207-13 Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In.(100 mm Through 3,600 mm)
 - 4. ANSI/AWWA C651 Standard for Disinfecting Water Mains
 - 5. ANSI/AWWA C800 Underground Service Line Valves and Fittings
 - 6. ANSI/AWWA C901-08 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm) for Water Service
 - 7. ANSI/AWWA C906-15 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In.(100 mm to 1,650 mm), for Waterworks.
- C. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
 - 2. ASTM D1557 - Standard Test Method for Laboratory Compaction

- Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
- 3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- 4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- 5. ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings.
- D. NSF www.nsf.org:
 - 1. NSF/ANSI 61 Drinking Water System Components – Health Effects.
- E. National Utility Contractors Association:
 - 1. NUCA - HDD Installation Guidelines.
- F. The Plastic Pipe Institute, Inc.:
 - 1. PPI Handbook of Polyethylene Pipe- 2009 (2nd Edition)
 - 2. PPI Generic Butt Fusion Joining Procedure TR-33.
 - 3. PPI-Disinfection of Newly Constructed Polyethylene Water Mains TR-34.
 - 4. PPI-Installation Guidelines for electrofusion couplings 14-inch and larger TN-34.
 - 5. PPI- Recommended Minimum training guidelines for PE Pipe Butt Fusion Joining operators for Municipal and Industrial Projects (2009).
 - 6. Municipal Advisory Board generic electrofusion procedure for field joining of 12 inch and small Polyethylene (PE) Pipe.

1.5 DESIGN REQUIREMENTS

- A. Design Criteria:
 - 1. Drilling Steering System: Remote with continuous electronic monitoring of boring depth and location.
 - 2. Directional Change Capability: 90 degree with 35 foot radius curve.
 - 3. Ratio of Reaming Diameter to Pipe Outside Diameter:
 - a. Nominal pipe diameter of 6 inches and smaller: 1.5 maximum.
 - b. Nominal pipe diameter larger than 6 inches: Submit recommended ratio and reaming procedures for review.

1.6 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit technical data for equipment, method of installation, and proposed sequence of construction.
 - 2. Include information pertaining to pits, dewatering, method of spoils removal, equipment size and capacity, equipment capabilities including installing pipe on radius, type of drill bit, drilling fluid, method of monitoring line and grade and detection of surface movement, name plate data for drilling equipment and mobile spoils removal unit.
- B. Product Data:
 - 1. Identify source of water used for drilling.
 - 2. Submit copy of approvals and permits for use of water source.
- C. Project Record Documents: Record actual locations of pipe and invert elevations.
- D. Identify and describe unexpected variations to subsoil conditions or discovery of

uncharted utilities.

- E. Record actual depth of pipe at 25-foot intervals.
- F. Record actual horizontal location of installed pipe.
- G. Show depth and location of abandoned bores.
- H. Record depth and location of drill bits and drill stems not removed from bore.

1.7 QUALITY ASSURANCE

- A. Perform work in accordance with the following:
 - 1. NUCA HDD Installation Guidelines.
 - 2. ASTM F1962.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary end caps and closures on piping and fittings until pipe is installed.
- B. Protect pipe from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.
- C. Accept products on site in manufacturer's original containers or configuration. Inspect for damage.
- D. Use shipping braces between layers of stacked pipe. Stack piping lengths no more than 3 layers high.
- E. Support pipes with nylon slings during handling.

PART 2 PRODUCTS

2.1 DRILLING FLUID

- A. Drilling Fluid: Liquid bentonite clay slurry; totally inert with no environmental risk.

2.2 PIPE

- A. Water Distribution System Pipe: HDPE DR-9.

2.3 FILL MATERIALS

- A. On-site suitable material.

2.4 WATER SOURCE

- A. Water: Potable.

2.5 ACCESSORIES

- A. HDPE mechanical joint adapter meeting the requirements of AWWA C111/ANSI A21.11.
- B. Mechanical joint accessory kits
- C. Grout: 1 part Portland cement, 3 parts mortar sand, and water.

PART 3 EXECUTION

3.1 PREPARATION

- A. Notification: The Town of Nags Head should be notified at least seventy-two (72) hours prior to beginning the work of this Section.
- B. Call NC One Call service at 811 not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- C. Locate, identify, and protect from damage any utilities indicated to remain.
- D. Identify required lines, levels, contours, and datum locations.
- E. Protect plant life, lawns, and other features remaining as portion of final landscaping.
- F. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.2 DEWATERING

- A. Intercept and divert surface drainage, precipitation, and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps or other means.
- B. Develop and maintain substantially dry subgrade during drilling and pipe installation.

3.3 EXCAVATION

- A. Excavate subsoil as specified in Section 31 23 23 Trenching and Backfilling and Compacting for Utility Systems.
- B. Excavate approach trenches and pits as site conditions require. Minimize number of access pits.
- C. Provide sump areas to contain drilling fluids.
- D. Restore areas after completion of drilling and carrier pipe installation.

3.4 DRILLING

- A. Drill pilot bore with vertical and horizontal alignment as indicated on drawings and details.
- B. Guide drill remotely from ground surface to maintain alignment by monitoring signals transmitted from drill bit.
 - 1. Monitor depth, pitch, and position.
 - 2. Adjust drill head orientation to maintain correct alignment.
- C. Inject drilling fluid into bore to stabilize hole, remove cuttings, and lubricate drill bit and pipe.
- D. Continuously monitor drilling fluid pumping rate, pressure, viscosity, and density while drilling pilot bore, back reaming, and installing pipe to ensure adequate removal of soil cuttings and stabilization of bore.
 - 1. Provide relief holes when required to relieve excess pressure.
 - 2. Minimize heaving during pullback.
- E. Calibrate and verify electronic monitor accuracy during first 50 feet of bore in presence

of the Town Project Representative before proceeding with other drilling. Excavate minimum of four test pits spaced along first 50 feet bore to verify required accuracy. When required accuracy is not met, adjust equipment or provide new equipment capable of meeting required accuracy.

- F. After completing pilot bore, remove drill bit.

3.5 DRILLING OBSTRUCTIONS

- A. When obstructions are encountered during drilling, notify Town of Nags Head Project Representative immediately. Do not proceed around obstruction without Town of Nags Head Project Representative approval.
- B. For conditions requiring more than 3 feet deviation in horizontal alignment, submit new shop drawings to Town of Nags Head Project Representative for approval before resuming work.
- C. Maintain adjusted bore alignment within easement or right-of-way.

3.6 PIPE INSTALLATION

- A. After completing pilot bore, remove drill bit. Install reamer and pipe pulling head. Select reamer with minimum bore diameter required for pipe installation.
- B. Attach pipe to pipe pulling head. Pull reamer and pipe to entry pit along pilot bore.
- C. Inject drilling fluid through reamer to stabilize bore and lubricate pipe.
- D. Install piping with horizontal and vertical alignment as shown on drawings and details.
- E. Protect and support pipe being pulled into bore so pipe moves freely and is not damaged during installation.
- F. Do not exceed pipe manufacturer's recommended pullback forces.
- G. Install trace wire continuous with each bore. Splice trace wire only at intermediate bore pits. Tape or insulate trace wire to prevent corrosion and maintain integrity of pipe detection.
 - 1. Terminate trace wire for each pipe run at structures along pipe system.
 - 2. Provide extra length of trace wire at each structure, so trace wire can be pulled 3 feet out top of structure for connection to detection equipment.
 - 3. Test trace wire for continuity for each bore before acceptance.
- H. Provide sufficient length of pipe to extend past termination point to allow connection to other pipe sections.
- I. Slip the gland ring over the pipe end and then butt fuse the HDPE MJ adapter to the end of the pipe using the PPI generic Butt Fusion Joining Procedure TR-33.
- J. Mark location and depth of bore with spray paint on paved surfaces, and wooden stakes on non-paved surfaces at 25-foot intervals.

3.7 SLURRY REMOVAL AND DISPOSAL

- A. Contain excess drilling fluids at entry and exit points until recycled or removed from site. Provide recovery system to remove drilling spoils from access pits.
- B. Remove, transport and legally dispose of drilling spoils.

1. Do not discharge drilling spoils in sanitary sewers, storm sewers, or other drainage systems.
 2. When drilling in suspected contaminated soil, test drilling fluid for contamination before disposal.
- C. When drilling fluid leaks to surface, immediately contain leak and barricade area from vehicular and pedestrian travel before resuming drilling operations.
- D. Complete cleanup of drilling fluid at end of each work day.

3.8 ERECTION TOLERANCES

- A. Maximum Variation From Horizontal Position: 12 inches.
- B. Maximum Variation From Vertical Elevation: 2 inches.
- C. Minimum Horizontal and Vertical Clearance from Other Utilities: 12 inches with the exception of the following:
- D. Lateral Separation of Sewers and Water Mains. Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation—in which case:
1. The water main is laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or
 2. The water main is laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
 3. Crossings. A water main that crosses a sewer shall be laid a minimum vertical distance of 18 inches from the outside of the water main and the outside of the sewer, either above or below the sewer, with preference to the water main located above the sewer. One full length of water pipe shall be located so that both joints will be as far from the sewer as possible.
 4. Water Mains and Reclaimed Water Distribution Lines. Water lines shall be located at least 10 feet horizontally from or at least 18 inches above water pipes carrying treated and disinfected wastewater in reclaimed water distribution lines. Crossings shall be made in accordance with 15A NCAC 18C .0906 Relation of Water Mains to Non-Potable Water Lines.
 5. Special Conditions. If an engineer demonstrates it is impractical to maintain the separation distances noted above, taking into consideration feasibility, cost, and the factors set forth in this Paragraph, a deviation may be approved on a case-by-case basis if supported by data and alternative construction criteria submitted by the design engineer. Data and Alternative construction criteria submitted by the design engineer to justify the deviation shall describe:
 - a) the rationale for determining that separation criteria described in 15A NCAC 18C .0906 Relation of Water Mains to Non-Potable Water Lines are impracticable;

- b) the extent of the deviation from separation criteria described in 15A NCAC 18C .0906 Relation of Water Mains to Non-Potable Water Lines;
 - c) a consideration of pipe materials, pressure ratings, type of joints for water main and non-potable water line, and soil conditions;
 - d) the ability to provide adequate work space to repair or replace pipe segments or other utility infrastructure without causing damage to or otherwise compromising the integrity of pipes; and
 - e) the rationale for determining that the deviation will not result in unreasonable risk to public health
- E. Separation of Water Mains and Storm Drain Pipes:
- 1. There shall be a minimum of 12” vertical separation between the outside of storm drain lines and outside of water mains. When storm drains cross over a water main, one bag of unopened bags of concrete mix shall support the storm pipe on either side of crossing.
 - 2. There shall be a minimum of 12” horizontal separation between water mains and storm drain lines.
 - 3. If an engineer demonstrates it is impractical to maintain the separation distances noted above, taking into consideration feasibility, cost, and the factors set forth in this Paragraph, a deviation may be approved on a case-by-case basis if supported by data and alternative construction criteria submitted by the design engineer. Data and Alternative construction criteria submitted by the design engineer to justify the deviation shall describe:
 - a) the rationale for determining that separation criteria described in Paragraphs (a) and (b) of 15A NCAC 18C .0904 Pipe Laying are impracticable;
 - b) the extent of the deviation from separation criteria in Paragraphs (a) and (b) of 15A NCAC 18C .0904 Pipe Laying;
 - c) a consideration of pipe materials, pressure ratings, type of joints for water main and non-potable water line, and soil conditions;
 - d) the ability to provide adequate work space to repair or replace pipe segments or other utility infrastructure without causing damage to or otherwise compromising the integrity of pipes; and
 - e) the rationale for determining that the deviation will not result in unreasonable risk to public health.
- F. When pipe installation deviates beyond specified tolerances, abandon bore, remove installed pipe, re-bore, and reinstall pipe in correct alignment.
- G. Fill abandoned bores greater than 3” in diameter with grout or flowable fill material.

3.9 FIELD QUALITY CONTROL

- A. Upon completion of pipe installation, test pipe in accordance with the following:
 - 1. Water Distribution Pipe Testing: Section 33 11 00 Water Utility Distribution.

3.10 CLEANING

- A. Upon completion of drilling and pipe installation, remove drilling spoils, debris, and unacceptable material from approach trenches and pits. Clean up excess slurry from ground.
- B. Restore approach trenches and pits to original condition.

END OF SECTION 33 05 24

SECTION 33 11 00 – WATER UTILITY DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. Subsurface Exploration Report, (as applicable).

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Pipe and fittings for public water main, including potable waterline and fire water line.
 - 2. Tapping sleeves and valves.
 - 3. Valves and fire hydrants.
 - 4. Underground pipe markers.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. General and Supplementary Conditions for allowances, definitions and procedures.
 - 2. Division 31 Section 311000 "Site Clearing" for site stripping, grubbing, topsoil removal, and tree protection.
 - 3. Division 31 Section 312513 "Erosion Controls", for all areas of the site that are graded or disturbed by any construction operations
 - 4. Division 31 Section 312317 "Trenching, Backfilling & Compacting for Utility Systems"
 - 5. Division 31 Section 312000 "Earth Moving"

1.3 MEASUREMENT AND PAYMENT

- A. Pipe and Fittings:
 - 1. Basis of Measurement: By Linear Foot. The length of water lines to be paid for will be determined by measuring along the centerlines of the various sizes of pipe furnished and installed. Pipe will be measured from center of fitting to center of fitting, from the center of the water distribution line to end of service connection and from center of water distribution line to center of hydrant.
 - 2. Basis of Payment includes:
 - a. Excavation for piping and all fittings, including all valves, sleeves, hydrants, and blow-offs.
 - b. Removal of unsuitable soil material.
 - c. Piping and fittings.
 - d. Removal of unsuitable material.
 - e. Concrete thrust restraints.
 - f. Connection to public utility water source.
 - g. Backfilling with suitable trench excavation or on-site suitable soil.
 - h. Testing.

- B. Valves
 - 1. Basis of Measurement: Per each unit installed.
 - 2. Basis of Payment includes:
 - a. Valve
 - b. Accessories and kits.
 - c. Valve Box
 - d. Concrete collar as required
 - e. Blocking
 - f. Backfilling
- C. Tapping Sleeve and Tapping Valve
 - 1. Basis of Measurement: Per each unit installed.
 - 2. Basis of Payment includes:
 - a. Tapping sleeve and tap valve
 - b. Testing of assembly before wet tap
 - c. Cutting the wet tap
 - d. Blocking
 - e. Backfilling
- D. Fire Hydrant
 - 1. Basis of Measurement: Per each unit installed
 - 2. Basis of Payment includes:
 - a. Fire hydrant
 - b. Blocking and rodding
 - c. Drainage aggregate
 - d. Backfilling
 - e. Painting
- E. Blow Off
 - 1. Basis of Measurement: Per each unit installed
 - 2. Basis of Payment includes:
 - a. Complete blow off assembly per drawings and details
 - b. Blocking
 - c. Backfilling
- F. Backflow Preventer
 - 1. Basis of Measurement: Per each unit installed
 - 2. Basis of Payment includes:
 - a. Complete backflow preventer assembly
 - b. Accessories
 - c. Enclosure
 - d. Blocking backfilling
 - e. Testing

1.4 DEFINITIONS

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed. Refer to the following section for additional definitions of classified excavations.

- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base course, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Surface Course: The top layer of the pavement structure placed on base course or subgrade.
- E. Base Course: Layer placed between the subgrade elevation and asphalt paving courses.
- F. Bedding Course: Layer placed over excavated subgrade in a trench before laying pipe.
- G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.
- J. Unsuitable Soil: Soil produced from excavation of drainage features, cut to sub-grade, or required stripping that does not meet the definition and requirements of suitable soil.
- K. Suitable Soil: Soil produced from excavation of drainage features, cut to sub-grade, or required stripping that meets the definition and requirements of suitable soil.
- L. Topsoil: Soil produced from stripping the top or upper 4"-8" soil layer from areas to be further excavated, re-landscaped, or re-graded without contamination from the subsoil. Stripping of topsoil is not required where excavation width is less than 10' OR for the installation of pipe utilities. Topsoil shall be stockpiled on site at designation location for future use. Topsoil shall not be removed from site.
- M. Porous Fill: Fill material supporting utility pipe installation that also minimizes upward capillary flow of water.
- N. Undercut excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions as directed by the Town Water Department. Authorized undercut excavation and replacement material will be paid for according to Contract unit price for UNDERCUT and BACKFILL.
- O. Approved Drawings: The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor. The plans shall be prepared by a North Carolina licensed Professional Engineer and approved by the Town of Nags Head Water Department and by the North Carolina Department of Environmental Quality, (NCDEQ).
- P. Approved Equal: Shall mean comparable equipment or materials to specified equipment or materials as determined by the Design Engineer, Owner or authorized agent.

- Q. Contractor: The individual or entity with which the Owner has contracted for performance of Work.
- R. Defective Work: Work that does not conform to the requirements of the Town of Nags Head Code of Ordinances, Technical Specifications, and/or Approved Drawings.
- S. Developer: The property owner, developer, or subdivider of the land to which , or across which, the water main is being planned.
- T. Engineer: A professional engineer registered in the state of North Carolina.
- U. Shop Drawings: All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
- V. Drawings: The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
- W. Subcontractor: An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
- X. Specifications: Written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
- Y. Work: The entire construction or the various separately identifiable parts thereof required to be provided under the Approved Drawings and Specifications. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning.
- Z. Working Day: A calendar day during which normal construction operations could proceed for a major part of a shift, excluding Saturdays, Sundays and Town of Nags Head holidays

1.5 REFERENCES

- A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. American Society of Mechanical Engineers:
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
- C. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).

5. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
6. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
8. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
9. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Jointing Plastic Pipe

D. American Water Works Association:

1. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 4 In. Through 48 In. (76 mm Through 1,219 mm), for Water.
3. AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
5. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
6. AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service, 4 inches and Larger.
7. AWWA C200 - Steel Water Pipe 6 In. (150 mm) and Larger.
8. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
9. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied.
10. AWWA C206 - Field Welding of Steel Water Pipe.
11. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
12. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
13. AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
14. AWWA C300 - Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
15. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
16. AWWA C509 - Gate Valves for Water and Sewage Systems.
17. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
18. AWWA C605 - Water Treatment - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
19. AWWA C606 - Grooved and Shouldered Joints.
20. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
21. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
22. AWWA C702 - Cold-Water Meters - Compound Type.
23. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
24. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm Through 300 mm), for Water Distribution.

25. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 36 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution.
 26. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
 27. AWWA M23 – PVC Pipe – Design and Installation
- E. Manufacturer’s Standardization Society of the Valve and Fitting Industry:
1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.
- F. National Fire Protection Agency:
1. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- G. North Carolina Department of Transportation:
1. Policies and Procedures for accommodating Utilities on Highway Rights-of-Ways, State of North Carolina, Department of Transportation, current version.
- 1.6 SUBMITTALS
- A. Product Data: Submit data on all pipe materials, pipe fittings, valves and accessories.
 - B. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified:
 - C. Manufacturer's Certificate: Certify that products meet or exceed specifications.
 - D. Certificates of Conformance: To be provided by the Design Engineer or authorized representative for each lot of pipe to be incorporated into the project meets the approved specifications.
 - E. Record Documents (As-Built Drawings): Record location and depth of cover for pipe runs, valves, tees, and other fittings. Identify and describe variations to drawings and discovery of unidentified buried objects. Provide color photographs for all tee and valve connections and fire hydrant assemblies taken prior to placing any backfill. Photographs shall be numbered and keyed to the appropriate location on the as-built drawings.
- 1.7 QUALITY ASSURANCE
- A. All work shall conform to applicable AWWA and ASTM standards as the manufacturer’s recommendations and instructions.
 - B. All work shall be conducted in accordance with NCDOT Policies and Procedures for accommodating Utilities on Highway Rights-of-Ways, State of North Carolina, Department of Transportation, current version.
 - C. Pre-Construction Conference: Conduct conference at Project site with Design Engineer and Town of Nags Head project representatives.
- 1.8 INSTALLER QUALIFICATIONS
- A. Installer shall be a licensed underground utility contractor licensed for such work in the State of North Carolina. Installing contractor’s license status shall be current.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. All pipe, of whatever material, shall be transported, handled, stored, and installed in strict compliance with applicable AWWA and ASTM standards as well as the manufacturer's instructions and recommendations.
- B. Deliver and store valves in shipping containers with labeling in place.
- C. Block individual and stockpiled pipe lengths to prevent moving.
- D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
- E. Store polyethylene materials out of sunlight.

1.10 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing and then only after acceptable temporary utility services have been provided.
 - 1. Provide a minimum 72 hours' notice to the Owner and receive written notice to proceed before interrupting any utility.
 - 2. Maximum open length of trench at any time during construction shall be 400 feet.
 - 3. Construction site to be cleaned immediately following backfilling operations.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

PART 2 - PRODUCTS

2.1 WATER PIPING

- A. Ductile Iron Pipe: AWWA C151. Bituminous outside coating: AWWA C151. Pipe Mortar Lining: AWWA C104, double thickness. Polyethylene Encasement: AWWA C105.
 - 1. Ductile cast iron pipe shall be Grade 60-42-10 centrifugally cast in accordance with ANSI Standard A21.51 (AWWA C151), latest revision for 200 psi operating pressures plus surge allowance of 100 psi. Wall thickness and strength shall conform to ANSI Standard A21.50 for cover as shown on the drawings and details. Each pipe shall be hydrostatically tested, before shipment, to a minimum of 500 psi. Factory tests and basis for acceptance shall be as specified in ANSI Standard A21.51. Unless otherwise specified, thickness class shall conform to ANSI A21.51 (AWWA C151).
 - a. Bells for push-on joints shall conform to the requirements of ANSI Standard A21.51, such as "Fastite," "Tyton", "Bell-Tite", or approved equal. Pipe shall be nominal 18' lengths. Joint detail, including rubber gaskets, shall conform to ANSI Standard Specification A21.11., AWWA C111, latest revision.
 - b. The pipe shall have an outside pipe coating of bituminous material in accordance with AWWA C151, latest revision. The final coat shall be continuous and smooth, being neither brittle when subjected to low temperatures nor sticky when exposed to hot sun. The coating shall be strongly adherent to the pipe at all temperatures.
 - c. Pipe 6" and larger shall be Class 50. 4" diameter pipe shall be Class 51 or 52.
 - d. Polyethylene encasement on cast iron pipe shall be required in corrosive soil.

2. Fittings for ductile iron pipe sizes 4"-12" shall be cast from ductile iron in accordance with ANSI/AWWA C153/A21.53. Fittings for ductile for ductile iron pipe less than 4" in diameter are prohibited.
 - a. All fittings shall be Class 350 ductile iron fittings, mechanical joint. Mechanical joints shall conform to ANSI/AWWA A21.11/C111. Wall and socket thicknesses shall be equal to Class 54 ductile iron pipe as specified in ANSI/AWWA A21.51/C151. Ductile iron shall be in accordance with ASTM A563 with minimum physical qualities of 70,000 psi tensile strength, 50,000 psi yield strength, and 5% elongation.
 - b. All ductile cast iron fittings shall have cement mortar lining conforming to ANSI Standard A21.4, latest edition. Buried fittings shall be given a full coat inside and outside of a bituminous coating which conforms to ANSI 21.4, latest revision.
 3. Mechanical jointing ductile iron pipe shall be used only at the specific locations indicated on the drawings and details or as approved by the Town Water Department. The mechanical joint shall consist of:
 - a. a bell cast integrally with the pipe or fitting and provided with an exterior flange having cored or drilled bolt holes and interior annular recesses for the sealing gasket and the spigot of the pipe or fitting;
 - b. a pipe or fitting spigot;
 - c. a sealing gasket;
 - d. a separate cast iron follower gland having cored or drilled bolt holes; and
 - e. (5)tee head bolts and hexagon nuts. The joint shall be designed to permit normal expansion, contraction and deflection of the pipe or fitting while maintaining a leak proof joint connection. The mechanical joint shall conform to the requirements of ANSI Standard Specification A21.11 and AWWA C111 Specifications, latest revision.
 4. Ductile iron flanged pipe shall be supplied in accordance with ANSI/AWWA C115/A21.15. Pipe barrels and flanges shall have a taper pipe thread (NPT) in accordance with B1.20.1, with thread diameters adapted to ductile iron pipe standard outside diameters. Ductile iron pipe used for flanging shall be centrifugally cast in metal molds and shall meet the requirements of ANSI/AWWA C151/A21.51. Flanges shall conform to ANSI/AWWA C110/A21.10. Flanged pipe shall be furnished in maximum length of 17'6" for sizes 4-48". The flanges shall conform to the drilling and facing requirements of ANSI B16.1 Class 125 flanges. Face to face dimensions shall conform to a tolerance of ± 0.12 " for sizes 3-64". The minimum class thickness for ductile iron flanged pipe to be threaded is class 53.
- B. Polyvinyl Chloride (PVC): AWWA C900 DR 18 Class 150 (pipe 4" – 12") and AWWA C905, DR 18 Class 150 (pipe larger than 12").
1. Fittings for PVC pipe sizes 4" and larger shall be cast from ductile iron in accordance with ANSI/AWWA C153/A21.53.
 2. Ductile iron fittings shall have a working pressure rating of 350 psi for fitting sizes 12" and less. Fitting over 12" shall have a minimum rated working pressure of 250 psi. Mechanical joints shall conform to ANSI/AWWA A21.11/C111. Wall and socket thicknesses shall be equal to Class 54 ductile iron pipe as specified in ANSI/AWWA A21.51/C151. Ductile iron shall be in accordance with ASTM A563 with minimum physical qualities of 70,000 psi tensile strength, 50,000 psi yield strength, and 5% elongation.

- a. All ductile cast iron fittings shall have cement mortar lining conforming to ANSI Standard A21.4, latest edition. Buried fittings shall be given a full coat inside and outside of a bituminous coating which conforms to ANSI 21.4, latest revision.
 - b. Appropriate transition gaskets shall be utilized for the SDR or class of PVC pipe.
3. The pipe shall be furnished in nominal lengths of 20'. Each joint shall be clearly marked as complying with National Sanitation Foundation standards.
- C. Polyvinyl Chloride (PVC): PVC pipe of 3" nominal diameter and less shall conform to ASTM Specification D-2241, "Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR)", as it applies to Class 12454 (A or B) polyvinyl chloride plastic pipe, SDR 21 water pressure ratings of 200 psi at 23 C (73.4 F), with minimum physical requirements as listed in the following table. Each joint shall be clearly marked as complying with National Sanitation Foundation standards.

Nominal Size (in.)	Outside Diameter (in.)	Min. Wall Thickness (in.)	Weight (lbs.)	Working Pressure (psi)
3/4	1.0501	0.060	11.8	200
1	1.315	0.063	15.9	200
1-1/4	1.66	0.079	24.8	200
1-1/2	1.900	0.090	32.2	200
2	2.375	0.113	50.8	200
2-1/2	2.875	0.137	74.2	200
3	3.500	0.167	110.0	200

1. Fittings for PVC 3/4" – 2" shall be brass compression X MIP fittings. Solvent weld (glue) fittings will not be accepted.

2.2 TAPPING SLEEVES AND VALVES

- A. Tapping Sleeves: Furnish and install tapping sleeve and valve at the location(s) shown on the Contract Drawings and as required herein. The tapping sleeve and valve shall be suitable for wet installation without interrupting water service in any manner. The tapping sleeve and valve shall be installed in accordance with the manufacturer's recommendations and as shown on the drawings.
1. The tapping sleeve shall be fully gasketed wrap around tapping sleeve. The sleeve body shall be 18-8 stainless steel. The bolts and nuts shall be 18-8 stainless steel. The gasket shall be gridded virgin GPR compounded for water service in accordance with ASTM D2000-80M 4AA607. The outlet gasket shall be Buna-N. The flange shall be ductile iron. The tapping sleeve shall be fitted with a female 3/4" NPT test port and supplied with a 3/4" 18-8 stainless steel plug with square head.
- B. Tapping Valves:
1. Tapping valves shall be "O" ring type with mechanical joint and conforming to AWWA C509 non-rising stem construction. Inlet flange end shall be Class 125 (ASME B16.1). Tapping valve shall be "Waterous" resilient wedge type, or approved equal. The valves shall be as specified under section 2.3 of this specification for gate valves

2.3 VALVES AND FIRE HYDRANTS

A. Gate Valves: All gate valves shall be resilient seated wedge type that fully comply with the requirements of the latest revision of AWWA Standard C-509. All gate valves shall open by turning in a counterclockwise direction:

1. Valves 2" and larger shall be iron body, bronze mounted, resilient seat type.
2. All valves other than flanged end valves shall be of the non-rising stem type.
3. Gate valves shall be vertical open, counterclockwise, of the non-rising stem type with mechanical joint ends and 2 inch square operating nut.
4. Unless otherwise shown on the drawings or stated in the proposal, all gate valves 2"-12" shall be designed for a working pressure of 200 psi and shall be tested to a minimum pressure of 400 psi.
5. All gate valves 14"-24" shall be designed for a working pressure of 150 psi and hydrostatically tested to a minimum pressure of 300 psi.
6. All buried valves shall be provided with a 2-piece screw-type valve box. Valve boxes shall be of close-grained, grey cast iron, consisting of a lower base piece which shall be flanged at the bottom to fit around the stuffing gland and rest on the valve bonnet and an upper part which shall also be flanged on the lower part and the upper end constructed in the form of a socket to receive the cover.
 - a. The valve box shall be a Champion metals cast iron 5 1/4" diameter adjustable valve box (screw type) 18"-24" #461-S, 24"-36" #562-S or approved equal.
 - b. The cover shall have cast on the upper surface in raised letters the word "Water" Valve boxes shall be painted prior to shipment with a coat of asphaltum paint. "Where a valve box will be placed in the pavement the lid shall be a Bingham and Taylow road lock water screw type iron lid # CUL5LWL or approved equal
7. Gate valves shall be of the mechanical joint type unless otherwise indicated on the drawings and details.
8. All mainline valves smaller than 4 inches must be a Ford ball valve, Mueller or approved equal.
9. All gate valves shall be manufactured by Mueller Co., M&H Valve, Clow, or approved equal.

B. Blow-off Valves:

1. All blow-off valve assemblies should be a Ford inch MIP x FIP Ball Valve.

C. Swing Check Valves:

1. Valves 2" to 12": Swing check valves shall conform to AWWA C 508, latest revision.
2. Small swing check valves shall have iron bodies with NPT ends.
3. The swing disc shall be internally weighted or spring loaded and constructed of composition or bronze with rubber seats.
4. Valves shall be rated at 175 lb. service water pressure or 200 lb. WOG.
5. Valves shall be installed in a horizontal position. Some operating conditions may dictate the need for an assisted closure feature, such as outside weight and lever or outside spring and lever, to reduce or eliminate check valve slam. Above ground or vaulted installations may use flanged valves.

D. Fire Hydrants: Fire hydrants shall be of the compression or gate type conforming to AWWA C-502, latest revision and shall be the Owner's standard which consists of Waterous WB67 5-1/4" Pacer, or Town approved equal.

1. All hydrants shall have a bronze-to-bronze main valve assembly.

2. The hydrant shall have two 2-1/2" hose nozzles with caps and one 4-1/2" steamer connection conforming to the Town of Nags Head Water System Standards. All nozzles shall have NPT threads. Nozzles shall be bronze with cast iron cap secured thereto with suitable steel chain. A drain outlet shall be provided.
3. Threads on nozzles and caps and operating nuts shall conform to National Standard Threads.
4. The upper hydrant opening stem within the bonnet shall be sealed and lubricated by means of an oil or grease bath. The operating nut shall be National Standard pentagon type measuring 1 1/2 inches from point to flat. Hydrants shall open by turning counterclockwise and shall be so marked.
5. The hydrant main valve shall meet or exceed the flow requirements of AWWA C-502 and shall be at least 5-1/4" in diameter.
6. Elbow shall have interior coated with minimum 4 mils thickness epoxy in accordance with AWWA C550.
7. Hydrants shall be 6 inches in size, or mechanical joint type.
8. The hydrant barrel shall be of such length to provide a minimum of 3'0" of bury.
9. All hydrants shall be traffic models with breakable safety sleeve stem coupling with SS stem coupling pins.
10. The Contractor shall provide for fire hydrants and accessories all hydrant barrel extensions necessary to set the pumper nozzle at the specified height at the location shown on the drawings and details.
11. The hydrant shall have stainless steel bolts in the base and the bonnet, and a "breakaway" flange that will allow the upper barrel to be broken off while the hydrant valve remains closed and reasonably tight.
12. Hydrants shall be designed for a 300-psi test pressure and a 150-psi working pressure
13. All hydrants shall be factory primed and finish painted.
14. Final color of the hydrant body and bonnet shall be Rustoleum enamel or equal "Safety Red".
15. All hydrants shall be painted with two coats on the entire portion of the hydrant above the finished grade.

2.4 BACKFLOW PREVENTERS

- A. All existing and proposed water services (if listed as a hazard); dedicated fire lines; irrigation lines; and private distribution systems must be provided with an backflow prevention in accordance with the Town of Nags Head Cross Connection Control Plan and the Rules Governing Public Water Systems as found in Title 15A, Subchapter 18C of the North Carolina Administrative Code.
- B. Service Connection Relation to Plumbing Code. No supplier of water shall provide a service connection to any plumbing system that does not comply with the North Carolina State Building Code, Volume II, and all applicable local plumbing codes. Where required, the supplier of water shall install or require to be installed an appropriate testable backflow prevention assembly prior to making the service connection. Design of backflow prevention assemblies for service connections shall not require Department review.
- C. Connections Requiring Departmental Review. Connections between a public water system and the connection types in Parts (A) through (D) of this Subparagraph shall require review and approval by the Department prior to making the connection. Installation of a testable backflow prevention assembly or air gap shall be required if the connection is non-potable or unapproved.

Engineering plans and specifications shall be submitted in accordance with Section .0300 of this Subchapter.

- (1) Any regulated public water system;
- (2) any community non-regulated public water system. Before providing a connection, a supplier of water shall ensure that the construction of the non-regulated public water system either was approved in accordance with Rule .0301(a) of this Subchapter or that backflow prevention is provided in accordance with this Rule;
- (2) non-potable water treatment processes within a potable water treatment plant; and
- (4) all cross-connections between potable water supplies and non-potable or unprotected supplies that are not specifically addressed in this Rule or AWWA M-14 Backflow Prevention and Cross Connection Control.

- D. Approved backflow prevention assemblies shall be installed above ground. Assemblies may be installed inside of buildings as long as there are no unprotected taps between the main and the building.
- E. The backflow prevention assembly(s) must be readily accessible at all times. Readily accessible means that only a one piece cover must be removed for an outside installation to test or perform maintenance on the assembly.
- F. All backflow prevention assemblies shall be installed in accordance with the manufacturer's specifications, University of Southern California guidelines and/or the latest edition of the North Carolina building code, whichever is most restrictive. Testing of backflow prevention assemblies shall be performed by a certified backflow prevention assembly tester. Such tests are to be conducted after installation and annually thereafter. A record of all testing and repairs is to be retained by the customer.

2.5 VALVE LOCATION MARKERS

- A. All valve locations and blow offs shall be marked with a 4"x4" painted pressure treated post valve marker. Valve markers will be provided by the Town of Nags Head.

2.6 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2'-6" deep. Tape shall be Alarmtape by Paul Potter Associates, Detectatape by Allen Systems, Inc., Terra Tape by Griffolyn Co., Inc., or approved equal.
- B. Color: Blue
- C. Text: "CAUTION – WATER LINE BURIED BELOW".
- D. Detectable Tracer Wire: At all locations where pressure piping is installed and at lateral locations, non-ferrous or ferrous materials, the contractor shall install a continuous length of #10, 12 or 14 solid copper wire, on top and parallel to the pipe. Tracer wire shall be Pro-Line Safety Products or Town approved equal.

2.7 BEDDING AND COVER MATERIALS

- A. Bedding: NCDOT #57 or #67 stone.
 1. Install stone bedding only at the direction of the Design Engineer or Town of Nags Head Project Representative.

B. Soil Backfill from Above Pipe to Finish Grade

1. For any trenches with water, sanitary, or storm sewer utilities that are not located under curb or paved areas, backfill using on-site suitable soil when available.
2. For any trenches with water, sanitary, or storm sewer utilities that are located under curb or paved areas, backfill using only approved off-site select borrow.

2.8 ACCESSORIES

A. Anchorages:

1. Concrete Reaction backing: Portland cement concrete mix, 3,000 psi
 - a. Cement: ASTM C 150, Type I
 - b. Fine Aggregate: ASTM C33, sand
 - c. Coarse Aggregate: ASTM C33, crushed gravel
 - d. Water: Potable

B. Steel rods, bolt, lugs and brackets: ASTM A36/A36M or ASTM A307 carbon steel.

C. Protective Coating: Bituminous coating

2.9 SERVICE FITTINGS

A. All fittings shall be compatible with Ford or Mueller products:

1. Service clamp for 1 inch water taps shall be Ford Double Strap Brass Saddle 202-B AWWA C-800 threads or Mueller.
 - a. 1-1/2 inch and 2-1/2 inch water taps shall have a Ford 202 B series Double Strap Brass Saddle or Mueller with an iron tap outlet.
 - b. A Ford BO11 series ball valve or Mueller ball valve shall be used with the above saddle in 1-1/2 inch or 2-inch taps.
 - c. For 1-1/2 inch and 2-inch water taps, the meter setter shall be a Ford Custom Setter Catalog No. VBH66-18X length for 1-1/2 inch meter, and Catalog No. VBH77-18X length for 2-inch meters, or an approved equal setter.
 - d. The setter shall consist of a brass oval flanged angle check valve outlet. The setter must also have a 1-inch copper bypass line at its base, with a 1-inch ball valve installed in the bypass. The bypass line ball valve shall be a Ford "B" series ball valve equipped with padlock wings or Mueller.
2. Corporation stop shall be a Ford F-1000-G or Mueller for 1" taps.
3. Service lines shall be 200 psi Copper Tubing Size (CTS) polyethylene Phillips or approved equal tubing. All brass fittings shall be compression type. All 1" service lines shall have a Ford B43-332W or Ford B43-444W ball valve, or Mueller, installed on the end of the line in the meter box. All new service lines shall have a minimum diameter of 1".
4. Service lines which cross a public or private street shall be encased in a minimum 2 in. SCH 40 PVC sleeve. The sleeve shall extend a minimum 3' beyond the edge of pavement.
5. Water meter shall be Master Meter, 5/8X3/4 inch with serial number on lid and stamped on meter body. Water meters 1 to 2 inches shall be Master Meter series meters.
6. Water meters larger than 2 inches shall be Master Meter or approved equal.

7. Meter box shall be a heavy-duty plastic box with a cast iron lid which includes a meter reading lid.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify existing utility water main size, location, and inverts are as indicated on drawings.
- B. Pre-Construction Site Photos: (Recommended Only – NOT required).
 1. Take photographs along centerline of proposed pipe trench; minimum one photograph for each 50 feet of pipe trench.
 2. Show mail boxes, curbing, lawns, driveways, signs, culverts, and other existing site features.
 3. Include project description, date taken and sequential number on back of each photograph.
- C. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.
- D. Remove scale and dirt on inside and outside before assembly.
- E. Prepare pipe connections to equipment with flanges or unions.

3.2 DEWATERING

- A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect open trench excavations soils from softening and damage by rain or water accumulation.
 1. Reroute surface water runoff away from excavated areas without causing damage to adjacent properties. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep subgrades dry and convey groundwater away from excavations. Maintain until dewatering is no longer required.
 3. The contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all water entering excavations, trenched, or other parts of the work.

3.3 TRENCH WIDTH

- A. Trenches shall be excavated to a width which provides adequate working space and sidewall clearances for proper pipe installation, jointing and embedment. However, the limiting trench width from the bottom of the trench to an elevation 1 foot above the top of installed pipe, and the minimum permissible sidewall clearances between the installed pipe and each trench wall shall be as follows:

Nominal Pipe Size (in.)	Minimum Sidewall Clearances (in.)	Maximum Trench Width (in.)
6	6	27
8	8	32
10	10	36
12	12	42
15	15	50
18	18	60

- B. Stipulated minimum sidewall clearances are not minimum average clearances but are minimum clear distances which will be required.
- C. Cutting trench banks on slopes to reduce earth load to prevent sliding and caving shall be used only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits. Slopes shall not extend lower than 1 foot above top of the pipe.

3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 33 for Work of this Section. Handtrim excavation for accurate placement of pipe to elevations indicated on Drawings.
- B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- D. Provide sheeting and shoring in accordance with Section 31 23 33.
- E. Granular bedding for PVC pipe shall be sand with not more than 25 percent retained on a No. 4 sieve and not more than 7 percent passing a No. 200 sieve. For all other pipe, granular bedding shall be crushed rock or pea gravel with not less than 95 percent passing a ½ inch sieve and not less than 95 percent retained on a #4 sieve; to be placed in not more than 6-inch layers and compacted by vibratory tamper.

3.5 INSTALLATION - PIPE

- A. Install pipe in accordance with AWWA C600 and AWWA M23.
- B. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on drawings.
- C. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.
- D. Lateral Separation of Sewers and Water Mains. Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation—in which case:
 - 1. The water main is laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or
 - 2. The water main is laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
 - 3. Crossings. A water main that crosses a sewer shall be laid a minimum vertical distance of 18 inches from the outside of the water main and the outside of the sewer, either above or below the sewer, with preference to the water main located above the sewer. One full length of water pipe shall be located so that both joints will be as far from the sewer as possible.
 - 4. Water Mains and Reclaimed Water Distribution Lines. Water lines shall be located at least 10 feet horizontally from or at least 18 inches above water pipes carrying treated and disinfected wastewater in reclaimed water distribution lines. Crossings shall be made in accordance with 15A NCAC 18C .0906 Relation of Water Mains to Non-Potable Water Lines.

5. Special Conditions. If an engineer demonstrates it is impractical to maintain the separation distances noted above, taking into consideration feasibility, cost, and the factors set forth in this Paragraph, a deviation may be approved on a case-by-case basis if supported by data and alternative construction criteria submitted by the design engineer. Data and Alternative construction criteria submitted by the design engineer to justify the deviation shall describe:
 - a. the rationale for determining that separation criteria described in 15A NCAC 18C .0906 Relation of Water Mains to Non-Potable Water Lines are impracticable;
 - b. the extent of the deviation from separation criteria described in 15A NCAC 18C .0906 Relation of Water Mains to Non-Potable Water Lines;
 - c. a consideration of pipe materials, pressure ratings, type of joints for water main and non-potable water line, and soil conditions;
 - d. (4) the ability to provide adequate work space to repair or replace pipe segments or other utility infrastructure without causing damage to or otherwise compromising the integrity of pipes; and
 - e. the rationale for determining that the deviation will not result in unreasonable risk to public health
- E. Separation of Water Mains and Storm Drain Pipes:
1. There shall be a minimum of 12” vertical separation between the outside of storm drain lines and outside of water mains. When storm drains cross over a water main, one bag of unopened bags of concrete mix shall support the storm pipe on either side of crossing.
 2. There shall be a minimum of 12” horizontal separation between water mains and storm drain lines.
 3. If an engineer demonstrates it is impractical to maintain the separation distances noted above, taking into consideration feasibility, cost, and the factors set forth in this Paragraph, a deviation may be approved on a case-by-case basis if supported by data and alternative construction criteria submitted by the design engineer. Data and Alternative construction criteria submitted by the design engineer to justify the deviation shall describe:
 - a. the rationale for determining that separation criteria described in Paragraphs (a) and (b) of 15A NCAC 18C .0904 Pipe Laying are impracticable;
 - b. the extent of the deviation from separation criteria in Paragraphs (a) and (b) of 15A NCAC 18C .0904 Pipe Laying;
 - c. a consideration of pipe materials, pressure ratings, type of joints for water main and non-potable water line, and soil conditions;
 - d. (4) the ability to provide adequate work space to repair or replace pipe segments or other utility infrastructure without causing damage to or otherwise compromising the integrity of pipes; and
 - e. the rationale for determining that the deviation will not result in unreasonable risk to public health.

- F. Install ductile iron piping and fittings to AWWA C600.
- G. Torque applied to mechanical joint bolts shall be 75-90 ft/lb for joint sizes 4" to 24" in accordance with AWWA C600.
- H. Weld pipe in accordance with AWWA C206. Weld joints in accordance with AWWAC205.
- I. Flanged Joints: Not to be used in underground installations except within structures.
- J. Pipe depth and alignment shall be installed in strict conformance to the Approved Drawings.
- K. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, install air release valves as directed by Town Water Department or authorized Project representative.
- L. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.
- M. Prevent foreign material from entering pipe during placement.
- N. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- O. Install pipe using a pipe joint lubricant (soap) that meets the requirements of NSF 61.
- P. Close pipe openings with watertight plugs during work stoppages.
- Q. Establish elevations of buried piping with not less than 36 inches of cover. Measure depth of cover from final surface grade to top of pipe barrel. A minimum of 42 inches of cover shall be attained at street intersections.
- R. Install # 12 copper tracer wire on top of all lines and lateral lines terminating to each valve box and meter box.
- S. Install plastic ribbon tape continuous buried 12 inches below finish grade.

3.6 INSTALLATION- VALVES AND HYDRANTS

- A. Install valves in conjunction with pipe laying; set valves plumb.
- B. Install hydrants; provide support blocking and drainage gravel; do not block drain hole:
 - 1. Set hydrants plumb with pumper nozzle facing roadway; set hydrants with centerline of pumper nozzle 20 inches above finished grade and safety flange not more than 6 inches nor less than 2 inches above grade.
 - 2. Hydrant shall be set on compacted crushed stone base 30 inches square by 10 inches thick. Stone shall extend above the hydrant leg a minimum of 12 inches.
 - 3. Reaction backing shall be installed behind the based of the hydrant in accordance with Section 3.7

3.7 INSTALLATION- TAPPING SLEEVES AND VALVES

- A. Install tapping sleeves and valves in accordance with drawings and in accordance with manufacturer's instructions.

3.8 INSTALLATION- BACKFLOW PREVENTERS

- A. All backflow prevention shall be installed in accordance with the manufacturer's specifications.

- B. Backflow prevention assemblies shall be installed at a minimum height of 12 inches and a maximum height of 60 inches above the floor or ground. Assemblies shall also have a clear horizontal distance of 18 inches around the entire diameter of the device.
- C. All backflow prevention assemblies installed outside of buildings must be installed in an approved enclosure with the exception of residential lawn irrigation backflow prevention assemblies. All enclosures shall be insulated and shall meet the requirements of ASSE standard 1060.
- D. Double check valves and double detector check valves may be installed vertically with approval from the water department.
- E. Reduced pressure backflow prevention assemblies shall be installed only horizontally.
- F. All backflow preventers are required to be tested by a certified backflow prevention assembly tester within ten days of installation.
- G. Refer to the Town of Nags Head Cross Connection documentation for further details.

3.9 CONCRETE REACTION BACKING

- A. Minimum bearing area against undisturbed trench wall in square feet. The numbers in the table below are based upon an internal pressure of 100 psi and a 4 foot bury depth in a sand soil type with a unit weight of 110 pcf. Should these conditions change, the minimum bearing area should be adjusted accordingly:

Fitting	Pipe Size (Nom. Dia. in inches)									
	2"	4"	6"	8"	10"	12"	16"	18"	20"	24"
Tee/Plug	1.6	1.9	2.8	3.8	4.7	5.9	7.5	8.5	9.4	11.3
90 bend	1.5	1.9	2.8	3.8	4.7	5.9	7.5	8.5	9.4	11.3
45 bend	1.0	1.4	2.1	2.8	3.5	4.3	5.5	6.2	6.9	7.7
22.5 bend	0.8	1.0	1.5	2.0	2.5	3.1	4.0	4.5	4.9	5.5

Unsuitable soil conditions for trench wall shall either require securing fittings with tie rod clamps and concrete or doubling square footage requirements.

- B. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks. Pour concrete thrust blocks against undisturbed earth. Poured concrete shall be ready mixed. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair.
- C. Install thrust blocks, tie rods, and joint restraint at dead ends of water main.
- D. All concrete thrust blocks shall set for a minimum of 36 hours before any load is applied.

3.10 LATERAL CONNECTIONS

- A. Existing water lines

- 1. Connections shall be made with system pressure on or off as specified by the Town of Nags Head. Existing water lines shall be adequately supported during the tie-in operations and prior to placement of backfill.
 - a. Prior to cutting existing pipe lines, the surface of the existing pipe shall be thoroughly be cleaned by wire brushing and scraping. When a cut-in is made under pressure, the

existing pipe surface shall be washed down with a 4% solution of chlorine prior to installing the tapping valve and a sleeve. All fitting, pipes, valves, etc., used in the connection that cannot be disinfected during normal water line chlorination shall be swabbed out with a 4% solution or stronger solution of chlorine (Roman Cleanser, Clorox, etc.) during assembly. Care shall be exercised in order to prevent contamination of the existing water lines, and failure to comply with this requirement will necessitate chlorination of existing water lines at the developer's expense.

- b. After connection is made, drain sufficient water from the connection to effect removal of the chlorine solution.
- c. The dimensions of existing water lines may not allow use of standard mechanical joint fittings, since these water mains may be pit cast pipe, asbestos-cement pipe and/or classes other than standard.
 - i. When connections are made with system pressure on, a tapping valve and sleeve shall be installed.
 - ii. When connections are made with system pressure off, a solid or cutting-in sleeve shall be installed.

2. Service Lines

- a. General: Provide minimum 1 inch service to all lots. Larger services may be required for commercial or multiple housing.
- b. Line and Grade: Service line shall be located on the side property line of each lot and shall be at right angles to street centerline. Minimum depth to top of pipe line shall be 30 inches.
- c. Tapping Water Line: Corporation stop shall be installed 45 degrees above center and provide horizontal loop with service line at top.

Maximum Tap Sizes for varying pipe size (in.)					
Pipe type	4 in. dia.	6 in. dia.	8 in. dia.	10 in. dia.	12-24 in.
Cast Iron CL22	1/2	3/4	1	1-1/4	2
All other types	1	1-1/2	2	2	2

- d. Meter and Box: Shall be provided for each lot and located at the right-of-way line.

3.11 BACKFILLING

- A. Backfill in accordance with Section 31 23 33 – Trenching, Backfilling & Compaction for Utility Systems.

3.12 DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

3.13 FIELD QUALITY CONTROL

- A. Pressure test system to 150 psi. Repair leaks and re-test:
 - 1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct, in presence of Town Water Department, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.

SECTION 331300 - DISINFECTION OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Disinfection of potable water distribution system.
 2. Testing and reporting results.

1.2 MEASUREMENT AND PAYMENT

- A. Disinfection: No payment will be made for disinfection of water distribution piping. Cost of disinfection shall be included in the unit price bid for size and type of pipe material.

1.3 REFERENCES

- A. American Water Works Association:
1. AWWA B303 – Sodium Chlorite.
 2. AWWA C600- Installation of Ductile Iron Water mains and their appurtenances.
 3. AWWA C651- Disinfecting Water Mains
 4. North Carolina Administrative Code Title 15A, Subchapter 18C, Section .1000

1.4 SUBMITTALS

- A. Product Data: Submit procedures, proposed chemicals, and treatment level for review.
- B. Disinfection Report
1. Type and form of disinfection used.
 2. Date and time of disinfectant application start time and completion.
 3. Test location(s)
 4. Name of person collecting samples.
 5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
 6. Date and time of flushing start and completion.
 7. Disinfectant residual after flushing in ppm for each outlet tested.
- C. Bacteriological Report
1. Date issued, project name, and testing laboratory name, address, and telephone number.
 2. Time and date of water sample collection.
 3. Name of persons collecting samples.
 4. Test location(s).
 5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
 6. Coliform bacteria test results for each outlet tested.

1.5 QUALITY ASSURANCE

- A. Conform to provisions of AWWA C-651 for water line disinfection. Do not use Tablet Method therein.
- B. Conform to provisions of AWWA C-652 for water tank disinfection.
- C. Comply with all requirements of the North Carolina Department of Environmental Quality for disinfection of potable water lines, valves, hydrants, storage tanks, and appurtenances.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

- A. Hypochlorites meeting AWWA B303.
- B. NSF Certified Chlorine Solution.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify piping system has been cleaned. Inspected, and pressure tested.
- B. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

- A. Before being placed into service, and before certification of completion by the County Engineering Department, all new water systems, or extensions to existing systems or valved section of such extensions, or any replacement in the existing water system, or any exposed section of the existing system shall be disinfected, according to the requirements of the North Carolina Administrative Code Title 15A, Subchapter 18C, Section .1000.
- B. Disinfection of New Systems:
 - 1. All interior surfaces of new potable water supply systems, including wells, filters, storage tanks and distribution lines shall be thoroughly disinfected by means of hypochlorite or chlorine solutions, after which bacteriological test samples shall be collected.
 - 2. After disinfection the water supply shall not be placed into service until bacteriological test results of representative water samples analyzed in an approved laboratory are found to be satisfactory.
- C. Disinfection of Storage Tanks and Distribution Lines:
 - 1. Water distribution systems, including storage tanks and water mains, after flushing to remove sediment and other foreign matter, and after testing for leaks, shall be disinfected by the addition and thorough dispersion of a chlorine solution in concentrations sufficient to produce a

chlorine residual of at least 50 milligrams per liter (or ppm) in the water throughout the distribution system, including all water mains and storage tanks.

2. The chlorine solution shall remain in contact with interior surfaces of the water system for a period of 24 hours. Then the water system shall be flushed with fresh water from an approved water source until the chlorine solution is dispelled. All piping systems shall be thoroughly flushed by providing a velocity of 2 feet per second in the line being flushed.
 3. Representative samples of the water shall then be collected when residual chlorine concentration is approximately 2 ppm. If bacteriological tests of the samples indicate that the water quality is satisfactory, the water mains and storage tanks may be placed in service.
 4. In unusual situations where large volume tanks are involved and where there is not sufficient water available to fill the tank or there is not available a suitable drainage area for the chlorinated water, an alternate disinfection procedure for tanks may be proposed. Such proposal must be submitted in writing completely describing the proposed disinfection procedure and substantiating the need for an alternate procedure in the particular circumstance. Such alternate procedure must be approved before being implemented. The conclusion of the department shall be final.
- D. At locations where new water lines are to be tied into the existing system, the interior of all new fittings and valves required shall be bathed with a concentrated chlorine solution at the time of installation. Water shall be flushed through the new valve a sufficient time to wash out the chlorine solution before closing the valve and installing additional pipe. The new valve shall remain closed until the new section of pipe to be installed has passed all tests.
- E. The Contractor shall be required to make arrangements for having tests conducted. All expenses incurred in making tests shall be borne by the Contractor and should be included in his bid per linear foot of pipe material
- F. Calcium Hypochlorites: Apply solutions to water mains with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions.
1. The contractor shall prepare a 10,000 parts per million (ppm) solution in water and pump at a constant rate into the water line while bleeding off the water at the distal end.
 2. The bleed rate will determine the feed rate of the chlorine to achieve a 50 ppm solution in the water line.
- G. Liquid Chlorine:
- Storage Tanks: (AWWA C-652-11 Method 2)
1. The contractor shall prepare a 200 mg/L available chlorine solution which shall be applied directly to the surfaces of parts of the transmission facilities that would be in contact with water.
 2. The chlorine solution may be applied with suitable brushes or spray equipment. The solution shall thoroughly coat surfaces to be treated, including the inlet an outlet piping, and shall be applied to any separate

drain piping such that it will have available chlorine of not less than 10 mg/L when filled with water.

3. The disinfected surfaces shall remain in contact with strong chlorine for at least 30 minutes, after which potable water shall be admitted, the drain piping purged of the 10-mg/L chlorinated water, and the facility filled fully. Following this procedure and subject to satisfactory bacteriological testing, appropriate chlorine residual, an acceptable aesthetic water quality, the water may be delivered.

Water Distribution Mains:

1. The contractor shall prepare a 10,000 parts per million (ppm) solution in water and pump at a constant rate into the water line while bleeding off the water at the distal end.
 2. The bleed rate will determine the feed rate of the chlorine to achieve a 50-ppm solution in the water line
- H. Application (Continuous Feed Method).
1. Connect chlorinator or force pump to water main upstream from point of repair or replacement, or new lines via a corporation cock.
 2. Proportion application rate of chlorine solution to obtain a minimum concentration of 50 mg/l of available chlorine. Use high range test kit to determine concentration. See Table 2.

TABLE 2 - QUANTITY OF DISINFECTANT REQUIRED FOR 50 mg/l OF AVAILABLE CHLORINE PER 100 FT. OF PIPE						
PIPE DIAMETER (INCHES)	POUNDS		OUNCES			QUA RTS
	SOLUTION	HYPOCHLORITE				
	70%	70%	14.7%	5.25%	14.7%	5.25%
2	0.1	0.2	0.8	2.1	0.1	0.1
4	0.1	0.6	3.0	8.3	0.1	0.3
6	0.1	1.4	6.7	18.7	0.2	0.6
8	0.2	2.5	11.9	33.2	0.4	1.1
10	0.3	3.9	18.5	51.9	0.6	1.6
12	0.4	5.6	26.7	74.7	0.9	2.4
14	0.5	7.6	36.3	102.0	1.2	3.2
16	0.7	10.1	47.5	133.0	1.5	4.2
18	0.8	12.6	60.0	168.0	1.9	5.3
24	1.4	22.4	107.0	298.0	3.4	9.4

3. In the absence of a meter, determine rate either by placing a pitot gage at discharge or by measuring the time to fill a container of known volume. See Table 3.

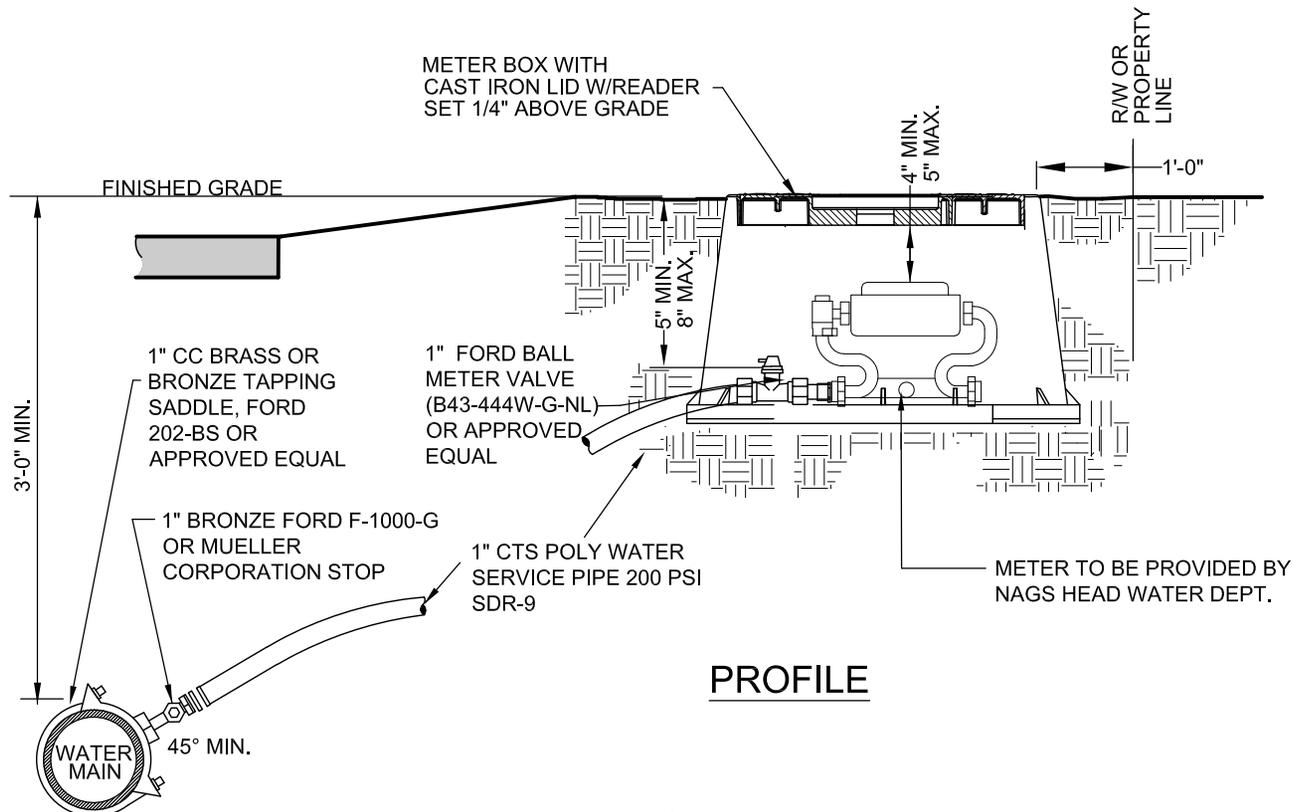
TABLE 3 - TIME FOR DISINFECTANT TO FLOW THROUGH 100 FT. OF PIPE - MINUTES			
PIPE DIAMETER (INCHES)	@ 25 GPM	@ 100 GPM	@ 500 GPM
2	0.7	0.2	0.04
4	2.6	0.7	0.13
6	5.9	1.5	0.3
8	10.5	2.6	0.5
10	16.3	4.1	0.8
12	23.5	5.9	1.2
14	32.0	8.0	1.6
16	41.8	10.5	2.1
18	52.9	13.2	2.7
24	94.0	23.5	4.7

4. Continue to apply chlorine solution until it reaches discharge. Check for the presence of chlorine at discharge.
5. Maintain chlorinated water in the main for a minimum of 24 hours.
6. Operate all valves and hydrants to insure their proper disinfection.
7. Prevent back flow of super chlorinated water into existing distribution system.

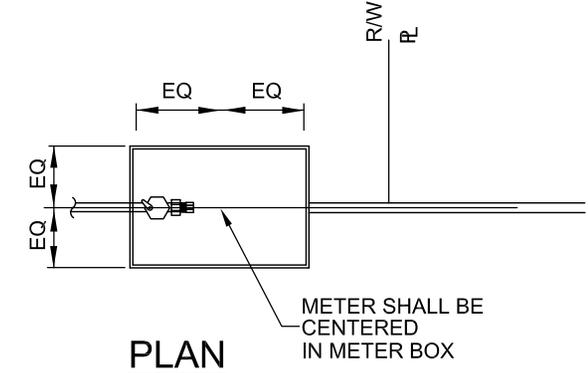
3.3 FIELD QUALITY CONTROL

- A. Final Flushing:
 1. After a 24-hour retention period, flush main until maximum chlorine concentration is 2.0 mg/l.
 2. Discharge super chlorinated water in a manner that will not adversely affect plants and animals. Comply with applicable State regulations for waste discharge.
- B. Bacteriological Tests:
 1. Test water main for bacteriological quality before putting pipe into service. A minimum of two successive sets of samples shall be taken at 24-hour intervals. Both sets of samples shall indicate bacteriological safe water before putting the facility in operation. Pay all expenses incurred for testing.
 2. Tests shall be conducted by a laboratory approved by the state of North Carolina Department of Environmental Quality.
- C. Give all test results to Town of Nags Head Project Representative.
 1. Should test results prove any part of the system bacteriologically unsafe, repeat disinfection procedures until satisfactory results are obtained.

END OF SECTION 33 13 00



PROFILE



PLAN

METER SHALL BE CENTERED IN METER BOX

NOTES:

1. ALL MATERIALS TO BE APPROVED BY TOWN OF NAGS HEAD
2. SERVICE LATERAL SIZE 1" CTS POLYETHYLENE UNLESS OTHERWISE SPECIFIED
3. SERVICE LATERAL INSTALLATION SHALL BE APPROVED BY THE TOWN

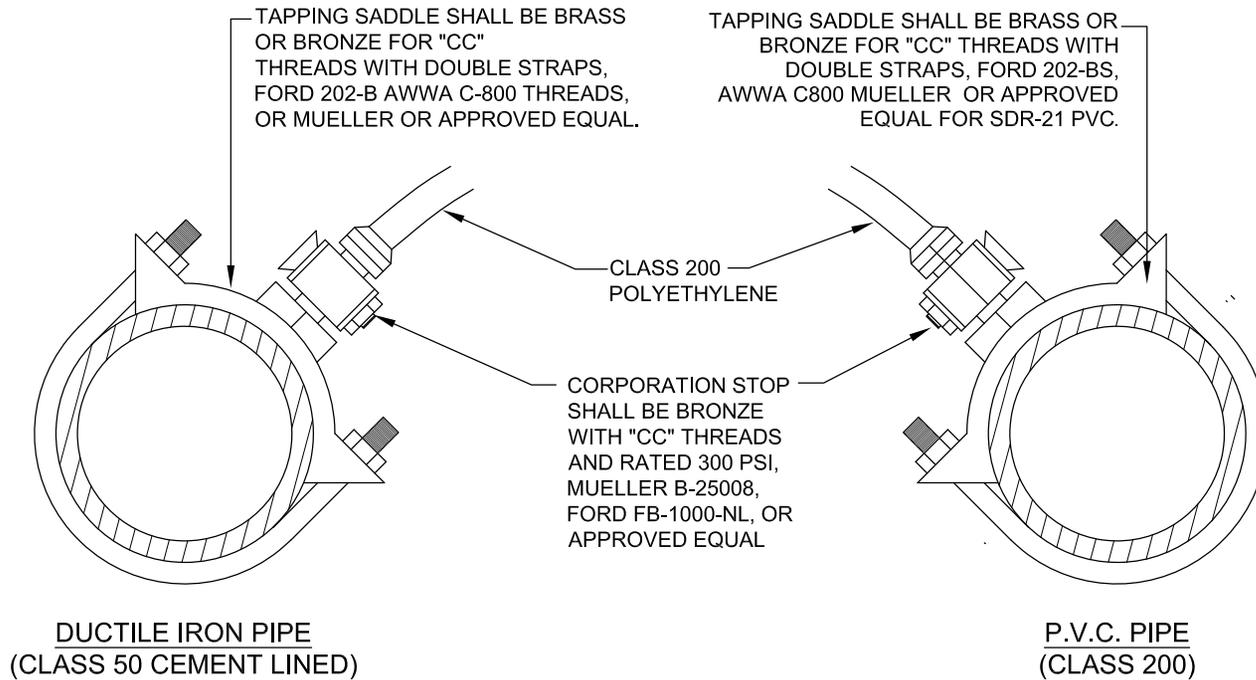


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WATER SERVICE LATERAL DETAIL

SCALE: NONE
 ISSUE DATE: 6-7-2021
 REVISION DATE:
 SHEET NO: 1 OF 1
 DRAWN BY: DMR

DETAIL NO.:
W-1



NOTE:

1. ALL 1-1/2 INCH AND 2-1/2 INCH WATER TAPS SHALL HAVE A FORD 202B SERIES DOUBLE STRAP BRASS SADDLE OR MUELLER WITH AN IRON TAP OUTLET.
2. ALL MATERIALS USED IN THE POTABLE WATER SYSTEM MUST BE NSF61 AND NSF372 CERTIFIED AND MEET THE LATEST FEDERAL SAFE DRINKING WATER ACT REQUIREMENTS.
3. ALL TAPS SHALL BE MADE ON THE TOP QUARTER OF MAIN.

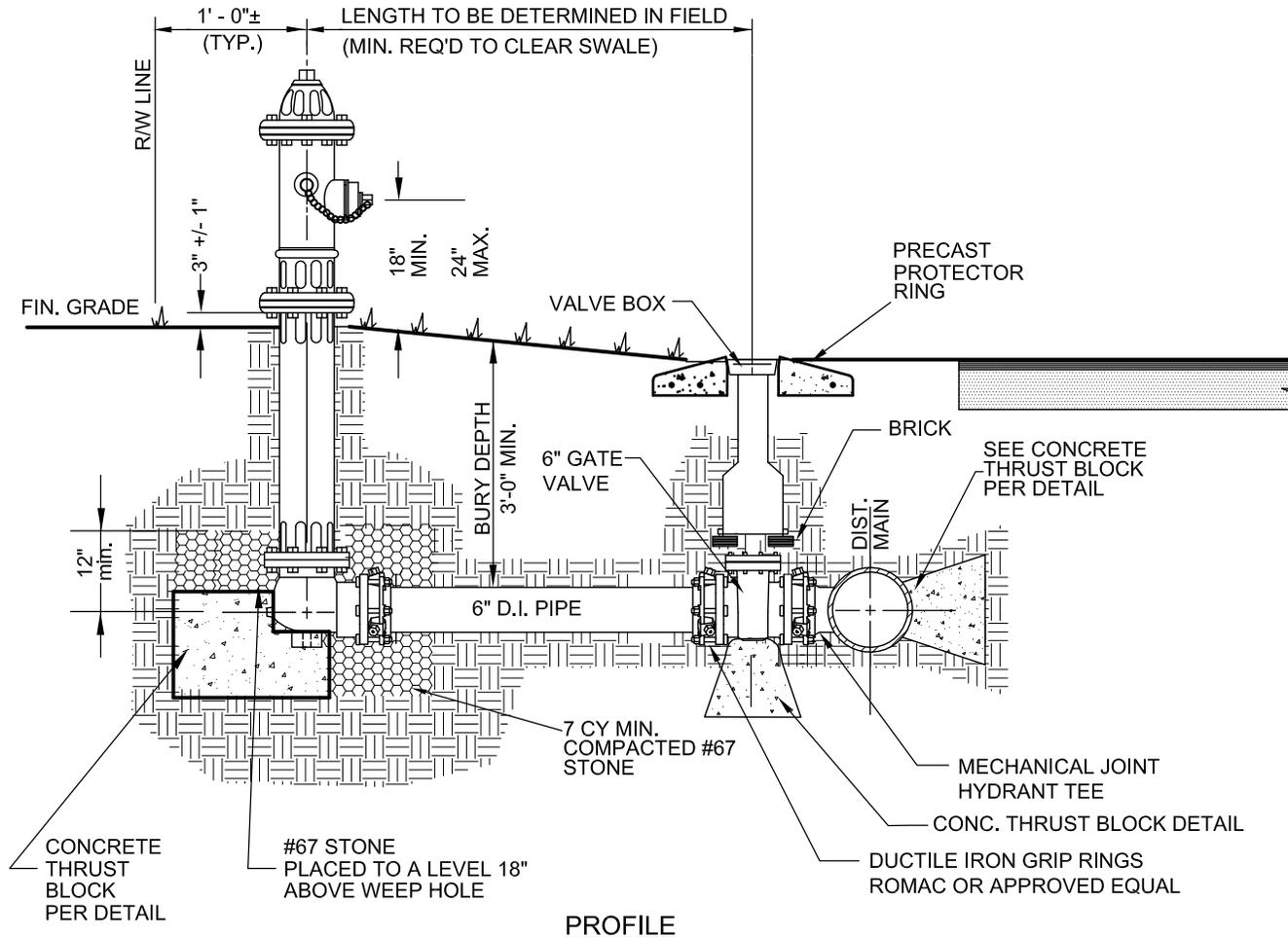


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STANDARD WATER TAP DETAIL

SCALE: NONE
ISSUE DATE: 6-7-2021
REVISION DATE:
SHEET NO: 1 OF 1
DRAWN BY: DMR

DETAIL NO.:
W-2



PROFILE

NOTES:

1. DO NOT BLOCK HYDRANT DRAIN W/ THRUST BLOCKING
2. DO NOT SUPPORT VALVE BOX DIRECTLY ON VALVE
3. HYDRANT TO BE WATEROUS PACER WB-67 w/5-1/4" VALVE OPENING
4. HYDRANT SHALL BE PAINTED W/(2) COATS OF FEDERAL SAFETY RED, RUSTOLEUM BRAND, CONTINUOUS ABOVE GRADE

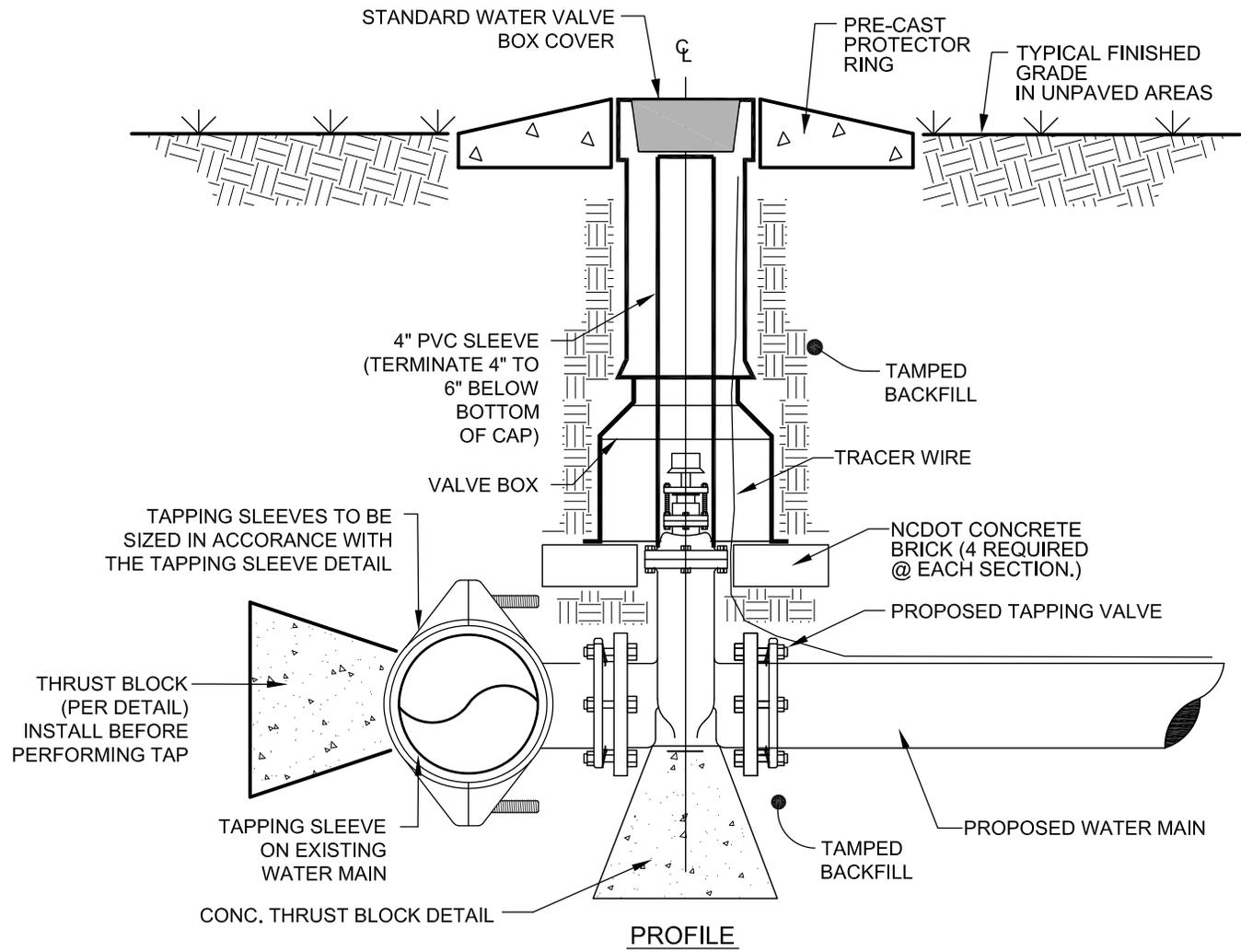


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FIRE HYDRANT ASSEMBLY DETAIL

SCALE: NONE
 ISSUE DATE: 6-7-2021
 REVISION DATE:
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 DRAWN BY: DMR

DETAIL NO.:
W-3



NOTES:

1. TAP SHALL BE PERFORMED IN THE PRESENCE OF A REPRESENTATIVE OF THE TOWN OF NAGS HEAD WATER DEPARTMENT AND DESIGN ENGINEER
2. TAPPING SLEEVE AIR TEST SHALL BE PERFORMED AT A MIN. 100 PSI FOR 15 MINUTES
3. VALVE BOX SHALL NOT CONTACT THE WATER MAIN OR VALVE



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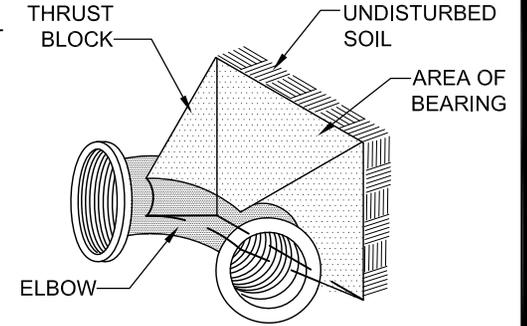
TAPPING SLEEVE DETAIL

SCALE: NONE
 ISSUE DATE: 6-7-2021
 REVISION DATE:
 SHEET NO: 1 OF 1
 DRAWN BY: DMR

DETAIL NO.:
W-4

NOTES:

- 1.) THRUST BLOCKS SHALL BE INSTALLED ON WATER DISTRIBUTION LINES 6" THRU 12" DIA. IN THE MANNER SHOWN.
- 2.) COMPACT FITTINGS ARE NOT ACCEPTABLE. STANDARD FITTINGS SHALL BE USED WITH CONCRETE THRUST BLOCKING.
- 3.) THRUST BLOCKS SHALL BE INSTALLED ON WATER MAIN IN THE MANNER SHOWN.
- 4.) IF SAC-CRETE IS USED, MIXING MUST BE ON SITE UTILIZING A MECHANICAL MIXER.
- 5.) NO CONCRETE SHALL BE PLACED ON BOLTS. WRAP JOINT FITTINGS WITH PLASTIC.
- 6.) CONCRETE SHALL BE A MINIMUM OF 3/4 C.Y. @ 3,000 psi.
- 7.) ALL BEARING SURFACES SHALL BE AGAINST UNDISTURBED SOIL AND SHALL BE APPROVED BY TOWN REPRESENTATIVE PRIOR TO PLACEMENT OF CONCRETE.
- 8.) USE OF RESTRAINED JOINT DUCTILE IRON WILL BE REQ'D IF SOIL CONDITIONS DO NOT ALLOW THE USE OF THRUST BLOCKS
- 9.) ALL VERTICAL BENDS SHALL BE RESTRAINED USING RESTRAINED JOINT DUCTILE IRON PIPE.

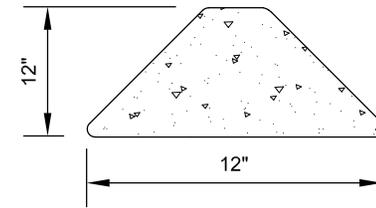


MINIMUM BEARING AREA EACH DIRECTION OF THRUST IN SQUARE FEET

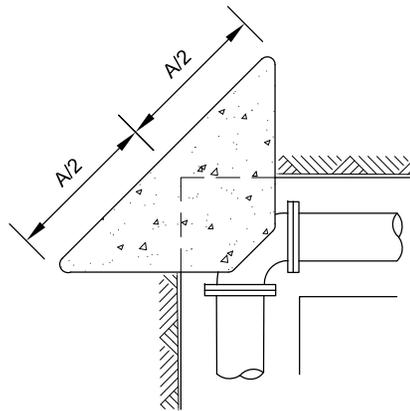
(based on soil supporting value of 2,000psf @ 100 psig internal pressure)

FITTING	PIPE SIZE (NOM. DIA. IN INCHES)									
	2"	4"	6"	8"	10"	12"	16"	18"	20"	24"
TEE	1.6	1.9	2.8	3.8	4.7	5.9	7.5	8.5	9.4	11.3
90° BEND	1.5	1.9	2.8	3.8	4.7	5.9	7.5	8.5	9.4	11.3
45° BEND	1.0	1.4	2.1	2.8	3.5	4.3	5.5	6.2	6.9	7.7
22.5° BEND	0.8	1.0	1.5	2.0	2.5	3.1	4.0	4.5	4.9	5.5

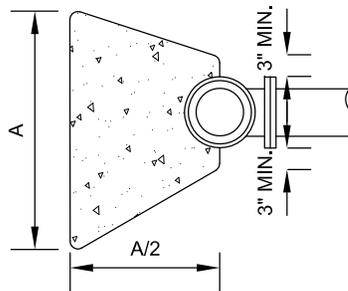
TABLE "A" DIMENSIONS (IN FEET)



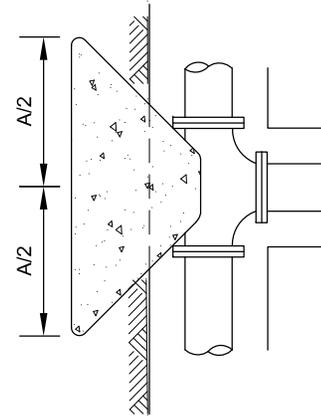
VALVE SUPPORT



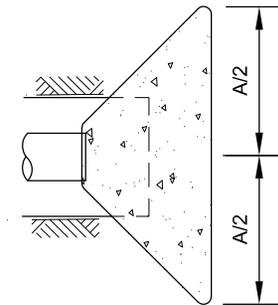
90° BEND (PLAN)



90° BEND/TEE (SECTION)



TEE (PLAN)



PLUG (PLAN)

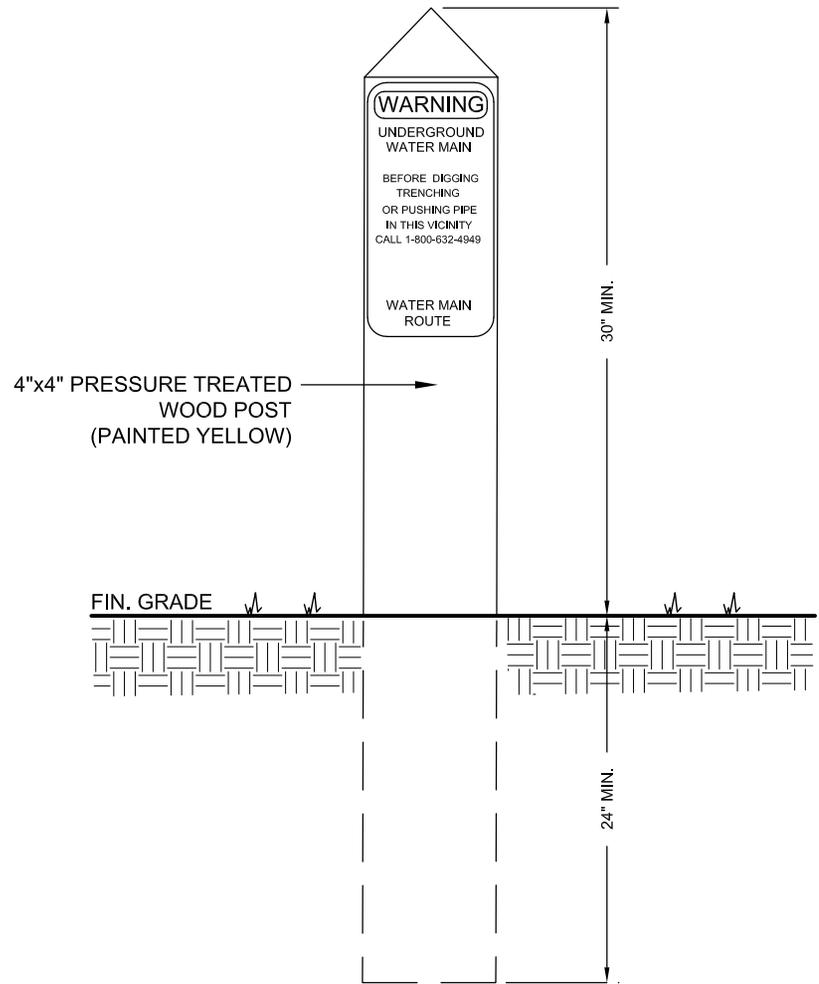


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THRUST BLOCK DETAIL

SCALE: NONE
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DETAIL NO.:
W-5



PROFILE



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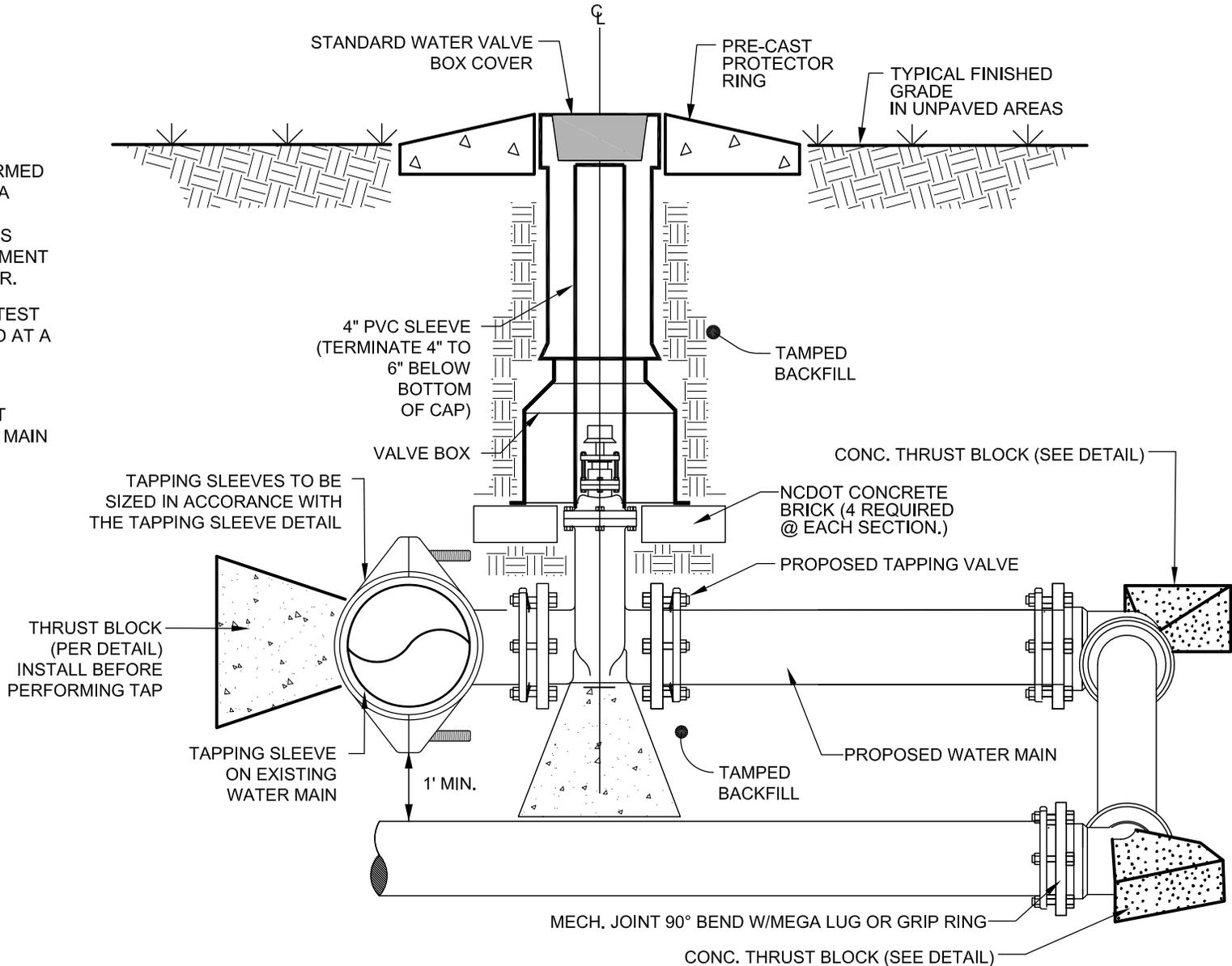
VALVE MARKER DETAIL

SCALE: NONE
 ISSUE DATE: 6-7-2021
 REVISION DATE:
 SHEET NO: 1 OF 1
 DRAWN BY: DMR

DETAIL NO.:
W-6

NOTES:

1. TAP SHALL BE PERFORMED IN THE PRESENCE OF A REPRESENTATIVE OF THE TOWN OF NAGS HEAD WATER DEPARTMENT AND DESIGN ENGINEER.
2. TAPPING SLEEVE AIR TEST SHALL BE PERFORMED AT A MIN. 100 PSI FOR 15 MINUTES.
3. VALVE BOX SHALL NOT CONTACT THE WATER MAIN OR VALVE



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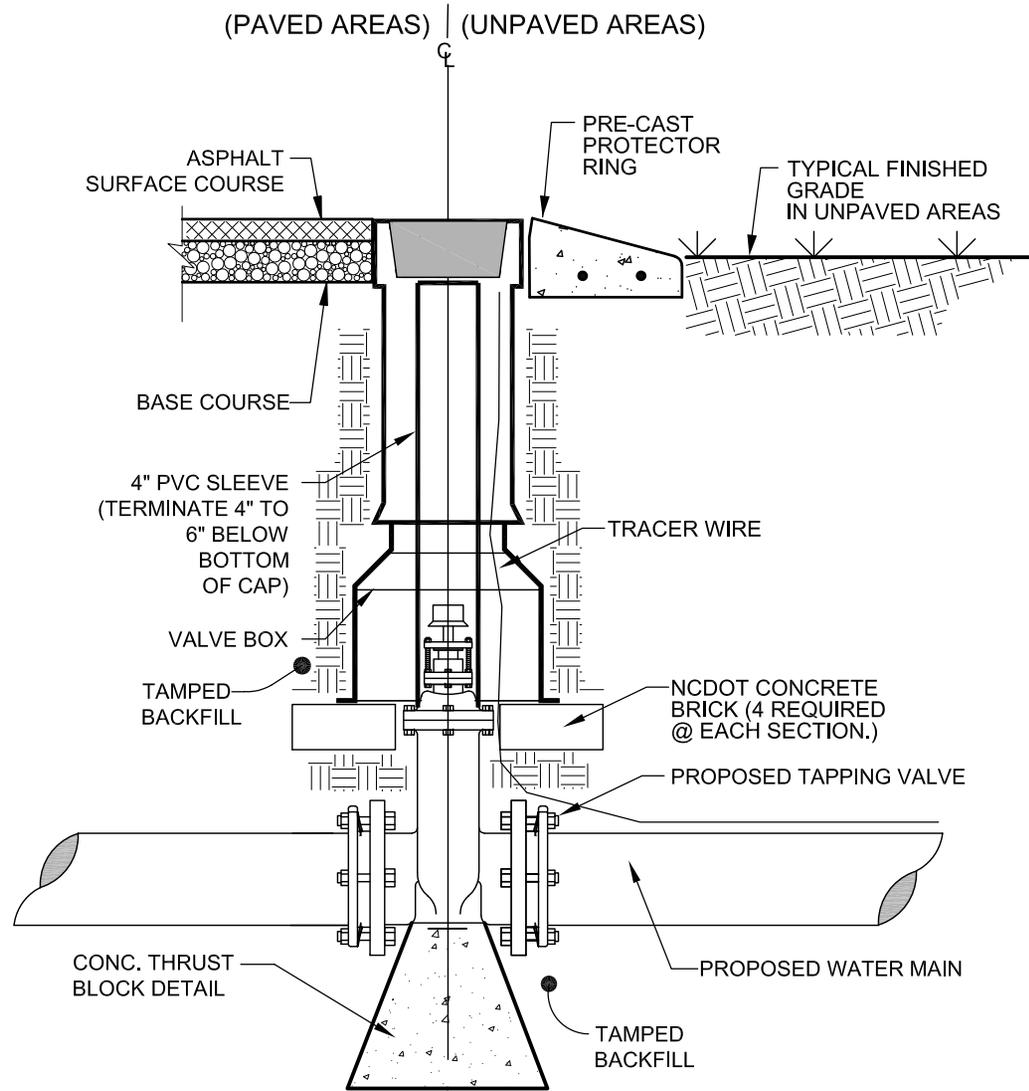
WRAP AROUND TIE-IN ASSEMBLY DETAIL

SCALE: NONE
 ISSUE DATE: 6-7-2021
 REVISION DATE:
 SHEET NO: 1 OF 1
 DRAWN BY: DMR

DETAIL NO.:
W-7

NOTES:

1. ALL MATERIALS SHALL BE IN ACCORDANCE WITH AWWA STANDARDS.
2. RESILIENT WEDGE GATE VALVE SHALL BE AS MANUFACTURED BY WATEROUS RESILIENT WEDGE TYPE OR APPROVED EQUAL.
3. ALL VALVES SHALL HAVE 2" SQUARE OPERATING NUT AND SHALL OPEN COUNTERCLOCKWISE.
4. VALVE BODY, BONNET AND GATE SHALL BE IN ACCORDANCE WITH AWWA C-509/C-515 AND NSF61.
5. VALVE BODY AND BONNET SHALL BE COATED ON ALL INTERIOR AND EXTERIOR SURFACES WITH A FUSION BONDED EPOXY IN ACCORDANCE WITH AWWA C-550-90.
6. ALL VALVES 24" AND SMALLER SHALL HAVE A SAFE WORKING PRESSURE OF 200 PSI. MIN.
7. ALL MAINLINE VALVES SMALLER THAN 4 INCHES SHALL BE A FORD BALL VALVE OR MUELLER.
8. SEE VALVE BOX DETAIL FOR ADDITIONAL INFORMATION.
9. SEE VALVE BOX PROTECTOR RING DETAIL FOR ADDITIONAL INFORMATION.
10. VALVE BOX SECTIONS ARE REQUIRED. THE USE OF PIPE IN LIEU OF VALVE BOX SECTIONS SHALL NOT BE PERMITTED.



PROFILE

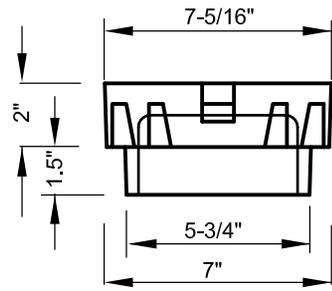


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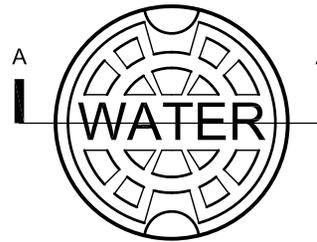
STANDARD GATE VALVE INSTALLATION DETAIL

SCALE: NONE
 ISSUE DATE: 6-7-2021
 REVISION DATE:
 SHEET NO: 1 OF 1
 DRAWN BY: DMR

DETAIL NO.:
W-8

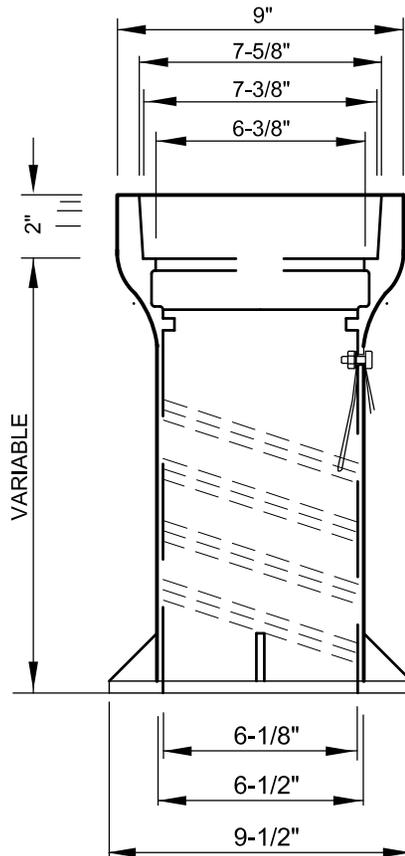


SECTION "A-A"

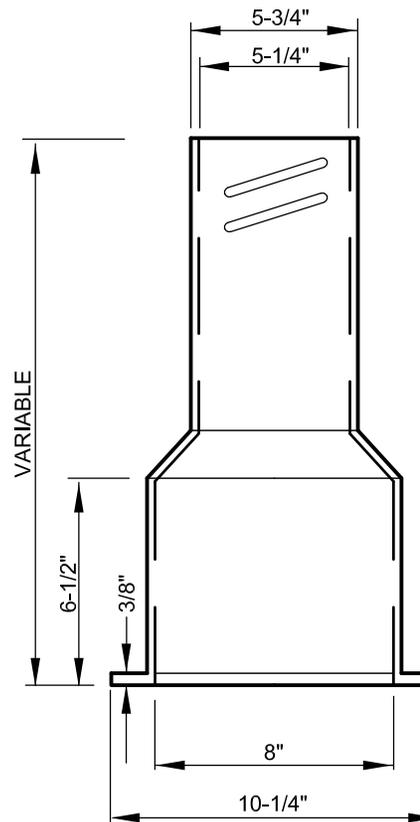


PLAN

5-1/4" DROP LID



TOP SECTION



BOTTOM

NOTES

1. VALVE BOX SHALL BE 3 PART SCREW-TYPE, CLOSE-GRAINED GRAY CAST IRON MANUFACTURED BY CHAMPION METALS OR APPROVED EQUAL.
2. VALVE BOX SHALL HAVE RAISED LETTERS "WATER" CAST INTO COVER.
3. VALVE BOX ACCOMMODATES 4" THRU 12" VALVES.
4. VALVE BOX SHALL HAVE (1) COAT OF PROTECTIVE ASPHALTUM PAINT.
5. DIMENSIONS SHOWN ARE FOR INFORMATION ONLY AND VARY BASED UPON THE MANUFACTURER.
6. WHERE A VALVE BOX WILL BE PLACED IN THE PAVEMENT THE LID SHALL BE A BINGHAM AND TAYLOR ROAD LOCK SCREW TYPE IRON LID #CUL5LWL OR APPROVED EQUAL.
7. EACH VALVE BOX SHALL BE PROTECTED WITH A PRECAST CONCRETE VALVE PROTECTOR.



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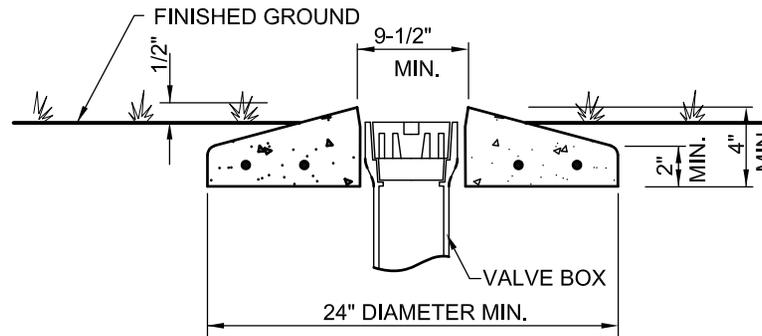
VALVE BOX DETAIL

SCALE: NONE
 ISSUE DATE: 6-7-2021
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 DRAWN BY: DMR

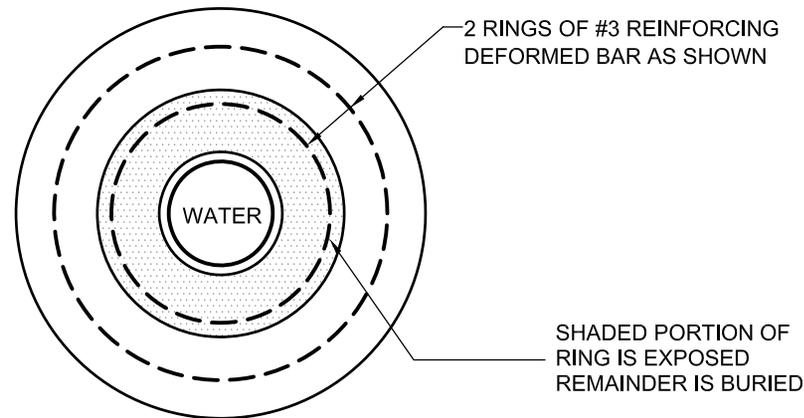
DETAIL NO.:
 W-9

NOTES:

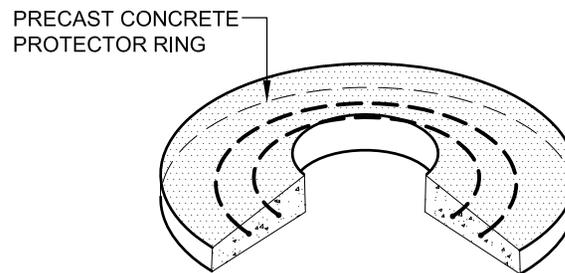
1. CONCRETE PROTECTOR RING SHALL BE 2500 P.S.I. PRECAST REINFORCED CONCRETE
2. VALVE BOX SHALL BE AT GRADE W/PROTECTOR RING EXTENDING 1/2" ABOVE GRADE
3. SEE GATE VALVE AND BOX DETAIL
4. VALVE BOX PROTECTOR RINGS SHALL BE INSTALLED AROUND VALVE BOX IN UNPAVED NON-TRAFFIC AREAS, AND SHALL NOT CREATE A HINDERANCE TO MOWING OPERATIONS.



PROFILE



TOP



CUT AWAY VIEW

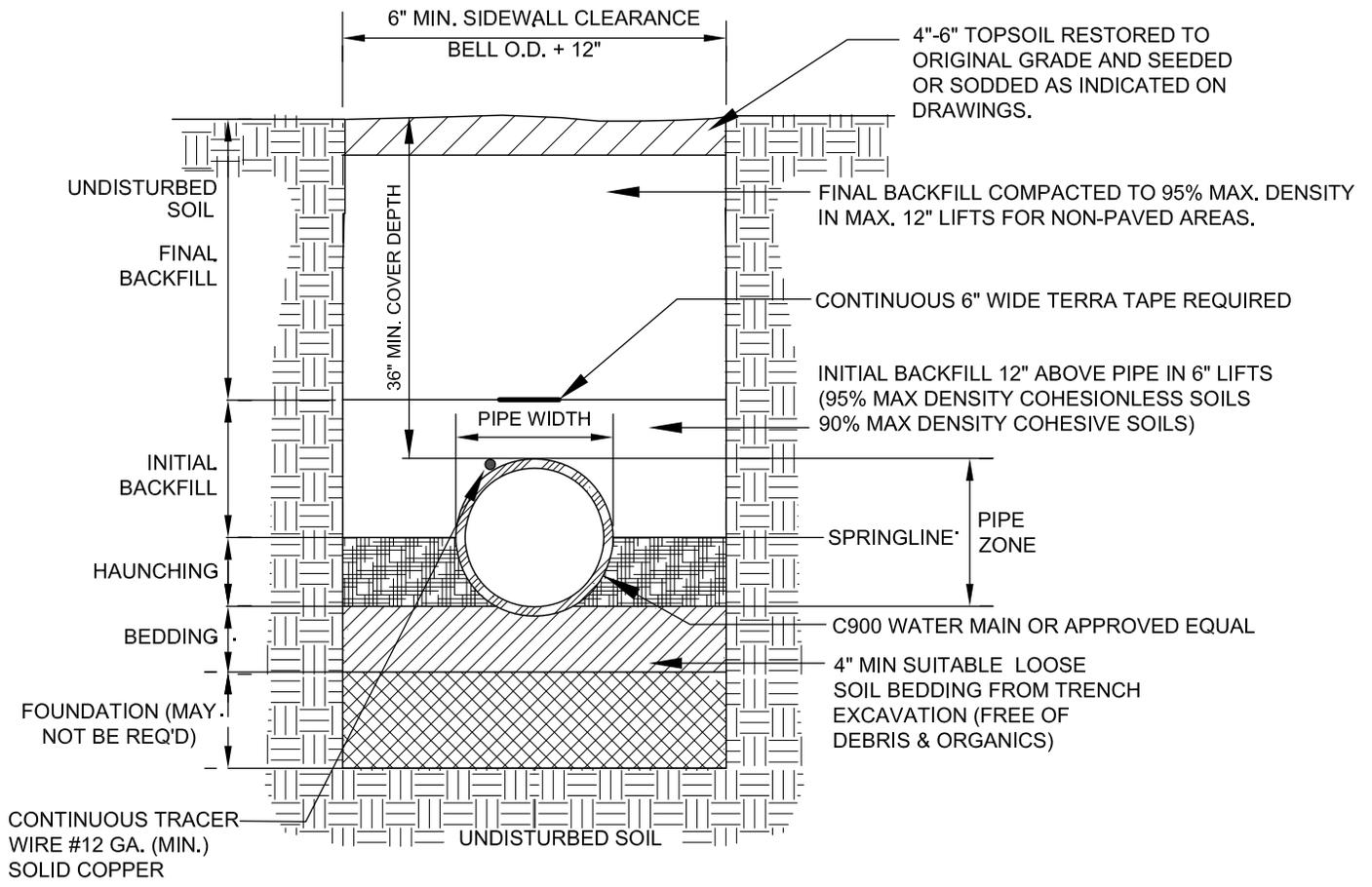


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CONCRETE PROTECTOR RING DETAIL

SCALE: NONE
 ISSUE DATE: 6-7-2021
 REVISION DATE:
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DETAIL NO.:
W-10



PROFILE

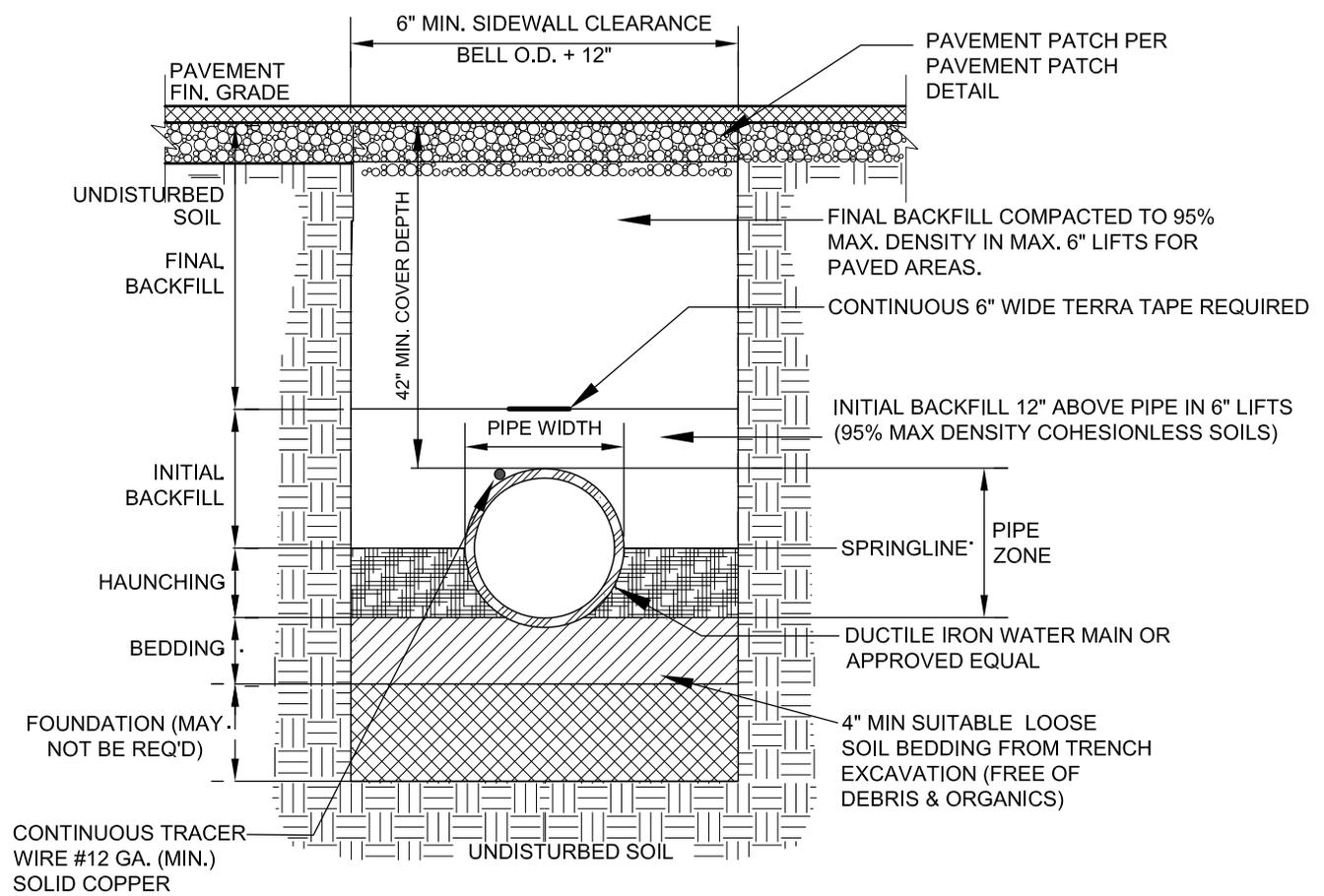


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WATER MAIN TRENCH DETAIL (UNPAVED)

SCALE: NONE
ISSUE DATE: 6-7-2021
REVISION DATE:
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DETAIL NO.:
W-11



PROFILE



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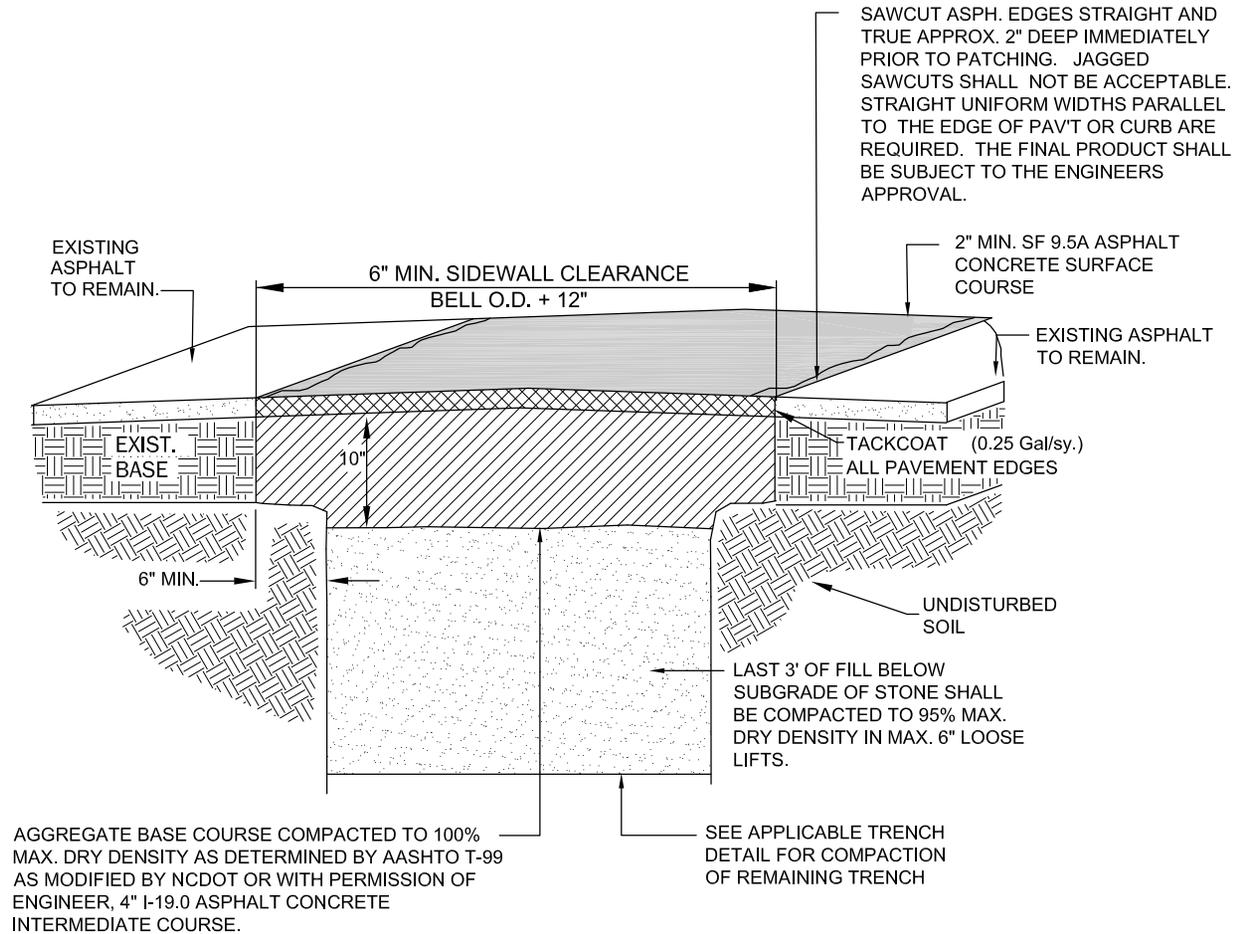
WATER MAIN TRENCH DETAIL (PAVED) FOR STREET CROSSINGS

SCALE: NONE
 ISSUE DATE: 6-7-2021
 REVISION DATE:
 SHEET NO: 1 OF 1
 DRAWN BY: DMR

DETAIL NO.:
W-12

NOTES:

1. THE ENTIRETY OF THE VERTICAL CUT EDGE SHALL BE TACKED.
2. ASPHALT PAVEMENT SURFACE COURSE SHALL BE INSTALLED AND COMPACTED THOROUGHLY WITH A SMOOTH DRUM ROLLER TO ACHIEVE A SMOOTH LEVEL AND CONTINUOUS PATCH.
3. NO HAND PATCHING IS PERMITTED.
4. PAVEMENT CUTS WITHIN THE NCDOT RIGHT-OF-WAY SHALL CONFORM TO THE CONDITIONS OUTLINED ON THE APPROVED RIGHT-OF-WAY ENCROACHMENT AGREEMENT..



ISOMETRIC

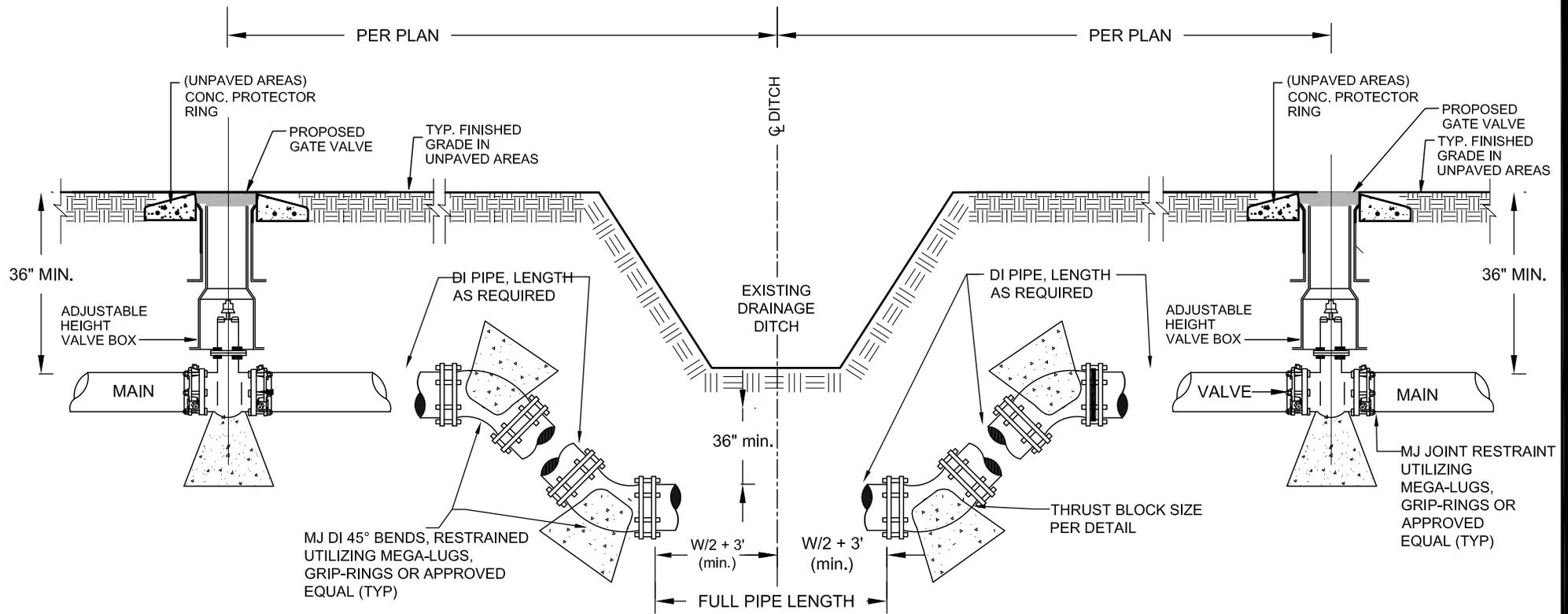


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STANDARD PAVEMENT PATCH DETAIL

SCALE: NONE
ISSUE DATE: 6-7-2021
REVISION DATE:
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DRAWN BY: DMR

DETAIL NO.:
W-13



PROFILE

NOTES:

1. CONTRACTOR TO COORDINATE NECESSARY OUTAGES WITH ENGINEER AND AFFECTED CUSTOMERS. MINIMUM 48 HOUR NOTICE REQUIRED.
2. ALL FITTINGS AND PIPE TO BE RESTRAINED UTILIZING MEGA-LUGS, GRIP-RINGS OR APPROVED EQUAL.
3. ALL PIPE AND FITTINGS TO BE DUCTILE IRON.
4. NEW WATER MAIN TO BE SWABBED WITH A CHLORINE SOLUTION AND FLUSHED PRIOR TO PLACING INTO SERVICE
5. TOWN OF NAGS HEAD PERSONNEL SHALL BE PRESENT DURING WORK
6. DIMENSIONS ARE GIVEN AS GUIDANCE, EXACT DIMENSIONS ARE SUBJECT TO CHANGE BASED ON FIELD CONDITIONS



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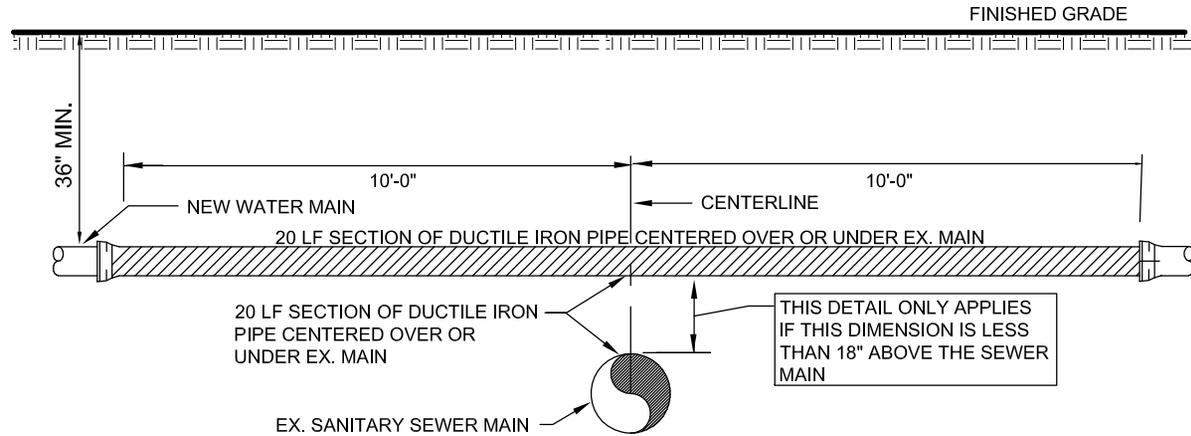
WATER CROSSING CONFLICT (DITCH) DETAIL

SCALE: NONE
 ISSUE DATE: 6-7-2021
 REVISION DATE:
 SHEET NO: 1 OF 1
 DRAWN BY: DMR

DETAIL NO.:
W-14

NOTES:

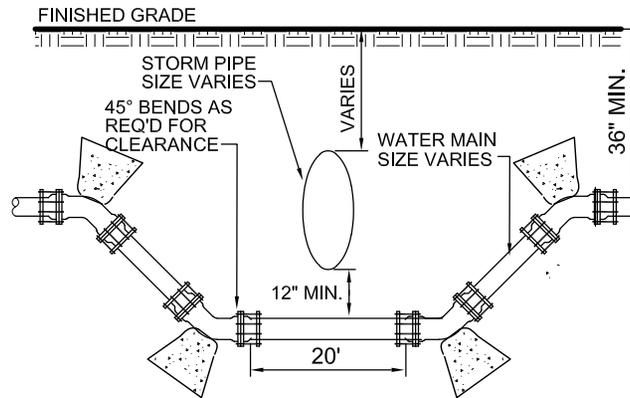
1. DUCTILE IRON PIPE IS ONLY REQUIRED IF LOCAL CONDITIONS PREVENT AN 18 INCH VERTICAL SEPARATION. IF THE VERTICAL SEPARATION IS LESS THAN 18 INCHES, A SINGLE LENGTH OF DUCTILE IRON PIPE SHALL BE CENTERED OVER THE POINT OF CROSSING.
2. NOTE 1 SHALL APPLY TO A WATER MAIN CROSSING OVER A SANITARY SEWER MAIN OR A SEWER MAIN CROSSING OVER A WATER MAIN.
3. DUCTILE IRON PIPE SHALL BE REQUIRED FOR BOTH WATER MAIN AND SANITARY SEWER MAIN IF THE VERTICAL SEPARATION IS LESS THAN 18 INCHES.



WATER MAIN-SANITARY SEWER CROSSING *

NOTES:

1. TO THE MAXIMUM EXTENT PRACTICABLE, CENTER PIPE SECTIONS OVER THE POINT OF CROSSING.
2. IF LOCAL CONDITIONS PREVENT THE MINIMUM 12 INCH VERTICAL SEPARATION FROM BEING OBTAINED, CONSULT WITH THE TOWN OF NAGS HEAD WATER DEPARTMENT FOR POTENTIAL ALTERNATIVES.*
3. IT IS RECOMMENDED (2) 60# BAGS OF PREMIX CONCRETE ON EITHER SIDE OF PIPE CROSSING FOR STORM PIPE SUPPORT.
4. CONCRETE THRUST BLOCKS SHALL BE INSTALLED PER THRUST BLOCK DETAIL.



WATER MAIN-STORM SEWER CROSSING *

* Exceptions to separation distances may be permitted if authorized in accordance with 15A NCAC 18C .0904 Rules Governing Public Water Systems - Distribution Systems Pipe Laying

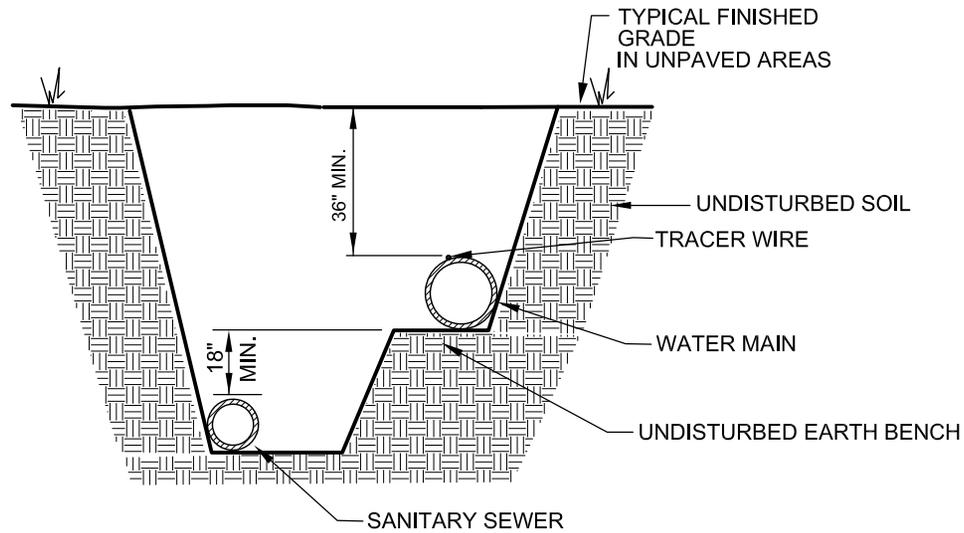


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WATER MAIN CROSSING (UTILITY) DETAILS

SCALE: NONE
ISSUE DATE: 6-7-2021
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DETAIL NO.:
W-15



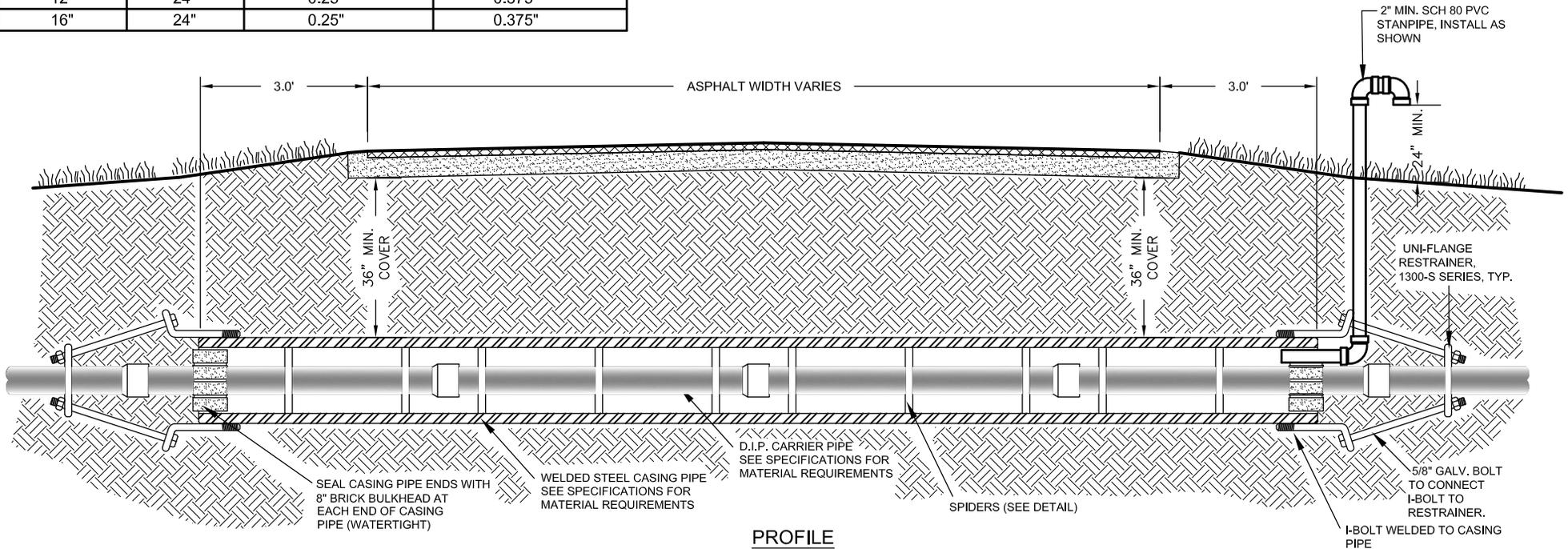
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BENCHED TRENCH UTILITY DETAIL

SCALE: NONE
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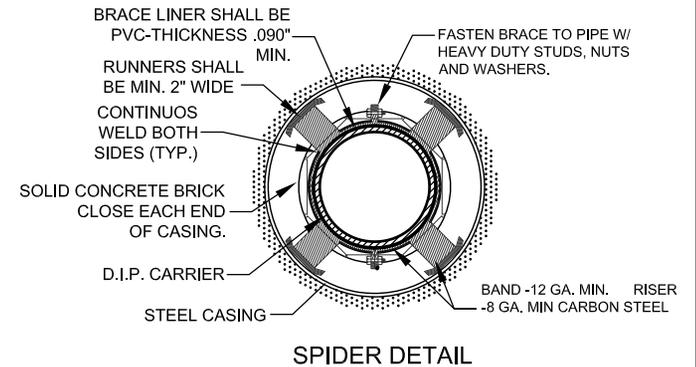
DETAIL NO.:
W-16

BORE SIZING CHART *			
CARRIER PIPE SIZE	MIN. CASING SIZE	ROADWAYS MIN. WALL THICKNESS	RAILROADS MIN. WALL THICKNESS
6"	12"	0.25"	0.281"
8"	16"	0.25"	0.281"
12"	24"	0.25"	0.375"
16"	24"	0.25"	0.375"



NOTES:

1. INSTALLATION SHALL BE DRY BORE AND JACKING OF SMOOTH WALL STEEL PIPE. JETTING OR WET BORING WITH WATER SHALL NOT BE ALLOWED.
2. SEE BORE SIZING CHART FOR CARRIER PIPE SIZE AND STEEL CASING SIZE, MIN. DIA. AND WALL THICKNESS.
3. CASING PIPE SHALL BE IN ACCORDANCE WITH ASTM A-53, GRADE B WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI EACH END OF ENCASMENT TO BE PLUGGED WITH BRICK.
4. ALL VOIDS OUTSIDE THE CASING PIPE SHALL BE COMPLETELY FILLED WITH 1:3 PORTLAND CEMENT GROUT AT SUFFICIENT PRESSURE TO INSURE NO SETTLEMENT OF ROADWAY/ RAILROAD.
5. THE BORE SHALL BE ACCOMPLISHED BEFORE PIPE CONSTRUCTION BEGINS. THE MAXIMUM TOLERANCE, IF ANY, IN VARIATION OF INVERT ELEVATIONS BETWEEN ENDS OF CASING AND CARRIER PIPE IS SHOWN ON THE PLAN PROFILE FOR EACH SPECIFIC BORE LOCATION AND STATION.
6. THE BORING SHALL BE PERFORMED FROM "UPHILL" TO "DOWNHILL".
7. THE BORING OPERATION SHALL BE CONDUCTED IN A MANNER THAT THE FLOW OF TRAFFIC IS NOT IMPEDED OR IN SUCH A MANNER SO AS NOT TO CREATE A HAZARD.
8. IF AN OBSTRUCTION IS ENCOUNTERED DURING THE BORING OPERATION, THE AUGER SHALL BE WITHDRAWN THE EXCESS CASING PIPE CUT-OFF, CAPPED AND THE INTERIOR AND EXTERIOR VOIDS SHALL BE COMPLETELY FILLED W/1:3 PORTLAND CEMENT GROUT UNDER PRESSURE.
9. CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF THE "POLICIES AND PROCEDURES FOR ACCOMMODATING UTILITIES ON HIGHWAY RIGHTS-OF-WAY" AS PREPARED BY N.C.D.O.T.



- USE TWO (2) ALIGNMENT GUIDES PER JOINT FOR D.I.P. CARRIER PIPES TYP.
- USE THREE (3) ALIGNMENT GUIDES PER JOINT FOR PVC CARRIER PIPES TYP.

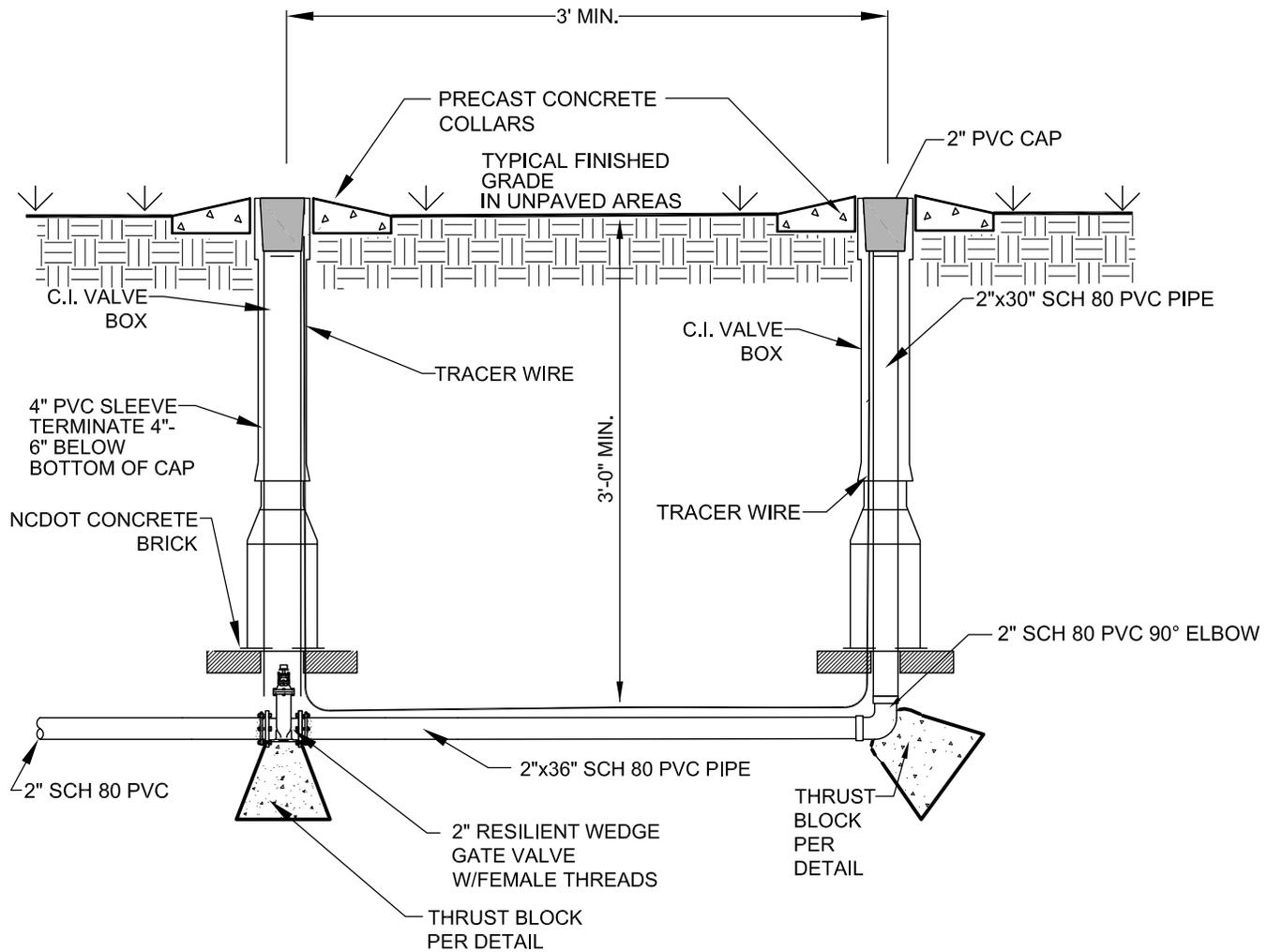


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BORE & JACK CONSTRUCTION DETAIL

SCALE: NONE
ISSUE DATE: 6-7-2021
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DETAIL NO.:
W-17



PROFILE

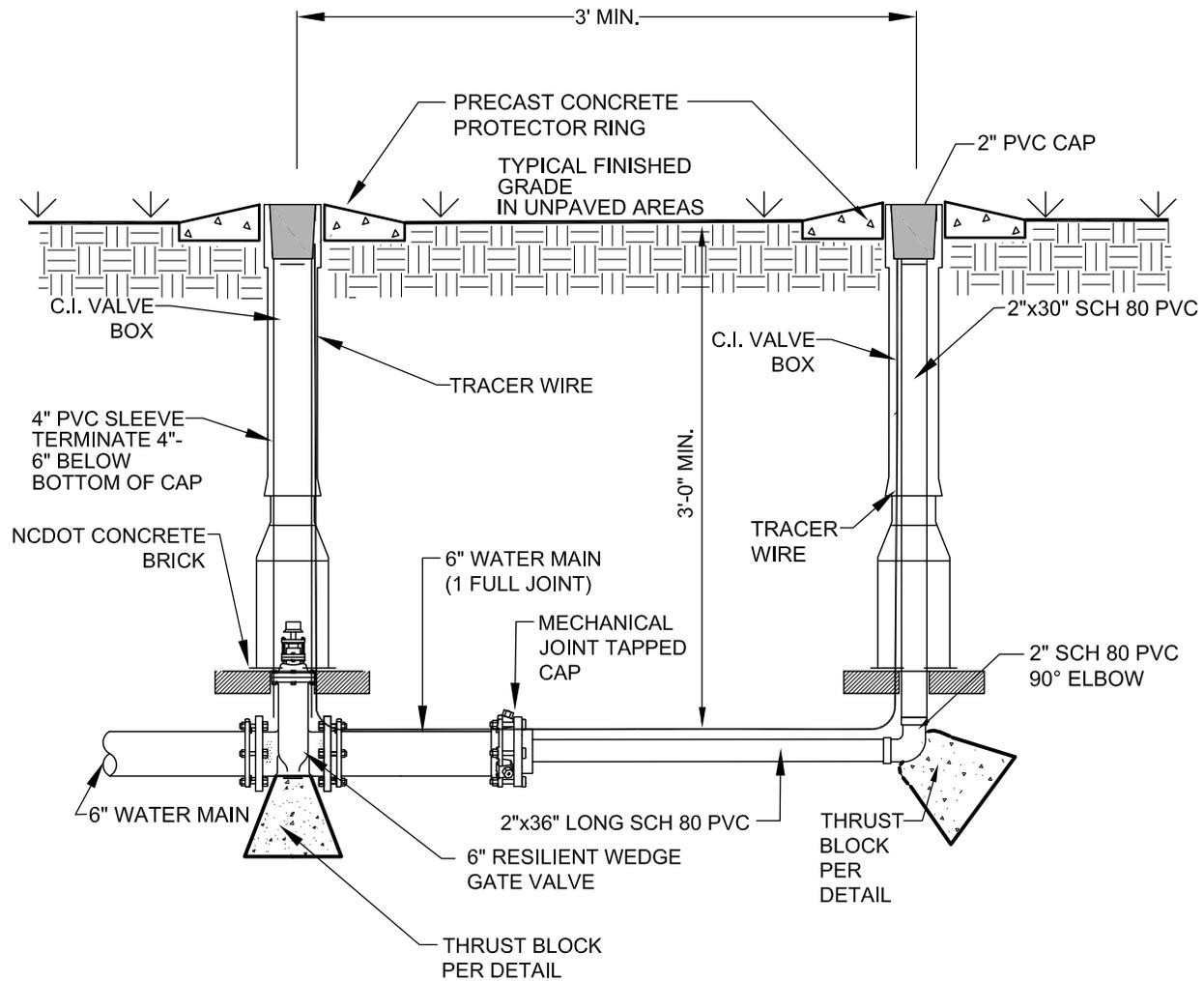


TOWN OF NAGS HEAD
 DEPARTMENT OF PUBLIC WORKS
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 NAGS HEAD, NC 27959
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2" PERMANENT BLOWOFF ASSEMBLY DETAIL

SCALE: NONE
 ISSUE DATE: 6-7-2021
 REVISION DATE:
 SHEET NO: 1 OF 1
 DRAWN BY: DMR

DETAIL NO.:
 W-18



PROFILE



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2" TEMPORARY BLOWOFF ASSEMBLY DETAIL

SCALE: NONE
 ISSUE DATE: 6-7-2021
 REVISION DATE:
 SHEET NO: 1 OF 1
 DRAWN BY: DMR

DETAIL NO.:
 W-19