DESIGN AND CONSTRUCTION STANDARDS

FOR

WATER, SEWER, AND STREETS

Prepared for:

Mayor & Council
Town of Georgetown
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SECTION 1 - GENERAL CONDITIONS

1.1 PURPOSE OF DESIGN AND CONSTRUCTION STANDARDS

A. The purpose of these Design and Construction Standards for Water, Sewer, and Streets is to set forth the minimum requirements of the Town of Georgetown, Delaware, for the planning, design, construction and acceptance of water systems, wastewater systems, storm water systems, and streets constructed within the Town of Georgetown. It is not the intention of the general conditions and/or any other part of these specifications to contradict or supersede any ordinance or legislative enactment of the Town of Georgetown but to act only as a supplement thereof.

B. These Design and Construction Standards shall be used, when applicable, in conjunction with Sewers, Chapter 176, Streets and Sidewalks, Chapter 190, Subdivision of Land, Chapter 194, Water, Chapter 222, and Zoning, Chapter 230, from the Code of the Town of Georgetown.

1.2 AUTHORITY

A. The authority for these Design and Construction Standards is set forth in the Georgetown Town Charter, adopted as Chapter 276, Volume 65, of the Laws of Delaware as amended.

1.3 INTERPRETATIONS

A. The provisions of these Design and Construction Standards shall be held to be minimum requirements. Where these Design and Construction Standards impose a greater restriction than is imposed or required by other provisions of law or by other rules or regulations or resolutions, the provision of these Design and Construction Standards shall control.

B. Where other laws, rules, regulations or resolutions require greater restrictions than are imposed by these Design and Construction Standards, the provisions of such other laws, rules, regulations or resolutions shall control.

C. For the purpose of these Design and Construction Standards, the word “shall” is mandatory and not discretionary. The word “may” is permissive.

1.4 DEFINITIONS AND TERMS

A. Whenever in these specifications, bond and other contract documents, the following terms or pronouns are used, the intent and meaning shall be interpreted as follows:

“Approved”, “As Required”, and similar expressions.
Meaning shall be construed as "as approved by the Town" and "as required by the Town".

"Contract" or "Contract Documents"
All things contained in the specifications, drawings, proposals, agreement and bond, and therein referred to, are to be considered as one instrument forming the contract, including any and all supplementary agreements which could reasonably be required to complete the construction contemplated.

“Contractor”
Party responsible for the construction of a utility or the construction of a sidewalk, curb, gutter or driveway or the construction or restoration of any street or road surface, acting directly or through his or her agents or employees.

“Developer”
Any individual, firm, association, syndicate, co-partnership, corporation, trust or any other legal entity commencing proceedings to affect development or subdivision of land for himself or for another.

"Drawings"
All drawings or reproductions of drawings, pertaining to the work under the contract, which are furnished or approved by the Town.

“Equivalent Dwelling Unit (EDU)
A term used to express the load produced on a sanitary sewerage system approximately equal to one dwelling place or 225 gallons per day.

"Furnish"
A direction to the Contractor to supply and make payment for materials and equipment but not necessarily to install or pay workmen to install, or both, these items.

“General Conditions”
Provisions that establish and pertain to the legal responsibilities between the parties involved in the work, namely the Town and Contractor.

"Material" or "Materials"
Unless the context otherwise requires, these words or either of them, shall include equipment.

"Provide"
A direction to the Contractor to furnish all materials, equipment and labor and make payment for all of these necessary to complete the contract.

“Resident Project Representative”
The authorized representative of the Engineer assigned to the site to serve as the liaison between the Owner, Engineer and Contractor and who’s duties include conducting on-site observations to monitor the progress and quality of work with the contract documents;

“Shop Drawings”
Drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor or any subcontractor, manufacturer, supplier or distributor, and which illustrate some portion of the work.

“Specifications”
The definitions, descriptions, directions, provisions and requirements contained herein, and all written supplements thereto, made or to be made, pertaining to the contract, and the materials, equipment and workmanship to be furnished under the contract.

"Street"
Any avenue, boulevard, road, lane, parkway, viaduct, alley or other way open to public travel and which is an existing state or municipal roadway for public use. A street shall include the land between the street lines, whether improved or unimproved, and may comprise pavement, shoulders, gutters, sidewalks, parking areas and other areas within the street lines.

"Subcontractor"
Any individual, firm or corporation who contracts with a contractor to perform part or all of the latter's contract.

"Town of Georgetown" or "Town"
Town of Georgetown, Sussex County, Georgetown, Delaware, acting through the Town Council or its authorized representative.

"Work"
Any and all things agreed to be furnished or done by, or on the part of, the Contractor, and which are required in the construction and completion of the project herein contemplated. Includes also labor, material and equipment.

B. Whenever in the specifications and upon the drawings, the words DIRECTED, REQUIRED, PERMITTED, ORDERED, DESIGNATED, PRESCRIBED, and words of like import are used, it shall be understood that the directions, requirements, permission, order, designation, or prescription of the Town is intended. In the case of shop drawings and similar submissions by a contractor or subcontractor, the words APPROVED, ACCEPTABLE, SATISFACTORY, and words of like import shall mean the submission by the contractor or subcontractor is approved by, or acceptable or satisfactory to the Town unless otherwise expressly stated. Town approval shall not negate reliance on the contractor's selection of materials or methods to achieve a performance objective specified by the Town.

C. All references herein to the singular shall include the plural, to the plural, shall include the singular, and to any gender shall include all genders.

1.5 ABBREVIATIONS

A. ACI - The American Concrete Institute

B. ANSI - The American National Standards Institute

C. ASA - The American Standards Association

D. ASTM - The American Society of Testing and Materials

E. AWWA - The American Water Works Association

F. AASHTO - The American Association of State and Highway Transportation Officials

G. DelDOT - Delaware Department of Transportation

H. DNREC - Delaware Department of Natural Resources and Environmental Control

I. GPD - Gallons per Day

J. GPM - Gallons per Minute

K. NEC - The National Electrical Code

L. OSHA - The Occupational Safety and Health Administration

1.6 CONSTRUCTION DRAWINGS AND SPECIFICATIONS

1.6.1 FINAL SITE AND SUBDIVISION CONSTRUCTION IMPROVEMENT PLANS

A. The Developer and his Engineer are responsible for preparation of detailed drawings. Sheet numbers shall be placed in a prominent location in the lower right corner of each sheet and shall use the following order and sheet number conventions. The drawing sheet size shall be 24 x 36 inches. The drawing title block shall identify the project and be consistent on each drawing sheet. All drawings shall be signed and sealed by the responsible Delaware registered professional engineer.

1. Order of Sheets:

a) Title Sheet containing (The title sheet need not contain a sheet number)
b) Record Plat(s) for subdivision projects. (First sheet in this series will be a key sheet if record plat takes up more than one sheet.)
c) General Sheet (General Notes, Site Data Notes, etc.)
d) Construction Key Plan (For large projects.)
e) Site and Grading Plans Horizontal
f) Utility Plans Horizontal (For scale of 1"=20' utilities may be shown on site and grading plans. For scale of 1" = 30' or 1" = 40', and where necessary for clarity, provide utility drawings separate from grading drawings).
g) Sediment and Stormwater Plans and Details (Per DNREC requirements.)
h) Street and Stormdrain Profiles
i) Site Details Using Georgetown Standards where applicable and available
j) Utility Profiles (Sewer, water and force main.)
k) Pump Station if applicable (Site Plan at 1" = 10', Section and Details)
l) Sewer, and Water Details Using Georgetown Standards where available
m) Traffic Signs and Striping Plan for Dedicated Streets (May be included on Site and Grading Plans for small projects.)
n) Landscape and Lighting Plan
o) Architectural where applicable
p) Electrical/Mechanical where applicable

2. Revision Blocks

Provide a revision block on each sheet to accurately disclose and identify all drawing revisions made after the first submittal for preliminary plan review. Provide a Revision Summary Table on the title sheet with sheet number and date of revision.

3. Title Sheet and G-1 General Sheet

   a) Title of Project and Address.
   b) Phase of Project if applicable
   c) Developers' Name, address, phone, and fax number.
   d) Design Engineers' Name, address, phone and fax number.
   e) Drawing Index
   f) Certification Blocks
   g) Location Map showing location of Project within the Town and related to area streets. Scale shall be no smaller than one inch equals 1000 feet.
   h) Phasing Map if drawings are for one phase of the development.
   i) Design Engineer's Seal and Signature.
   j) General Legend
   k) General Notes:

4. The following minimum general notes shall appear on construction improvement plans if applicable:

   a) The boundary information shown on these drawings is based on a survey performed by _____ , on _____. (if the boundary is based on a previous survey, provide the following) and recorded in the Sussex County recorder of deeds office, plat book _____, page _____.

   b) A topographic survey was performed by _____ of _____, Delaware on _____. Elevations are based on control monument _____, with an elevation of _____ NAVD88.

   c) Horizontal datum is based on Delaware State Grid, NAD83/91, control monuments _____.

   d). Existing utilities are shown in accordance with the best available information. Completeness or correctness thereof is not guaranteed. It shall be the Contractor's responsibility to contact the utility companies involved in order to secure the most accurate information available as to utility location and elevation. No construction around or adjacent to utilities shall begin without notifying their owners at least 48 hours in advance. The Contractor shall take the necessary precautions to protect the existing utilities and maintain uninterrupted service and any damage done to them due to his/her negligence shall be immediately and completely repaired at the Contractor's expense. To locate existing utilities in the field prior to construction, the Contractor shall contact Miss Utility Delmarva (see note 24).

   e) All materials shall be installed in accordance with the manufacturer's recommendations. Materials and workmanship shall meet the requirements of the Town of Georgetown design and construction

standards for water, sewer, and streets, and all applicable agencies having jurisdiction over the proposed improvements.

f) Use only suitable and approved granular material for back filling trenches.

g) The Contractor shall determine the location of all right-of-way lines and property lines to his own satisfaction. Any disturbed areas beyond the right-of-way or easement lines shall be restored immediately to their original condition.

h) All valve closures and cut-ins shall be coordinated with the Town. Town officials will carry out all necessary valve closures. Contractor shall coordinate isolation of existing water mains with the town and notify affected residents at least 48 hours prior to cut-in.

i) Pipeline detection tape shall be color coded, appropriately labeled, and installed 18 inches below the ground surface and directly above all proposed water main, sewer main, sewer laterals, and water services.

j) Conductive tracer wire shall be installed with all non-metallic water pipe and services; and along all sewer laterals and forcemain. Wire shall be secured to the pipe and shall be securely bonded together at all wire joints with approved watertight connectors. Tracer wire shall be accessible at all valve boxes, meter pits, cleanouts, and air release valves.

k) Prior to isolation and cut-in procedures, Contractor shall excavate, locate, and observe function of all existing valves to assist in the system isolation.

l) Shop drawings for any item(s) which will eventually be taken over by the Town shall be submitted to the town for review and approval prior to the installation of the item(s).

m) All sanitary sewer mains and forcemains shall have a minimum cover of 36 inches and all water mains shall have a minimum cover of 42 inches as measured from the top of pipe to proposed grade. Sewer laterals shall have a minimum diameter of six (6) inches and have a minimum cover of 36 inches.

n) There shall be a minimum horizontal separation between water mains and sanitary sewer mains and forcemains of 10 feet, as measured from edge of pipe to edge of pipe. There shall be a minimum vertical separation of 18 inches between water mains and sanitary sewer mains or forcemains at crossings. One full length of water pipe shall be located so that both joints will be as far from the sewer as possible at crossings.

o) There shall be a minimum vertical separation of 12 inches between any storm drainpipe and any water main or sewer main. If 12 inches cannot be maintained, a minimum of six (6) inches is required and provisions shall be made acceptable to the Town of Georgetown for properly installing a sleeve 10 feet from either side of the water main.

p) Insert a note which gives the FEMA firm panel number and floodplain classification for this site.

q) All roadways are to be swept free of sediment on a daily basis.

r) The Contractor shall remove and immediately replace, relocate, reset or reconstruct all obstructions in the work area, including, but not limited to, mailboxes, signs, landscaping, lighting, planters, culverts, driveways, parking areas, curbs, gutters, fences, or other natural or man-made obstructions. traffic control regulatory, warning and informational signs shall remain functional and visible to the appropriate lanes of traffic at all times, with their relocation kept to a minimum distance. The cost shall be included in the cost of items bid.

s) It is the Contractor's responsibility to ensure that paving is installed to the elevations shown and that no ponding of water will occur after paving is complete.

t) The storm drainage system has been designed using the criteria of the state of DelDOT Standards and Regulations for Subdivision Streets and State Highway Access, latest edition.

u) All fire lanes, fire hydrants, exits, and standpipes will be marked in accordance with State Fire Prevention Regulations.

v) Delaware regulations prohibit the burial of construction demolition debris, including trees and stumps on construction sites. Any solid waste found during the excavation for structures and utility lines on and off site must be removed and properly discarded. Any remedial action required is the responsibility of the owner.

w) Drawings do not include necessary components for construction safety. All construction must be done in compliance with the Occupational Safety and Health Act of 1970, as amended, and all rules and regulations thereto appurtenant.

x) Contractor shall grade, topsoil, seed and mulch all disturbed areas of construction, including pipe installation or ditch construction. Erosion control matting shall be provided on all slopes greater than 4:1.

y) A professional surveyor licensed in the State of Delaware shall be responsible for permanently re-establishing any property markers or monuments disturbed during construction. A survey and metes and bounds that includes the re-established marker(s) or monument(s) shall be presented to the property owner for comparison with the original plat, for verification.

z) Miss Utility shall be notified three (3) consecutive working days prior to excavation, at 1-800-282-8555.

aa) Upon approval of the construction drawings, the developer shall provide a CD with digital information in AutoCAD format (version 2010 or later) of all water, sanitary sewer and storm drains to be Town maintained upon project completion.

bb) The Contractor shall notify the Town a minimum of two weeks prior to the start of construction and schedule a pre-construction meeting. The site Contractor and the owner, or his/her representative shall be in attendance.

Town of Georgetown - (302) 856-7391

5. The following minimum General Notes shall appear on record plans or recordable site plans if applicable:

a) The boundary information shown on these drawings is based on a survey performed by _____ , on _____. (if the boundary is based on a previous survey, provide the following) and recorded in the Sussex County recorder of deeds office, plat book_____, page ____.

b) A topographic survey was performed by _____ of _____, Delaware on _____. Elevations are based on control monument _____, with an elevation of _____ NAVD88.

c) Horizontal datum is based on Delaware State Grid, NAD83/91, control monuments _____.

d) Insert a note which gives the FEMA firm panel number and floodplain classification for the site.

e) All fire lanes, fire hydrants, exits, and standpipes will be marked in accordance with State Fire Prevention Regulations.

f) Delaware regulations prohibit the burial of construction demolition debris, including trees and stumps on construction sites. Any solid waste found during the excavation for structures and utility lines on and off site must be removed and properly discarded. Any remedial action required is the responsibility of the owner.

g) Drawings do not include necessary components for construction safety. All construction must be done in compliance with the Occupational Safety and Health Act of 1970, as amended, and all rules and regulations thereto appurtenant.

h) Insert a note declaring who will be responsible for the short term (during construction) and long term (after final acceptance) maintenance of the stormwater management and storm sewer systems.

i) Insert a note declaring who will be responsible for all water and sanitary sewer mains associated with the project.

J) The Town of Georgetown will assume ownership and maintenance responsibility of water, sewer, and storm sewer pipes and appurtenances installed within town right-of-way, and easements dedicated to the Town, after all items have passed town inspection; after the Town has received and approved digital and hard copies of the record drawings; after the rights-of-way have been deeded to the town; and after all the water, sewer, and storm sewer items have been transferred to the Town by bill of sale.

k) Sewer and water capacity are not guaranteed until building permits are issued, all fees are paid, and suitable utilities are in place for proper conveyance, treatment, and disposal.

l) All lot lines shall be reserved for a 10' wide drainage and utility easement.

6. Site and Grading Plans

a. The scale shall be 1-inch equals 20 feet for small projects up to a maximum of 1-inch equals 50 feet for large projects. A larger scale may be used upon approval of the Town.
b. North Arrow.
c. The existing and proposed legend if different from main legend
d. Special drawing notes
e. Location, elevation, and description of all the Project Benchmarks
f. Property lines, lot lines, lot numbers, and rights-of-ways and easements with bearings and distances, and location of all monuments and references.
g. Location of all existing and proposed structures and buildings with unit numbers.
h. Beginning and end of proposed construction, including phase limits and offsite improvements where applicable.
i. Existing and proposed street names.
j. Stormwater management, drainage pipe, culverts, slopes, spot elevation and pipe material.
k. Location of all other drainage facilities and public utilities.
l. Existing and proposed contours (minimum of 1-foot vertical intervals) with major vegetation noted. Provide this information within a minimum of 100 feet beyond the property line or proposed improvements.
m. Ownership of abutting properties.
n. Width of pavement, curb lines and sidewalks.
o. Outfall ditches shall be shown for a minimum of 1000' from the property line. Elevation shall be taken at a minimum of 50' intervals.
p. Recreation, open space, common use areas, and parking.
q. Radii at intersections.
r. Stationing of roads with curve data, points of tangent and curve.
s. Curbing locations with type denoted plus top and bottom elevations, at all changes in elevations, and minimum 50-foot intervals. (10' for ADA ramps or more as needed.)

t. Centerline street data with bearings, distances, and curve data and stations corresponding to the profile.
u. Traffic signage & striping plans.
v. Intersection details (subdivisions only).

7. Utility (Water and Sewer) Plans

a. Same as a. through l. under Item 6 (Site and Grading Plans), above.

b. Location of all existing water mains, valves, hydrants, services, meters, etc.
c. Location and sizes of all proposed water lines with stationing.
d. Locations of proposed valves, fittings, meters, services and fire hydrants.
e. Property lines with details of existing and proposed easements where required.
f. Location of existing and proposed structures and buildings.
g. Beginning and end of proposed construction, and connections to existing and future utilities.
h. Locations of proposed service lines.
i. Location of all other drainage facilities and public utilities.
j. Provide profiles at all utility crossings.
k. All existing sanitary sewer facilities (i.e. manholes and pipelines) and labeled for inverts and size.
l. Location, sizes, type and slope of all proposed sanitary sewer lines with stations corresponding to the profiles.
m. Location of all manholes with grades and invert elevations.
n. Location of proposed laterals, wyes, cleanouts, etc.
o. Proposed manhole numbers

8. Pumping Stations and Force Mains

a. Same as a. through l. under Item 7 (Utility Plans), above.
b. Metes and bounds for property lines to be deeded to the Town with details of any easements where required.
c. Electrical service with transformers, equipment cabinet, generator, etc.
d. Related landscaping
e. Pump and system curves showing the system's flow and total dynamic head for both proposed and future demands and conditions.
f. Design calculations for average daily flow, peak factor, and volume of wet well calculations.
g. Force main and stationing

9. Profiles (Streets)

a. Scale to match plan horizontally. Vertical scale shall be 1/10 of the horizontal scale.
b. Existing and proposed grades with elevations noted at 25' intervals for vertical curves.
c. Drainage pipes and outfalls.
d. Street Name.

e. Stationing, high points, low points, vertical curves, longitudinal slopes along the center line, the left flow line, and the right flow line.

10. Profiles (Sanitary Sewers, Water, and Force Mains)

a. The horizontal scale shall be identical to the horizontal plan. Vertical scales shall be 1/10 of the horizontal scale.
b. Profiles of existing and proposed ground surface over the pipe with elevations at the top of manholes and air release vaults and at the inverts line.
c. Pipe size, material, slope, manholes, air release vaults, manhole and air release valve numbers, bends and any necessary concrete encasements.
d. Location of all utility and storm drain crossings.
e. Cross section or profile of each location where a proposed water main crosses a sewer, storm drain or other significant utility.
f. Centerline stationing.

11. Profiles (Storm Drain)

a. The horizontal scale shall be identical to the horizontal plan. Vertical scales shall be 1/10 of the horizontal scale.
b. Profiles of existing and proposed ground surface over the pipe with elevations at the top of all inlets, manholes, and junction boxes.
c. Invert elevations at all structures.
d. Location of all utility crossings.
e. Pipe size, material, slope.
f. Centerline stationing.
g. 10-year HGL.

12. Details

a. Provide copies of applicable utility, street and storm drain details per Standard Construction Details as provided by the Town of Georgetown for all facilities proposed to be dedicated to the Town.
b. Dimension all air release valve vault or manhole details for each location installed.
c. Street cross section.
d. Curbing type(s), and sidewalks.
e. Entrances.
f. Other as required.

1.6.2 CERTIFICATIONS AND SIGNATURE BLOCKS FOR FINAL IMPROVEMENT PLANS (This information is to be located on the Title Sheet in a 3" x 5" box at the bottom of the plan.).

A) <u>DESIGN ENGINEER (SURVEYOR, ARCHITECT) STATEMENT</u> (as applicable): (Note to applicant: Site plans which also contain public street, public utilities, or stormwater management shall be sealed by an Engineer or a Surveyor.)

I hereby certify that I am a registered engineer (licensed surveyor, registered architect) in the State of Delaware, that the information shown hereon has been prepared under my supervision and to my best knowledge and belief represents good engineering practices as required by the applicable laws of the State of Delaware. (Print Name, Address and Phone Number)

Signature:_____Date:_____
(Printed Name)

B) OWNER'S, DEVELOPER'S, or OWNER/DEVELOPER CERTIFICATION*

I hereby certified that I am the (owner, developer, or owner/developer) of the property described and shown on this plan. The plan was made at my direction, that I acknowledge the same to be my act. It is my desire to have the plan developed as shown and in accordance with all applicable laws and regulations.

Signature:_____Date:_____
(Print Name, Address and Phone Number)

*If owner and developer are separate entities, certification statements are to be provided for each.

C) TOWN ENGINEER AND TOWN OF GEORGETOWN

A 3" x 5" box shall be placed at the bottom right corner of the plan set for the certifications for the Town Engineer and the Town of Georgetown. Certifications will be applied by Town staff prior to final plan approval.

1.6.3 RECORD DRAWINGS

A. No later than 90 days after completion of construction, the Developer/Contractor shall submit to the Town a draft copy of the record drawings for review and comment. Record drawing information shall include surveyed as-built elevations of the following:

1. All property monuments or markers, found and set;

2. Sewer manhole rims, pipe sizes, and pipe inverts;

3. Sewer cleanout covers and inverts;

4. Pump station wet well rim and bottom, pipe sizes, and pipe inverts;

5. Pump station valve vault rims, pipe sizes, and inverts;

6. Forcemain inverts every 50 feet;

7. Air release valve rims, pipe sizes, and inverts;

8. Grease trap rims, pipe sizes, and inverts;

9. All water valves, hydrants, vaults, meter pits, and curb stops (where required);

10. All storm sewer catch basin grates and manhole rims, all pipe sizes, and inverts;

11. All other items deemed necessary by the Town.

B. When the record drawings have been approved, the Developer/Contractor shall submit to the Town four (4) signed and sealed paper copies of the approved record drawings, a CD of the signed and sealed record drawings in PDF format; and a CD with the record information in digital AutoCAD (2010 or newer) format. The digital AutoCAD information shall be on Delaware State Plane horizontal control and NAVD 88 vertical control.

1.7 SHOP DRAWINGS AND SUBMITTALS

A. The Contractor shall submit shop drawings and other submittals as required by these Standard Specifications and the project specific requirements, to afford the Town the opportunity to review the intended equipment, materials, installation and/or construction methods and other aspects of the project prior to the ordering, fabrication, installation and/or construction of the work. This review function is to serve the Town's interest and does not in any way modify or affect the Contractor's responsibility to fully satisfy the requirements of these Standard Specifications and the approved project construction plans and specifications.

B. The Contractor warrants that the Town's review of the shop drawings and other submittals and any notations issued as part of that review do not relieve the Contractor from full compliance with the requirements of these Standard Specifications and the approved project construction plans and specifications. The Contractor will be solely responsible for confirming and coordinating the quantities, dimensions, adjacent and related work, fabrication process, installation methods, construction methods, and all other requirements of the work. The Contractor is solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work.

C. All submittals shall be in electronic format distributed to the Town and Town Engineer for review.

D. Each copy of all shop drawings and submittals shall include a shop drawing certification that includes the following information:

1. Project identification.

2. A reference to the specification or drawing description.

3. Contractor's certification statement as follows: This shop drawing

submission complies with the requirements of the Contract Documents.

4. The Contractor's name.

5. The signature of the Contractor's representative.

6. The date of signing.

7. Blank space (5" x 8.5") for Town stamp.

E. Shop drawings and submittals are required for the items listed below, and for any other items as directed in writing by the Engineer:

1. Pipes, valves, fire hydrants, fittings, and appurtenances.

2. Precast concrete structures.

3. Concrete mix designs.

4. Concrete admixtures.

5. Concrete reinforcing steel.

6. Manhole frames and covers.

7. Pumps and appurtenances.

8. Emergency generators, automatic transfer switch, and related equipment.

9. Electrical equipment, instrumentation, and controls.

10. Lighting fixtures.

11. Remote Pump Monitoring and Control Systems.

12. Chemical feed equipment.

13. HVAC equipment.

14. Hot mix and stone.

1.7.1 PRODUCT OPTIONS

A. Where a particular manufacturer’s product is specified, provide the product named. Substitutions may be considered, unless otherwise indicated.

B. Where a list of manufacturers’ products is specified, provide one of the products named. Substitutions may be considered, unless otherwise indicated.

C. Where a product or list of products is specified, including the term "or approved equivalent" or "approved equal", provide one of the products listed or another product that complies with requirements. Submit the following, in addition to other required submittals, to obtain approval of an unnamed product:

1. Evidence that the proposed product will produce the required results, and that it is compatible with other portions of the work.

2. A detailed comparison of significant qualities of the proposed product with the specified product(s).

3. Significant qualities include attributes such as performance, weight, size, materials of construction, durability and specific features.

4. Evidence that proposed product provides an equivalent warranty.

5. A list of completed product installations for similar projects with contact names and addresses if requested.

6. Samples, if requested.

1.7.2 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall provide two (2) paper copies and two (2) digital copies of manufacturer's operation and maintenance manual for the items listed below, and for any other items as directed in writing by the Engineer:

a. Pumps

b. Valves

c. Emergency generators

d. Automatic transfer switches

e. Control panels

f. Remote Pump Monitoring and Control System

g. Chemical feed systems

h. HVAC equipment

B. The manuals shall be provided in suitable binders and include spare parts lists, printed instructions and diagrams required for installation, service, repair or replacement, and the name, address and phone number of agency that will make repair or replacement during warranty period, and/or where spare parts

may be obtained.

1.7.3 WARRANTY

A. The Contractor shall warrant that all workmanship, material, and equipment furnished and installed by him shall be free of defects for a period of two (2) years after acceptance by the Town. In the event that portions of a project are accepted individually, the warranty shall be for two (2) years after each certificate of acceptance. Should such defects appear, the Contractor shall repair or replace such defects at no cost to the Town. The warranty will encompass at a minimum the following items:

1. Against all faulty materials and against all imperfect, careless, and unskilled workmanship.

2. That the entire equipment and each and every part thereof shall operate (with proper care and attention) in a satisfactory and efficient manner, and in accordance with the requirements of these specifications.

3. That all structures shall be watertight and leakproof at every point, and in every particular.

4. The Contactor agrees to replace, with proper workmanship and materials, and to reconstruct, correct, or repair, without cost to the Town, work which is improper, imperfect, does not operate in a satisfactory manner, fails to perform as specified, or all of these.

5. The guarantee obligations assumed by the Contractor under the contract documents shall not be held or' taken to be in any way impaired because of the specifications errors, indication of approval by or on behalf of the Town of articles, materials, means, combinations or' things used in the construction, performance and completion of the work or any part thereof, or all of these.

6. No use acceptance by the Town of the work or any part thereof, nor any failure to use the same, nor any repairs, adjustments, replacements or corrections made by the Town due to the Contractor's failure to comply with his or her obligations under the contract documents, shall impair in any way the guarantee obligations assumed by the Contractor under the contract documents.

7. Should the Contractor fail or refuse to remove and renew defective materials used or work performed previously or to make any necessary repairs: in an acceptable manner, and in accordance with the requirements of these specifications, within the time indicated in writing, the Town shall have the authority to cause the unacceptable or defective materials or work to be removed and renewed or such repairs to be made at the Contractor's expense.

1.8 PERMITS, FEES, AND NOTICES

A. The Contractor shall pay taxes, royalties, and fees, and secure licenses and permits that are required, during the time of the contract, by local, county, state and federal laws, ordinances, rules, codes and regulations for the legal performance of the contract.

B. The Contractor shall perform the work in accordance with notices issued by public authorities having jurisdiction over the work including but not limited to Delaware Department of Transportation (DelDOT), Delaware Department of Health and Social Services, and DNREC Sediment and Stormwater Management Program or their delegated agency.

C. If the Contractor performs work, knowingly or ignorantly, contrary to requirements of local, county, state and federa11aws, ordinances, rules, codes and regulations, he or she shall assume full responsibility therefore and shall bear all costs of suits, actions and damages resulting from his or her illegal work performance.

1.9 PERFORMANCE (GUARANTEE) BOND

A. The Developers of major subdivisions and any other project deemed appropriate by the Town, shall submit a Performance Bond in the amount of 150% of all improvements to be eventually taken over by the Town. These improvements may include, but are not limited to, the costs of installing streets, curb, and sidewalks; water and sewer utilities and appurtenances; storm sewer pipes and catch basins; street lighting; and any other improvements that the Town deems necessary for bonding.

B. The Performance Bond shall be in a form acceptable to the Town, and it shall include an agreement which defines the terms of the bond. The Bond and agreement shall be submitted to the Town for review and approval.

C. The Performance Bond shall not be surrendered by the Town until the Mayor and Town Council have formally acknowledged Final Acceptance of the improvements; and not until a two (2) year Maintenance Bond has been submitted to and approved by the Town.

1.10 MAINTENANCE BOND

A. Following acknowledgement of Final Acceptance of a major subdivision or other project for which a Performance Bond has been required by the Town, the owner shall submit a Maintenance Bond to the Town for review and approval. The Bond shall be in an amount equal to 10% of the Performance Bond; or in an amount equal to the portion of the Performance Bond which the Town will release. The term of the Maintenance Bond shall be a period of two (2) years, unless otherwise specified for the project, which shall begin on the date of the Town’s acknowledgement of Final Acceptance.

B. The Maintenance Bond shall be in a form acceptable to the Town, and it shall include an agreement which defines the terms of the Bond.

1.11 INDEMNIFICATION

A. The Contractor shall indemnify and hold harmless the Town, and all who represent them, from" and against claims, damages, losses and expenses arising out of the Contractor's

performance of the work, provided such claim, damage, loss and expense" are related to:

1. Bodily injury, sickness, disease or death, or to injury to tangible property, including the loss of use resulting there from, and

2. Negligence, recklessness and/or malfeasance of the Contractor or his or her subcontractors and others directly related to the project, or both.

1.12 COOPERATION OF CONTRACTOR AND REPRESENTATIVE

A. The Contractor shall give the work his or her constant attention to facilitate the progress thereof and shall cooperate with the Town. The Contractor shall have at all times a competent and reliable English-speaking representative on the work, authorized to receive orders and act for him or her.

1.13 COOPERATION WITH OTHER CONTRACTORS

A. The Contractor shall cooperate with and so conduct his or her operations as not to interfere with or injure the work of other contractors or workmen employed by the Town. He or she shall promptly make good, at his or her own expense, any injury or damage which may be done by him or her or his or her employees or agents on the work.

B. The Contractor shall suspend such part of the work herein specified, or shall carry on the same in such manner, as may be ordered by the Town.

1.14 DEFECTIVE MATERIALS AND WORK

A. The materials and work as described and outlined in these specifications are for the sole purpose of maintaining quality, conformity, and safety in all project construction (and materials used) performed within the town limits and authority of the Town of Georgetown. All materials not conforming to the requirements of these specifications shall be considered as defective, and all such materials whether in place or not, shall be rejected and shall be removed immediately from the work unless otherwise permitted. No material which has been rejected, the defects of which have been corrected or removed, shall be used until approval has been given. All work which has been rejected or condemned shall be remedied, or if necessary, removed and replaced in an acceptable manner by the Contractor at his/her own expense.

1.15 FAILURE TO REMOVE AND RENEW DEFECTIVE MATERIALS AND WORK

A. Should the Contractor fail or refuse to remove and renew defective materials used or work performed previously or to make any necessary repairs: in an acceptable manner, and in accordance with the requirements of these specifications, within the time indicated in writing, the Town shall have the authority to cause the unacceptable or defective materials or work to be removed and renewed or such repairs to be made at the Contractor's expense.

1.16 LAWS TO BE OBSERVED

A. The Contractor shall observe and comply with federal, state, county, and local laws, ordinances, rules, regulations, decrees and orders that are in effect and applicable to the work during the time of construction; and he or she shall see that his or her subcontractors

likewise meet this requirement. He shall indemnify, and hold harmless, the Town and its representatives against claims and liability arising from Contractor's and/or subcontractor's violations of such laws, ordinances, rules, regulations, decrees, and orders, whether such violations be by the Contractor or any Subcontractor, or any of their agents and/or employees.

1.17 LINES, GRADES AND ELEVATIONS

A. The Contractor shall be responsible for layout of the lines, grades, and elevations of the work and shall conform his or her work thereto.

B. The Contractor shall furnish the Town, at least five days prior to the start of construction, two record copies of line and grade stakeout data as well as cut sheets for approval. The furnishing of such record data shall in no way release the Contractor from his or her responsibility for the completeness and accuracy of stakeout work necessary for construction.

C. All survey and stakeout work shall be done by qualified licensed personnel subject to the approval of the Town.

D. All proposed manholes, catch basins, etc., shall be field located by the Contractor prior to the start of construction. Notice shall be given to the Town to observe the location and make any adjustments deemed necessary.

1.18 SANITARY PROVISIONS

A. The Contractor shall provide and maintain in a neat and sanitary condition such sanity conveniences and accommodations for the use of his or her employees as may be necessary to comply with the requirements and regulations of the Department of Health or of other bodies or tribunals having jurisdiction thereof. He shall commit no public nuisance.

1.19 PUBLIC CONVENIENCE AND SAFETY

A. The Contractor shall conduct the work in a manner that will minimize obstruction to traffic in the area. The safety and convenience of the general public and of the residents and occupants of property along and adjacent to the work shall be provided in an adequate and satisfactory manner. Footways and portions of highways and streams adjoining the work shall not be obstructed more than absolutely necessary. In no case shall any traveled thoroughfare be closed without permission of the Town.

B. Fire hydrants on or adjacent to the work shall be kept accessible to fire apparatus at all times, and no obstructions shall be placed within 15 feet of a hydrant.

C. Gutters and storm drain inlets shall be kept unobstructed at all times, except as temporarily required to prevent entrance of construction related debris.

D. In order to protect the lives and health of his or her employees, the Contractor shall comply with all pertinent provisions of the Contract Work Hours and Safety Standards Act, as

amended, commonly known as the Construction Safety Act as pertains to health and safety standards; and shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under contract.

1.20 ACCESS BY RESIDENTS AND BUSINESSES

A. The Contractor shall schedule his work so as to minimize the time during which vehicular access to each dwelling along the work route is prevented. The Contractor shall provide, at all times, safe pedestrian access to all dwellings.

B. Vehicular access on side streets, in the proximity of the route of the work, shall not be encumbered by the Contractor.

C. Public access to businesses shall be provided during all periods of construction.

1.21 DETOURS

A. Detours may be requested by the Contractor. Traffic may be detoured over approved routes along existing roads with written approval of the Town and/or DelDOT (if applicable). The Cost of all work associated with any detour, including revisions to the M.O.T. plans and erection and maintenance of the detour signs, etc., is to be borne by the Contractor.

B. The Contractor shall notify the Town and/or DelDOT (if applicable), local fire companies, post office and the school district of all proposed detours seven (7) days prior to implementation of any detour.

1.22 BARRICADES, DANGER, WARNING, AND DETOUR SIGNS

A. The maintenance of traffic shall be in accordance with a Town and/or DelDOT approved Maintenance of Traffic (MOT) Plan. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient lights, danger signals and signs, provide a sufficient number of watchmen and take all necessary precautions for the protection of the work and safety of the public. Highways closed to traffic shall be protected by effective barricades, on which shall be placed acceptable warning signs. All signage materials and placement; and all flagging, staging, and personnel shall be in accordance with current DelDOT requirements. The Contractor shall detour traffic and shall furnish and maintain all detour signs required to direct traffic over the entire route of the detour. Costs for maintaining traffic shall be the responsibility of the Contractor.

1.23 WORK WITHIN STATE RIGHT-OF-WAY

A. All materials and construction methods for work affecting DelDOT jurisdiction shall be done in complete accordance with permit and/or franchise stipulations or directives issued by same. All costs for such work shall be the responsibility of the Contractor.

B. Maintenance of traffic shall be accomplished in full accordance with current DelDOT

requirements. Work in DelDOT right-of-way shall not commence without an approved MOT plan.

1.24 PRESERVATION AND RESTORATION OF PROPERTY

A. Easements for proposed work on private property shall be submitted to the Town for review and approval during the plan review process. The Contractor shall not enter private property without an easement approved by the Town, or in the case of "minor" and unanticipated necessary encroachment, permission from the property owner that is first verified by the R.P.R. or Town inspector.

B. The Contractor shall take necessary measures to preserve public and private property, including paving and lawns outside the required excavation lines, adjacent to the property. He shall not permit monuments to be moved until an authorized agent has referenced their locations, and until directed to move them. The Contractor shall pay all expenses for replacing property markers disturbed. Replacement shall be by a surveyor licensed in the state of Delaware.

C. The Contractor shall be responsible for damages to public and private property whether caused by himself, his or her subcontractors, or as a result of negligent construction methods. Contractor shall provide restoration of damaged property to its original condition, or better, at no additional cost to the Town. If the contractor fails to restore such property, the Town may, upon 48-hours notice, have property restored at the Contractor's expense.

1.25 EROSION AND SEDIMENT CONTROL

A. The Contractor shall provide for safe disposal of run-off from construction areas in accordance with current DNREC erosion and sediment control requirements. Such requirements may be defined in the approved construction drawings, or ordered during construction by the controlling agency, the Town, or the Engineer. The cost of erosion and sediment control shall be the responsibility of the Contractor.

1.26 CONTRACTOR'S RESPONSIBILITY FOR WORK

A. Until final acceptance of all the work has been indicated in writing by the Town, the work shall be under the charge of and care of the Contractor. He shall take every precaution against destruction of, injury, or damage to the work or to any part thereof from any other cause whatsoever. The Contractor shall rebuild, repair, restore, and make good, at his or her own expense, any destruction to, injury of, or damage made to the work before its final completion. Acceptance of any restored, rebuilt or repaired work shall be indicated in writing by the Town.

B. Contractor shall furnish, and maintain in safe working condition, equipment necessary to properly perform the work in the scheduled time.

1.27 SUBCONTRACTORS

A. The Contractor shall give his personal attention to the faithful performance of the work, shall keep the same under his own control, and shall not assign the contract by power of

attorney or otherwise. No sub-contractor shall be engaged upon any branch of the work, who is not thoroughly practical and reasonable, and at the time of making this contract conducting business in the particular branch of trade for which he is employed.

B. If the Town or Engineer objects to any proposed sub-contractor, materials or equipment supplier, the Contractor shall furnish such data as may be required to secure the Town's and Engineer's approval. If such approval is not then forthcoming, the Town and the Contractor will negotiate the matter to a mutually acceptable conclusion.

C. The Contractor shall not be released from any of his liabilities or obligations should any sub-contractor or sub-contractors fail to perform in a satisfactory manner the work undertaken by him or them.

D. The Contractor agrees that he is as fully responsible to the Town for the acts and omissions of his sub-contractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

E. Nothing contained in any document shall create any contractual relation between any subcontractor and the Town.

1.28 CONTRACTOR'S EMPLOYEES

A. Employees of the Contractor or persons connected with the Contractor shall be discharged upon request of the Town for any or all of the following reasons:

1. Directing profanity or abusive language, or both, at the Resident Project Representative and/or other Town representatives.

2. Interfering with Resident Project Representative and/or other Town representatives in performance of their work.

3. Disobeying or evading, or both, instructions of the Resident Project Representative and/or other Town representatives.

4. Carelessness or incompetence, or both.

5. Discharged employees shall not be rehired without the consent of the Town.

1.29 TEST OF SAMPLES OF MATERIALS

A. Tests of materials shall be made at the Contractor's expense, by a certified testing laboratory, in accordance with the officially approved methods as described or designated. The Town reserves the right to conduct verification testing at its own expense.

1.30 STORAGE OF MATERIALS

A. Materials shall be stored so as to insure the preservation of their quality and fitness for the work. When considered necessary, they shall be placed on wooden platforms or other hard clean surfaces, and not on the ground, and shall be placed under cover when

directed. Stored materials shall be located so as to facilitate prompt inspection. Lawns, grass plots, or other private property shall not be used for storage purposes without written permission of the owner or lessee.

1.31 QUALITY OF MATERIALS AND WORKMANSHIP

A. Materials and workmanship shall be of best possible quality and feasibility for the intended purpose, whether or not a brand name *is* specified. Materials shall be new and unused, and they shall be in accordance with approved shop drawings where such drawings submissions are required.

B. Representative preliminary samples of materials may be requested by the Town for examination or testing, or both. Materials, for which samples are submitted to the Town, shall not be ordered by Contractor until the Town furnishes written approval of said samples. Materials may be further inspected by the Town during preparation and construction of the work; materials found to be substandard will be rejected.

1.32 CLEAN UP

A. The Contractor shall, at his or her own expense, keep the sites of his or her operations clean during construction and remove all rubbish as it accumulates.

B. Upon failure of the Contractor to keep the sites of his or her operations clean to the satisfaction of the Town, the Town may, upon 24 hours notice to the Contractor, remove rubbish, as *is* deemed necessary, and charge the cost thereof to the Contractor.

C. On or before the completion of the work, the Contractor shall, without charge therefore, tear down and remove all his or her buildings and temporary structures built by him or her, shall remove all rubbish of all kinds from any grounds which he or she has occupied, and shall leave the site of the work in a clean and neat condition.

1.33 TEMPORARY SUSPENSION OF WORK

A. The Town shall have the authority to suspend the work, wholly or in part, for such period or periods as he or she may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for the suitable execution of the work, or for such time as is necessarily due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract. If it should become necessary to stop work for an indefinite period, the Contractor shall store all materials in such manner that they will not obstruct or impede the traveling public unnecessarily nor become damaged in any way, and he or she shall take every precaution to prevent destruction, damage or deterioration of the work performed, provide suitable drainage by opening ditches, shoulder drains, etc., and erect temporary structures where necessary. The Contractor shall not suspend the work without authorization. Neither the failure of the Town to notify the Contractor to suspend the work on account of bad weather or other unfavorable conditions nor permission by the Town to continue work during bad weather or other unfavorable conditions, shall be a cause for the acceptance of any work which does not comply in every respect with the contract and specifications.

1.34 CONDITIONAL ACCEPTANCE

A. Whenever, in the opinion of the Town, the Contractor shall have the work in an acceptable manner in accordance with the terms of the contract, the Contractor shall arrange for start-up of each facility and an inspection of the entire work by the Town and upon completion of all repairs or renewals which may appear at the time to be necessary, the Town will conditionally accept the work.

1.35 MAINTENANCE, REPAIRS, ETC., AFTER COMPLETION

A. The Contractor, at his or her entire cost and expense, shall maintain all portions of the work to meet the requirements of these specifications for and during the period of one (1) month from and after the date of the conditional acceptance of the entire work by the Town, and, in addition, shall at his or her entire cost and expense, make all repairs and replacements of the work and appurtenances which may become necessary, in the judgment of the Town at any time or times, during the following one (1) month period, on account of any failures or defects in said work and appurtenances due to improper work done or materials furnished by the Contractor.

1.36 FINAL ACCEPTANCE

A. For projects where the Contractor is under Contract directly with the Town:

1. One (1) month after the date of conditional acceptance of the work, the Town shall make a final inspection of the entire work, witness and approve the satisfactory operation of all facilities and complete restoration, and upon completion of all repairs or renewals which may appear at that time to be necessary in the judgment of the Town, shall certify in writing as to the final acceptance of the entire project.

B. For projects where the Contractor is under Contract with an owner other than the Town, such as a major subdivision or other project involving infrastructure which will be taken over by the Town, the Town shall not grant Final Acceptance until the following have been satisfied:

1. All monumentation must be complete.

2. All improvements to be taken over by the Town must be completed to the satisfaction of the Town, except, in the case of a major subdivision, the topcoat of asphalt.

3. In the case of a major subdivision, the ownership of no lots or parcels shall be transferred until the Town has granted Final Acceptance of the project or the current phase.

4. A Maintenance Bond in the amount of 10% of the amount of any Performance Bond must be submitted to the Town for review and approval. Final Acceptance will not be granted until the Maintenance Bond has been approved. The term of the Maintenance Bond shall be two (2) years, unless otherwise specified. When Final Acceptance has been granted, the Performance Bond will be released, except that the cost of any remaining topcoat of asphalt which has not yet been installed shall remain bonded in an amount of 150% of the value until it has been installed.

5. All rights-of-way to be taken over by the Town must be formally deeded to the Town, at the expense of the Grantor.

6. A Bill of Sale for all items which will be taken over by the Town must be submitted, reviewed, and approved.

7. Unconditional Releases of Liens from the General Contractor, all sub-contractors, and all major material suppliers must be submitted and approved by the Town.

8. The record ("as-built") drawing submission must be reviewed, and approved by the Town.

1.37 TERMINATION OF MAINTENANCE PERIOD(S)

A. It shall be the Contractor's responsibility to notify the Town prior to the termination of any two (2) year maintenance period.

B. Upon being notified that any maintenance period is near the termination point, the Town shall perform an inspection of the items for which the bond applies. The Town shall, if necessary, generate a punch list and provide a copy to the Contractor. When all items are acceptable to the Town, the Maintenance Bond, or its unused portion, shall be released by the Town.

1.38 UNLIMITED LIABILITY OF CONTRACTOR

A. It is understood and agreed that any and all of the duties, liabilities and/or obligations imposed upon or assumed by the Contractor by or under these specifications, shall be taken and construed to be cumulative, and that the mention of any specific duty, liability or obligation imposed upon or assumed by the Contractor under these specifications shall not be taken or construed as a limitation or restriction upon any or all of the other duties, liabilities and/or obligations imposed upon or assumed by the Contractor.

1.39 WORK HOURS

A. No work between the hours of 6:00 PM and 7:00 AM shall be permitted without first obtaining written permission of the Town.

1.40 LEGAL HOLIDAYS

A. The Contractor will not be permitted to work on Sundays or days which are legal holidays in the Town of Georgetown, except in cases of emergency, and only with the written permission of the Town.

B. If the Contractor desires to work upon any such legal holidays, he or she shall notify the Town in writing at least two (2) days in advance of such holiday stating that he or she desires to work and the location of the proposed work The Town reserves the right to deny or approve the Contractor's request.

1.41 SCHEDULE OF CONSTRUCTION

A. The Contractor shall complete the utility or street construction contract according to a schedule of construction as submitted by the Contractor and approved by the Town. Submit three copies for approval.

1.42 LOCATION OF EXISTING UTILITIES

A. The Contractor shall contact "Miss Utility", or other such appropriate telephone number, at (800) 282-8555 at least 48 hours prior to digging in the vicinity of existing underground utilities to have them located and marked. It shall then be the Contractor's responsibility to verify these utilities, by test pits, a minimum of fifteen (15) days in advance of actual construction operations in the vicinity of the utilities.

B. The failure to show on the contract documents any existing utilities shall not relieve the Contractor of his or her responsibilities of determining the location of these utilities, and any damage to the utilities or interruption of service shall be repaired by the Contractor according to the Town or utility company specifications. The Town shall be notified of any damage to any utilities.

1.43 EXISTING WATER AND SEWERAGE SYSTEMS

A. It is essential that the existing water and sewerage systems remain in operation throughout the construction period. Connections to existing pipes and structures shall be scheduled and coordinated with the Town. Although some interruptions in service may be impossible to avoid, the Contractor shall make every effort to keep these interruptions to a minimum.

B. Certain connections to existing systems might have to be made during weekends or nighttime hours. This determination shall be made by the Town.

1.44 WATER SUPPLY

A. The Contractor shall at his or her own cost provide such quantities of clean water as may be required for any and all purposes under the contract. He shall supply sufficient drinking water to all his or her employees.

1.45 RIGHT-OF-WAY AND LOT LINE MONUMENTATION REQUIRED

A. Monuments must be set at all points of deflection of newly formed or existing (if not found) right-of-way and lot lines and curves. In the case of major subdivisions, monumentation must be complete and included in the record (as-built) submission prior to Final Acceptance; and in the case of minor subdivisions, the monumentation must be complete prior to the issuance of a Certificate of Occupancy.

END OF SECTION

SECTION 2 – EARTHWORK

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SECTION 2 – EARTHWORK

2.1 CLEARING AND GRUBBING

A. Clearing and grubbing shall consist of clearing, grubbing, stockpiling, removing, and disposing of all vegetation and debris, except such objects as are designated to remain or are to be removed. This work shall also include the preservation from injury or defacement of all vegetation, trees and objects designated to remain and the restoration of those objects designated for preservation that have been injured or defaced.

B. All materials removed by the clearing and grubbing operation shall be disposed of in accordance with all state and local regulations.

C. Trees, shrubbery, plants, and other objects which are not to be removed shall be protected from damage. If any plants are damaged, they shall be either replaced or repaired by the Contractor or by a competent tree surgeon. Paint required for cut or scarred surfaces of trees or shrubs selected for retention shall be asphaltum base paint prepared specifically for tree surgery.

D. Grading operations shall not be started in any area until all the operations of clearing and grubbing within the area affected have been completed. In areas where excavation is to be made, the ground shall be cleared of all living or dead trees, stumps, brush, or other objectionable materials. All stumps, root mats, etc., shall be removed to a depth of 2 feet below the subgrade or slope surfaces. All depressions made below the subgrade or slope surfaces by the removal of stumps or roots shall be backfilled with approved material and compacted as directed.

2.2 EXCAVATION AND BACKFILL FOR TRENCHES

A. This item includes all excavation and backfilling. The Contractor shall provide all labor and materials required for the excavation and backfill of utility trenches, including but not limited to sheeting, shoring, sheet piling, and bracing; pumping or other approved methods to keep excavations free of water and other liquids; accommodation of sewage and drainage flows; support and protection of utilities and other structures encountered in the work; furnishing and maintaining adequate barricades, warning signs, lights, and other means of protecting the public; disposal of surplus excavated materials and the restoration of the site. All excavations shall be in accordance with OSHA guidelines. Braced excavations shall be designed by a Delaware registered professional engineer.

B. The trench subgrade shall provide uniform and continuous bearing and support on solid undisturbed earth for the full length of each pipe, except for that portion of the bell hole. Any part of the bottom of the trench excavated below the specified subgrade shall be corrected with approved material and thoroughly compacted. Where the bottom of the trench excavation is unstable or unsuitable material is present, including ASTM Class IV and Class V material, the excavation shall be carried to such depth as directed by the Town. The trench bottom shall be restored to subgrade with stone bedding.

C. Bell-holes shall be excavated in the bottom and sides of trenches to permit the proper installation of pipe joints.

D. The sides and ends of all excavations or structures shall be supported, when necessary, with soldier piles and lagging, sheeting and shoring, trench boxes, etc. to maintain a stable excavation and prevent damage to adjacent public and private property.

E. All excavation bracing shall be removed as trench backfilling is completed, except where and to such extent as the Town directs the Contractor to leave the shoring in place. The Contractor shall cut off any bracing left in place at least 18 inches below finished grade wherever directed and shall remove the material cut off.

F. The Town may at any time request the immediate backfill of open trenches over completed pipeline, if in Town's judgment, such action is necessary. If work is stopped on any trench, for any reason except by direction of the Town, and the excavation is left open for an unreasonable length of time in advance of construction, the Contractor shall, if so directed, backfill the trench, and shall not again excavate the trench until Contractor is ready to complete the utility installation. If the Contractor fails to refill the trench completely within 48 hours after notice, the Town shall authorize the work to be completed at the expense of the Contractor.

G. All excavations shall be kept free of water to below the trench subgrade. This may be accomplished by ordinary pumping methods, use of underdrains, or by well points, whichever will produce the required results. Well points shall be installed to maintain a stable excavation and in accordance with all State of Delaware regulations and requirements. Water removed from an excavation shall be disposed of in a manner as to not cause injury to public health, private property, street systems and embankments, or to any portion of the work completed or in progress.

H. Detection and warning tape shall be provided for all buried utilities and shall be of the metallic type with metal foil running the full length and width of the tape. Detectable warning tape shall be as manufactured by Pro-Line Safety Products Company or equivalent. Tape shall have a solid aluminum core, be 6 inches wide and minimum 5.0 mil’s thick, encased in a high visibility color coded and reverse printed polypropylene film that has diagonal stripes and continuous identification legends clearly imprinted on it. Colors and legends shall be in accordance with the American Public Works Association's recommended color code and the following:

Utility	Color	Legend
Electric	Safety Red	Caution buried electric line below
Gas, Oil, Flammable Materials	High Vis. Yellow	Caution buried gas line below
Telephone Communications	Safety Orange	Caution buried telephone line below
Fiber Optic Cable	Safety Orange	Caution buried fiber optic cable below
Water Systems	Safety Blue	Caution buried water line below
Sewer Systems	Safety Green	Caution buried sewer lines below
Sewer Force Mains	Safety Green	Caution buried force main below
Reclaimed Water	Safety Purple	Caution buried reclaimed water line below
Storm Sewers	Safety Green	Caution buried storm sewer line below

I. Detection and warning tape shall consist of detectable metallic tape placed directly above the utility. The depth at which the detectable tape is buried is determined by the depth of

the trench. Tape shall be installed at half of the trench depth. At no time shall detectable tape be placed at a depth less than 6 inches or more than 36 inches.

J. Material excavated from the trench may be used for backfill, provided that, in the opinion of the Town, the excavated material is suitable for backfilling.

K. Trench backfill shall be carefully deposited in the trench by methods which will not damage or disturb the pipe or structures and shall be firmly tamped around the pipe or structure. Care shall be taken to assure that sufficient soil material has been worked under the haunch of the pipe to provide adequate side support. Precautions shall be taken to prevent movement of the pipe during placement of the material under the haunch.

L. The trench shall be refilled in 8-inch compacted layers. All compaction of material from the bottom of the trench to the spring line of the pipe shall be done by pneumatic hand tampers; or if the material is composed largely of coarse aggregate, the use of other hand tampers may be required.

M. The moisture content of the material being compacted shall be within plus or minus three (+/-3) percentage points of optimum, as determined by ASTM D 1557. Material containing an excess of moisture shall be processed and dried, or permitted to dry until the moisture content is within the specified range. The processing shall include removal of large rocks, root matter and other foreign material prior to use as backfill. Material which is too dry shall be wetted until the moisture content is within the specified range.

N. Each layer of trench backfill under pavement or shoulders, including existing or proposed, shall be compacted to 95 percent or more of the maximum density, as determined by ASTM D 1557. Backfill not under existing or proposed pavement or shoulders shall be compacted to 90 percent or more of the maximum density, as determined by ASTM D 1557.

O. Testing of the compaction of fill shall be performed by the Contractor’s testing agency, Copies of the test results shall be provided to the Town. The Town’s Engineer may perform in-place density testing during trench backfill and compaction, or upon completion of the backfill operations. If the results of any tests show that backfill does not meet the specified compaction requirements, the Contractor shall correct the condition in such portions of the trench represented by the unsatisfactory test results.

P. Backfill of all excavations not in paved areas shall be restored to the condition that existed prior to beginning work and maintained for a period of 12 months following the date of acceptance.

Q. The Contractor shall maintain all backfilled excavations. The trench surfaces shall be reshaped where necessary. All depressions developing following excavation and backfill shall be properly refilled. If the Contractor fails to make repairs within 48 hours after receipt of written notice from the Town, the Town may backfill the depression or install temporary protection and signage without notice to the Contractor, and the cost of so doing shall be paid by the Contractor.

R. The Contractor shall be responsible for any injury or damage that may result from lack of maintenance of backfilled excavations at any time prior to the date of final acceptance.

S. After completion of backfilling, all unused material shall be removed and properly disposed of by the Contractor in accordance with current regulatory requirements and contract requirements. All roads, sidewalks, and other places within the project boundaries shall be left clean and in good order.

2.3 EXCAVATION AND REFILL FOR STRUCTURES

A. The Contractor shall perform all excavation, refill, and filling, and shall provide all fill material required for the construction of structures including but not limited to sheeting, shoring, sheet piling, and bracing; pumping or other approved methods to keep excavations free of water and other liquids; accommodation of sewage and drainage flows; support and protection of utilities and other structures encountered in the work; furnishing and maintaining adequate barricades, fencing, warning signs, lights, and other means of protecting the public; disposal of surplus excavated materials and the restoration of the site.

B. Where structure or structure footings are to bear on material other than rock or piles, care shall be taken so as not to disturb the bottom of the excavation. After each excavation is completed, the Contractor shall proof-roll the subgrade in the presence of the Town. No stone bedding, steel reinforcement, or concrete shall be placed until the Town has reviewed the proof-rolling and the condition of the subgrade.

C. The Contractor shall be required to maintain structure excavations dewatered during construction activities by such methods as the Contractor deems necessary. This may be accomplished by ordinary pumping methods, use of underdrains, or by well points, whichever will produce the required results. Well points shall be installed in accordance with all State of Delaware regulations and requirements. Water removed from an excavation shall be disposed of in a manner as to not cause injury to public health, private property, street systems and embankments, or to any portion of the work completed or in progress.

D. The Contractor shall support the sides and ends of all excavations and structures shall be supported, when necessary, with soldier piles and lagging, sheeting and shoring, trench boxes, etc. to maintain a stable excavation and prevent damage to adjacent public and private property Braced excavation shall be designed by a Delaware registered professional engineer.

E. All excavation bracing shall be removed as trench backfill is completed, except where and to such extent as the Town’s Engineer directs the Contractor to leave the shoring in place. The Contractor shall cut off any bracing left in place at least 18 inches below finished grade wherever directed and shall remove the material cut off.

F. Excavated material may be used for backfill provided that, in the opinion of the Engineer, the excavated material is suitable.

G. All excavated material not required or suitable for backfill or other designated purposes shall be removed from within the limits of the work and disposed of by the Contractor.

H. No backfill shall be placed against any new concrete or masonry structure until all of the provisions for curing, dampproofing, and/or waterproofing have been complied with, and

until the compression strength testing of concrete cylinders prepared during concrete placement indicate that the concrete has obtained the desired compressive strength. Concrete compressive strength test results shall be provided to the Town for their review.

I. Backfill material shall be placed in uniform layers not more than 8 inches thick. Each layer shall be uniformly compacted to 95 percent or more of the maximum density, as determined by ASTM D 1557, before the next layer is placed. The placement and compaction of backfill material shall be monitored and tested by the Contractor's testing agency. Daily field reports, including observations and test results shall be provided to the Town for their review.

J. The moisture content of the material being compacted shall be within plus or minus three (+/-3) percentage points of optimum, as determined by ASTM D 1557. Material containing an excess of moisture shall be processed and dried, or permitted to dry until the moisture content is within the specified range. Material which is too dry shall be wetted until the moisture content is within the specified range.

K. The Engineer may perform in-place density testing during backfill placement and compaction or upon completion of the backfill operations. If the results of any tests show that backfill does not meet the specified compaction requirements, the Contractor shall correct the condition.

L. Backfill of all excavations not in paved areas shall be restored to the condition that existed prior to beginning work and maintained for a period of 12 months following the date of final acceptance.

M. The Contractor shall maintain all backfilled excavations. All depressions developing following excavation backfill shall be properly refilled. If the Contractor fails to make repairs within 48 hours after receipt of written notice from the Town, the Town may backfill the depression or install temporary protection and signage without previous notice to the Contractor, and the cost of so doing shall be paid by the Contractor.

N. The Contractor shall be responsible for any injury or damage that may result from lack of maintenance of backfilled excavations at any time prior to the date of final acceptance.

O. After completion of backfilling, all unused material shall be removed and properly disposed of by the Contractor in accordance with current regulatory requirements and contract requirements. All roads, sidewalks, and other places within the project boundaries shall be left clean and in good order.

2.4 DEWATERING

A. All excavations must be kept free of water below the subgrade of the work while work is in progress. This may be accomplished by ordinary pumping methods or by well points, whichever will produce the required results. Upon removal of dewatering equipment, the Contractor shall backfill all holes and restore disturbed areas to their original condition.

B. Dewatering for the structures and pipelines shall commence when groundwater is first encountered and shall be continued until such time as backfill has been completed. No concrete footings shall be laid in water, nor shall water be allowed to rise over them until the concrete or mortar has set at least eight (8) hours. Groundwater shall not be allowed to

rise around the pipe until the trench is backfilled.

C. The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property. No water shall be drained into work built or under construction without prior consent of the Town. Water shall be disposed of in such a manner as not to be a menace to public health.

D. The Contractor shall remove any siltation deposits in storm sewer systems, resulting from his or her dewatering or construction operations. He shall also be responsible for conveyance of dewatering flows and for erosion and sediment control.

2.5 SHEETING, SHORING AND BRACING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support excavations more than 4 feet deep excavated through unstable soil, loose, or soft material. Provide sheeting, shoring, bracing or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at the completion of excavation work.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

2.6 SELECT BACKFILL

A. Should the Contractor encounter unsuitable material during excavation, he/she shall remove and dispose of such material.

B. Should sufficient suitable material from excavations of the project not be available for backfill, the Contractor shall furnish Backfill (Type C in accordance with the DelDOT Standard Specifications, latest edition), upon approval of the Town.

C. The Contractor shall furnish certification that his borrow is from a DelDOT approved source.

2.7 TEMPORARY REPAVING

A. The Contractor shall furnish, place and compact two (2) inches of cold patch as temporary pavement surface over all backfill areas created for pipeline and structure installation located in roadways or driveways. This surface shall be maintained by the Contractor until permanent surface restoration has been performed.

B. Should the Contractor remove existing pavement beyond the width specified or detailed on the plans, or should pavement be disturbed from settlement, slides or other

construction activities, he shall saw cut back the pavement and provide temporary paving in these areas.

C. On state highways and all other areas over which the Delaware Department of Transportation exercises jurisdiction, all pavement restoration shall be done in accordance with the permit requirements of the Division of Highways.

2.8 PERMANENT PATCH REPAVING

A. The Contractor shall furnish, place and compact eight inches (8") of BCBC or six inches (6") of Class A Concrete. Contractor shall place a minimum of two inches (2") of Type C Hot Mix or match existing pavement thickness (whichever is greater).

B. Contractor shall, at a minimum, place concrete or BCBC one foot (1') wider than the pipe trench and place hot mix one foot (1) wider than concrete or BCBC layer.

C. On state highways and all other areas over which the Delaware Department of Transportation exercises jurisdiction, all pavement restoration shall be done in accordance with the permit requirements of the Division of Highways.

2.9 SITE FINISHING AND RESTORATION

A. Non-paved areas disturbed by the construction shall be topsoiled, seeded, and mulched.

B. Excavation shall be carried to acceptable lines, grades, and slopes as indicated in the contract drawings. All earth slopes shall be finished to neat, regular lines.

C. For pipeline construction, the restoration of unpaved areas shall be accomplished at a uniform rate closely following installation of the pipeline. The area shall be neatly dressed within 1 week following backfilling operations and when the soil has consolidated after a period of time, the area shall be again dressed or permanently restored. Surface restoration shall be completed within 15 days after the installation of the pipeline.

D. The Contractor shall install and maintain erosion sediment controls to prevent the erosion of freshly graded areas during construction and restoration. All sedimentation and erosion control measures shall be in accordance with the Delaware Erosion & Sediment Control Handbook, latest edition.

E. The Contractor shall maintain restoration work for a period of 12 months after final acceptance. Maintenance of the restoration shall include all labor, equipment, material, and supplies necessary, including trench refill and additional topsoil, seeding, mulching, watering, and erosion protection.

2.10 TOPSOILING, SEEDING AND MULCHING

A. All disturbed areas not specified to be paved shall be topsoiled to a depth of 4 inches, seeded and mulched.

B. Before placing or depositing topsoil, the subgrade shall be approved by the Engineer. The topsoil shall be placed in reasonably close conformity to the desired lines, grades, and elevations.

C. Seeding shall consist of preparing the ground and furnishing and placing all lime, fertilizer, and seed on the areas to be seeded. Seeding shall not be done during windy weather or when the ground is frozen, excessively wet, or otherwise untillable. The Town reserves the right to stop seeding operations whenever conditions are determined to be unfavorable.

D. The area to be seeded shall be thoroughly loosened to a depth of 6 inches, and if just prior to seeding, the top 3 inches of soil is loose, friable, and free of large clods, rock, or other extraneous matter 1 inch or more in diameter, measured at the widest dimension; and if shaped to the prescribed grade, it shall be a satisfactory seedbed and require no further work. However, when the area to be seeded is partially sodded, barren, weedy, or packed and hard, any grass and weeds shall first be cut or otherwise satisfactorily removed; and the soil shall then be scarified or otherwise loosened to a depth of 4 inches. Clods and lumps shall be broken, rubbish, rocks, and other extraneous matter removed clear of the site; and the upper 3 inches shall be disked or otherwise worked into a satisfactory seedbed.

E. Limestone shall be applied at the rate of 3,000 pounds/acre. Fertilizer shall be applied according to the quantities of actual plant food/acre required for the seed mix.

F. The seeded area shall be mulched at a rate of 90 pounds per 1,000 square feet with either wood cellulose fiber mulch or straw mulch. A chemical mulch binder shall be used at the rate of 60 gallons/acre. Asphaltic-base binder shall not be permitted.

G. The following maintenance procedure shall be followed prior to acceptance:

1. Maintain surfaces and supply additional topsoil where necessary including areas affected by erosion.
2. Water to ensure uniform seed germination and to keep surface of soil damp.
3. Apply water slowly so that surface of soil will not puddle and crust.
4. Cut newly planted grass for the first time when it reaches a height of 2-1/2 inches and maintain a minimum height of 2 inches. Do not cut more than 1/3 of the blade at any mowing. Remove clippings.
5. After the first mowing, water grass sufficiently to moisten the soil from 3 inches to 5 inches deep.
6. Apply weed killer, if weeds start developing, during calm weather when air temperature is above 50 degrees.
7. Replant damaged grass areas showing root growth failure, deterioration, bare or thin spots and eroded areas.

H. Seeded areas will be accepted at the end of maintenance period when seed areas are properly established and otherwise acceptable.

2.11 LANDSCAPING

A. Replacement small trees and shrubs shall be furnished and installed in kind in the event that existing plants which are to remain are damaged beyond repair.

B. The Contractor shall backfill all areas following removal of trees and stumps, specifically designated for complete removal for the proper installation of facilities.

C. Tree removal shall include but not be limited to the removal of all roots and organic material to a depth of 18 inches below the surface. Blasting shall not be permitted as a method of removal. The excavated area shall be backfilled with select granular material.

D. All precautions customary in good trade practice shall be taken in preparing plants for transplanting. Plants transplanted with workmanship that fails to meet the highest standards will be rejected. All plants shall have firm, natural balls of earth of ample proportions and diameter as specified in the "USA Standard for Nursery Stock". Plants with cracked, broken, or crushed balls which occur either before or during planting operations, will be rejected and shall be removed from the site immediately. Bare root plants shall be dug with sufficient spread and depth of roots as to insure full and prompt recovery and development of the plants. All plants shall be handled so that roots are adequately protected and moist at all times. Material that cannot be planted immediately after delivery shall be adequately protected by covering with canvas, wet straw, burlap, moss, or other suitable material and kept covered until ready to be planted. Trees shall not be planted with frozen earth balls.

E. In all mass plant areas, the plants shall be evenly spaced to give uniform cover in the planting bed area. No planting shall commence until all locations are approved.

F. All trees and shrubs shall be planted in pits excavated with vertical sides. They shall be of such a depth that when planted and settled, the crown of the plant shall bear the same relation to finished grade as it did to soil surface in its place of growth. All backfill topsoil shall be covered with waterproof material after mixing. Pits shall be backfilled with specified soil mix and compacted firmly, especially under ball of roots to establish a firm foundation. Plants shall be set in the center of pits in a vertical position so that the crown of the plant is level with the finished grade after allowing for watering and settling of soil. The soil mixture shall be carefully and firmly worked and tamped under and around the base of the ball to fill all voids. When partially backfilled and compacted, the burlap shall be removed from the sides and tops of the balls and cut away to prevent air pockets, but no burlap shall be pulled from under the balls. A ring of earth shall be formed around the plant to produce a dish for watering. All plants shall be thoroughly watered immediately after planting. This shall mean complete saturation of all backfill in the pits and beds during the same day of planting. Care shall be taken during all planting operations to ensure that no excavated material is dumped on any grassed area unless a suitable type of matting or protective underlay is used.

G. Trees and shrubs shall be watered as necessary to maintain the plantings until established.

H. Trees, shrubs, and ground cover shall be mulched with a 2-inch cover of mulch. Mulch shall be placed the same day of planting. All trees shall be wrapped with the wrapping material overlapping 1-1/2 inches from the lowest main branches to the base of the tree. The wrapping shall be tied at the top and bottom, and at 1-foot intervals along the trunk with twine.

I. Upon the completion of the restoration of surfaces, final cleaning shall be done within the limits of the project and shall consist of completely cleaning the project of excess material, sweeping pavements and structures of dirt and rubbish, and the removal of any unused material which will mar the appearance of the project.

END OF SECTION

SECTION 3 – CONCRETE

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SECTION 3 – CONCRETE

3.1 DESIGN CRITERIA

A. Concrete in direct contact with sewage shall be 4,000 psi, Class B in accordance with Subsection 3.4 - MATERIALS, below. Concrete not in direct contact with sewage shall be 3,000 psi, Class C.

B. Concrete shall conform to all provisions of the "Specifications for Structural Concrete for Buildings", ACI 301, as published by the American Concrete Institute, except as modified herein.

C. Concrete shall conform to all provisions of the latest edition of the following publications which shall be incorporated as part of these Standard Specifications:

1.	ACI 304	Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
2.	ACI 305	Recommended Practice for Hot Weather Concreting
3.	ACI 306	Recommended Practice for Cold Weather Concreting
4.	ACI 315	Manual of Standard Practice for Detailing Reinforced Concrete Structures
5.	ACI 318	Building Code Requirements for Reinforced Concrete
6.	ACI 347	Recommended Practice for Concrete Formwork
7.	ACI 525	Minimum Requirements for Thin-Section Precast Concrete Construction
8.	ASTM C31	Method of Making and Curing Concrete Test Specimens in the Field
9.	ASTM C33	Specification for Concrete Aggregate
10.	ASTM C39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
11.	ASTM C138	Test for Weight per Cubic Foot, Yield and Air Content (Gravimetric) of Concrete
12.	ASTM C143	Test Method for Slump of Portland Cement Concrete
13.	ASTM C150	Specification for Portland Cement
14.	ASTM C172	Method of Sampling Freshly Mixed Concrete
15.	ASTM C173	Test for Air Content of Freshly Mixed Concrete by the Volumetric Method
16.	ASTM C231	Test Method for Air Content of Freshly Mixed Concrete by Pressure Method
17.	ASTM C685	Specification for Concrete Made by Volumetric Batching and Continuous Mixing
18.	AWS B3.0	Standard Qualification Procedure
19.	AWS D1.0	Code for Welding in Building Construction
20.	AWS D1.1	Recommended Practice for Welding Reinforcing Steel, Metal
21.	CRSI 65	Recommended Practice for Placing Bar Support

3.2 SUBMITTALS

A. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

B. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315R, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

C. Drawings-Fabrication/Erection/Installation: Drawings for reinforcement and accessories, without reference to the contract drawings.

1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
2. ACI 211, “Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete.”
3. ACI 212.3R, “Chemical Admixtures for Concrete.”
4. ACI 301, "Specification for Structural Concrete."
5. ACI 302.1R, “Guide for Concrete Floor Slab Construction.”
6. ACI 305R, “Hot Weather Concreting.”
7. ACI 306.1, “Cold Weather Concreting.”
8. ACI 308R, “Guide to External Curing of Concrete.”
9. ACI 309R, “Guide for Consolidation of Concrete.”
10. ACI 315R, “Details and Detailing of Concrete Reinforcement,” latest edition.
11. ACI 318, “Building Code Requirements for Reinforced Concrete,” latest edition.
12. ACI 347R, “Guide to Formwork for Concrete.”

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Design and engineering of formwork are Contractor's responsibility.

E. Shoring and Re-shoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing re- shoring.

F. Welding Certificates: Copies of certificates for welding procedures and personnel.

G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Form materials and form-release agents.
3. Steel reinforcement and reinforcement accessories.
4. Admixtures.
5. Curing materials.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.

10. Joint-filler strips.
11. Pigmented dry-shake floor hardener.

3.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. The Contractor shall employ a competent foreman for all concrete work. The foreman shall be thoroughly familiar with all phases of concrete construction including materials, formwork, reinforcing, mixing, and placing and protection during the initial period of curing.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and re-shoring installations that are similar to those indicated for this Project in material, design, and extent.

D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

2. Material manufacturers shall be ISO 9001/9002 registered proof of documented quality assurance system. Quality system must be independent auditing registrar. ISO 9001/9002 certification shall be included with material submittals.

E. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

F. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

G. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

3.4 MATERIALS

A. Portland Cement Concrete

1. Portland cement concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, admixtures and water, prepared and constructed in accordance with these Standard Specifications.
2. The composition of the mix and strength requirements as established by ASTM C94 shall conform to the following:

Class of Concrete:	A	B	C
Min. 28-Day Compr. Strength (PSI):	4500	4000	3000
Cement Content:			
Minimum Sacks/CY:	7-1/2	7	6
Minimum Pounds/CY:	705	658	564
Water Cement Ratio:	.45	.45	.45
Slump (Inches):	2-4	2-4	2-4

3. Proportions shall provide proper strength, place ability, and durability.
4. Required or permitted admixtures shall be incorporated according to manufacturer's directions.
5. All concrete exposed to weather and unheated areas shall contain 4% to 6% entrained air as indicated in Chapter 3, ACI 301. Use an air entraining admixture and normal Portland cement or an air entraining Portland cement. Measure air content at point of discharge at job site.

B. Cement

1. Cement for all concrete not in direct contact with sewage shall be Portland Gray Cement conforming to ASTM C150, Type I or Type IA. Only one brand of any one type shall be used for exposed surfaces.
2. Cement for all concrete in direct contact with sewage (even if coated) may be the same as above except the C3A content shall be less than 8 percent. Portland blast furnace slag cement (ASTM C 595), Type IS (MS) or IS-A (MS) also may be used as well as Portland Pozzolan Cement (ASTM C 595). Types IP or IPA, with pozzolan content not exceeding 25 percent by weight.
3. Concrete exposed to weather shall be made with not more than 6 gallons of water per bag of cement, including the free moisture in the aggregate.

C. Aggregates

1. Fine aggregate for use in concrete shall be in accordance with ASTM C 33, and shall be graded as follows:

Sieve Size	Percent Passing
3/8 inch	100
No. 4	95-100
No. 16	50 - 85
No. 50	10 - 30
No. 100	2 - 10

2. Coarse aggregate shall be hard, durable, uncoated, crushed stone or gravel conforming to ASTM C 33. Maximum size of aggregate shall not exceed 3/4 inch. Coarse aggregate for concrete in sewage and other liquid containing structures shall conform to ASTM C 33 except the following limitations shall apply:

   a. Soft particles: 20 percent
   b. Chert as a soft impurity: 1.0 percent
   c. Total of soft articles and chert as a soft impurity: 2.0 percent
   d. Flat and elongated particles long dimension more than 5 times short dimension: 15.0 percent.

Size 3/4 inch to No. 4

(ASTM No. 67)

Sieve Size	Percent Passing
1 inch	100
3/4 inch	90 - 100
3/8 inch	20 - 55
No. 4	0 - 10

D. Concrete Admixtures

1. Calcium chloride shall not be permitted as an admixture.
2. Admixtures for air entrainment shall conform to ASTM C 260 and shall be AER as manufactured by SIKA Chemical Corporation, MBOR as manufactured by Master Builders, or equivalent.
3. Chemical Admixtures shall conform to ASTM C 494. This specification applies to:
   a. Type A - Water-reducing admixtures
   b. Type B - Retarding admixtures
   c. Type C - Accelerating admixtures
   d. Type D - Water-reducing and retarding admixtures
   e. Type E - Water-reducing and accelerating admixtures
4. Water reducing admixtures shall conform to ASTM C 494, and shall be Plastiment as manufactured by SIKA Chemical Corporation, Pozzolith as manufactured by Master Builders, or equivalent.
5. Water used in mixing, curing, or other designated applications shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substance injurious to the finished product. Water shall meet the requirements of ASTM C94. Water known to be of potable quality may be used without a test. The water shall have a pH of 4.5 to 8.5.

E. Reinforcing Steel

1. Reinforcement bars shall meet the requirements for Deformed Billet Steel Bars for Concrete Reinforcement, ASTM A615, Grade 60. Bars shall be free of loose scale, rust, or other coatings that will reduce bond.
2. Accessories include all spacers, chairs, bolsters, ties, and other devices necessary for properly placing, spacing, supporting, and fastening reinforcement in place.

Metal accessories shall be galvanized after fabrication or plastic protected where legs will be exposed in finished concrete surfaces. Accessories shall conform to requirements of The Concrete Reinforcing Steel Institute "Manual of Standard Practice of Reinforced Concrete Construction".

3. Wire mesh shall conform to the requirements of ASTM A 1064. Wire mesh shall be fabricated from No. 10 gauge wire conforming to the requirements of ASTM A1064. Individual wires shall be on six-inch centers in each direction.
4. Continuous masonry wire reinforcing shall be of truss design, minimum 9 gauge welded steel wire conforming to the requirements of ASTM A1064 with 0.8 oz. hot-dip zinc coating after fabrication in accordance with ASTM A 116, Class 3.
5. Wire mesh for reinforcement in concrete pavement construction shall be composed of cold drawn steel wires meeting the requirements of ASTM A1064.
6. Bar mat reinforcement shall consist of deformed bars conforming to the requirements of ASTM A1064, Intermediate Grade.
7. Reinforcement shall be in accordance with Chapter 5, ACI 301.
8. Fabricate all reinforcement in strict accordance with shop drawings which have been reviewed by the Engineer. Bars with kinks or bends not shown on the Drawings or on the reviewed shop drawings shall not be used.
9. Reinforcement shall not be bent or straightened in a manner that will injure the material. All bars shall be bent cold. Bends for stirrups and ties shall be made around a pin having a diameter not less than two (2) times the minimum thickness of the bar. Bends for the other bars, including hooks, shall be made around a pin having a diameter not less than six (6) times the minimum thickness of the bar.
10. Before the start of concrete placement, accurately place all concrete reinforcement and positively secure and support by concrete blocks, metal chairs or spacers, or by metal hangers. Clearances shall be as follows:
    a. The clear space between bars shall not be less than 1 1/2 times the normal diameter of round bars.
    b. In no case shall the clear distance be less than 1 1/2 inches nor less than 1 1/3 times the maximum size of aggregate.
    c. The following minimum concrete covering of reinforcement shall be used:
        i. Concrete below ground against forms: Two (2) inches
        ii. Concrete deposited against earth: Three (3) inches
11. Place bars in horizontal members with minimum laps at splices sufficient to develop the strength of the bars. Bars may be wired together at laps except at point of support of the member, at which point preserve the clear space described above.
12. Whenever possible, stagger the splices of adjacent bars. Splice 36 bar diameters minimum.
13. Make all splices in wire fabric at least 1-1/2 meshes wide.
14. All steel dowels shall be anchored into position before the concrete is placed.

F. Concrete Curing Agents

1. Curing compounds shall conform to ASTM C 309. The curing compound shall be compatible with subsequent finished or shall be completely removed. Curing compound shall be Hydrocide Curing Compound by Sonneborne-Contech or equivalent.
2. Liquid membrane curing compounds shall meet the requirements of AASHTO M 148 for Type 2, Class A or B, White Pigmented. Acceptance for continued use will be based upon satisfactory field performance.
3. Sheet materials used for covering the surface of concrete to inhibit moisture loss during the curing period shall conform to the requirements of AASHTO M 171 for

Polyethylene Film and Waterproof Paper. The name of the waterproof paper manufacturer shall be marked or imprinted clearly on the paper for proper identification and it shall retain 90% of the mix water.

4. Mortar sand shall conform to AASHTO M 45 and 100 percent of the material shall pass a Number 4 sieve.
5. Rubber Joint Sealant shall be a multipart chemically curing polyurethane sealant which meets or exceeds the curing requirements of Federal Specification TT-S-00227E (3) and TT-S-00230C (2) Nonsag type, Class A, compounds resistant to 50 percent total joint movement. The color shall be gray to match concrete. A primer shall be used as recommended by the sealant manufacturer. A bond breaker such as masking tape, polyethylene film, or backing rod as supplied by the manufacturer shall be used at the bottom of the joint. The sealant shall be Fox Industries FX-570/571 or equal.
6. Waterstops shall be dumbbell type on horizontal joints and center bulb on vertical joints, polyvinyl chloride (PVC) compounded as necessary to meet the requirements as manufactured by Greenstreak, or equal. No reclaimed PVC from any source shall be incorporated in the compounding. The extruded material shall be dense, homogeneous, and free from porosity or other imperfections which could affect its durability of performance.
7. Form lumber in contact with exposed concrete shall be new and conform to the following:
    a. For concrete exposed to view use plywood with DFPA stamp of "B-B Plyform". Plyform shall be 5/8" thick for supports 12 inches on center maximum or 3/4" thick for supports 16 inches on center maximum. Use in as large sheets as practical to keep joints to a minimum.
    b. For concrete not exposed to view use clean, straight lumber, plywood, or metal.
    c. Form oil shall be colorless and non-staining.
    d. Form ties used for exposed concrete surfaces shall have a minimum working strength when fully assembled of at least 3,000 pounds. Ties shall be adjustable in length to permit complete tightening of forms and of such type as to leave no metal closer than 1 1/2" to the surface. Ties shall be factory fabricated, removable, or snap-off ties that will not allow form deflection and will not spall concrete upon removal, fitted with devices that will leave holes in the concrete surface not less than 1/2 inch or more than one inch in diameter and of depth not greater than diameter at the exposed surface
    e. Form snap ties shall have water stops incorporated and be as manufactured by Dayton Sure Grip, Type 42, or equal with 1 1/2" set back from the face of the wall as detailed in ACI 347.
    f. All vapor barriers shall be 10 mil polyethylene.
    g. Slots and inserts shall be standard types to engage anchors supplied. Slots shall be dovetail type, 24 gauge galvanized sheet steel minimum with fillers.
    h. Grout for base and bearing plates shall be high strength, non-shrink and non-metallic.
    i. Expansion joint material shall consist of ½ inch polyurethane bonded in conformance with AASHTO M153 Type IV rubber.

3.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Avoid damaging coatings on steel reinforcement.
2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D3963/D3963M.

B. All concrete shall be ready mixed and transported in accordance with ASTM C-94 except that, with the approval of the Town, concrete may be volumetrically batched, transported, and mixed in accordance with ASTM C-685 and the following shall be adhered to:

1. Aggregate sizes, slumps, concrete strengths, and air contents shall be specified herein.
2. Proportions of the concrete shall be determined by Alternate 2, with the request stipulated in Paragraph 5.3.2 of ASTM C 685 being carried out.
3. The supplier will be required to have one (1) person at the job site to operate the mixers. It shall be the responsibility of this person to set, record, and maintain surveillance of all gauges on the mixers at the job. No other personnel will be allowed to perform this function.

C. The Contractor shall keep a record at the job site showing the time and place of each pour of concrete, together with transit mix delivery slips certifying contents of the pour; and make the record available to the Engineer for his inspection upon request; and upon completion of each portion of the work, shall deliver the records and delivery slips to the Town.

D. Bagged cement shall be stored on platforms off ground and protected against the elements. Fine and coarse aggregates shall be handled separately in a manner to prevent intrusion of foreign material. All reinforcement shall be covered until used. The Contractor shall not use any frozen materials or any hardened cement.

3.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90° F (30° and 32°C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90° F (32° C), reduce mixing and delivery time to 60 minutes.

B. Mixers: Concrete may be job-mixed or ready-mixed. Shrink mixing will not be permitted. Transit mixed concrete shall be mixed and have water added only at the site. All mixing equipment must, in the opinion of the inspector, be suitable for the job. A standard type of batch mixer shall be used, and no hand mixing will be permitted. Ready-mixed concrete shall conform to ASTM C94. Contractor is to maintain a readily available file of delivery tickets stating design strength, mix slumps, aggregate and admix (if applicable) and yards delivered for all concrete.

C. Charging Procedure: Mix shall be kept at a consistency which can be placed readily without segregation. Aggregates shall be measured in grated hoppers by weight, in a manner which

can easily be checked. Cement shall be measured by volume or by weight. Air slacked cement or cement which is lumpy, whatever the cause, shall not be used. Worming of cement directly into truck mixers shall not be permitted.

D. Mixing Procedure: In stationary mixers, mixing time shall be a minimum of ten minutes after addition of water. If an extra charge of water is required because of too low slump, the drum shall be turned a minimum of 30 revolutions after adding such charge. Once initial set has taken place, no attempt shall be made to temper the concrete by the addition of water. Any concrete so tempered will be rejected and shall be removed from the site. Mixers shall not be charged in excess of the rated speed. Mixer shall be completely discharged before recharging.

E. Time Limit: When either Type I or Type II Portland cements are in use, the elapse time between the initial contact of the cement with water and the discharge of the batch on the job shall not be more than 1 ½ hours or 300 revolutions.

F. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

3.7 CONCRETE FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class B, 1/4 inch (6 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1

vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

M. Joints and Embedded Items

1. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

    a. Install anchor bolts, accurately located, to elevations required.
    b. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

2. Joints and embedded items shall be in accordance with Chapter 6, ACI 301.
3. Construction joints shall be constructed and located so as not to impair the strength of the structure. The location of construction and control joints shall be approved by the Engineer prior to starting concrete placement. Maximum spacing of vertical construction joints shall be thirty (30) feet. All construction joints below liquid levels shall be keyed and water stopped.

4. At construction joints, erect a temporary wood bulkhead so that the jointing will follow a vertical plane at right angles with the direction of the main reinforcement. To this bulkhead fasten a wood strip 2" thick and of width equal to one-third the depth of the concrete slab to form a tongue and grooved joint.
5. Waterstops shall be installed continuous and shall be welded at butt joints and intersections in strict accordance with manufacturer's instructions.
6. Slots shall be installed in face of all concrete against which masonry will be installed. Space at 2'-0" on centers horizontally or as required by details and/or job conditions. Slots shall also be installed where masonry will abut concrete.

N. REMOVING AND REUSING FORMS

1. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50° F (10° C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

2. Leave formwork, for structural elements that support weight of concrete in place until concrete has achieved the following:
   a. At least 70 percent of 28-day design compressive strength.
   b. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.

3. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
4. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the Town.

O. SHORES AND RESHORES

1. Comply with ACI 318 (ACI 318M), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and re-shoring.

2. Plan sequence of removal of shores and re-shore to avoid damage to concrete. Locate and provide adequate re-shoring to support construction without excessive

3.8 VAPOR RETARDERS

A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions. Lap joints 6-inches and seal with manufacturer's recommended tape.

B. Fine-Graded Granular Material: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

3.9 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.10 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
2. Locate joints for beams, slabs, and walls in the middle third of spans.
3. Space vertical joints in walls as indicated.
4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Grooved Joints: For sidewalks and as indicated, form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete as soon as cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.11 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in wall to base slab intersections and at other locations indicated, according to manufacturer's written instructions, bonding fastening and firmly pressing into place. Install in longest lengths practicable.

3.12 CONCRETE PLACEMENT

A. Do not place concrete until forms and reinforcement are inspected by the Engineer. Contractor shall notify the Town of all concrete pours at least 24 hours prior to pouring concrete.

B. All concrete, unless otherwise specifically permitted by the Town, shall be transmit-mixed in accordance with ASTM C-94.

C. For chuting, pumping, and pneumatically conveying concrete, the Contractor shall use only equipment of such size and design as to ensure a practically continuous flow of concrete at the delivery end without loss or separation of materials.

D. Place concrete as dry as possible consistent with good workmanship, never exceeding the

maximum specified slump.

E. When placement is started, it shall be carried on as a continuous operation until the panel or section is complete. A retempered concrete or concrete that has been contaminated by foreign materials shall not be used.

F. Do not pour a greater area at one time than can be properly finished without checking. In any case, a slab length pour greater than 60 feet shall not be placed without construction joints.

G. Do not use concrete with a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Do not allow concrete temperature to exceed 90°F during placement. Use all means necessary to avoid drying the concrete prior to finishing operations. Provide and use all required windbreaks, sunshades, fog sprays, and other devices to protect the concrete.

H. No aluminum shall come in contact with concrete at any time during batching, transporting, placing, finishing, or curing operations.

I. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

J. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Engineer.

K. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

L. Dropping of concrete over 4 feet or through a cage of reinforcing steel will not be permitted.

M. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while the preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
3. Provide a minimum of 2 vibrators in good working condition on the job at all times.

N. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

O. Concrete shall not be deposited during rain. Concrete shall not be deposited into areas of standing or running water.

P. Maximum Pours: Maximum length of wall pours shall be 40 feet (12.1 m), unless otherwise noted or approved by Engineer. All joints shall be as approved by the Engineer or as detailed on the drawings. All reinforcement, forms and ground with which concrete is to come in contact, shall be free of frost.

Q. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40° F (4.4° C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50° F (10° C) and not more than 80° F (27° C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
4. Protection After Placement: Suitable means as defined in ACI 306.1 shall be provided for maintaining a temperature in the concrete of at least 50° F for not less than three days after the concrete is placed. For a period of seven days, the concrete shall not be exposed to a temperature below 40° F.
5. Concrete placement shall be made when air temperature is at least 32° F and rising, unless special precautions acceptable to the Engineer.

R. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90° F (32° C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

S. Placement of Slabs on Earth

1. Place over a well-compacted subgrade. Over subgrade, place a porous fill consisting of clean, washed gravel or crushed stone graded from 1/2" to 3/4" thickness as indicated. Roll or tamp fill until thoroughly compacted. Over porous fill lay vapor barrier, lap joints 2'-0", and seal with tape or mastic; turn up on walls approximately 4", stretch and weight edges and laps to maintain their positions until concrete is placed. Provide wood runways for wheeled equipment for transporting concrete. Do not displace film. Immediately place concrete of required thickness and strike off at proper levels. Repair all holes in vapor barrier prior to placement of concrete.
2. Tamp slabs with a jitterbug to depress the rock, and then pushfloat with a bullfloat as necessary. Care shall be taken that the set slab meets the screeds accurately and does not rise above or lower below them. Slab depressions shall be provided as required for the finishes indicated on the Drawings.
3. Floor slabs shall be planed to a Class A tolerance, that is, true planes within 1/8" in 10 feet, as determined by a 10-foot straightedge placed anywhere on the slab in any direction.
4. Slabs shall slope toward drains when required.

3.13 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, re- straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

C. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re- straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot (3.05-m) long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:
   a. 1/4 inch (6.4 mm).

D. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

F. Finishing of Formed Surfaces

1. Finishing of formed surfaces shall be in accordance with Chapter 10, ACI 301 and as follows:
   a. Provide smooth rubbed finish to all concrete exposed to view and in contact with contained liquids even if to be coated.
   b. Provide rough or board form finish to concrete not exposed to view.
   c. Clean exposed concrete. Remove blemishes, form oil stain, and other discolorations. Clean surfaces by brushing with a mild detergent and water.
   d. Nails, tie wires, and form ties shall be cut off flush, and all surfaces left smooth and clean. The Contractor shall remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surfaces and pointing up and rubbing the resulting pockets to match the surrounding areas.
   e. The Contractor shall flush all holes resulting from the use of spreader rods and sleeve nuts, using water, and then solidly pack throughout the wall thickness with cement grout applied under pressure by means of a grouting gun. Grout shall be one (1) part Portland cement to 2-1/2 parts sand and shall be applied immediately after removing forms.

3.14 CONCRETE PROTECTION AND CURING

A. General: Take curing measures immediately after casting and extend period according to the Engineer's/Architect's recommendation based upon prevailing temperature, wind, and relative humidity.

1. Keep concrete continuously moist for minimum 14 days after casting.
2. Maintain concrete temperature at minimum 50 degrees Fahrenheit for seven days after casting.
3. Avoid alternate wetting and drying and fluctuations of concrete temperature.
4. Protect fresh concrete from direct rays of sun, rain, drying winds, soiling, and damage.
5. Do not permit curing method to affect adversely finished or treatments applied to finished concrete.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions will cause moisture loss before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Curing/Sealing Methods for Slabs: Cure all concrete surfaces with one or a combination of the following methods. Where a specific curing procedure is not specified, at the Contractor's selection, one or more of the following methods shall be used.

1. Water curing: Keep concrete surfaces continuously wet with clean water during the curing period by immersion, maintaining a continuous flow of water over the surface, continuous spraying, continuous sprinkling or a combination of these. For all curing methods, the difference in temperature between the water used for curing and the concrete shall not exceed 20 degrees Fahrenheit.
2. Wet Coverings: Cover the concrete surfaces with burlap, cotton mats, sand, earth, or other suitable moisture retaining materials and keep these materials saturated during the curing period. Lap all fabrics at least 8 inches at all joints. On exposed concrete, do not use any type covering which will discolor the concrete surface.
3. Waterproof coverings: As soon as possible after finishing, thoroughly wet the concrete surfaces and cover the concrete surfaces with waterproof paper or plastic film immediately after wetting. For a period or at least 8 hours after the concrete has taken its initial set, maintain a continuous flow of clean water over the concrete surface under the covering. Lap all joints in the covering at least 8 inches and provide weights and other means and methods to keep the waterproof covering in direct contact with the concrete during the curing period.
4. Membrane forming curing compounds: All exposed interior slabs, not receiving a liquid densifier, and troweled slabs receiving mastic applied adhesives or "shake-on" hardeners shall be cured with the specified curing and sealing compound. Exterior slabs, sidewalks, curbs, and architectural concrete, not receiving a penetrating sealer, shall be cured with the specified clear, non-yellowing curing and sealing compound. Maximum coverage shall be 4000 ft^2/gallon on steel troweled surfaces and 300 ft^2/gallon on floated or broomed surfaces for the curing/sealing compound.

D. Other Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

E. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.15 PATCHING

A. Repair of surface defects shall be in accordance with Chapter 9, ACI 301.

B. Immediately after forms and curing membranes have been removed, inspect all concrete surfaces and patch all pour joints, voids, rock pockets, form tie holes, and other imperfections before the concrete is thoroughly dry. Concrete shall not be notched until it has been inspected by the Town.

C. In minor defective areas, the concrete shall be chipped away to a depth of about one inch, leaving edges perpendicular to the surface; the area to be patched shall be wetted along with a space of at least six (6) inches wide around it to prevent water from being absorbed out of the mortar. The area to be patched shall be coated with a cement wash consisting of neat cement and solution of one part "Konsest", or equal, to four parts of water; patching mortar shall be applied immediately. Patching mortar shall consist of one part cement to three parts water, to a consistency as dry as possible within the requirements of handling and the mortar shall be installed by ramming it into place. The patch shall be screed off so as to leave the patch slightly higher than surrounding surface; left undisturbed for a period of one or two hours to permit initial shrinkage, and then final finished by matching the patch to adjacent surfaces and keeping it wet for at least seven days. Protective covering shall be provided.

D. If the defects are serious or affect the strength of the structure, or if patching does not satisfactorily restore the quality and appearance of the surface, the Engineer may require "cement gun concrete" to be used or the concrete to be removed and replaced complete in accordance with the provisions of these Specifications.

3.16 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi-rigid epoxy joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.17 FIELD QUALITY CONTROL

A. Inspection:

1. Notify the Town at least 24 hours in advance of all concrete pours. No concrete shall be deposited before the Engineer has reviewed the reinforcing and given permission to proceed. Such inspection and permission to proceed shall in no way release the Contractor of the responsibility for proper placement of reinforcing and placement of concrete, and the responsibility for adherence to the requirements of the Contract Documents.

2. Provide unobstructed access to work areas for the Engineer, furnish a wheel barrow for concrete sampling and a suitable storage box for initial curing of cylinders, as specified in ASTM C 31. Make running water available at the testing site.

B. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Test reports shall be submitted to the City inspector, contractor and concrete manufacturer, within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

C. Testing Services: Testing of composite samples of fresh concrete shall be obtained and tested according to ASTM C 172 / C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.

   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.

6. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

    b. Cast and field cure **two** sets of two standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.

    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete

by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

16. The expense of any and all reinspection and/or retesting required due to failure of concrete to meet requirements shall be borne by the Contractor.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

E. Reports

1. Test reports shall include the following:

a. Exact mix, including quantities of admixture, etc.
b. Date of pour.
c. Exact location of pour in building or at site.
d. Slump.
e. Truck number.
f. Ticket number.
g. Type of break.
h. Air entrainment.
i. Water content including aggregate moisture.

2. Field inspection reports shall include the following:

a. Extent of reinforcement and formwork inspected.
b. Date of inspection.
c. Any problems encountered or instructions given to the Contractor.

END OF SECTION

SECTION 4 – WATER DISTRIBUTION SYSTEMS

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SECTION 4 – WATER DISTRIBUTION SYSTEMS

4.1 GENERAL

A. Water distribution system extensions and improvements shall be designed in accordance with all requirements of these Standards, the Delaware State Fire Prevention Regulations, the State of Delaware Regulations Governing Public Drinking Water System, and the Recommended Standards for Water Works (Ten States Standards), latest revision. In the event of a conflict, the stricter of the requirements shall prevail.

B. Where water mains are to be installed for residential or commercial development, the Developer is responsible for all costs associated with the design, Town review, and installation of the improvements. Developer shall hire a Contractor approved by the Town of Georgetown to install the improvements. The improvements shall include the installation of all water services, including curb stops and meter pit assemblies. All water services must be installed before any paving will be permitted to take place.

4.2 DESIGN CRITERIA

A. Water Mains

In determining the required size and capacity of the water main, the following factors should be considered.

1. Estimated average and maximum water demand for the design period.
2. Topography of area.
3. Depth of excavation.
4. Firefighting requirements.
5. Number of proposed services.
6. The calculations for design of the water mains shall accompany the Project drawings, when submitted to the Town Engineer for review when requested.
7. Hydrant tests.

B. Water Service Lines

Each dwelling unit shall be served by at least one individually metered water service connection. Sub-metering shall be the responsibility of the Developer. Service lines sizes shall be designed by the developer for the use intended. Minimum standards shall include the following:

	Min. Service Size	Min. Meter Size (Each Unit)
Single family residence	2"	5/8" x 3/4"
Each duplex residence	2"	5/8" x 3/4"
4-unit apartment, condominium or townhouse (gang service)	2"	5/8" x 3/4"

8-unit apartment, condominium or apartment (gang service)	2"	5/8" x 3/4"

C. The water system shall be designed on the basis of an average daily demand of 225 gallons per day per equivalent dwelling unit. Additional allowance may be required for irrigation demands.

D. All water mains shall be sized after a hydraulic analysis based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of 21 psi at ground level at all points in the distribution system with a minimum flow of 500 gallons per minute above domestic demands or as required per Fire Marshal regulations. Design of new pipe shall use an aging C-factor of 100 for ductile iron pipe and 120 for plastic. Design engineer shall provide certification of design and fire flow conditions. The static pressure in the distribution system should be designed for 52 psi wherever new pressure sources are provided.

E. The minimum size of water main for providing fire protection shall be 6-inch diameter with a minimum 8-inch diameter at all other locations. Larger mains will be required, if necessary, to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure as required by the Delaware State Fire Protection Regulations.

F. Any departure from minimum requirements shall be justified by hydraulic analysis and future water use and can be considered only in special circumstances.

G. Water mains shall be located within street rights-of-way where possible. If it is not possible to locate a water main within a street right of way, the water main shall be located within a utility easement, obtained by the Developer.

H. Concrete thrust blocking or other means of restraint shall be specified on all buried lines at bends, tees, capped or valved ends.

I. Minimum depth of cover over water mains shall be 42 inches as measured from the top of the pipe to finished grade.

J. Sufficient valves shall be provided on the water mains for isolation during repairs. Valve spacing shall be in accordance with the Delaware State Fire Protection Regulations and the State Office of Drinking Water but at a minimum of 800-foot intervals, three (3) at each tee, and at other locations as required by the Town.

K. Hydrants should be located on mains at each street intersection and at other locations as required or requested by the Town. Hydrant location and spacing shall be in accordance with the Delaware State Fire Protection Regulations.

L. Each service connection, except fire service, shall be individually metered. Fire services shall be installed with a detector check meter system.

M. Dead ends shall be minimized by looping and interconnecting of all water mains to the greatest extent feasible to minimize stagnation and friction losses associated with dead end mains. Hydrants shall be placed at the end of all dead-end lines. Blow-offs shall not be substituted for hydrants.

N. Water mains should be located at least 10 feet away from any existing or proposed storm or sanitary sewer, however, upon approval of the Town Engineer it may be reduced to no less than 5 feet. Water mains crossing storm or sanitary sewers shall be located at least 18 inches above the sewers. If 18 inches is unattainable, a sleeve shall be installed 10 feet from either side of the water main for a total length of 20 feet. The end treatments for the sleeve shall be Fernco couplers/seals manufacturer part number #1056-X-Y (where X is the sleeve size and Y is the carrier pipe size), or approved equal. Crossings shall be arranged so that the joints in the water main will be as far as possible from sewer joints. Water mains shall not pass through or come in contact with any sewer manhole.

O. Pipe Identification

1. Each length of pipe shall be marked at intervals of five (5) feet to include the following when applicable to that type of pipe:

   a. Nominal size and/or O.D. base
   b. Material code designation or cell classification
   c. Schedule or dimension ratio number
   d. AWWA pressure class
   e. AWWA and/or ASTM designation number
   f. Manufacturer's name or trademark
   g. Seal of testing agency verifying potable water service

4.3 WATER IMPACT STUDY

A. Study required for 11 or more EDUs.

B. Developer’s engineer is responsible for determining whether adequate flows and pressures are available to meet project needs and for sizing and designing onsite improvements; for sizing and locating any offsite water main extensions or loops needed to meet those needs based upon existing (or proposed, if available) system pressures and flows. The study shall indicate any needs for upgrading existing portions of the system if applicable.

C. In cases where there is an impact on the existing system requiring improvements, the Town may require additional information or conduct an impact study of its own with information provided by the developer’s engineer. The cost of this study shall be reimbursed to the Town by the developer.

D. Indicate any high-rise projects, isolated areas, commercial and institutional projects needing flows in excess of capacity of existing system, for the project will install private booster pumping and/or tankage to meet site demands.

E. Obtain a current hydrant test data from the Department of Public Works and run additional hydrant tests as needed.

F. Provide a water main layout and with sizes needed to meet project demands for fire, domestic, and process with a schematic of proposed improvements drawn to scale.

G. Upon request from the Town, provide the proposed water main layout in a scaled drawing or electronic format on Delaware State Plane Coordinates. The Town may elect to enter this into a master water model for plan review purposes.

H. Checklist:

1. Name and contact information of developer and engineer.
2. Proposed water demands (fire, domestic, other). EDU calculation.
3. Demand phasing schedule for build outs in excess of 5 years.
4. Copies of hydrant test results, source and date.
5. Written summary and pertinent backup information to indicate that design parameters will be met when connecting to the existing system, or proposed improvements to meet project needs.
6. If applicable, show scope of proposed offsite water extensions with schematic.
7. If applicable, show proposed offsite easements or use of public rights of way.
8. If applicable, indicate water quality needs if they are different from normal domestic potable water.
9. Estimated itemized construction cost for offsite improvements and extensions.

I. Developments greater than 50,000 gallons per day require a scoping meeting and the Town may elect to have source and treatment components added to the impact study.

4.4 MATERIALS

A. General:

1. Water main pressure piping installed in open-cut trench: PVC or DI
2. Water main installed by directional drilling: HDPE
3. Water main installed by jack and bore: PVC

B. Polyvinyl chloride (PVC) pressure pipe for water mains shall be in accordance with ANSI/AWWA C900 or C905 as applicable, with a maximum dimension ratio of DR18. Molecularly oriented polyvinyl chloride pressure pipe (PVCO) shall be in accordance with ANSI/AWWA C909, having a 150-psi pressure classification. Fittings for PVC pipe shall be fabricated or molded from the same material as the pipe in which they are installed, or ductile iron fittings may be used.

1. The Contractor shall provide all necessary adapters for connecting PVC pipe to cast iron fittings and valves or other pipelines. Adapters shall be as recommended by the pipe manufacturer.

2. Polyvinyl chloride pipe shall be delivered and stockpiled in unit pallets. Store pipe on flat surface. No stacking of pallets of random lengths above 5 feet in height will be allowed. If pipe is stockpiled for more than 30 days prior to installation in the trench, it must be suitably covered with reflective materials to protect the pipe from ultra-violet rays emanating from sunlight. Do not use plastic sheets. Allow for air circulation under covering.

3. Bowed sections of pipe will not be acceptable and will not be allowed to be installed.

C. Ductile iron pipe for water mains shall conform to ANSI/AWWA C151, Class 50 in streets and Class 56 under railroads unless otherwise required. Joints shall be push-on or mechanical conforming to ANSI/AWWA C111. Standard Fittings shall conform to ANSI/AWWA C110 and compact fittings shall conform to ANSI/AWWA C153. All ductile iron water main pipe and fittings shall have an internal cement lining in accordance with the latest revisions of ANSI/AWWA CI04/A21.4. No bituminous coating shall be used on the inside of pipe and fittings. Pipe and fittings shall have an external standard asphaltic coating approximately 1 mil thick.

D. HDPE pipe for water mains fabricated from material having a classification of ASTM D 3350 and meet the requirements of AWWA C906, and a PPI rating of PE 3408. Pipe shall be color coded by a minimum of six (6) blue stripes to indicate potable water and shall have an outside diameter equivalent to ductile iron pipe.

1. Fittings

a. Butt fusion fittings – HDPE Fittings shall be made of PE4710, meet the requirements of AWWA C906 and have a pressure rating equal to the pressure rating of the pipe to which the fitting is joined. Molded fittings shall be manufactured, tested and marked per ASTM D3261. Fabricated fittings shall be manufactured, tested and marked per ASTM F2206, or individual fittings standards.
b. Electrofusion Fittings – Fittings shall be made of HDPE material with a minimum material designation code of PE 4710, a manufacturing standard of ASTM F1055, and a pressure-rating equal to the pipe. Markings shall be according to ASTM F1055.
c. Flanges and Mechanical Joint adapters – Flanges and MJ adapters shall have a material designation code of PE4710. Flanges shall be made in accordance with ASTM F2880. MJ adapters shall be made to ASTM D3261. Flanges and MJ adapters shall have a pressure rating equal to the pipe to which it is joined. Markings for molded or machined flange adapters or MJ adapters shall be per ASTM D3261.

E. Service Connections

1. Residential Services

a. Each new dwelling and commercial building shall be provided with a minimum 2” SDR-9 HDPE service line and a dual meter pit to allow for both domestic and irrigation 5/8 × ¾ meters. One 2” water main tap may service 2 dual pits at a common property line. No cutting of a new street (within 5 years) will be allowed for irrigation or other meters after the final surface pavement course has been applied. Water service pipe shall not cross water main that it is tapped into.
b. Where there is no potential for irrigation, and only with prior approval from the Town, dwellings may use 1” SDR-9 HDPE service line. Service lines shall conform to AWWA C-901 and ASTM D-2737.
c. Corporation stops shall be AWWA/CC taper thread inlet by pack joint

outlet for plastic tubing (CTS), Ford F1000-4 for 1" and FB1000-7 for 2". Install stainless steel liner at compression connections to plastic service line. Liners shall be Ford Insert-52 or approved equal. Curb stops shall be Ford B44-444 for 1" and B44-777 for 2". Valve boxes shall be 4 ¼" Mueller roadway screw type with arch base.

d. Cutting tools shall be of the hollow, shell bit type for removal of pipe plug. For tapping PVC mains use only Mueller Plastic Cutting Tool. On multiple taps, place corporation stops as recommended by pipe manufacturer. Furnish saddles with standard AWWA/CC corporation stop tapered inlet thread. Saddles shall be Ford banded stainless steel type FS313 for 1" tap on AWWA/C900 PVC water mains and iron water mains.

e. Meter box covers shall be Ford A32 for single meter setters and Ford A3 for dual meter setters, or approved equals. Locate meters outside traffic areas and sidewalks wherever possible. (Lids shall be inset cast iron with the words "WATER METER" and plugs for remote reading precast into them.) Lids shall include lifter worm locks with a standard pentagon bolt. Frames shall be 4" in depth. Three (3) meter box lid wrenches will be supplied to the Town. Contractor shall verify fit and compatibility of assembly components prior to ordering.

f. Prefabricated meter box assemblies shall not be installed in traffic areas. Meter box assemblies shall also not be installed in sidewalks unless approved by the Town. The box shall be 18" I.D. X 36" PVC for single meter setters and 20" I.D. X 36" PVC for dual meter setters. Meter support shall be by a lateral PVC brace. For 5/8" x ¾" meter pit assemblies angle check valve shall be Ford HA 31-323. System shall also include an angle ball valve with lock wings. Valve shall be Ford BA13-332W. Coupling for inlet connection shall be ¾" F.I.P. x 1" P/J CTS Ford C14-34 with stainless steel insert. Coupling for outlet connection shall be ¾" F.I.P. x ¾" P.J. CTS Ford C14-33 with stainless steel insert.

g. Any meter boxes approved for installation in driveways shall have a 2' x 2' x 2' concrete collar installed around the box.

2. Commercial Services

a. All commercial services shall be Schedule 80 PVC (IPS) or SDR-9 CTS polyethylene tubing. Water service pipe shall not cross water main that it is tapped into.

b. For 2" taps in ductile iron pipe or PVC C900 pipe use Mueller Model BR 2W Series Bronze Service Saddles with 304L stainless steel double straps and 200 psi pressure rating. The nuts and bolts shall be stainless steel and the Contractor shall apply "Never Seez" anti-seizing compound to the bolts prior to installing the nuts. The tapping boss shall be 2-inch with CC (AWWA taper) thread. For taps 3" and larger, see Section 4.4, K and L. Use Teflon tape and brass nipple for threaded service connections. Do not torque saddles or sleeves without water pressure in main.

c. Use 2" Ford curb stop on all 2" services. Valve boxes shall be 4-1/4 inch Mueller roadway screw type with arch base.

d. Meter pits and setters shall be as detailed on the approved plans. Pits shall be PVC. Covers shall be MC-30 by Ford, or approved equal, with

lifter worm lock and precast hole for remote reading. Meter pit setters shall not be installed in traffic areas.

3. Gang Meter Pits (Up to 4 meters)

   a. All service lines connecting gang meter pits to water mains shall be 2-inch Schedule 80 PVC threaded service pipe (IPS) or 2-inch SDR 9 CTS HDPE tubing. The manifold in the pit shall be Schedule 80 PVC pipe. The service pipes downstream of the pit shall be ¾-inch diameter SDR 9 CTS HDPE tubing.
   b. The gang meter shall be installed in a precast concrete meter pit by Penn-Cast Products, Inc., Model #448, or approved equal, top section only. The service piping or tubing must be installed through a wall sleeve.
   c. Tapping shall be as specified for 2" taps in section 4.4E of these specifications.
   d. Curb valve shall be Mueller 2-inch oriseal valve H-10291. The valve box shall be 4-1/4 inch Mueller roadway screw type with arch base.
   e. The setting shall be as detailed on the plans. Use Ford yoke 502P, Ford straight yoke ball valve B91-323W, Ford straight yoke check valve HS92-323, P/J coupling Ford C84-33 and Ford expansion connection EC-23W.
   f. Cover shall be Model R-1642, self-sealing application, as manufactured by Neenah Foundry; or, model 1045, watertight assembly, manufactured by East Jordan Iron Works.
   g. Gang meter pit vaults shall not be permitted to be installed in traffic areas unless approved by the Town. If vaults are permitted to be installed in traffic areas, they will be required to have a solid concrete bottom with an opening provided to permit drainage.

4. Water Meters

   a. All water meters (residential or commercial) less than 2" shall be Kamstrup flowIQ®2200, 2250, or 3200 meters. All meters shall register in U.S. gallons. The contractor shall check all connecting fittings for compatibility prior to ordering.
   b. All water meters 2" and larger shall be Kamstrup flowIQ®3200 or 4200 meters. All meters shall register in U.S. gallons. The contractor shall check all connecting fittings for compatibility prior to ordering.
   c. Contact the Town for information regarding meters larger than 2 inches that are approved for use.

F. Restrained Mechanical Joint Fittings

1. Gland body and restraint components: minimum ASTM A536, 60-42-10 ductile iron. Restraint shall be incorporated into the design of the follower gland. Restraints shall be MEGALUG manufactured by EBAA Iron, Inc. with breakaway bearings.

G. Water valves shall be resilient wedge gate valves conforming to ANSI/AWWA

C509/C515. Valve wedge shall be constructed of ductile iron, encapsulated in resilient rubber except for guide and wedge nut areas or it shall have a replaceable, internally reinforced, contoured molded rubber disc seat ring attached to the face of the wedge with self-locking stainless-steel screws. Wedge rubber shall seat against accurately formed seating surfaces in the valve body. Waterway shall be smooth and shall have no depressions or cavities in the seat area. Valve body and bonnet shall be epoxy coated, inside and out with fusion bonded epoxy conforming to ANSI/AWWA C550. Buried valves shall be fitted with 2-inch square operating nuts. Valve shall open counter clockwise. Water valves shall be manufactured by Kennedy Valve Company, or approved equal.

H. Stem and wedge nuts shall be bronze. Stems shall be sealed by at least two O-rings. Seals shall be replaceable with the valve fully open and while subject to the rated pressure.

I. Provide each gate valve with a 5 ¼ inch diameter Buffalo screw type, heavy-duty cast iron valve box with "WATER" cast in the lids. All valve boxes shall be Tyler Union 6850 series, three-piece valve boxes with standard base. If valve boxes placed on valves installed on existing or approved new water mains cannot be adjusted to reach the finished surface, cast iron adjustable valve box extensions, as manufactured by Tyler Union, shall be installed. Valves with operating nuts greater than 3'-0" below the finished surface shall be equipped with operating nut extensions, as distributed by Pollard Water or approved equal. Extensions shall be equipped with a plate that will keep the top nut centered in the valve box. If operating nut extensions are used, the top of the extended operating nut shall be between 1'-0" and 2'-6" from the finished surface. Lids shall be extra deep and have two holes for removal of lid. All valve boxes, valve box extensions, bases, and lids shall be as manufactured by Tyler Union or approved equal.

J. The appropriate size and model Valve Box Adapter II adapters, as manufactured by Adapter, Inc. shall be installed on the bonnet of all valves.

K. Tapping sleeves shall be of all stainless-steel construction including sleeve, bolts and nuts. Sleeves shall wrap 360º around the pipe with gridded full circumference gasket. Units shall be FAST Model by Ford Meter Box Co. or approved equal. Tapping sleeves shall be hydrostatically tested to a pressure of 100 psi. The 100 psi test pressure must be maintained for a period of one (1) hour for successful completion of the test. The tap may not be executed if the sleeve does not pass the test.

L. Tapping valves shall be cast iron as manufactured by Kennedy.

M. Install tapping sleeve and valve per manufacturer's recommendations, and minimum 1' from end to end.

N. Hydrants shall be compression type with a 5 ¼ inch main valve opening, two 2 ½ inch hose nozzles, one 4 ½ inch pumper nozzle, and a 6 inch mechanical joint hub base. Hydrant seats shall be provided with bronze-to-bronze threaded connections.

O. All nozzle and steamer threads shall conform to National Standard. Hydrants shall be of proper length for a 4-foot trench depth or as required by field conditions and be the Guardian model manufactured by Kennedy Model K-81. They shall meet the requirements of AWWA C-502.

P. All dead-end streets in new subdivisions and rehabilitation projects shall be installed with a Mueller Hydro-Guard Model HG-4 Underground Flushing Unit, part number: HG4ABL2BRN036LPLG.

Q. All individual water service connections shall be metered with remote reading type meters. Water meters shall be purchased from the Town.

R. Meter boxes shall be prefabricated and pre-notched plastic and compatible frame lids equipped with a worm type lifter lock and the word "WATER" cast on the cover. Water meters shall not be installed in traffic areas.

S. Backflow Preventers

1. Utilize the reduced pressure principle and shall consist primarily of a pressure differential relief valve located in a zone between 2 positive seating check valves. The relief valve shall contain a separate means whereby free air will enter the zone, and contained water will be discharged to atmosphere when the valve is fully open. The assembly shall include two tightly closing shut-off valves (1 upstream and 1 downstream) and test cocks. The device shall meet all requirements of ASSE Standard 1013 and ANSI/AWWA C510 and C511, latest revision. Backflow preventers shall be Zurn Wilkins Models 975XL3 or 375AST, or approved equal.
2. See cross connection control plan for additional information.

T. Concrete shall be Class C concrete in accordance with Section 3 – Concrete of these Standard Specifications.

U. Miscellaneous Materials

1. Polyethylene Sheeting: ASTM D 4397, with at least 8-mil thickness.
2. Casing chocks: Metal components shall be stainless steel, type 304, liner shall be PVC and skids shall be fiberglass reinforced nylon. Manufacturer: PowerSeal Pipeline Products Corporation.
3. Casing End Seals: Model AM Molded End Seal by Advanced Products, Inc.
4. Detectable Pipeline Wire: Insulated (blue color) solid copper, #12 AWG, 600 volt, of not less than 90% conductivity, conforming to ASTM Designation B.58. Splicing of wires shall be by a solderless, split-bolt lug connector, Type IK-8, by ILSCO or equal.
5. Detectable Pipeline Warning Tape: Metallic type with metal foil running the full length and width of the tape. Tape shall be 6-inches wide. Foil shall be encased in a high visibility, color coded, polypropylene film with continuous, clearly imprinted identification legends. Detectable warning tape shall be in accordance with Section 2 – Earthwork of these Standard Specifications.

4.5 CONSTRUCTION METHODS

A. Excavation and backfill for water main trenches shall be in accordance with Section 2 – Earthwork of these Standard Specifications.

B. Ductile iron water main pipe and appurtenances shall be installed and placed into service in conformance with ANSI/AWWA C600, latest revision.

C. PVC water main pipe and appurtenances shall be installed and placed into service in conformance with ANSI/AWWA C605, latest revision.

D. Fittings, hydrants, gate valves and valve boxes shall be placed along the water mains at the locations indicated on the drawings or where otherwise designated by the Town. The base of hydrants and gate valves shall bear firmly on 4-inch x 8-inch x 16-inch solid concrete blocks set on undisturbed soil or sufficiently compacted fill.

E. Valve box adapters shall be installed over valve bonnets and a valve box shall be carefully placed over the adapters on each gate valve with the top at the finished surface of the street, sidewalk or at such other elevation as the Town shall direct. The valve box shall be set exactly plumb. In tamping the backfill around the box special care shall be taken to keep the box plumb. Any box which is found out of plumb, or which is not firmly supported, shall be excavated and reset in a satisfactory manner, at the Contractor's expense.

F. Precautions shall be taken to keep interiors of pipes and fittings clean before installation and kept clean until final acceptance. Pipe delivered for construction shall be stored so as to minimize entrance of foreign material. When pipe laying is not in progress, all openings in the pipeline shall be closed by watertight plugs. Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

G. Pipe and fittings shall be carefully handled and placed in the trench. Special care shall be taken to ensure that each length of pipe abuts against the next in such a manner that there shall be no shoulder or unevenness of any kind along the inside of the bottom half of the pipe.

H. Concrete thrust blocking and anchors shall be constructed in accordance with Section 3 – Concrete of these Standard Specifications. Blocking and anchors shall be poured against undisturbed earth.

I. Service saddles shall be used on all service connections to PVC water mains.

J. Place pipeline detectable tape shall be installed at half of the trench depth. At no time shall detectable tape be placed at a depth less than 6 inches or more than 36 inches.

K. Place pipeline detectable wire along the full length of the installed pipe including encased road crossings and directional drilled pipe. Remove the insulation at the splices, so a metal-to-metal connection is made. Place the wire in the bottom of the trench prior to any backfilling such that it and the water main are separated by not more than 3 inches distance. Bring the wire up to the surface of the ground at the beginning and termination of the pipe, and at any in-line valving (interior of the valve box or manhole) and any other appropriate location.

L. New pipe systems shall be disinfected in accordance with ANSI/AWWA C651 prior to connection to the existing pipe network.

4.6 TESTING AND ACCEPTANCE

A. WATER MAINS

1. New water mains shall not be placed into service prior to pressure testing, disinfection, flushing and acceptance by the Town.

2. After the pipe is backfilled and all trapped air is expelled and prior to connecting the new pipe to the existing pipe network, hydrostatically test the pipe at a pressure 2.0 times the normal working pressure with a minimum pressure of 150 psi. Hold the test pressure for a period of at least two (2) hours, as measured at the highest elevation of the pipe in testing, during which time the test pressure shall not vary more than 5 psi of the specified test pressure.

3. Expel air completely from the pipe and valves before applying the specified test pressure. If permanent air vents are not located at all high points, install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, close the corporation cocks and apply the test pressure. At the conclusion of the pressure test, remove the corporation cocks and plug the openings, or leave in place at the discretion of the Town.

4. Acceptance shall be determined based on allowable leakage. If a test of pipe laid discloses leakage greater than specified, the Contractor shall, at his own expense, locate and repair the defective material until the leakage is within the specified allowance. All visible leaks are to be repaired regardless of the amount of leakage.

5. A leakage test shall be performed concurrently with the pressure test. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or at any valved section thereof, to maintain pressure within five psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

6. Allowable Leakage. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

   L = (ND)(SQRT of P)/7400

   in which the allowable leakage, in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in pounds per square inch gage.

7. When hydrants are in the test section, the test shall be made with hydrant valves open and hydrant nozzles closed.

TABLE 1
Allowable Leakage per 1000 feet of Pipeline*
- gph Nominal Pipe Diameter - inch

Ave. Test Pressure psi	2	3	4	6	8	10
150	0.18	0.28	0.37	0.55	0.74	0.92
125	0.17	0.25	0.34	0.50	0.67	0.84
100	0.15	0.23	0.30	0.45	0.60	0.75

Ave. Test Pressure psi	12	14	16	18	20	24
150	1.10	1.29	1.47	1.66	1.84	2.21
125	1.01	1.18	1.34	1.51	1.68	2.01
100	0.90	1.05	1.20	1.35	1.50	1.80

Formula L = (ND)(SQRT of P) / 7,400

L = Allowable leakage (gph per 1,000 feet of pipeline)
N = Number of joints in length of pipeline tested
D = Nominal diameter of pipe in inches
P = Average test pressure during leakage test in psi

*For pipe with 18-ft nominal lengths. To obtain the recommended allowable leakage for pipe with 20-ft nominal lengths, multiply the leakage calculated from the table by 0.9. If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

8. Contractor shall test tracer wire for conductivity.

B. SERVICE CONNECTIONS

1. Except where directed by the Town, service connections to existing users are not to be disturbed by the installation of the new water lines. Services damaged by the Contractor shall be repaired to the satisfaction of the Engineer at the Contractor's cost. Existing service connections are to remain in use until all new service connections have been completed, tested, accepted by the Engineer, and placed into service.

2. Where existing small water lines are to be replaced by a new water main, new service connections from the new main to the existing curb box are to be provided by the Contractor. Existing curb stops and boxes shall be replaced.

3. Where PVC water main is installed, a service clamp shall be used for

connection of the corporation stop. For ductile iron water main, direct tapping shall be permitted.

4. The corporation stop shall be placed in the upper half of the water main. Service tubing shall be loosely laid at the indicated depth without kinking. Curb stops shall be set at the proper depth shown on the Town's standard details. Curb boxes shall be set plumb, adequately braced, and set to existing grade. The outlet service connection from the curb stop for future services shall be fitted with a screw plug to restrict dirt from entering the curb stop.

5. All water service crossing under the road shall be bored or jacked if roadway pavement occurred within the previous 5 years. Open cut installations will only be allowed in pavement installed greater than the previous 5 years. The use of water or other fluids to facilitate carrier pipe placement and spoil removal is prohibited.

6. After the encasement conduit has been installed, the water service pipe shall be installed and the ends of the encasement conduit plugged.

7. All service connections shall be tested for visible leakage. After the service connection has been installed and prior to backfilling, both the corporation stop and curb stop shall be fully opened and the service shall be inspected for leaks around all fittings and connections.

8. All visible leaks shall be corrected immediately by the Contractor and the test performed again at no additional expense to the Town.

9. Service connections shall not be accepted until all testing has been approved by the Engineer.

C. FIRE HYDRANTS

1. All hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to, the curb or centerline of roadway, with the pumper nozzle facing the curb or roadway.

2. Each hydrant shall be connected to the water main with a 6-inch ductile iron pipe branch controlled by an independent 6-inch valve.

3. All hydrants to be furnished with non-kinking chains on the 2 ½ inch nozzles.

4. When a dry-barrel hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand, from the bottom of the trench to at least 6 inches above the waste opening in the hydrant and to a distance of 1 foot around the elbow. Where groundwater rises above the drain port or when the hydrant is located within 8 feet of a sewer, the drain port shall be plugged, and water pumped from the hydrant when freezing may occur.

5. When a dry-barrel hydrant with an open drain is set in clay or other impervious soil, a drainage pit 2 ft. x 2 ft. x 2 ft. shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand, under and around the elbow of the hydrant and to a level of 6-inches above the drain port.

6. Provide hydrant operating wrenches and repairs kits. Deliver a minimum of one wrench and repair kit per project, and a minimum of one per five hydrants installed.

7. All hydrants shall be well braced with thrust blocking and shall be restrained by means of retainer glands as shown on the Drawings or as approved by the Engineer.

8. Fire hydrants shall be covered with a plastic bag until that portion of the water main has been tested and placed in service in accordance with the Contract Documents or as directed by the Engineer.

9. After water mains have been tested and accepted, each hydrant shall be opened with all discharge nozzles fully closed and inspected for leaks. All visible leaks shall be corrected immediately by the Contractor and the test performed again at no additional expense to the Town. Each hydrant shall be flow tested in accordance with the recommended Practice for Fire Flow Testing and marking of Hydrants, NFPA 291, as adopted and/or modified by the State of Delaware Fire Prevention Regulations.

10. After testing for leaks and flow testing, all hydrants shall be painted with color to be selected by the Town. Paint shall be durable for highway/roadway markings.

11. Hydrant bonnets shall be color-coded. Bonnet color shall be based on flow test data. Color shall be as follows or as required per State Fire Prevention Regulations:

CLASS	CAPACITY	COLOR
AA	1500 GPM or greater	Light blue
A	1000 - 1499 GPM	Green
B	500 - 999 GPM	Orange
C	250 - 499 GPM	Red
D	Less than 250 GPM	Black

12. Hydrant barrels shall be provided with a reflective tape of a minimum of 2 inches width around the barrel under the top flange.

13. Hydrants shall not be accepted until all testing has been approved by the Engineer. A sworn certificate of inspection and testing shall be furnished by the manufacturer.

4.7 DISINFECTION

A. Upon completion of water main construction, disinfect main and appurtenances. Disinfection shall be done in accordance with ANSI AWWA C-601, latest addition. Contractor shall submit a plan of disinfection for approval by the Town.

B. Precautions shall be taken to protect interior of pipes, fittings, hydrants, and valves against contamination. Pipe delivered for construction shall be stored so as to minimize entrance of foreign material. When pipe laying is not in progress, all openings in the pipeline shall be closed by watertight plugs. Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

C. Calcium hypochlorite tablets conforming with ANSI/AWWA B300 and NSF 61 shall be placed in each section of pipe and also in hydrants, hydrant branches, and other appurtenances. They shall be attached by an adhesive, except for the tablets placed in hydrants and in the joints between the pipe sections. All tablets within the main shall be placed at the top of the main. If the tablets are fastened before the pipe section is placed in the trench, their position shall be marked on the section to assure that there will be no rotation.

D. Tablets shall be attached using food grade adhesive. There shall be no adhesive on the tablet except on the broad side next to the surface to which the tablet is attached.

E. The following table gives the number of hypochlorite tablets required for pipe of various section lengths and diameter.

NUMBER OF HYPOCHLORITE TABLES OF 5-g REQUIRED FOR DOSE OF 25 mg/l*

Length of Section	Diameter of Pipe - Inches					
Ft.	2	4	6	8	10	12
13 or less	1	1	1	1	2	3
18	1	1	1	2	3	4
20	1	1	1	2	3	4
30	1	1	2	3	4	6
40	1	1	2	4	5	7

*Based on 3 3/4 g available chlorine per tablet.

F. When installation has been completed, the main shall be filled with water at a velocity of less than 1-ft/sec. This water shall remain in the pipe for a minimum of 24 hours. Valves shall be manipulated so that the strong chlorine solution in the line being

treated will not flow back into the line supplying the water.

G. After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 mg/l. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline. This water shall be discharged to the sanitary sewer system.

H. After final flushing, and before the water main is placed in service, a sample or samples shall be collected from the end of the line and tested for bacteriologic quality and shall show the absence of coliform organisms. At least one sample shall be collected from chlorinated supplies where a chlorine residual is maintained throughout the new main. In the case of extremely long mains, samples shall be collected along the length of the line as well as at its end.

I. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. The tablet method cannot be used in these subsequent disinfections. When the samples are satisfactory, the main may be placed in service.

J. The procedures outlined below apply primarily when mains are wholly or partially dewatered as a result of cutting into or repairing existing water mains. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure shall require no disinfection.

K. When existing water mains are excavated for repair work, the trench will likely be wet and badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such contamination. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

L. The following procedure shall be considered as the minimum procedure used to disinfect water mains during repair work. The interior of all pipe and fittings used in making the repair, particularly couplings and tapping sleeves, shall be swabbed with a 1 percent hypochlorite solution before they are installed.

M. Thorough flushing shall be the means of removing contamination introduced during repairs. If valving and hydrant locations permit, flushing from both directions shall be provided. Flushing shall be started as soon as the repairs are completed and continued until discolored water is eliminated.

N. All disinfection procedures, requirements for bacteriologic tests, and determination of acceptability shall be subject to the requirements of the Delaware Health and Social Services, Division of Public Health.

O. The contractor is responsible for requesting tests from the Delaware Department of Public Health. He shall provide written documentation when a section of mains can be placed in service. A copy of all test results shall be submitted to the Town.

END OF SECTION

SECTION 5 – GRAVITY SEWER SYSTEMS

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SECTION 5 – GRAVITY SEWER SYSTEMS

5.1 GENERAL

A. Where sewer mains are to be installed for residential or commercial development, the developer is responsible for all improvements. Developers shall hire a contractor approved by the Town of Georgetown and pay all costs associated with the work. The Developer shall install sewer laterals with cleanouts in the pipe laying process. Connections to the main shall be made with wye fittings.

B. Laterals shall be constructed of the same material as the sewer main. Maintain a minimum of 36-inch cover. Lateral extensions from the cleanout to the house shall conform with State Plumbing Regulations.

5.2 DESIGN CRITERIA

A. Sewer Mains

In determining the required size and capacity of the sanitary sewer, the following factors should be considered:

1. Average and peak hourly domestic sewage flow.

2. Topography of area.

3. Depth of excavation.

4. Pumping requirements if necessary.

The calculations for design of the sanitary sewers shall accompany the Project's Drawings, when submitted for review.

B. Design Flow

1. Average Flow

a. The sanitary sewer system shall be designed on the basis of an average daily flow of sewer of 225 gallons per day equivalent dwelling unit. Additional allowance may be required for high water use appliances and fixtures.

2. Peak Design Flow

a. Sanitary sewers shall be designed on a peak flow basis using the 3.5 ratio of peak to average daily flow unless approved otherwise.

C. Minimum Size

1. Sanitary Sewer Main

a. The Developer shall provide the Town with flow calculations supporting the gravity sewer system design. Average sewage flow shall be computed using 225 gallons per day per EDU. Peak flow for gravity sewer design shall be calculated as 3.5 times the average flow. The minimum size for sanitary sewer main is eight (8") inches.

b. Minimum depth of cover over sewer mains shall be three (3') feet as measured from the top of the pipe to finished grade.

2. Sewers shall be designed based on the Manning formula to provide a minimum flow velocity of 2 feet per second (FPS) when flowing full. The Manning friction coefficient “n” used in velocity calculations shall be 0.011 for PVC pipe and 0.013 for ductile iron pipe. Where full flow conditions will not be reached, the pipe slope shall be increased to provide a 2 FPS minimum velocity at the design flow. Specifying oversized sewers for the purpose of using flatter slopes shall not be approved. Sewer slopes shall be greater than or equal to the following limits:

Using an "n" value of 0.010 for P.V.C., the following are the minimum slopes which are allowed:

Sewer Size (inches)	**Minimum Slope in Feet Per 100 Feet**	
	Design	**As Constructed**
8	0.30	0.28
10	0.25	0.22
12	0.20	0.17
15	0.17	0.12
18	0.15	0.10
21	0.12	0.08

Using an "n" value of 0.013 for Ductile Iron Pipe, the following are the minimum slopes which are allowed:

Sewer Size (inches)	**Minimum Slope in Feet Per 100 Feet**	
	Design	**As Constructed**
8	0.50	0.40
10	0.35	0.28
12	0.30	0.22
15	0.25	0.17
18	0.20	0.14
21	0.05	0.02

3. Under no circumstances shall gravity sewers be designed to carry storm water flows.

4. Gravity sewer mains shall be located within street rights-of-way, under the center line of the pavement to the extent possible. If it is not possible to locate a sewer main within a street right of way, the sewer main shall be located within a utility easement dedicated to The Town of Georgetown, obtained by the Developer.

5. Sewers shall be located at least 10 feet horizontally from any existing or proposed water main. Sewers crossing water mains shall be located to provide a minimum vertical separation distance of 18 inches between the water main and the sewer. Crossings shall be arranged so that the joints in the sewer pipe will be as far as possible from water main joints. If 18 inches separation is unattainable, a sleeve shall be installed 10 feet from either side of the water main or force main for a total length of 20 feet. The end treatments for the sleeve shall be Fernco couplers/seals manufacturer part number #1056-86 (or equivalent suitable sized sleeve) or approved equal by The Town of Georgetown.

6. Lateral Connections

   a. Each individual dwelling unit and multi-family units, with the exception of structures where each unit may not extend to the ground floor, shall have an individual lateral installed. The minimum diameter of laterals extending from the Town maintained cleanouts shall be six (6") inches. Cleanouts shall be placed at the property line. Additional cleanouts shall be per the State or County Plumbing Code in effect. Should an existing lateral not have a cleanout installed, a cleanout will be required to be installed at the right-of-way line, unless alternate location approved by the Town, and must be shown on the plans.
   b. The minimum slope for 6-inch sewer laterals shall be one (1) foot per 100 feet, or 1.00%; unless approved otherwise by the Town.

D. Manholes

1. Location and Spacing

   Manholes shall be installed at the end of each line; at all changes in grade, size or alignment; at all intersections, and at distances not greater than 400 feet.

2. Terminal Manholes

   Terminal manholes shall not be substituted for manholes. However, terminal manholes may be approved under Special Conditions by the Town Engineer on a case-by-case basis. Under no conditions shall terminal manholes be installed at the end of a main line sewer greater than 150 feet from the last manhole.

3. Drops

   A drop manhole shall be provided for an incoming sanitary sewer that is 24 inches or more above the manhole invert, and, the invert shall be filleted to minimize solids deposition. Inside drop connections only shall be used, except for on a case-by-case basis with prior approval by the Town.

4. Minimum Diameter

   The minimum diameter of manholes shall be 48 inches. Larger diameters are

required for drop connections in new construction. A minimum access diameter of 24 inches shall be provided.

5. Flow Channels

The flow pipe channel through manholes shall be precast and conform in shape and slope to that of the sewers. The top of the channel shall be at the same elevation as the crown of the main sewer line in the manhole. Channel shall drop a minimum of 0.10 foot from influent pipe unless otherwise approved. Brick and mortar may be used upon approval of the Town.

6. Use coring machine for connection to an existing manhole and provide flow channel reconstruction to suit. Grouting in of new pipe shall be via Link Seal or Town approved sand collar. Connection shall be watertight.

E. Grease Traps

Grease traps are required for all commercial operations, restaurants, convenience stores, etc. which have cooking operations. Traps shall be designed to prevent accumulation of grease in sanitary sewers. Maintenance of grease traps shall be at a minimum of 1 time per month or as needed. Maintenance is the responsibility of the property Owner. The property Owner shall submit to the Town a maintenance contract with a local hauler defining these responsibilities for inspection and pump out as required. Maintenance records shall be provided to the Town on a quarterly basis.

1. Sizing of grease interceptors shall be calculated using the Environmental Protection Agency (EPA) 2 Model, “Recommended Grease Trap Sizing Formula” or latest revision for restaurants, the 2003 Uniform Plumbing Code, Appendix H Sizing Method for other type commercial kitchens, or the 2021 Uniform Plumbing Code using Drainage Fixture Units. Minimum size grease trap size should be 1000 gal.

2. Only sanitary sewer laden with fats, oils, and grease from food preparation appliances and fixtures shall be directed into a grease interceptor.

3. Location of grease interceptors should be accessible for maintenance. If located within a vehicular traffic area, grease interceptor shall be AASHTO H-20 rated.

4. Calculations for all grease interceptors shall be submitted to the Town for approval.

F. Oil/Water Separators

Oil/water separators are required for all commercial facilities engaged in business of food preparation, car wash and automotive services. Separators shall be designed to prevent accumulation of oils in sanitary sewers. Maintenance of oil/water separators shall be at a minimum of 1 time per month or as needed. Maintenance is the responsibility of the

property Owner. The property Owner shall submit to the Town a maintenance contract with a local hauler defining these responsibilities for inspection and pump out as required. Maintenance records shall be provided to the Town on a quarterly basis.

1. The sedimentation pit shall be located upstream of the oil/water separator.
2. The design shall ensure that all non-domestic waste from the commercial operation is directed to one or more sedimentation pits and one or more oil/water separators before discharge to the sewer.
3. The sampling ports shall be readily and easily accessible at all times. A sampling port may consist of a simple tee or an opening for a pump sampling tube.
4. The sediment pits and oil/water separators shall be inspected once per month. The depth of bottom sludge and floating oils shall be measured.
5. The solids in the sedimentation pit(s) shall not exceed 75 percent of the wetted height of the sedimentation pit. (As solids build up in the bottom of the pit, efficiency of the pit decreases and the chance of sludge passing through the interceptor increases.)

5.3 SEWER IMPACT STUDY

A. Study required for 11 or more EDUs.

B. Developer is responsible for conducting the study and submitting it to the Town for review, or, by decision of the Town, the Town may conduct the study and be reimbursed by the Developer.

C. The study will include existing collection system capability and may include treatment and disposal capability upon review by the Town. All projects over 50,000 gpd and projects needing treatment and disposal capacities require a scoping meeting.

D. EDU determination component (non-residential uses)

E. Checklist:

1. Contact information for developer and engineer doing study.
2. Proposed sewer flows and EDU calculation.
3. Flow phasing schedule for build outs in excess of 5 years.
4. Written summary and pertinent backup information to indicate that design parameters will be met when connecting to the existing system, or proposed improvements to meet project needs.
5. If applicable, show scope of proposed offsite sewer extensions with schematic.
6. If applicable, show proposed offsite easements or use of public rights of way.
7. Estimated itemized construction cost for offsite improvements and extensions.
8. Indicate sewage quality if different from normal domestic.

5.4 MATERIALS

A. Pipe Identification

1. Each length of pipe shall be marked at intervals of five (5) feet to include the following when applicable to that type of pipe:

a. Nominal size and/or O.D. base
b. Material code designation or cell classification
c. Schedule or dimension ratio number
d. AWWA pressure class
e. AWWA and/or ASTM designation number
f. Manufacturer's name or trademark
g. Seal of testing agency verifying potable water service
h. Use push-on or mechanical joints below grade unless otherwise specified
i. Use flanged joints above grade unless otherwise specified

B. Polyvinylchloride (PVC) pipe for sewer mains and laterals shall conform to ASTM D3034, Type PSM. The SDR number which expresses the ratio of pipe diameter to wall thickness shall be SDR 35. All pipe and fittings shall be made from PVC compounds as defined and described in ASTM D 1784. Joints shall be of the push-on type using flexible elastomeric seals in accordance with ASTM D 3212 and ASTM F 477.

C. Ductile Iron gravity sewer pipe shall conform to ASTM A 746. Joints shall be push-on or mechanical conforming to ANSI/AWWA C111. Standard Fittings shall conform to ANSI/AWWA C110 and compact fittings shall conform to ANSI/AWWA C153. All ductile iron gravity sewer pipe and fittings shall be lined with a material specifically formulated to resist the corrosive atmosphere of wastewater sewers. Pipe and fittings shall have a standard internal and external asphaltic coating conforming to ANSI/AWWA C151.

D. Laterals along the ductile iron main shall be installed using a ductile iron tee fitting. The lateral branch of the tee shall be 6”. Extend the 6” ductile iron lateral pipe vertical to a ductile iron 45-degree bend. Connect another length of 6” ductile iron to the bend and then transition to 6” PVC using a Fernco coupling with stainless steel sheer ring and clamps. Lateral shall have a minimum diameter of 6”. Lateral shall not cross sewer main it connects into.

E. For gravity sewer deeper than 15 feet, as measured to the invert of the pipe, PVC SDR-26 or ductile iron pipe shall be used.

F. All concrete for manhole base slabs and cradles, encasements, blocking, etc., shall have a minimum compressive strength of 3000 psi at 28 days. Precast concrete shall have a compressive strength of 4000 psi in 28 days.

G. Manholes shall consist of pre-cast reinforced concrete base, riser and eccentric cone top sections conforming to ASTM C 478. Joints between riser sections shall be fitted with an O-ring rubber gasket conforming to ASTM C 443 and C 361 and wrapped with EZ-Wrap 9" wide by Press-Seal Gasket Corporation. The manholes shall utilize A-LOK watertight rubber gaskets or equal cast integrally in the wall and located as required for sewer pipe connections. The minimum inside diameter (I.D.) shall be 48 inches. Grade rings shall be Cretex Pro Ring™ or approved equal, to match diameter of manhole frame and cover.

H. Interior surfaces of all new and existing manholes that will receive sewage force main discharge water shall receive two (2) coats of amine cured epoxy having a total dry film thickness of 16 – 24 mil.

I. Exterior surfaces for all manhole types shall receive a plant-applied SSPC-SP-16, asphalt and mineral spirit protective coating having a 20-mil minimum dry film thickness applied in one coat. Exterior coating shall be Seaboard Asphalt Products Company, LN-12 Seaboard Quick Drying Asphalt Paint.

J. Manhole frames and covers shall be composite moldings consisting of a thermosetting resin matrix blended and/or combined with reinforcing fiber rovings, short fiber filaments, or equivalent nonmetallic reinforcing structures(s). The thermosetting resin matrix shall be a polyester, vinylester, or a blend of these. The moldings shall be true to pattern in form and dimension and free from cracks, pores, knit-lines, or other defects in locations affecting their strength and value for the service intended. Manhole frames and covers shall be Composite Access Products, CAP ONE ®-26, East Jordan 2600, Durostreet ® composite assembly or approved equal. Cover lettering shall read: “Sanitary Sewer.”

K. Manhole steps shall be 3/8-inch diameter deformed steel reinforcing bar encased in polypropylene plastic with a notched tread ridge and retainer lug on each side, as manufactured by M.A. Industries, Inc., or equal. Steps shall be OSHA approved and cast or anchored into sidewalls at 12-inch intervals.

L. Cleanout frames and covers shall be grey iron shall be cast from gray iron, of uniform quality, closed pickholes. free from blow holes, porosity, hard spots and well cleaned by shot blasting. Material shall conform to ASTM A 48, Class 35. Frames and covers for 6-inch diameter cleanouts and smaller shall be Neenah Foundry No. R-1974-A, or approved equal. Frames and covers for 8-inch cleanouts shall be Neenah Foundry No. R-1976, or approved equal. Cover lettering shall read: “S” or “Sewer”.

M. All frames and covers shall be of the sizes and types approved by the Town and with "SANITARY SEWER" and two pick holes cast into the cover.

N. Doghouse Manholes: Precast Concrete Manholes: ASTM C 478 precast, reinforced concrete bases, risers and flat top sections.

1. Diameter: 60 inches minimum
2. Base Section: Open bottom with “doghouse” type pipe openings.
3. Top Section: Flat-slab type for shallow manholes.
4. Joint Sealant: ASTM C 443 and C 361, O-ring rubber gasket.
5. Steps: 3/8-inch diameter deformed steel reinforcing bar encased in polypropylene plastic with a notched tread ridge and retainer lug on each side, as manufactured by M.A. Industries, Inc., or equal. Steps shall be OSHA approved and cast or anchored into sidewalls at 12-inch intervals.

O. Force main discharge manholes shall consist of polymer concrete base, riser and eccentric cone top sections conforming to ASTM C 478. Joints between riser sections shall be fitted with an O-ring rubber gasket conforming to ASTM C 443 and C 361 and wrapped with EZ-Wrap 9" wide by Press-Seal Gasket Corporation. The manholes shall utilize A-LOK watertight rubber gaskets or equal cast integrally in the wall and located as required for sewer pipe connections. The minimum inside diameter (I.D.) shall be 48 inches. Grade rings shall be Cretex Pro Ring™ or approved equal, to match diameter of manhole frame and cover. All benches and channels shall consist of polymer concrete, no Portland cement shall be allowed as part of the mix.

P. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
   a. Invert Slope: 0.1 foot drop across manhole.

2. Benches: Concrete, sloped 4 percent minimum, to drain into channel.

Q. Manholes connected to gravity sewer greater than 15 feet deep, as measured to the invert of the pipe, shall be minimum 60” in diameter.

R. Detectable Pipeline Warning Tape: Metallic type with metal foil running the full length and width of the tape. Tape shall be 6-inches wide. Foil shall be encased in a high visibility, color coded, polypropylene film with continuous, clearly imprinted identification legends. Detectable warning tape shall be in accordance with Section 2 – Earthwork of these Standard Specifications.

5.5 CONSTRUCTION METHODS

A. Excavation and refill for gravity sewer trenches shall be in accordance with Section 2 - Earthwork of these Standard Specifications.

B. Sewer pipe and fittings shall be installed and placed into service in conformance with ASTM D 2321 and the pipe manufacturer's recommendations.

C. Precautions shall be taken to keep interiors of pipes and fittings clean before installation and kept clean until final acceptance. Pipe delivered for construction shall be stored so as to minimize entrance of foreign material. When pipe laying is not in progress, all openings in the pipeline shall be closed by watertight plugs. Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

D. Pipe and fittings shall be carefully handled and placed in the trench. Special care shall be taken to ensure that each length of pipe abuts against the next in such a manner that there shall be no shoulder or unevenness of any kind along the inside of the bottom half of the pipe.

E. Before pipe is placed, the bottom of the trench shall be carefully shaped to fit the lower part of the pipe exterior with reasonable closeness for circumference of at least 60% of the pipe diameter. Bell holes shall be dug sufficiently large to insure the making of proper joints and so that after placement, only the barrel of the pipe receives bearing pressure from the trench bottom. No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Any defects due to settlement shall be made good by the Contractor.

F. Pipe laying shall commence at the lowest elevation and pipe bells shall be placed on the upgrade end. Pipe shall be laid with true lines.

G. Sewer laterals and wyes connecting to sewer mains with greater than 8 feet of cover shall be connected using the deep sewer lateral connection method. See detail D5-8.

H. Proper and suitable tools and appliances for the safe and convenient handling and laying of pipe shall be used.

I. Whenever a pipe requires cutting to fit into the line or to bring it to the required location, the work shall be done in a satisfactory manner so as to leave a smooth end.

J. Pipeline detectable tape shall be installed continuously along all sewer. The tape shall be installed directly above the pipe and 18 inches from the ground surface.

K. Pipeline tracer wire shall be installed along all gravity sewer and sewer laterals.

L. For direct burial of gasketed-joint gravity sewer and sewer laterals, tracer wire shall be fastened directly to the top of the pipe, at each end and in the center. The distance between attachment points shall be no greater than 10 feet. Tracer wire shall be a #12 AWG high strength, copper-clad steel (HS-CCS) conductor, insulated with a 30 mil, high-density, high molecular-weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. Insulation color shall meet the APWA color code standard for identification of buried utilities. Tracer wire shall be Copperhead HS-CCS HDPE 30 mil insulation as manufactured by Copperhead Industries, LLC of Monticello, MN.

M. Splicing of tracer wire shall not be permitted. Long runs of tracer wire may not be greater than 400 feet (+/-). At these intervals, tracer wires shall be extended from the gravity sewer to grassed area behind the curb or sidewalk. Magnetized tracer boxes, as manufactured by Copperhead Industries, LLC shall be installed in the grassed area and the tracer wires shall be installed up into the boxes and connected to lugs in the boxes. All boxes shall have a color-coded cover to match the APWA color code standard for identification of buried utilities. Tracer on sewer laterals shall be connected to magnesium anode at the sewer main. Anode shall be as manufactured by Copperhead Industries, LLC. The upstream end of the tracer wire shall be run up into the cleanout frame and cover where it shall be fixed and made accessible to the locater.

N. All dead ends of tracer wire not made accessible at the ground surface, either in a tracer wire box or a sewer cleanout frame and cover shall be grounded by attaching the end to a magnesium anode as manufactured by Copperhead Industries, LLC.

O. No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when the Town shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation unless all required precautions as to the minimum length of open trench and promptness of backfilling are observed.

P. Whenever directed, the Contractor shall lay pipe upon an artificial foundation which he or she shall construct. Such foundation may consist of gravel or of concrete and shall be to the dimensions and placed in a manner required by the Town.

Q. Manholes shall be installed as pipe laying progresses.

R. Interior and exterior joint spaces of all precast concrete manhole risers shall be filled. The interior joint shall be mortared with in conformance with "Standard Specifications for Portland Cement", ASTM: Designation C 150 for Type II. The exterior joint shall be mortared or filled with a joint filler compound. Mortar on exterior joints shall receive a bitumastic coating.

S. Pipe penetrations for connecting sewers to existing manholes shall be core bored. Cored openings shall be clean cut circular openings with no irregularities along the perimeter of the opening. Pipe-to-manhole connections at cored openings shall be made by using Kor-N-Seal® I Connectors, as manufactured by E.J. Prescott, Inc.

T. Channels for receiving and passing water shall be formed in the bottom of manholes. All such channels shall be lined with brick, with brick and split pipe, or concrete. Channels shall slope smoothly and evenly from the main pipe entering the manhole to the outlet pipe. Channels for future pipe shall be built into manholes.

U. Manhole frames, covers, and steps shall be installed as the work progresses. Frames shall be well bedded in mortar. Steps shall be spaced vertically and aligned to allow unobstructed access to the manhole. For all manholes located within grass areas and other locations determined by the Town, a 7' x 7' concrete collar with a minimum thickness of 4 inches and 6 x 6 W2.9xW2.9 WWF shall be poured around the manhole frame and cover. Set rim height at finished grade and finish concrete collar for positive drainage.

V. All cleanouts shall be located outside of driveways or traffic areas except as previously approved by the Town. Any cleanout located within paved area shall be 2' x 2' x 2' concrete collar installed around the cleanout frame and cover.

W. Wye or tee branches shall not be covered with backfill until the location is recorded.

X. Service branches for laterals in new construction shall be molded or fabricated with gasketed connections. Saddles shall not be permitted in new construction. Pipes requiring cutting to fit into the line or to bring it to a required location shall have square cuts and the spigot end shall be beveled to an angle of 15 degrees.

Y. All caps and plugs shall be adequately secured to the pipe to prevent leakage under the maximum anticipated thrust from internal operating conditions or test pressures from water or air. Plugs shall be HDPE or stainless steel inflow stopper inserts with double valves and lifting handle. (Parsons or equal).

Z. Manhole stubs shall be extended 4 feet outside of the manhole wall unless otherwise required. Gasketed plugs shall be installed in the ends of the stubs.

AA. All house connections shall be constructed to terminate at an angle perpendicular to the property line.

BB. All laterals shall be marked with 2 x 4 lumber markers extending from the end of the lateral vertically to one foot or more above the ground surface. The markers shall be securely anchored and maintained in a proper vertical position until backfilling has been completed.

CC. The excavation in which pipe is being laid shall be kept free from water and no joint shall be made underwater. Care shall be used to secure water tightness and to prevent damage to or disturbing of the joints during the backfilling process or at any time. After pipes have been laid and the joints have been made, walking on or working over the pipe shall be limited to such as may be necessary for tamping until there is a covering of at least 2 feet over the top of the pipe.

DD. Capped stubs shall be provided for future connections from manholes. An end cap or end plug shall be placed on a short section of pipe extending from a manhole. All plugs and caps shall be braced, staked or anchored to prevent leakage or blow off.

EE. Detection and warning tape shall be installed at half of the trench depth. At no time shall detectable tape be placed at a depth less than 6 inches or more than 36 inches.

5.6 TESTING AND ACCEPTANCE

A. Contractor shall furnish all labor, tools, materials, and equipment, including water, pumps, compressors, stopwatch, gauges, flashlights or other artificial lighting, mirrors and meters, subject to the approval of the Town, for testing in accordance with these specifications.

B. The Town shall be notified in advance of all tests, and all tests shall be conducted to the entire satisfaction of the Town.

C. Sewer mains must pass all test requirements listed hereafter prior to acceptance by the Town with no exceptions.

D. Connections to sanitary sewers shall not be completed until the final inspection and tests have been approved.

E. Prior to the request for inspection, it shall be the Developer’s responsibility to examine all completed pipelines to ensure that they are laid to the proper alignment and grade and be free from foreign material. After this has been done to the satisfaction of the Town, tests shall be made on all portions of the constructed sewers. The Developer shall cooperate and furnish all assistance necessary to perform the tests as specified herein and to the satisfaction of the Town.

F. Initial inspections and tests shall not be conducted until at least 20 days after the pipeline segment being inspected and tested has been backfilled in accordance with Section 2 – Earthwork of these Standard Specifications, and all dewatering pumps have been removed from the area.

G. Gravity sewers shall be subject to mirror-light testing to determine that the alignment is straight and true, and sewers not allowing the passage of a full circle reflected light shall not be accepted.

H. Deflection Testing: All PVC sanitary sewers shall be tested for deflection (reduction in vertical inside diameter). Testing shall be performed by passing a 5 percent undersized Go / No-Go mandrel or sewer ball through the pipeline or measuring deflection continuously by using a deflectometer. Maximum allowable deflection shall be 5 percent.

I. Gravity sewers shall be subject to visual testing using closed circuit television (CCTV) equipment suitably sized for the diameter of the sewer segments being tested. Sanitary sewer showing signs of infiltration shall be tested for leakage infiltration in accordance with Paragraph 33.94, Water (Hydrostatic) Test of the "Recommended Standards for Wastewater Facilities," 2014 Edition. The maximum allowable amount of infiltration rate measured by the test shall be 25 gallons per inch of pipe diameter per mile per 24 hours. CCTV survey results shall be submitted to the Town for review and approval. CCTV video inspection shall follow the below requirements:

1. All pipe inspections must be completed by a National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) certified professional.

2. The video should include identification before each run of pipe is filmed. This identification will include the project number or subdivision name, the structure number and the pipe run number corresponding to the construction plans. Inspections shall be from center of the starting manhole to the center of the ending manhole.

3. Recording shall be of a quality sufficient for ENGINEER to evaluate the condition of the sewer, locate the sewer service connections, and to verify cleaning. If ENGINEER determines that the quality is not sufficient, re-televise the sewer segment and provide a new recording and report at no additional compensation.

4. Adjust light levels, clean fouled or fogged lens, and allow vapor to dissipate from camera lights in order to produce acceptable recordings. All TV inspection recordings that do not meet the specified requirements shall be re-televised.

5. Record all information using proper NASSCO PACP defect codes and pipe ratings. The reports shall include at least the minimum amount of information required by PACP, including required PACP header information. Color still shot images of all defects encountered shall be included with each pipe segment.

6. Each pipe run must be a separate video file.

7. The video shall indicate the distance traversed along the pipe. The distance shall have an accuracy of one foot per 100 feet.

8. The camera must move through the pipe at a speed not greater than 30 feet per minute.

9. Provide sufficient lighting to produce a clear image of the full circumference of the pipe.

10. Provide a full unobstructed and centered view of the entire pipe. The view shall be centered both horizontally and vertically.

11. Stop at every joint for three (3) seconds. When infiltration or other defects are evident, use pan and tilt camera to document the entire circumference of the pipe joint.

12. The camera operator shall provide a continuous video during the CCTV process. The operator shall stop and center the camera as needed to measure and record any defects or irregularities found during the videoing. All defects shall be described in accordance with NASSCO PACP coding requirements. Irregularities shall include any questionable item such as a stain, crack, paint mark, shadow, or character change in a pipe being inspected.

13. Stop at every lateral connection. Center the camera so that the lighting and the pan and tilt view can be used to inspect as far into the lateral connection as possible. Pan the circumference of the tap, recording all defects found in the service connection. Where lateral flow is observed, observe flows from service connections for approximately two minutes to ascertain if the flow is sanitary or extraneous flow. The video recording may be paused during observation. Record results of the flow observed on video recording and inspection logs

J. Gravity sewers shall be subject to a low-pressure air test. Low-pressure air test shall be completed in accordance with ASTM F1417: “Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air” and with UNI-B-6: “Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.” The Contractor shall furnish all equipment and personnel to conduct this test in accordance with the following procedure:

1. All branch fittings and ends of lateral stubs shall be securely plugged to withstand the internal test pressures. The section of line being tested shall also be securely plugged at each manhole. All stoppers shall be adequately braced when required.

2. Air shall be slowly supplied to the plugged pipeline until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any groundwater above the pipe, but not greater than 9.0 pounds per square inch. At least 2 minutes shall be allowed for temperature stabilization before proceeding further.

3. The rate of air loss shall then be determined by measuring the time interval required for the internal pressure to decrease from 3.5 to 2.5 psi above the average groundwater back pressure.

4. The line shall be considered acceptable if the time, T, in seconds required for the 1.0 psi pressure drop is not less than 0.0850 DK/Q Where:
   D = pipe diameter, inches
   L = length of line being tested, feet
   K = 0.000419DL, but not less than 1.0
   Q = rate of loss of 0.0015 cu. ft./min./sq. ft. of internal surface

MINIMUM HOLDING TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

Pipe Minimum Diameter (Inches)	Time (min-sec)	Length for Minimum Time (ft.)	Time for Longer Length (sec.)		Specified Time for Length (L) Shown (min-sec) 100'	150'	200'	250'	300'	350'	400'	450'
4	3:46	597	.380	L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854	L	5:40	5:40	5:40	5:40	5:40	5:42	5:42	6:24
8	7:34	298	1.520	L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374	L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418	L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342	L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692	L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
24	22:48	099	1.368	L	22:48	34:11	45:35	57:00	68:23	79:47	91:10	102:34
27	28:57	088	1.731	L	28:51	43:16	57:42	72:07	86:33	100:58	115:24	129:49
30	35:37	080	2.137	L	35:37	53:25	71:14	89:02	106:51	124:34	142:28	160:16

K. If the measured leakage rate exceeds the allowable amount, additional tests shall be conducted on individual segments of the gravity sewer system as required to locate the leaks. Any observed leakages of the gravity sewers or manholes shall be repaired. Sanitary sewer showing signs of infiltration shall be tested for leakage infiltration in accordance with Paragraph 33.94, Water (Hydrostatic) Test of the "Recommended Standards for Wastewater Facilities," 2014 Edition. The maximum allowable amount of infiltration rate measured by the test shall be 25 gallons per inch of pipe diameter per mile per 24 hours.

L. Manholes

1. Manholes shall be vacuum tested at the discretion of the Engineer in accordance with ASTM C1244 "*Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure Test Prior to Backfill*".

2. Manholes shall be complete and ready for backfill prior to execution of the test. Expandable plugs shall be installed and inflated in all interior pipe openings. Bracing of plugs may also be required.

3. Vacuum test pressure shall be 10 inches, Hg, or 5 psi.

4. The duration of the vacuum test shall be in accordance with the diameter and depth of the manhole and the table below.

Minimum Test Times for Manhole Vacuum Test

Manhole Depth (feet)	Diameter (inches	
	48	60
	Time (seconds)	
15 feet or less	60	60
Greater than 15 feet	90	90

5. The manhole shall pass the test if the vacuum pressure does not drop below nine (9) inches Hg, or 4.5 psi in the appropriate time in the table above.

END OF SECTION

SECTION 6 – WASTEWATER PUMPING STATIONS

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SECTION 6 – WASTEWATER PUMPING STATIONS

6.1 DESIGN CRITERIA

A. General Requirements

1. Wastewater pumping stations shall typically be configured with submersible pumps in a polymer concrete wet well and valves and flow meter in a below-grade polymer concrete vault. Electrical equipment shall be housed in an above-grade, free-standing enclosure or building. All pumping stations shall include variable frequency drives (VFDs).

2. The designer shall schedule a pre-design conference with the Town and the Town's engineer to discuss and confirm the pumping station configuration, site location, design requirements, required appurtenances and other issues.

3. Design calculations supporting the specified wet well volume, pump cycle time, pump capacity, force main diameter, ventilation capacity, wet well and valve vault buoyancy measures, and GenSet capacity shall be submitted along with the construction drawings and specifications.

B. Site Requirements

1. The pumping station site shall be conveyed to the Town by fee-simple deed.

2. The site shall be accessible by vehicle in all weather conditions. The access road and area inside the fence shall be concrete- or hot mix-paved and be located off the traffic way of streets and alleys.

3. All structures, including the mechanical and electrical equipment, shall be designed to be protected from damage due to a 100-year flood, and to remain in full operation during a 25-year flood.

4. The site and all facilities shall meet OSHA safety requirements.

5. The site shall be secured with slatted chain link fence, gate, and locks.

6. Security lighting shall be provided.

7. Potable water service connection and a yard hydrant shall be provided.

C. Pumps and Piping

1. Two sewage pumps shall be required as a minimum in all pumping stations. Each pump shall have the same capacity and individually be capable of handling flows in excess of the expected maximum flow. If determined necessary due to wide variations in initial and ultimate pumping rates and hydraulic conditions, three pumps may be required by the Town. Approved submersible pumps include Flygt (preferred) and Myers.

2. Hardware shall be Type-316 stainless steel and shall include guiderails, brackets, chains, cables, etc.

3. Design Pumping Rate: An average daily flow of 225 GPD per equivalent dwelling unit served, with a 3 peak to average flow ratio shall be used to determine the design pumping rate.

4. The pump motor horsepower rating shall not be exceeded at any point on the pump's operating curve.

5. Pipe Size: Discharge and force main piping shall be sized to provide a flow velocity of not less than 2.5 feet per second and not more than 5.5 feet per second at the design pumping rate, unless approved by the Town Engineer.

6. A by-pass pumping connection shall be provided to enable pumping from the wet well into the force main via a portable pump.

7. All influent pipes shall have a screening basket installed, Series B1 as manufactured by Halliday Products or approved equal.

D. Wet Well

1. The minimum wet well operating volume for duplex, alternating pump systems shall be determined by the formula:

$V = t Q/4$

where:

V= Minimum Operating Volume (Gallons)
t = Minimum allowable time between starts of the same pump based on motor manufacturer's recommendations or 7.5 minutes, whichever is greater
Q = Design pumping rate

2. Wet well floors shall be grouted to form a sump sloped at 1:1 toward the pump inlets and in accordance with the pump manufacturer's recommendations. A pump manufacturer's preformed sump insert may also be specified if it is manufactured from corrosion resistant materials.

3. Adequately sized access hatches shall be constructed for the installation and removal of pumps and other equipment.

4. The wet well structure shall be designed to prevent positive buoyancy due to groundwater conditions. Buoyancy calculations shall be provided based on wet season ground water elevation at the finished ground surface elevation with a safety factor of 2.0.

5. A manhole shall be installed just upstream of the wet well. The invert out of this manhole shall be plugged when bypass pumping is required, and the manhole shall serve as a standby wet well for the suction line during bypass pumping.

E. Valves

1. Check valves and isolation valves shall be installed on all pump discharge lines. The check valve shall be located between the pump and the isolation valve.

2. All valves regardless of type shall be located in a below-grade valve vault completely isolated from the wet well.

3. Valve vaults shall have adequately sized access hatches for entry by maintenance personnel and minimum inside height clearance of 6'.

4. The valve vault structure shall be designed to prevent positive buoyancy due to groundwater conditions. Buoyancy calculations shall be provided based on wet season ground water elevation at the finished ground surface elevation with a safety factor of 2.0.

5. Refer to Section 7 – Wastewater Force Mains of these Standard Specifications for air release and combination air valves.

F. Ventilation

1. Adequate ventilation shall be provided for wet wells and valve vaults.

2. Pumping stations shall have a permanent mechanical ventilation in the wet well.

3. Intermittently operating ventilation shall provide at least 30 complete air changes per hour. Intermittent ventilation shall be controlled by programmable timer with manual override.

4. Mechanical ventilation shall force fresh air into below-grade structures.

G. Electric Service

1. Pumping stations shall have metered electrical service complying with all utility company requirements, and an above-ground service entrance breaker switch.

2. Pumping stations shall be equipped with an emergency generator with the capacity to start and run the entire facility’s electrical load unless approved otherwise. Small stations may, on a case by a case basis, be allowed to substitute portable power generation or portable pumping equipment.

3. When sizing the generator, Pump #1 and all stations loads shall be included in Generator Step 1. Pump #2 shall be included in Step 2.

4. Due to differences in Utility Company service requirements with the Town of Georgetown, each station shall be coordinated specifically with the utility company to determine voltage and phasing for the station.

H. Standby Generator

1. All pumping stations shall be equipped with a standby-rated diesel or natural gas (preferred) engine-generator set (Genset), an automatic transfer switch and all necessary controls and auxiliaries to start and run the entire facility's electrical load during utility service outages.

2. The Genset shall have sufficient capacity to perform all pumping station electrical functions, including starting the lag pump when all other electrical loads, including the lead pump, are connected.

3. The Genset shall be designed for unattended automatic operation and for manual control. Instrumentation to provide adequate monitoring of performance under both conditions shall be provided.

I. Controls and Alarms

1. The functional description of controls and alarms are of general nature. The functionality described herein shall be provided regardless of size or style of pumping station and number of pumps.

2. The pump control panel (PCP) shall monitor the water level in the wet well with a continuous level transmitter and two (2) float switches. The transmitter level thresholds and level switch positions shall be set at heights in the wet well to serve the following functions:
   a. Level 7 - High High-Level Alarm and Backup Pump Control (Float Switch)
   b. Level 7 - High Level Alarm (Analog Transmitter Threshold)
   c. Level 5 - Lag Pump On (Analog Transmitter Threshold)
   d. Level 4 - Lead Pump On (Analog Transmitter Threshold)
   e. Level 3 - Pumps Off (Analog Transmitter Threshold)
   f. Level 2 – Low Level Alarm (Analog Transmitter Threshold)
   g. Level 1 – Low Low-Level Alarm and Backup Pump Control (Float Switch)

3. The PCP shall perform the following basic functions:
   a. Allow the operator to select any pump as a Lead pump.
   b. Allow the operator to select automatic alternation of the Lead and Lag Pumps on each successive start cycle.
   c. On rise to Level 4 (Lead On), the Lead Pump shall start its associated VFD and control its speed to maintain the Level 4 setpoint. The speed shall increase on rise in level to its full speed and decrease to its minimum speed on fall in level. The pump shall stop when level falls to Level 3.
   d. On rise to Level 5 (Lag On), the Lag Pump shall start and run until it stops at Level 3.
   e. On rise to Level 6 (High Level), energize an alarm circuit.
   f. On rise to Level 7 (High-High Level), energize an alarm circuit and start the lead pump. In the event that the lead pump does not start, the lag pump shall start after an adjustable start delay. Only one pump shall start on rise to Level 7.
   g. On fall to Level 3 (Pumps Off), stop all pumps.

h. On fall to Level 2 (Low Level), energize an alarm circuit and stop all pumps.
i. On fall to Level 1 (Low Low-Level), energize an alarm circuit, and stop all pumps.
j. In the event of a pump malfunction (overload trip, motor high temperature, pump fail to run when called, pump fail while running), promote the next pump in line and run it in place of the failed pump (promote Lag to Lead).
k. If a pump has failed, the PCP should consider it unavailable and remove it from the alternation cycle. It shall remain unavailable until the alarm is reset at the PCP.
l. Allow selection of “Maintain Level” or “Constant Speed” through the Human-Machine Interface (HMI).
m. Allow manual adjustment of the pump speed through the HMI.
n. The PCP shall monitor the status of the UPS for display on the OIT Screen and initiating a UPS Failure alarm, which automatically switches to incoming power.

4. The PCP shall be equipped with the following devices:
   a. Intrinsically safe barriers for connection to instruments and switches located in the wet well: level switches and submersible level transmitter.
   b. A pump motor relay for overtemperature and seal leakage alarms for each pump.
   c. A Hand-Off-Auto selector switch for each pump. Switches shall be heavy-duty, oil-tight and rated for the NEMA class of the enclosure (shall be provided in separate VFD enclosure)
   d. Alternation selector – selector switch(es) or other means of selecting pump alternation.
   e. Controller and HMI with means of receiving and indicating the following conditions:
      - High Water Level (float switch to discrete input)
      - Low Water Level (float switch to discrete input)
      - Wet Well Level (4-20 mA transmitter to analog input)
      - Station Discharge Flow (4-20 mA transmitter to analog Input)
      - Power On
      - Pump A Run
      - Pump B Run
      - Pump A Seal Leak (dry contact from motor protective relay to discrete input)
      - Pump B Seal Leak (dry contact from motor protective relay to discrete input)
      - Pump A Motor Temperature High Alarm (dry contact from motor protective relay to discrete input)
      - Pump B Motor Temperature High Alarm (dry contact from motor protective relay to discrete input)
      - VFD-A Fault (for VFD)
      - VFD-B Fault (for VFD)
      - Alarm Output Contacts to the cellular pump monitoring and control system

5. A backup level control circuit, based on relays to start both pumps (with a

time delay between each start) when the High-Level switch is activated and stop both pumps when the Low-Level switch is activated.

6. Field terminals

7. Graphic Screens - graphics screens shall include, but not limited to the following:
   a. Animate these screens to dynamically represent level in a graphic format. Provide numerical displays of all current analog inputs scaled to the appropriate engineering units with dynamic links to detail screens showing trends.
   b. Wet Well level in feet from bottom of wet well.
   c. Animate graphic device symbols for pumps to reflect current status of the device (Green = running, Red = alarm, Flash Yellow = failure alarm)

6.2 MATERIALS AND PRODUCTS

A. Wet Well and Valve Vault

1. Wet wells shall be constructed of polymer concrete base with a monolithic floor and riser sections, in conformance with ASTM C 478 and ASTM C 857 and reinforced in accordance with ACI 440.1R-15 with allowable compositional and sizing differences as designed by the polymer concrete manufacturer in a rectangular shape with a minimum size of 6' x 6’ or a round manhole with a minimum diameter of 6'. All joints shall be gasketed in conformance with ASTM C 443. Openings for pipe connections shall be fitted with cast in place resilient A-Lok or Z-Lok seals, or mechanical link-seals.
   a. Riser sections shall be joined with bell and spigot / ship-lap design seamed with butyl mastic and/or rubber gaskets (ASTM C 990) so that on assembly, base, riser and top section make a continuous and uniform structure
   b. Riser sections for polymer concrete lift stations shall be constructed from standard polymer concrete sections of the size indicated on drawings. Use various lengths of polymer concrete sections in combination to provide correct height with the fewest joints
   c. Design wall sections for depth and loading conditions with wall thickness as designed by polymer concrete manufacturer
   d. The wall thickness of polymer concrete structures shall not be less than that prescribed by the manufacturer’s design by less than 95% of stated design thickness
   e. Polymer Concrete Mix Design shall consist of thermosetting resin, sand, and aggregate. No Portland cement shall be allowed as part of the mix design matrix. All sand and aggregate shall be inert in an acidic environment
   f. Reinforcement shall use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R-06 as applicable for polymer concrete design
   g. Each polymer concrete component shall be free of all defects, including indentations, cracks, foreign inclusions and resin starved areas that, due to their nature and degree or extent, detrimentally affect the strength and

serviceability of the component part. Cosmetic defect shall not be cause for rejection. The nominal internal diameter of manhole components shall not vary more than 2%. Variations in height of two opposite sides of risers and cones shall not be more the 5/8 inch. The under run in height of a riser or cone shall not be more than ¼ in/ft of height with a maximum of ½ inch in any one section

h. Each structure shall be marked with the following information - Manufacturer's name or trademark, Manufacturer's location and Production Date

i. Minimum clearance between wall penetrations and joints shall be per manufacturer's design

j. Invert channels shall be constructed to provide smooth flow transition with minimal disruption of flow at pipe-manhole connections. Invert slope through manhole is as indicated on drawings. All precast base sections to be cast monolithically. Polymer bench and channel are to be constructed with all polymer concrete material. The polymer concrete lift stations shall be installed via tremie method. Extended ballast slab requirements for buoyancy concerns can be addressed with cementitious concrete material

k. All materials needed for grouting and patching will be a polyester mortar compound provided by the manufacturer or an approved equal by the manufacturer

2. Valve vaults shall be polymer concrete reinforced for H-20 bridge loading provided in two (2) sections for exterior heights up to 8'-0" and in three (3) sections for additional heights. Joints of sections shall be gasketed and sealed watertight when installed.

3. Top slabs shall be cast-in-place reinforced concrete.

B. Access Hatch Frames and Covers

1. Access hatch frames shall be 6063-T6 aluminum extrusion with a continuous anchor feature incorporated. Frames shall be designed to direct rain water via the channel frame to a drain connection. Covers shall be 1/4" aluminum 6061-T6 alloy diamond pattern plate.

2. Covers in non-traffic areas shall be reinforced to withstand a live load of 300 pounds per square foot. Covers subject to off-street vehicular traffic loads shall be reinforced for an AASHTO H-20 rating.

3. Covers shall be equipped with a minimum of two heavy duty hinges with stainless steel pins, an automatic hold-open arm and an enclosed stainless steel spring assist. A recessed lock box shall be provided. All hardware shall be stainless steel.

4. All material shall have a standard mill finish. The embedded portion of the frame shall receive a heavy shop coat of bituminous paint where in contact with concrete.

5. Hatch frames and covers shall be Series W1S or W2S as manufactured by

Halliday Products, Inc., Type J-AL or JD-AL as manufactured by The Bilco Company, or approved equal.

C. Pipe, Fittings and Valves

1. All pumping station piping shall be ductile iron pipe, conforming to AWWA C 151 and include cement-lining and asphaltic coating in accordance with AWWA C 104. Exposed ductile iron piping that will receive field applied finished paint coat shall receive outside primer coating. Buried ductile iron pipe shall be Class 52.

2. Joints for buried ductile iron pipe shall be mechanical or push-on in accordance with AWWA C 110 and AWWA C 111. Joints for exposed ductile iron pipe shall be flanged in accordance with AWWA C 110.

3. Standard ductile iron fittings shall conform to AWWA C 110 and compact fittings shall conform to AWWA C 153, Class 250 gray cast iron or Class 350 ductile iron conforming to ASTM A 536, minimum grade 70-50-05. Body thickness of fittings shall be equal to, or exceed, Class 53 ductile iron pipe thickness. Fittings shall include cement lining and asphaltic coating in accordance with AWWA C 104. Exposed fittings that will receive field applied finish coat shall receive outside primer coating.

4. Horizontal swing check valves shall be flanged, iron body, bronze mounted, swing gate, with outside lever and adjustable weight type, rated for the same pressure as the pipe in which installed. Bonnet shall be sufficiently large to permit cleaning and maintenance of the inner works without removing the valve body from the line. Valves shall be Figure 106LW as manufactured by Kennedy Valve, or Figure 250-US as manufactured by GA Industries.

5. Ball check valves shall be flanged, cast iron body. The ball shall be hollow steel with an exterior of nitrile rubber, resistant to sewage, grease petroleum products, tearing and abrasion. Valves shall be HDL Type 2016 as manufactured by ITT Flygt Corporation, or approved equal. Isolation valves shall be resilient wedge gate valves conforming to AWWA C515. Valve wedge shall be constructed of ductile iron, encapsulated in resilient rubber. Wedge rubber shall be molded in place and bonded to the ductile iron wedge, not mechanically attached with screws or rivets. Waterway shall be smooth and shall have no depressions or cavities in the seat area. Valve body and bonnet shall be epoxy coated, inside and out with fusion bonded epoxy conforming to AWWA C550. Buried valves shall be fitted with 2 inch square operating nuts. Valves located above ground or in vaults shall be equipped with handwheel, chainwheel or lever operators. Valves shall be as manufactured by Clow, American Flow Control, or equal.

6. Valve boxes shall be heavy-duty 3-piece adjustable screw type, 5 1/4 inch shaft diameter with "SEWER" cast in the cover. Valve boxes shall be as manufactured by Tyler Union 30U-6860 Screw Type, or equal.

7. Yard hydrants shall be non-freeze type with galvanized steel pipe casing, cast

iron head and lift handle with locking capability. All operating parts shall be bronze. Valve housing shall be equipped with a drain port. Furnish hydrant with a 3/4-inch male hose connection and vacuum breaker. Yard Hydrant shall be Zurn, Z1396, or equal.

8. Backflow preventers shall utilize the reduced pressure principle and shall consist primarily of a pressure differential relief valve located in a zone between 2 positive seating check valves. The relief valve shall contain a separate means whereby free air will enter the zone, and contained water will be discharged to atmosphere when the valve is fully open. The assembly shall include two tightly closing shut-off valves, one before and one after the device, and test cocks. The device shall meet all requirements of ASSE standard 1013 and AWWA C506, latest revision. Backflow preventers shall be Zurn Model 375AST, Zun Model 975XL3 or approved equal.

9. A magnetic flow meter sensor shall be installed on the discharge piping in the valve vault. The magnetic flow meter shall consist of a primary sensor rated for submersible duty IP-68 protection rating and a remotely mounted transmitter. Both the meter and transmitter shall be the product of a single manufacturer. The flow meter shall be factory calibrated. The flow meter sensor shall be model MAG 5100W by Siemens or Proline Promag W400 by Endress & Hauser The transmitter shall be model MAG 5000 by Siemens or Model RMA42 by Endress & Hauser

D. Submersible, Solids-Handling Sewage Pumps

1. Submersible, solids-handling sewage pumps shall be N-3000 Series (N-Technology) as manufactured by ITT Flygt Corporation, unless otherwise approved by the Town or 4R Series as manufacturer by Pentair Myers.

2. A Pump Monitor Relay (PMR) shall be provided with the pumps to provide Motor Over Temperature and Seal Leakage alarms. The PMR will be furnished by the pump vendor for installation in the Pump Control Panel (PCP) and wired to the pump controls for shutdown and alarming. The PMR shall be flush mounted in the door of the PCP. The Seal Leakage alarm shall disable the respective pump and initiate an alarm on the OIT alarm screen and maintain until the alarm is reset. The Over Temperature shall disable the pump until the motor housing cools off. The Over Temperature condition shall initiate an alarm on the OIT alarm screen.

3. Each pump shall be equipped with a lifting system with a rated capacity at least 50 percent greater than the weight of the pump. A portable davit crane in flush mount base shall be provided and have 360 degree pivoting 316 stainless steel boom and 316 stainless steel wire rope. Davit crane shall be stainless steel, Ensign Series by Thern with type M3 stainless steel spur gear hand winch with brake. For applications that exceed the rated lifting capacity of the Thern Ensign Series, or equal. An adhesive vinyl decal with the weight capacity rating shall be applied to the crane mast.

E. Submersible Grinder Pumps

1. Submersible sewage grinder pumps shall be Type M-3000 Series as manufactured by ITT Flygt Corporation, unless otherwise approved by the Town.

2. Pump monitor relay and lifting system shall be provided for submersible grinder pumps; refer to Part B.4 above.

F. Variable Frequency Drives (VFD)

1. AC Drive shall be Altivar, the latest model, Drive System by Schneider Electric. AC Drive shall include line reactors to limit total harmonic distortion to less than 5%. No substitutions allowed.

2. Alternate control techniques, other than pulse width modulated (PWM) control, are not acceptable.

3. Adequate reserve space shall be provided around the AC Drive, either inside the electrical equipment enclosure or on the wall of the control building, for future replacement of the AC Drive.

4. VFD's shall be selected based on the current pump HP with room to expand to the next NEC scheduled HP without modification from the panel to the pump.

5. Stations that the utility company only allows single phase service shall select a VFD for full 3 phase output.

G. Level Controllers

1. Level transducers shall be a KPSI model 720T with the following options:

   a. Titanium construction

   b. Sealed gage

   c. 4-20 mA output

   d. Open face nose cap

   e. Lifetime lightning/surge protection

   f. Stainless Steel cable hanging kit and anchor kit

   g. Series 815 Aneroid Bellows

2. Float Switches shall be EZconnex Narrow-Angled Floats in the cable weight mounting configuration. Floats shall be supplied with a 3-port manifold, a sealing plug, and 6 hook bracket.

H. Odor Control Systems

1. A passive vent scrubber shall be provided on wet well exhaust vent(s). Passive vent scrubber shall be model PV40 by Purafil Filtration Group.

2. For proposed pumping stations located near residential or business establishments and at the discretion of the Town, a powered odor control system shall be provided in lieu of a passive vent scrubber. The powered odor control system shall include stainless steel adsorber canister(s) with

manufacturer's odor adsorbing media, centrifugal blower, weather resistant acoustical enclosure, process stream piping, and packaged remote mount controller/control panel with variable frequency drive. All equipment and material shall be furnished and coordinated by a single manufacturer. Odor control system shall be model Skid Mounted Stainless Steel Series (SMSS) manufactured by EZ Vent LLC.

I. Electrical Equipment Enclosure

1. Electrical equipment enclosures shall be aluminum NEMA 3R rating adequately sized to house all electrical and control panels. The enclosure shall be furnished with an interior panel mounted on channels welded horizontally to interior body sides at top, bottom and center. Doors shall have oil resistant gaskets with steel retaining strips, grounding stud, print pocket and screws and clamps on three sides. Drip proof lips shall be provided over all louvers and doors.

2. Enclosure accessories and modifications shall include:

   a. A thermostatically controlled cooling fan package consisting of a fan, air filter, air plenum and finger guard and stainless steel grille.
   b. Stainless steel louver plates with air filters on intake and exhaust openings, Hoffman A-VK series or equal.
   c. Thermostatically-controlled electric heater(s), Hoffman D-AH series, or equal.
   d. Enclosure lighting consisting of fluorescent strip fixture(s) with manual switch and cold weather ballast, Hoffman A-LF series, or equal.

J. Circuit Breaker Panel

1. Busbars and all current carrying parts of circuit breaker panels shall be copper sized in accordance with the requirements of the Underwriters Laboratories, Inc. Branch circuits shall be comprised of the required number of interchangeable screw-down type magnetic circuit breakers. Plug-in breakers are acceptable in single-phase panels only. Tandem breakers shall not be acceptable.

2. Panel enclosures shall be NEMA type 3R steel with baked-on enamel finish. Trim shall include fully hinged door, locking handle, and card holder. All enclosures shall be for surface mounting.

3. Circuit breakers shall have quick-make and quick-break toggle mechanisms, non- fusible contact with inverse-time, interrupting characteristics. Breaker shall trip free on overload. They shall indicate clearly whether they are in the open or closed position. Multi-polar units shall have a single handle. Circuit breakers shall be bolted or plug-in as appropriate for the panel, readily removable from front of panelboard without disturbing adjacent units. All circuit breakers shall have interrupting ratings as follows:

   a. 480 or 277 volt service 14,000 amps minimum

b. 240 or 120 volt service 10,000 amps minimum

4. Ground fault interrupting breakers shall be provided on all circuits supplying receptacles and as otherwise required by the latest revision of the National Electrical Code.

5. At stations that require a 120/240VAC high leg service, a separate 120/240V single phase panel shall be provided for single phase loads.

6. All electrical components shall be manufactured by Square D. No substitutions shall be allowed.

K. Pump Control Panel

1. Enclosures shall be NEMA type 3R aluminum with baked-on enamel finish and an interior hinged deadfront panel.

2. The control system shall operate on 120 volt AC, single phase power supply unless otherwise approved by the Town.

3. All equipment and materials shall be suitable for operation at rated capability without degradation and without exceeding rated operating temperatures under ambient temperatures from -10^0 to 110^0F and up to 100 percent ambient relative humidity.

4. Panels shall be UL-508 certified.

5. Controllers/PLCs:

a. Programmable logic controller (PLC) with operator interface terminal (OIT) shall be provided instead of the use of relays, switches and indicator lights.
b. Programming Language: Relay Ladder Logic.
c. Software: Licensed copies of PLC & OIT programming software shall be provided.
d. Manufacturer & Model: Schneider Electric SCADAPack for PLC and Schneider Electric, Square D HMIGTO5310 for OIT. No substitutions will be accepted.

L. Cellular Pump Monitoring and Control System

1. Remote pump monitoring and control system shall be microprocessor-based monitor and backup controller on a cellular platform, Model MyDro 850 by Mission Communications in a NEMA 4X enclosure with remote mount high gain antenna and associated cables. Contractor shall furnish, install and test, complete and in place, the cellular remote alarm monitoring system including antenna and cables. No substitutions shall be accepted.

2. The monitoring and control system for pumping stations that have two (2), or three (3) pumps (if required), shall have the following inputs:

a. Wet Well Water Level

b. Discharge Flow

c. Pump A Running

d. Pump B Running

e. Pump A Failure (includes VFD failure)

f. Pump B Failure (includes VFD Failure)

g. Genset Run (direct from Genset)

h. Wet Well Analog Low Level

i. Wet Well Analog High Level

j. Genset Low Fuel (direct from Genset)

k. Backup Level Control Active (from Backup Level Control circuit)

l. AC Power Failure (direct from ATS)

m. PLC Failure

3. Other monitoring and control functions consist of the following:

   a. Maintain elapsed running time record of all pumps through elapsed time counters or Programmable Logic Controller (PLC)/Operator Interface Terminal (OIT).

   b. Maintain flow record of effluent discharge via flow transmitter.

M. Conduit and Wiring

1. Above ground conduits shall be hot dipped galvanized steel, underground conduits shall be schedule 80 PVC.

2. Liquid tight flexible metallic conduits shall be constructed of spirally wound and interlocked galvanized steel strip covered with an extruded polyvinyl chloride jacket. A continuous copper ground conductor shall be built into the core for permanent circuit and ground protection in conformance with provisions of Article 351 of the National Electric Code.

3. Junction and device boxes installed outside and in below-grade structures shall be gasketed watertight types and shall have watertight threaded conduit hubs. Junction, pull and device boxes installed inside buildings shall be NEMA-1 or non- gasketed galvanized pressed steel.

4. All wire shall be single conductor copper, 600-volt type THHN/THWN or XHHW. Minimum size shall be No. 12, except for control wires which may be No. 14. No. 8 and larger wire shall be stranded copper. All wire shall be clearly labeled with type, size, and voltage rating and color code shall conform to NEC.

5. Connections for No. 10 wire and smaller shall be made with approved type pressure connectors and insulating caps (wire nuts). Splices and connections in No. 8 wire and larger shall be made with approved type sleeve connectors and insulated to the same thickness as the adjoining wire insulation.

N. In-Line Centrifugal Fans

1. Wet well in-line centrifugal fans shall be FR Series by Fantech, or equal.
2. Blower ducts shall be Schedule 80 PVC or Schedule 20 Galvanized Steel

O. Standby Generator Set (Genset)

1. A standby generator set (Genset) shall be provided for backup power in the event of a power failure. The Genset and all major auxiliary equipment shall be manufactured by Cummins Power Generation, Kohler, or approved equal. No other substitutions shall be accepted.

2. The Genset shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

   a. Altitude: Sea level to 500 feet
   b. Ambient temperatures: Min.-10^{o}F (-23^{0}C), Max. 104^{o}F (40^{0}C)
   c. Relative humidity: 0 to 95 percent
   d. Salt atmosphere during storm conditions
   e. Dust laden air
   f. Insects/rodents
   g. Fungus growth

3. The Genset unit shall be capable of carrying the full rated load without reduction in performance requirements throughout the period of any and all interruptions to the normal power supply. Temperature rise shall be within NEMA MG 1-22.40 definition.

4. The Genset shall produce the following voltage and frequency regulation under the conditions stated:

   a. Under steady state, i.e. slowly changing, conditions, the terminal voltage and frequency shall remain constant within plus or minus one half percent of rated or set value.
   b. Frequency regulations shall not exceed 5 percent and voltage regulation shall not exceed 2 percent of rated or set value under any loading sequence from no-load to full load.
   c. Instantaneous voltage dip shall not exceed 20 percent of rated or set value and frequency shall not fall below 5 percent of rated value when full load at rated power factor is applied to the alternator. Recovery to stable condition at rated voltage and frequency shall occur within 2 seconds.

5. A rheostat control shall provide a minimum of plus or minus 5 percent voltage adjustment from rated value.

6. With the Genset unit carrying the full connected load, less the largest single motor load, the start-up of the largest single motor load shall not cause the voltage, frequency, and recovery time to fall outside the limits specified

herein.

7. Neither rejection of the full rated load nor rejection of the largest single motor load when the unit is carrying full rated load shall cause a speed rise in excess of the lower of the following:

   a. 15 percent of rated speed.
   b. 75 percent of the difference between the overspeed trip set point and rated speed.

8. Engine shall be 4-cycle, diesel-fueled or natural gas and equipped with the following:

   a. Fuel system including pumps, piping and fuel handling apparatus as required to supply diesel fuel to the engine. Combustion air system including air cleaner.
   b. Lubrication system supplied by a positive displacement oil pump.
   c. Cooling system with thermostatically controlled water jacket heater.
   d. DC electrical system including but not limited to starting motor with positive drive pinion engaging device and heavy-duty lead acid type batteries mounted on the engine skid.
   e. Exhaust system including but not limited to critical-type muffler to provide at least 30 decibel noise attenuation at 1,000 Hz., exhaust piping, and flexible exhaust connections.
   f. Isochronous governor to maintain output voltage and frequency to 2%.

9. Alternator shall conform to the following:

   a. The alternator shall be synchronous, revolving field, brushless type, open drip-proof design meeting in all respects provisions of NEMA MG-1 (ANSI C50.1) and the following:
      - Stator shall be solidly mounted to the engine flywheel housing. Windings and leads shall be designed and adequately secured to withstand maximum short circuit current, normal operating forces and vibration without distortion and movement.
      - Rotor shall be mounted in durable sealed, prelubricated bearings and driven through a coupling so designed as to assure continuous and permanent rotor alignment.
      - Grounded terminal with non-ferrous contact surfaces.
   b. Class H materials shall be used for insulation of the rotor and stator in conformance with NEMA MG-1. The rotor shall be impregnated with 100 percent solid epoxy resin and stator and other insulation shall be twice sprayed with varnish conforming to MIL-1-24092, Type M, Class 155, or equal method to maximize resistance to environmental factors, fungus, and other damage.
   c. Output connections shall provide for solidly grounded neutral.
   d. Excitation shall be provided by a brushless rotating rectifier exciter system. The exciter shall be controlled by a temperature compensated solid state automatic voltage regulator with quick-response

characteristics. The voltage regulator shall be powered by a separate permanent magnet generator (PMG) located on the end of the main Genset shaft.

e. Voltage wave form shall meet the requirements of NEMA MG-1 with total harmonic content less than 6 percent. Telephone influence factor shall meet NEMA MG-1.

10. Control System

a. The control, surveillance and protection system shall provide for complete startup, run, and shutdown of the Genset, in both automatic and manual modes with load or no-load selection feature and selector switch. The system shall include engine start/stop controls wired for manual switch control at the engine and from a remote circuit fully coordinated with the start/stop sensing device.

b. Engine controls and indicating devices shall include:
- RUN - STOP - REMOTE switch
- Remote start/stop terminals
- Oil pressure gauge
- Coolant temperature gauge
- DC volt meter
- Contacts to provide positive shutdown for low oil pressure, high coolant temperature, overcranking or overspeed conditions.
- A common alarm contact and alarm annunciator to provide mechanical indication of the alarm source.
- An extra set of dry contacts for connection to the monitoring and control system to indicate that the Genset has failed to operate.

c. Genset controls and indicating devices shall include:
- AC Voltage adjusting rheostat (+/- 5 percent)
- Running time meter
- AC Voltmeter connected line to line
- AC Ammeter to measure current in each ungrounded line
- Frequency meter
- Voltmeter and ammeter phase selection switches.
- Exciter circuit breaker with manual reset and alarm indication wired to annunciator.

d. A main-line circuit breaker shall be provided as an integral part of the Genset package. The breaker shall be equipped for manual operation as well as automatically controlled for overload and fault conditions. Rating shall be as determined by manufacturer but in no case less than the continuous standby current rating of the unit and conforming to NEMA MG- 1 and NEC requirements for breaker ratings.

e. Fault current sensing together with alarm indication to annunciator shall indicate Genset breaker opening in the event of phase or ground fault. The type of fault, i.e., phase or ground shall be displayed and maintained on Genset panel until manually reset. Loss of voltage shall not inhibit the display.

11. Accessories shall include the following:

a. A welded and bolted reinforced heavy gauge steel, weatherproof enclosure bolted to the Genset base. The enclosure shall have lockable inspection doors located for easy access to control equipment and maintenance points. Expanded metal louvers shall be provided for air intake and radiator discharge. Exhaust piping and silencer mounting shall be sealed or flanged to ensure a weatherproof installation. Mounting of components shall be accomplished in such a way that vibration effect is not an inherent problem.

b. Outdoor Weather-Protective Enclosure-Quiet Site II

1. The generator set shall be provided with an outdoor enclosure to reduce the average sound level to a maximum of 70.2dBa. The package shall comply with the requirements of BS ISO 8528-4 2005, BS 7671:2008 + A1:2011 IET Wiring Regulations 17th Edition and relevant regional Codes for electrical installations for all the wiring materials and component spacing. The total assembly of generator set, enclosure, and sub-base fuel tank (when used) shall be designed to be lifted into place using spreader bars. This is required for bottom four-point lift. other enclosure may be provided with single point and two-point high level lifting arrangements and/ or forklift packets in the enclosure base.
2. Enclosure shall provide ample airflow for generator set operation at rated load in an ambient temperature of 50DegC. The enclosure shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable and include retainers to hold the door open during service. Enclosure roof shall be designed to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.
3. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two-step electro coating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:
    - Primer thickness, 0.5-2.0 mils. Topcoat thickness, 0.8-1.2 mils.
    - Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
    - Crosshatch adhesion, per ASTM D3359-93, 4B-5B.
    - Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.
    - Salt Spray, per ASTM B117-90, 1000+ hours.
    - Humidity, per ASTM D2247-92, 1000+ hours.
    - Water Soak, per ASTM D2247-92, 1000+ hours.

- Windspeed 180 mph

4. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant and designed to minimize marring of the painted surface when removed for normal installation or service work.
5. Enclosure shall be of all aluminum construction. All hardware and hinges shall be stainless steel.
6. A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.
7. The enclosure shall include the following maintenance provisions.
   - Flexible coolant and lubricating of drain lines that extend to the interior of the enclosure, with internal drain valves.
   - External radiator fill provision.
8. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 70.2 dBA at any location 7 meters from the generator set in a free field environment. Insulation in the enclosure shall be made with non-hydroscopic materials.
9. The enclosure shall be insulated with non-hydroscope materials.

c. Miscellaneous

1. Mounted and wired battery charger, located within the service enclosure.
2. Internally mounted and insulated exhaust system.
3. All connections to the generator set shall be flexible and all conduit within enclosure shall be EMT.
4. For diesel generators: UL 142 Dual Wall Sub-base, Basic Fuel Tank, 24-hour capacity with low and leak alarms, vents, and stub-up access. Include Line-X type coating on sub-base tank to minimize corrosion.

d. Provide a lockable fill station on the exterior of the enclosure with visual Low Fuel and High Fuel alarms. Include an integral overflow protection basin.

e. Stub-up access.

f. Remote Emergency Stop pushbutton, located within the remote, service enclosure.

g. Provide form C common alarm contact output for connection to the SCADA system.

h. Vibration isolators mounted between the Genset and the sub-base fuel tank.

12. Spare parts shall be furnished with each Genset as follows:

a. 1 spare air filter element
b. 1 spare of each oil filter
c. 1 spare of each fuel filter

P. Automatic Transfer Switch

1. Automatic transfer switches shall be Transfer Switch-Onan Power Command 225A or higher, as manufactured by Cummins Power Generation or Model KCP 225A or higher as manufactured by Kohler Power Systems. No substitutions shall be accepted. The transfer switch shall be rated for continuous duty and sized to handle the full-load amperage of the pumping station main entrance breaker or the emergency Genset whichever is higher. The equipment shall be UL-1008 listed and shall conform to appropriate NEMA Standard ICS 10, Part 4-2020.

2. The automatic transfer switch control system shall be designed for utility-to-Genset application. When the utility power fails or is unsatisfactory, the switch shall start the Genset and transfer the load to the Genset within 10 seconds. It shall return the load to the utility source upon its return to service.

3. The transfer switch shall be mechanically interlocked to positively ensure only one source being connected to the load both during and after transfer operations. The switch shall be electrically operated by a single-solenoid mechanism energized from the source to which the load is connected. A manual operator shall also be provided.

4. The enclosure shall be Type 3R for outdoor use. The indicator panel shall include:

a. Source Available/Connected LED indicators.
b. Test/Exercise/Bypass buttons.

5. The control module functions shall include, but not be limited to the following items:

a. Monitor the normal incoming phases with voltage sensing devices to drop out in an adjustable range of approximately 70 to 90 percent of nominal voltage, and to pick up in an adjustable range of approximately 80 to 98 percent of nominal voltage. The settings shall determine initiations of "transfer to emergency" signal and initiation of "return to normal" signal respectively.
b. Time delay and appropriate contacts to override momentary outages or fluctuations.
c. Time delay on transfer to and from emergency source.
d. Time delay and appropriate contacts to re-transfer to normal source.
e. Time delay and appropriate contacts to permit Genset cool down after

switching of load to normal source.

f. Programmed transition feature that provides an adjustable open period during transfer and retransfer.

g. Override of "return to normal" delay and appropriate contacts to effect immediate return to normal service in the event of standby service failure after normal service has returned.

h. Transfer of load to standby source shall be inhibited unless standby source voltage is at least 90 percent of nominal and frequency is at least 95 of nominal. Standby sensing may be single phase monitored.

i. Test switch to simulate normal service failure with option to test under load or no load.

j. Programmable Genset exerciser for automatic test operation. The timer period shall be adjustable to permit runs adjustable in 15-minute increments at least once per week.

k. Date/time-stamped event recording

6. 250 VAC, 10 amp, Form "C" auxiliary dry contacts (one normally open, one normally closed) shall be provided for normal and emergency source positions.

7. A 10-amp, solid state automatic battery charger, capable of charging the engine starting batteries from a discharged condition full float voltage condition in a period of not more than eight hours, shall be mounted inside the transfer switch cabinet.

Q. Chain-Link Fencing

1. Fencing shall be manufactured by Seagull Fence and Concrete LLC, or equal.

2. Fence fabric shall be 2-inch mesh, knuckle x twist chain link, extruded and bonded vinyl coating on 9-gauge, 0.148 inch O.D. zinc coated steel. Minimum height shall be 6 feet. Fabric shall meet the requirements of ASTM F-668 and the Chain Link Fence Manufacturers Institute Product Manual.

3. The PVC coatings shall be continuously bonded, not sprayed or dipped, by extrusion bonding under pressure of 5,000 psi. Color shall be selected by the Town from manufacturer’s full range of available color options.

4. Top locking, double-walled, vinyl privacy slats shall be installed in the fence fabric. Privacy slats shall be manufactured by Slat Source.

5. All posts shall be Type I, hot-dipped galvanized steel in accordance with ASTM F- 1083 for standard-weight SP40 (Schedule 40) vinyl coated pipe. Posts and rails shall be polymer coated in accordance with ASTM F-934. Line and terminal posts shall be 1-5/8 inches O.D., and gate posts 4 inches O.D, 6.55 lbs. per foot. Concrete footing, 12 inch diameter, 42” depth. Top and bottom rails shall be 1-5/8 inches O.D.

6. Bracing shall be terminal posts braces and trussed to the nearest line post and vinyl coated 3/8 inch truss rod and vinyl coated truss road tightener.

7. The wire shall be 8-1/4 inches vinyl coated 9-guage. Tie wire spaced 15 inches

on center for line posts and 24 inches on center for rails.

8. Swing gates shall conform to ASTM F-900 and shall include gate stops, pad locks and keys.

R. Paint

1. Products: Products that may be incorporated into the Work include, but are not limited to, products as follows:
   a. Tnemec Company (Referenced for the purpose of establishing standards of acceptability)
   b. All paint materials selected for coating systems for each type of surface shall be the product of a single manufacturer.

2. Colors: As selected from manufacturer's full color range.

3. The type of material to be used and the number of coats to be applied are listed in the "Painting Schedule" in this section.

4. The following items shall be painted:

STRUCTURE	LOCATION	SURFACES TO BE PAINTED
Cast-in-Place Concrete Structures	Interior	Ferrous Metals, Concrete
Precast Concrete Structures	Interior, Exterior	Ferrous Metals, Concrete

5. Painting Schedule:

		Mil DFT
Below Grade Exterior Concrete		
1)	First: Tnemec Series 46H-413	8.0-10.0
2)	Finish: Tnemec Series 46H-413	8.0-10.0
Corrosive/H2S Immersion Concrete Lining (wet well)		
1)	Resurfacer: Tnemec Series 218 Mortar Clad	1/16"
2)	Body Coat: Tnemec Series 434 PermaShield	125
3)	Glaze Coat: Tnemec Series 435 PermaGlaze	15-20
Non-Corrosive/ Benign Concrete		
1)	Filler: Tnemec Series 130 Envirofill,as needed	60-80 SF / Gal
2)	Intermediate: Tnemec Series V69 Hi-Build Epoxoline II	4.0-6.0
3)	Finish: Tnemec Series V69 Hi-Build Epoxoline II	4.0-6.0
Interior CMU		
1)	Filler: Tnemec Series 130 Envirofill	60-80 SF / Gal
2)	Intermediate: Tnemec Series 113 Tneme-Tufcoat	4.0-6.0
3)	Finish: Tnemec Series 113 Tneme-Tufcoat	4.0-6.0
Exterior Masonry/CMU		

1)	Filler: Tnemec Series 130 Envirofill	60-80 SF / Gal
2)	Prime: Tnemec Series 156 EnviroCrete	6.0-8.0
3)	Finish Coat: Tnemec Series 156 EnviroCrete	6.0-8.0

H2S Exposure Ductile Iron Pipe

1)	Prime: Tnemec Series 394 PerimePrime	2.5-3.5
2)	Intermediate: Tnemec Series V69 Hi-Build Epoxoline II	4.0-6.0
3)	Stripe Coat: Tnemec Series V69 Hi-Build Epoxoline II	3.0-5.0
4)	Finish Coat: Tnemec Series 435 PermaGlaze	15.0-20.0

Non Corrosive Exposure Ductile Iron Pipe

1)	Prime: Tnemec Series V69 Hi-Build Epoxoline II	4.0-6.0
2)	Finish: Tnemec Series V69 Hi-Build Epoxoline II	4.0-6.0

S. Construction Methods

1. Excavation and refill for pipe trenches and structures shall conform to Section 2 - Earthwork of these Standard Specifications.

2. Cast-in-place concrete shall conform to Section 3 - Concrete of these Standard Specifications.

3. Wet well level control devices shall be located free from any effects of turbulence of flows or suction.

4. Pumps

   a. Each submersible pump shall be automatically and firmly connected to its discharge connection, guided by two Schedule 40, 304 stainless steel guide rails extending from the access hatch to the discharge pipe connection. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. No portion of the pump shall bear directly on the sump floor.

   b. All power, control and signal conductors shall be continuous from the device to the control panel. There shall be no junction boxes or splices of any kind in these conductors unless approved by the Town on a case by case basis.

5. Electrical Installation

   a. All equipment furnished and electrical installations shall conform to all applicable requirements and recommendations of national, state, and local codes and regulations. These codes and regulations shall include but are not limited to: ANSI, IEEE, ICEA, NEC, NEMA, OSHA, UL, and Conectiv.

   b. Contractor shall give to the proper authorities all required notices, file all necessary drawings and documents, obtain all required permits, licenses, and inspections, and pay all fees for the same. Upon

completion of the work a certificate of inspection for work under this contract shall be obtained from an authorized Delaware inspection agency by the Contractor and submitted to the Engineer.

c. All damage resulting from drilling, cutting, and other electrical construction work shall be repaired or patched in a neat and permanent manner by competent tradesmen at the expense of the Contractor. Cutting or drilling of building construction or supporting materials shall not create any structural weakness. All cutting and repairs shall meet the approval of the Engineer.

d. Electrical equipment such as panel boards, switches, controls, junction and pull boxes, and such other apparatus as may require maintenance or operation shall be located to provide NEC clearances as a minimum and to provide ready accessibility.

e. All electrical equipment such as safety switches, starters, panels, etc. shall be properly identified by means of legible metallic or plastic nameplates permanently fastened to the equipment. Nameplates shall be furnished and installed by the Contractor.

f. All wires shall be tagged with permanent printed labels to facilitate tracing of wiring throughout the electrical system. Tag numbers shall be shown on as-built drawings provided by the Contractor.

g. Conduits shall be installed exposed on interior building walls. Otherwise conduits shall be installed above the ceiling or below the floor with vertical penetration into the room as required for apparatus lighting, etc. Conduits on walls shall be installed generally to run either parallel or perpendicular to the floor and to provide as little interference to other services as practicable. Conduit bends shall be made with tool designed for the purpose without any resulting crimps, bends, or breaks. Maximum number of bends between pull points shall not exceed 360^0 total. Conduit shall be preferably cut with hack saws and in any event sharp edges shall be filed smooth to prevent damage to wire and cable.

h. Motor connections shall be made up of flexible conduit as provided herein with Type SR-E silicone rubber power cable or similar good for 90^0 C or higher stranded type copper conductor in wet locations.

i. All grounding shall be in strict compliance with latest OSHA and NEC standards. All grounding conductors shall be soft drawn copper, sized in strict compliance as a minimum with NEC requirements.

j. Lighting fixtures, wiring device shells, and motors may be grounded to metal conduit system by proper conduit connections and terminations or to grounding conductor in PVC conduit.

k. All neutrals shall be grounded as required by NEC.

l. Provide and install appropriate grounding at the service entrance and in all feeders and branch circuits in accordance with NEC requirements and pursuant to the rules.

m. All exposed non-current carrying metallic parts of electrical apparatus, conduits, neutral, and ground conductors of the wiring system shall be interconnected and grounded in accordance with the National Electric Code Article 250 and OSHA standards. Surfaces where grounding connections are to be made shall be clean and dry. Steel surfaces shall be ground or filed to remove all rust, scale, oil, and dirt. Copper and galvanized surfaces shall be cleaned with emery cloth to remove oxide before making junctions. Grounding cable shall be stranded cooper conductor with a green colored insulation as required by NEC. All conduit connections to hubs, condulets, boxes, etc. shall be made up watertight on outdoor or underground locations and set up tight and firmly set to scrape off paint to insure adequate ground current conductivity where metal conduit is used. All areas scraped, as well as exposed conduit threads, shall be painted with 2 coats of rust inhibiting paint.

6. Standby Genset

a. Foundation and structural supports shall be provided and installed by the Contractor.

b. Sole plates and foundation bolts shall be provided for installing the equipment and control and excitation panels on a concrete foundation. Shock/vibration mounts shall be provided to minimize effects of vibration and transfer of noise to housing.

c. All electrical devices, connections, and controls shall be located at least 12 inches above the concrete pad.

7. Chain-Link Fencing

a. All posts shall be set in concrete footings. No attachment shall be placed on the post, nor shall the post be disturbed in any manner, within 72-hours after the individual post footing is completed. The top of all concrete footings shall be crowned (convex) with the highest point being 2-inches above finished grade. Footings shall conform to the following:

- Gate Posts – 4" diameter, 3'-6" below grade, post end 6" clear of bottom.
- End, Angle, Corner or Pull Posts - 1'-4" diameter, 3'-4" below grade, pipe end 6" clear of bottom.
- Line Posts - 1'-0" diameter, 3'-1" below grade, pipe end 3" clear of bottom.
- Plunger Bar Footings - 10" diameter, 2'-6" below grade.

b. All posts shall be plumb, and spaced at 10' centers maximum, with a

tolerance of minus 2'. Spacing of posts shall be as uniform as practical under local conditions. Terminal posts shall be installed at all abrupt changes in grade, at changes in line over 15^{o}, and at all ends. Post tops shall fit snugly on posts to prevent moisture penetration.

c. The top rail shall be continuous and shall pass through the post tops. The couplings used to join the top rail lengths shall allow for expansion. 1-5/8 inch O.D. or greater horizontal brace rails with 3/8 inch diameter diagonal truss rods and turnbuckles, shall be installed at all terminal posts. Sufficient braces shall be supplied to allow complete bracing from each terminal post to adjacent line posts.

d. The fence shall be true to line, taut, and shall comply with the best practices for chain link fence construction. The bottom of the fabric shall be placed a normal distance of 2 inches above the ground line; however, over irregular ground a minimum clearance of 1 inch and a maximum distance not to exceed 5 inches.

e. The fence fabric shall be installed on the side of posts away from the project site and shall be tied to top rails and brace rails with 9 gauge wire ties at 2' maximum intervals. Tension bars shall be attached to terminal parts by connectors equally spaced at 16" centers maximum or woven integrally into lock loops on roll form sections. End connectors shall be as close to the ends of the fabric as possible. Install privacy slats in accordance with the recommendations of the manufacturer and the Chain Link Fence Manufacturers Institute.

f. The fence shall be grounded to the pumping station ground system in accordance with NEC and Power Company requirements. Grounding intervals shall be 50 feet on center, at each end and on each side of the gate.

g. The grounding electrode shall be 3/4" x 10' ground rod driven into the earth until the top is 12 inches below elevation. When rock is encountered and it is impractical to install ground rods in a vertical position, they shall be installed horizontally with a minimum earth coverage of 12 inches. Attach a #4 copper conductor, by fusion weld process, to the ground rods and extend underground to the immediate vicinity of a fence post. The conductor shall be laced vertically into 12 inches of fence mesh and fastened by two approved bronze compression fittings, one for bonding wire to fence post and the other to bond wire to fence. Fence gate shall be bonded to supporting gate post by 1/8" x 1'-0" copper braid fastened by bronze machine screws or approved clamps.

h. After ground rod and fence connection have been completed, a ground resistance test shall be performed. The ground resistance shall not exceed 25 ohm under normal dry conditions. Where resistance requirements cannot be achieved, additional rods shall be installed not closer than 6 feet on center and no more than two additional rods shall be installed at each location.

6.3 TESTING AND ACCEPTANCE

A. Contractor shall make tests during and after installation to insure proper system performance and shall furnish all necessary test equipment. Apparatus, or items found to fail the tests, shall be replaced or repaired to be in new condition and the tests repeated. This testing shall continue until satisfactory performance is assured.

B. Equipment start-up: Contractor shall provide services of a qualified equipment manufacturer's representative to review equipment installation, perform pre-start-up checks, start-up, test, adjust, and demonstrate equipment and instruct the Town in operation and maintenance procedures. Manufacturer's representative shall perform all tests necessary to ensure each item of equipment operates in accordance with the design intent and specifications. When equipment has been started and tested by manufacturer's representative, all deficiencies have been corrected, and equipment operates as specified, the manufacturer's representative shall certify in writing that installation is satisfactory and that equipment is operating as specified.

C. A system performance demonstration shall be performed in such a manner as to demonstrate that the mechanical and electrical systems including, but not limited to, motors, controls, instrumentation, alarms, wiring, lights, etc. is performing in a fully satisfactory manner, meeting any and all design load conditions and the provisions of these Standard Specifications. Control and alarm circuits shall be fully tested under normal and alarm conditions. When all equipment components perform individually and as an integrated whole according to the design intent and as specified and all deficiencies have been permanently corrected, the system performance demonstration shall be considered successful.

D. All three-phase motors shall be tested to ensure correct rotation and shall be reconnected if error is found.

E. Upon completion of the work, the entire electrical installation shall be free from current leakages to ground, short circuits, and improper voltage.

F. Provide a Fall of Potential Test of the station grounding system by a third party testing firm.

G. Pumps

1. Engage a factory-authorized service representative to perform startup service.

    a. Complete installation and startup checks according to manufacturer's written instructions.
    b. Verify bearing lubrication.
    c. Disconnect couplings and check motors for proper direction of rotation.
    d. Verify that each pump is free to rotate by hand. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    e. Verify that pump controls are correct for required application.

2. Start pumps without exceeding safe motor power:

   a. Start motors.
   b. Open discharge valves slowly.
   c. Check general mechanical operation of pumps and motors.

3. Test and adjust controls and safeties.

4. Remove and replace damaged and malfunctioning components.

5. Set pump controls for automatic start, stop, and alarm operation as required for system application.

6. Set field-adjustable switches and circuit-breaker trip ranges as indicated, or if not indicated, for normal operation.

H. Standby Genset

1. Manufacturer's installation manuals and instructions shall be obtained and used for guidance by the Contractor in moving, storing, installing, testing and demonstrating all items of the Genset unit and controls.

2. Start-up of the Genset unit shall be performed by or under the guidance of a manufacturer's authorized service representative.

3. The manufacturer's standard factory tests, adapted as necessary to this installation, shall be performed by the manufacturer's authorized service representative and the Contractor in the presence of the Engineer to ensure the unit is properly installed and adjusted to perform the entire service for which it is intended including, but not limited to, start-up, transfer of load, running with load, retransfer, and shutdown. A 4-hour load bank test at full rated load shall also be conducted. Factory certified load test data shall be submitted to indicate unit capacity, as specified, while delivering full load continuously for 2 hours.

4. Upon completion of the tests the manufacturer's authorized representative shall advise the Town's operating personnel of the operating and maintenance procedures and techniques.

5. Upon completion of the installation the Contractor shall ensure the equipment is ready for operation with fully charged battery, fully lubricated, full tank of diesel fuel and electrical and mechanical adjustments correctly set. The unit shall be commercially clean and free of grease, dirt, debris, and all paint defects properly corrected. Full cooling liquid with antifreeze protection to -30 degree F shall be provided. Records of tests and "as-delivered" conditions shall be submitted to the Engineer.

I. All tests performed shall be accurately recorded and incorporated in a booklet and submitted to the Town’s Engineer. Report shall include, but not be limited to, records of the following tests:

1. Voltage tests
2. Grounding system tests
3. Motor current
4. Functional test results for controls, alarms, signal lights, etc.
5. Startup tests and reports
6. Load bank tests and reports
7. Fall of Potential Grounding Reports

J. Documentation provided for the control panel shall include installation, configuration, and operating instructions, description of control panel functions and a replacement parts list.

6.4 PROJECT CLOSEOUT DELIVERABLES

A. Complete administrative and procedural requirements for contract closeout, including, but not limited to, delivery of the following items to the Town:

1. Project Record Drawings
2. Operation and Maintenance Manuals
3. Warranties and Maintenance Bonds
4. Manufacturer’s Field Start-Up reports
5. Spare Parts

END OF SECTION

SECTION 7 – WASTEWATER FORCE MAINS

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SECTION 7 – WASTEWATER FORCE MAINS

7.1 GENERAL

A. Where wastewater force mains are to be installed for a residential or commercial development, the developer is responsible for all improvements. Developers shall hire a contractor approved by the Town of Georgetown and pay all costs associated with the work.

7.2 DESIGN CRITERIA

A. Force Mains

1. Force main pipe diameter shall be selected to provide a minimum flow velocity of 2.5 feet per second and a maximum of 5.5 feet per second under all pumping conditions, or approved by the Town Engineer.

2. Designer shall use Hazen & Williams equation and shall plot system curves for new pipe (C = 140 for PE or PVC or C = 130 for DIP) and minimum static head condition, and secondly for old pipe (C = 120 for PE or PVC or C = 100 for DIP) and minimum static head condition.

3. Concrete thrust blocking or other means of restraint shall be specified on all buried lines at bends, tees, capped or valved ends.

4. Force mains shall be located within street rights-of-way where possible. Where it is not possible to locate a force main within a street right of way, the force main shall be located within a 20-foot utility easement (with the centerline of the pipe being the centerline of the easement), obtained by the Developer.

5. Design and construct force main in profile with grades controlled to plus or minus one half inch to prevent unnecessary high points. Install an air release valve at each high point and at intervals as needed along flat or nearly flat force main grades. Air valves shall be cast iron combination sewage type with stainless steel internals, stainless steel isolation ball valve with street ell attached to top of outlet to prevent contamination from debris and provided with flushing connections. The minimum depth of cover over force mains shall be 4 feet (48 inches). The depth of cover over force main at high points at air release valves shall be sufficient to accommodate equipment with top of manhole flush with grade in pavements, shoulders, or traffic ways. There shall be a minimum of 6 inches of clearance provided between the top of the air release valve and the underside of the manhole cover.

6. Force mains discharging to a gravity sewer manhole shall connect at a point equal to the flow line inside the receiving manhole.

7. Force mains shall be located at least 10 feet away from any existing or proposed water main. Force mains crossing water mains shall be located to provide a minimum vertical separation distance of 18 inches between the force main and

water main. Crossings shall be arranged so that the joints in the force main pipe will be as far as possible from water main joints. If 18 inches is unattainable, a sleeve shall be installed 10 feet from either side of the water main for a total length of 20 feet. The end treatments for the sleeve shall be Fernco couplers/seals manufacturer part number #1056- X-Y (where X is the sleeve size and Y is the carrier pipe size), or approved equal.

8. Provide design basis calculations for pipe diameter, air release valves, combination valves, and vacuum valves sizing. The calculations for design shall accompany the Project's Drawings, when submitted for review.

7.3 MATERIALS

A. General:

1. Force main piping installed in open-cut trench: PVC or DI
2. Force main installed by directional drilling: HDPE or PVC
3. Force main installed by jack and bore: PVC or HDPE

B. Polyvinyl chloride pipe for force mains shall be PVC 1120 pressure pipe in accordance ASTM D 2241 with a maximum dimension ratio of SDR 26. Fittings for PVC pipe shall be fabricated or molded from the same material as the pipe, or ductile iron fittings may be used. Ductile iron Standard Fittings shall conform to AWWA C110 and ductile iron compact fittings shall conform to AWWA C153.

C. Ductile iron pipe for force mains shall conform to AWWA C151, Class 52. Joints shall be push-on or mechanical conforming to AWWA C111. Standard Fittings shall conform to AWWA C110 and compact fittings shall conform to AWWA C153. All ductile iron force main pipe and fittings shall be lined with a material specifically formulated to resist the corrosive atmosphere of wastewater sewers. Pipe and fittings shall have a standard internal and external asphaltic coating conforming to ANSI/AWWA C151.

D. HDPE pipe for force mains fabricated from material having a classification of ASTM D 3350 and meet the requirements of AWWA C906, and a PPI rating of PE 3408. Pipe shall have an outside diameter equivalent to ductile iron pipe.

E. Jack and bore encasement pipe shall be in accordance with Section 8 – Alternative Pipe Installation Methods of these Standard Specifications.

F. Fittings

1. Butt fusion fittings – HDPE Fittings shall be made of PE4710, meet the requirements of AWWA C906 and have a pressure rating equal to the pressure rating of the pipe to which the fitting is joined. Molded fittings shall be manufactured, tested and marked per ASTM D3261. Fabricated fittings shall be manufactured, tested and marked per ASTM F2206, or individual fittings standards.
2. Electrofusion fittings – Fittings shall be made of HDPE material with a minimum material designation code of PE 4710, a manufacturing standard of ASTM F1055, and a pressure rating equal to the pipe. Markings shall be

according to ASTM F1055.

3. Flanges and mechanical joint adapters – Flanges and MJ adapters shall have a material designation code of PE4710. Flanges shall be made in accordance with ASTM F2880. MJ adapters shall be made to ASTM D3261. Flanges and MJ adapters shall have a pressure rating equal to the pipe to which it is joined. Markings for molded or machined flange adapters or MJ adapters shall be per ASTM D3261.

G. Isolation valves shall be resilient wedge gate valves conforming to AWWA C509. Valve wedge shall be constructed of ductile iron, encapsulated in resilient rubber except for guide and wedge nut areas or it shall have a replaceable, internally reinforced, contoured molded rubber disc seat ring attached to the face of the wedge with self-locking stainless-steel screws. Wedge rubber shall seat against accurately formed seating surfaces in the valve body. Waterway shall be smooth and shall have no depressions or cavities in the seat area. Buried valves shall be fitted with 2-inch square operating nuts. Valve body and bonnet shall be epoxy coated, inside and out with fusion bonded epoxy conforming to AWWA C550. Valves shall be Kennedy Valve Company or approved equal.

H. Valve boxes shall be a 5 ¼ inch diameter Buffalo screw type, heavy-duty cast-iron valve box with "SEWER" cast in the lids. All valve boxes shall be Tyler Union 6860 series, three-piece valve boxes with standard base.

I. Air release valves shall be designed specifically for sewage applications and shall operate while pressurized, allowing entrained air to escape through the air release orifice. After entrained air escapes through the air release orifice, the valve orifice shall be closed by a needle mounted on compound lever mechanism and prevent sewage from escaping. Each air release valve shall be fitted with blow off valves, quick disconnect couplings, and minimum 6 feet of hose, to permit backflushing without dismantling valve. Air release valves shall be APCO Model 400 by DeZurik, Crispin Model S-20 or approved equal.

J. Sewage combination air valves shall be single body, double orifice and designed to allow large volumes of air to escape or enter through the larger diameter orifice when the force main is filling or draining. When the force main is filled and under pressure, the large orifice shall stay closed, but the smaller orifice shall remain operative and open to allow small pockets of entrained air to escape automatically and independently of the large orifice. Each combination air valve shall be fitted with blow off valves, quick disconnect couplings, and minimum 6 feet of hose, to permit backflushing after installation without dismantling valve. Combination air valves shall be APCO Model 440 by DeZurik, Crispin Model US20B, A.R.I. Model D-025L or approved equal.

K. Air valve manholes shall consist of pre-cast reinforced concrete base, riser and flat slab top sections conforming to ASTM C 478. Joints between riser sections shall be fitted with an O-ring rubber gasket conforming to ASTM C 443 and C 361. The minimum inside diameter (I.D.) shall be 60 inches. Exterior coating shall be in accordance with Section 5 – Gravity Sewer Systems of these Standard Specifications.

L. Air valve manhole frames and covers shall be Manhole frames and covers shall be composite moldings consisting of a thermosetting resin matrix blended and/or combined with reinforcing fiber rovings, short fiber filaments, or equivalent nonmetallic reinforcing structures(s). The thermosetting resin matrix shall be a polyester, vinylester, or a blend of these. The moldings shall be true to pattern in form and dimension and free from cracks, pores, knit lines, or other defects in locations affecting their strength and value for the service intended. Manhole frames and covers shall be Composite Access Products, CAP ONE ®-26, East Jordan 2600, Durostreet ® composite assembly or approved equal. Cover lettering shall read: "Sanitary Sewer."

M. Manhole steps shall be 3/8-inch diameter deformed steel reinforcing bar encased in polypropylene plastic with a notched tread ridge and retainer lug on each side, as manufactured by M.A. Industries, Inc., or equal. Steps shall be OSHA approved and cast or anchored into sidewalls at 12-inch intervals.

N. Detectable pipeline wire shall be insulated (green color) solid copper, #12 AWG, 600 volt, of not less than 90% conductivity, conforming to ASTM Designation B.58. Splicing of wires shall be by a solderless, split-bolt lug connector, Type IK-8, by ILSCO or equal.

O. Detectable warning tape shall be in accordance with Section 2 – Earthwork of these Standard Specifications.

7.4 CONSTRUCTION METHODS

A. Excavation and refill for force main trenches shall be in accordance with Section 2 - Earthwork of these Standard Specifications.

B. Jack and bored pipe installation shall be in accordance with Section 4 – Water Distribution Systems and Section 8 – Alternative Pipe Installation Methods of these Standard Specifications

C. Directional drilled pipe installation shall be in accordance with Section 4 – Water Distribution Systems and Section 8 – Alternative Pipe Installation Methods of these Standard Specifications

D. All pipe and appurtenances shall be installed and placed into service in conformance with the latest editions of ASTM D2774, AWWA C-600/C-605 and the manufacturer's recommendations.

E. Precautions shall be taken to keep interiors of pipes and fittings clean before installation and kept clean until final acceptance. Pipe delivered for construction shall be stored so as to minimize entrance of foreign material. When pipe laying is not in progress, all openings in the pipeline shall be closed by watertight plugs. Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

F. Pipe and fittings shall be carefully handled and placed in the trench. Special care shall be taken to ensure that each length of pipe abuts against the next in such a manner that there shall be no shoulder or unevenness of any kind along the inside of the bottom half of the pipe.

G. The trench bottom shall be constructed to provide the firm stable and uniform support for the full length of the pipe. Bell holes shall be provided at each joint to permit proper joint assembly and alignment. Any part of the trench bottom excavated below grade shall be backfilled to grade and shall be compacted as required to provide firm pipe support. When an unstable subgrade condition is encountered which will provide inadequate pipe support, additional trench depth shall be excavated and refilled with suitable foundation material.

H. Concrete thrust blocking and anchors shall be constructed in accordance with Section 3 - Concrete of these Standard Specifications. Blocking and anchors shall be poured against undisturbed earth.

I. The excavation in which pipe is being laid shall be kept free from water and no joint shall be made under water. The greatest of care shall be used to secure water tightness and to prevent damage to or disturbing of the joints during the backfilling process or at any time. After pipes have been laid and the joints have been made walking on or working over the pipe shall be limited to such as may be necessary in tamping until there is a covering of at least 2 feet in depth over the top of the pipe.

J. Valves shall be uniformly bedded and shall have support masonry as needed to maintain the stem plumb. The valve box shall be set plumb, centered over the operating nut, and uniformly bedded. The valve box cover shall be set flush with finished grade. In non-paved areas a concrete collar shall be provided around the top of the valve box.

K. Sewage air valves shall be located in air release manholes.

L. Pipeline detectable tape shall be installed continuously along all sewer and in accordance with Section 2 – Earthwork, of these standard specifications.

M. Pipeline tracer wire shall be installed along all force mains.

N. For direct burial of gasketed-joint force mains, tracer wire shall be fastened directly to the top of the pipe, at each end and in the center. The distance between attachment points shall be no greater than 10 feet. Tracer wire shall be a #12 AWG high strength, copper-clad steel (HS-CCS) conductor, insulated with a 30 mil, high-density, high molecular-weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. Insulation color shall meet the APWA color code standard for identification of buried utilities. Tracer wire shall be Copperhead HS-CCS HDPE 30 mil insulation as manufactured by Copperhead Industries, LLC of Monticello, MN.

O. Splicing of tracer wire shall not be permitted. Long runs of tracer wire may not be greater than 1,000 feet (+/-). At these intervals, tracer wires shall be extended from the force main to grassed area behind the curb or sidewalk. Magnetized tracer boxes, as manufactured by Copperhead Industries, LLC shall be installed in the grassed area and the tracer wires shall be installed up into the boxes and connected to lugs in the boxes. All boxes shall have a color-coded cover to match the APWA color code standard for identification of buried utilities.

P. All dead ends of tracer wire not made accessible at the ground surface, either in a tracer wire box or a sewer cleanout frame and cover shall be grounded by attaching the end to a magnesium anode as manufactured by Copperhead Industries, LLC.

Q. No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when the Town shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation unless all required precautions as to the minimum length of open trench and promptness of backfilling are observed.

R. Whenever directed, the Contractor shall lay pipe upon an artificial foundation which he or she shall construct. Such foundation may consist of gravel or of concrete and shall be to the dimensions and placed in a manner required by the Town.

7.5 TESTING AND ACCEPTANCE

A. Contractor shall furnish all labor, tools, materials, and equipment, including water, pumps, compressors, stopwatch, gauges, flashlights or other artificial lighting, mirrors and meters, subject to the approval of the Town, for testing in accordance with these specifications.

B. The Town shall be notified in advance of all tests, and all tests shall be conducted to the entire satisfaction of the Town.

C. Force mains must pass all test requirements listed hereafter prior to acceptance by the Town with no exceptions.

D. After the pipe is backfilled and all trapped air is expelled, the force main pipe system shall be hydrostatically tested at a pressure 1.5 times the normal working pressure with a minimum pressure of 150 psi. The test pressure shall be held for a period of at least 4 hours during which time the test pressure shall not vary more than +/- 5 psi.

E. If permanent air valves are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged, or left in place at the discretion of the Town.

F. Acceptance shall be determined based on allowable leakage specified in ANSI/AWWA C- 600 or C-605, as applicable. If a test of pipe laid discloses leakage greater than specified, the Contractor shall, at his own expense, locate and repair the defective material until the leakage is within the specified allowance. All visible leaks are to be repaired regardless of the amount of leakage.

END OF SECTION

SECTION 8 – ALTERNATIVE PIPE INSTALLATION METHODS

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SECTION 8 – ALTERNATIVE PIPE INSTALLATION METHODS

8.1 GENERAL

A. Where traditional open cut trench methods are difficult and unable to be used to install new or replacement pipes, alternative methods of pipe installation may be used.

8.2 METHODS

A. Jack and Bore

This method of pipe installation consists of installing a casing pipe by cutting or boring an opening in the soils material while simultaneously forcing a casing pipe through the soil by the use of hydraulic jacks.

B. Directional Drill

This method of pipe installation consists of drilling a pilot hole along a planned route between two predetermined points followed by pipe installation utilizing a cable pulled through the pilot hole.

C. Pipe Bursting

This method of pipe installation consists of splitting or fracturing the existing utility pipe and forcing the fragments into the surrounding soil to install a new pipe in the previous location typically using trenchless installation methods.

8.3 MATERIALS

A. General:

1. Pipe installed by directional drilling: HDPE
2. Pipe installed by jack and bore: PVC

B. Polyvinyl chloride pipe for force mains shall be PVC 1120 pressure pipe in accordance ASTM D 2241 with a maximum dimension ratio of SDR 26. Fittings for PVC pipe shall be fabricated or molded from the same material as the pipe, or ductile iron fittings may be used. Ductile iron Standard Fittings shall conform to AWWA C110 and ductile iron compact fittings shall conform to AWWA C153.

C. HDPE pipe for force mains fabricated from material having a classification of ASTM D 3350 and meet the requirements of AWWA C906, and a PPI rating of PE 3408. Pipe shall have an outside diameter equivalent to ductile iron pipe.

D. Jack and bore encasement pipe shall be ASTM A139 Grade B welded steel with a minimum wall thickness conforming to Delaware Department of Transportation Standard

Specifications. The pipe shall have a minimum yield strength of 35,000 psi and a minimum tensile strength of 60,000 psi. The pipe joints shall be fully welded. All encasement pipes crossing public streets shall be installed as close to perpendicular as possible.

E. HDPE pipe for water mains fabricated from material having a classification of ASTM D 3350 and meet the requirements of AWWA C906, and a PPI rating of PE 3408. Pipe shall be color coded by a minimum of six (6) blue stripes to indicate potable water and shall have an outside diameter equivalent to ductile iron pipe.

F. Fittings

1. Butt fusion fittings – HDPE Fittings shall be made of PE4710, meet the requirements of AWWA C906 and have a pressure rating equal to the pressure rating of the pipe to which the fitting is joined. Molded fittings shall be manufactured, tested and marked per ASTM D3261. Fabricated fittings shall be manufactured, tested and marked per ASTM F2206, or individual fittings standards.
2. Electrofusion fittings – Fittings shall be made of HDPE material with a minimum material designation code of PE 4710, a manufacturing standard of ASTM F1055, and a pressure rating equal to the pipe. Markings shall be according to ASTM F1055.
3. Flanges and mechanical joint adapters – Flanges and MJ adapters shall have a material designation code of PE4710. Flanges shall be made in accordance with ASTM F2880. MJ adapters shall be made to ASTM D3261. Flanges and MJ adapters shall have a pressure rating equal to the pipe to which it is joined. Markings for molded or machined flange adapters or MJ adapters shall be per ASTM D3261.

8.4 CONSTRUCTION METHODS

A. Jack-Bored, Encased Piping Installation

1. Install steel pipe encasement conduit by the jack boring method. Joints shall be welded around the entire pipe circumference.
2. The boring shall consist of pushing the pipe into the fill with the boring auger rotating within the pipe to remove the spoil. When augers or similar devices are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangement or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangement shall be removed from within the pipe in the event an obstruction is encountered.
3. The overcut by the cutting head shall not exceed the outside diameter of the pipe by more than ½ inch. The face of the cutting head shall be arranged to provide reasonable obstruction of the free flow of the soft material. The use of water or other fluids to facilitate carrier pipe emplacement and spoil removal is prohibited.
4. If an obstruction is encountered during installation that stops the forward movement of the pipe and it becomes evident that it is impossible to advance

the pipe, cease operations, abandon the pipe in-place and fill completely with grout.

5. Bored or jacked installations shall be essentially the same diameter as the outside of the pipe plus a thickness of the protective coating. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe plus coating by more than approximately one inch, fill the voids with grout or by other methods, reviewed and approved by the Engineer.
6. Pressure grout or freeze the soils before jacking or boring, if necessary, to stabilize the soils, control water, prevent loss of material, and prevent sediment or displacement of embankments. Grout shall be cement, chemical, or other special injection material selected to accomplish the necessary stabilization.
7. When water is known and expected to be encountered, operate and maintain pumps of sufficient capacity to handle the flow of water. Attend the pumps on a 24-hour basis until the operation can be safely halted. When dewatering, maintain close observation to detect any settlement or displacement of highways, embankments and facilities.
8. After the encasement conduit has been installed and accepted by the Town, install the carrier pipe as follows:
9. Attach casing chocks to the carrier pipe at not more than 2 feet from each the end of the casing and on 5-foot centers in between. Push the pipe into the encasement conduit with care being taken to ensure the joints are not displaced.
10. Test the carrier pipe for leakage prior to backfilling with stabilized sand. Mix stabilized sand in proportions of at least three (3) sacks of portland cement to each cubic yard of sand. Thoroughly mix the cement, sand and water in a mechanical mixer using only enough water to provide a mixture which will fill all voids. Place the stabilized sand mixture pneumatically or by other means approved by the Town.
11. Plug each end of the casing with end seals.

B. Horizontal Directional Drilled Pipe Installation

1. Directional drill the pipe path in no more than 10-foot increments. After each successive drill pipe, record all readings and plot on a scale drawing of 1" = 2' vertical and 1" = 20' horizontal. Provide access to all recorded readings and plan and profile information to the Town at all times.
2. Contain all drilling fluids and loose cuttings in pits or holding tanks for recycling or disposal. No fluids shall enter any unapproved areas or natural waterways. Upon completion of the directional drill project, dispose of the drilling mud and cuttings at an approved dump site.
3. The pilot hole on the bore path shall not deviate greater than 5% of depth over the length of the bore unless previously agreed to by the Town. Notify the Town in the event that pilot hole does deviate from the bore path more than 5% of depth over the length of the bore. The Town may require Contractor to pull back and re-drill from the location along bore path before the deviation. In the event of a drilling fluid fracture, inadvertent returns, or returns loss during pilot hole drilling operations, cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a March funnel and wait another 30 minutes. If mud fracture or returns loss continues,

discuss additional options with the Town. Proceed with the option approved by the Town.

4. Upon approval of the pilot hole location by the Town, begin the hole opening or enlarging phase of the installation. Increase the bore hole diameter to accommodate the pullback operation of the required size of carrier pipe. Determine the type of hole opener or back reamer to be utilized in this phase based on the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. Select the proper reamer type with the final hole opening being a maximum of 1.5 times the largest outside diameter pipe system component to be installed in the bore hole.
5. Stabilize the open bore hole by means of bentonite drilling slurry pumped through the inside diameter of the drill rod and through openings in the reamer. The drilling slurry shall be in a homogenous / flowable state serving as an agent to carry the loose cuttings to the surface through the annulus of the borehole. Calculate the volume of bentonite mud required for each pullback based on soil conditions, largest diameter of the pipe system component, capacity of the bentonite mud pump, and the speed of pullback as recommended by the bentonite drilling fluid manufacturer. Contain the bentonite slurry at the exit or entry side of the directional bore in pits or holding tanks. Recycle the slurry for reuse in the hole opening operation, or haul it to an approved dump site for proper disposal.
6. Pipe sections shall be joined together according to manufacturer's specifications. The gaskets and the ends of pipe shall be inspected and cleaned with a wet cloth prior to each joint assembly so they are free of any dirt or sand. The pipe shall be free of any chips, scratches, or scrapes.
7. Attach a pulling eye to the pulling head on the lead end of the pipe and in turn attach to a swivel on the end of the drill pipe. Attach detectable pipeline wire to the pulling eye and to the crown of the pipe with duct tape at 24" on center and a minimum of two full wraps around the pipe.
8. Elevate PVC restrained joint product pipe to the approximate angle of entry and support by means of a side boom with roller arm, or similar equipment, to allow for the "free stress**"** situation as the pipe is pulled into the exit hole toward the drill rig. Conduct the product pipe pullback phase of the directional operation in a continuous manner until the pipe reaches the original entry side of the bore.

C. Pipe bursting

1. Television Inspection

   a. All sewer sections and pressure pipelines, which are to be burst, are to be inspected by closed circuit television prior to bursting operations. All sewers or pipelines are to be cleaned as stated below prior to the television inspection.
   b. The television inspection shall be performed in order to supply a visual and audio record of the location of obstructions in the sewer that would interfere with or prohibit bursting of the sewer, and also to provide the location of service laterals that are to be reconnected to the main line after pipe bursting. Final CCTV inspection shall not be performed until all connections have been completed, including connections at manholes.

c. DVD's and a written log shall be made for each line inspected. The quality of the CCTV information shall be such that obstructions and service lateral locations are clearly identified and can be located. The contractor shall make the information available to the Town for review. The CCTV information shall be turned over to the Town at the completion of the work.

d. If there is an obstruction in the sewer line that will not allow the television camera to pass, then the camera shall be backed out of the line and an attempt shall be made to televise the line from the manhole at the other end. If the entire length of the sewer line cannot be televised because of two or more obstructions, then the Town shall be notified and a determination of how to proceed shall be made by the Town.

e. The cost of the television inspection and CCTV information shall be included in the unit cost of the pipe bursting.

2. Bursting and Pipe Installation

a. Disconnect laterals from host sewer main following approved submittals.

b. Provide access pits as required to facilitate pipe bursting insertion process.

c. Locate pits where interference to vehicular traffic and inconvenience to public is minimized.

d. Use sewer lateral connection locations, changes in sewer line and grade, and sags as access pit locations, and provide access to sewer from both directions.

e. Prevent damage to adjacent areas during bursting process.

f. Do not exceed approved submittal insertion rate or force at any time. Maintain logs verifying rate and force did not exceed submitted calculations.

g. Use approved lubricant to ease installation friction. Match lubricants to soil and insertion conditions.

h. Remove irregular internal bead projections that are not uniform and rolled-back from butt-fused joints.

i. Extend DIP joints to remove slack in locking restrained joints.

j. Remove and replace improperly burst sewer mains at no additional cost to the Commission.

k. Contractor is responsible for all costs related to inaccurately located or misidentified live/active sewer lateral connections.

l. Re-connect missed or active taps and abandon erroneously opened connections at no additional cost to the Town.

m. Allow inserted HDPE pipes to rest for a period of 4 hours before cutting and trimming replacement pipe or making any manhole connections.

n. If replacement pipe exhibits retraction, at end of relax period and after flexible manhole connectors' grout has set, anchor HDPE pipe at manholes following approved submittals.

o. After relax period, cut and trim replacement pipe 3 inches inside upstream and downstream manholes.

8.5 TESTING AND ACCEPTANCE

A. Testing and acceptance of all pipes installed by alternative methods shall follow the procedures indicated for water, gravity sewer or force main as noted in previous sections of these Standard Specifications.

END OF SECTION

SECTION 9 – STREETS

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SECTION 9 – STREETS

9.1 GENERAL

A. Where a Developer proposes to construct public streets in the Town of Georgetown, such streets shall be designed in accordance with the Standards defined herein.

9.2 SOILS INVESTIGATION

A. The Town may require the Owner or Developer to employ the services of a Geotechnical Engineering firm to perform a subsurface investigation for the purpose of obtaining information needed to design the proper pavement section.

B. If required, the Geotechnical Engineering firm used must have on staff, an engineer registered in the State of Delaware who is qualified and experienced in the field of Geotechnical Engineering and who is actually engaged in the practice of soils mechanics and foundation engineering.

C. Borings shall be made for all proposed streets within the project area. The following guidelines and methods will be followed when performing the field work:

1. Borings shall be accomplished by using hollow stem augers and/or other equipment necessary to obtain soil samples of each stratum encountered.
2. Boring locations shall be placed along the centerline of the street no more than 300 feet apart, with a minimum of two (2) borings per street. Boring shall be located such that all questionable areas are investigated.
3. Borings shall be performed to a depth of 6 feet below the subgrade of the proposed pavement system.
4. Soil shall be sampled by stratum and at least every one-foot depth of boring. At each soil composition change, a sample, sufficient in size to perform the required laboratory testing, shall be obtained.
5. When water is encountered, borings should be left open until water level stabilizes and then depth to water should be recorded.
6. A log of each boring should be performed by the Geotechnical field personnel. The following information should be recorded on the boring log.

    a. Name of street.
    b. Location of boring -- station and offset.
    c. Surface elevation.
    d. Date boring was performed.
    e. Depth, vertical arrangement and thickness of each stratum.
    f. Sample number.
    g. Visual soil classification of each stratum.
    h. Depth to water (if encountered).

D. The following laboratory tests shall be performed on the material sampled from each stratum encountered in the individual borings:

1. Practice for dry preparation of soil samples for particle-size analysis and determination of soil constants (ASTM Designation D-421).
2. Method of particle-size analysis of soils (ASTM Designation D-422).

3. Amount of material in soils finer than the number 200 sieve (ASTM Designation D-1140).
4. Method of laboratory determination of water content of soils (ASTM Designation D-2216).
5. Classification of soils for engineering purposes (ASTM Designation D-2487).
6. Test method for liquid limit, plastic limit and plasticity index of soils (ASTM Designation D-4318) when required.

E. Methods which deviate from any of the above procedures must be submitted to the Town for approval.

F. Results of the soil investigation submitted to the Town of Georgetown shall contain the following information:

1. A plan view of the proposed streets showing boring locations.
2. Logs containing the required data for all borings made.
3. Tests results of all laboratory tests performed.
4. A profile view of each boring plotted to scale showing the ASTM classification of soils encountered.
5. Pavement design report by geotechnical engineer.

G. The Town reserves the right to check soil survey borings and to inspect testing laboratories as part of their review of the investigative work.

9.3 STREET DESIGN CRITERIA

A. Street planning and geometric design shall conform to the Code of the Town of Georgetown, Chapter 194, Subdivision of Land, the Code of the Town of Georgetown Chapter 190, Street and Sidewalks, DelDOT Standard Construction Details (latest edition), DelDOT Standard Specifications for Road and Bridge Construction (latest edition), and the DelDOT Development Coordination Manual (latest edition). In the event of a conflict, the provisions of the Town Code shall control.

B. Sidewalk, curbing, curb ramps, curb openings and multi-use trails shall be in accordance with the DelDOT Standard Construction Details and the Development Coordination Manual.

C. Traffic controls and pavement marking shall conform to the DelDOT Signing and Striping Guidelines, DelDOT Development Coordination Manual, and the Delaware Manual on Uniform Traffic Control Devices. These include, but are not limited to, stop signs, speed limit signs, no parking signs, and street blades.

D. Entrances onto existing State-maintained and Town-maintained roads and internal subdivision streets shall be designed in accordance with the DelDOT Standards and Regulations for Access to State Highways, latest edition, and the Development Coordination Manual.

E. The arrangements of streets shall be such as to provide for the appropriate extension of existing streets.

F. Minor streets shall be designed to discourage through traffic.

G. Dead-end streets of a permanent nature, if approved, shall not be longer than three hundred (300') feet and shall provide a circular cul-de-sac turn around at the end with a minimum radius along the edge of paving of thirty-eight (38') feet. The radius of the right-of-way of the cul-de-sac shall be 52 feet.

H. If a dead-end street is of a temporary nature, a similar turnaround shall be provided and provisions made for future extension of the street and reversion of the excess right-of-way, to the adjoining properties.

I. No street shall have a name which will duplicate or so nearly duplicate as to be confused with the names of existing streets. The continuation of an existing street shall have the same name. Street names are subject to approval by Sussex County Geographic Information Office and the Town.

J. Monuments shall be set at each point of deflection along the approved rights-of-way.

K. Road Classifications

1. Minor Streets: Minor Streets are streets with less than or equal to 1,000 ADT.
2. Major Streets: Major Streets are streets with 1,001 to less than or equal to 3,000 ADT.
3. Collector Streets: Collector Streets are road with more than 3,000 ADT.

L. Minimum Rights – of – Way and Pavement Width

1. Minor Streets: 50 feet / 28’
2. Major Streets: 60 feet / 28’
3. Collector Roads (without grass island): 80 feet / 32’
4. Collector Roads (with grass island): 80 feet / 16’

M. Grades and Geometrics

1. The minimum longitudinal grade is one half of one percent (0.50%).
2. The maximum longitudinal grade is four percent (4%).
3. All changes in grade greater than 1% combined shall be connected by vertical curves of 100’ radius or as approved to provide a smooth transition and proper sight distance.
4. All streets shall intersect at right angles. Streets, upon approval of the Town Engineer, may be permitted to intersect at no less than seventy percent (70%).
5. The edge of pavement radius at all intersections shall be no less than twenty-five feet (25’).
6. Street jogs with centerline offsets of less than 125 feet shall be prohibited.
7. The minimum radius of the centerline of the curve shall be the radius as recommended in the AASHTO Green Book for normal crown roads in urban roads.
8. Dead End Streets shall be minimized. A turnaround as approved by the Office of State Fire Marshal is required for all dead-end streets longer than 300’ as measured along the centerline of a road from the intersection.

N. Road Pavement Design

1. Average daily trips. For the purposes of this chapter, the following average daily trips (ADTs) per unit shall be used:
   a. Single-family dwelling: 10 ADTs per unit.
   b. Townhouse: 7 ADTs per unit.
   c. Multifamily dwelling (not townhouse): 6 ADTs per unit.
   d. Manufactured home: 5 ADTs per unit.
   e. Retirement Community: 4 ADTs per unit.

2. Subbase course for standard pavement must include one of the following:
   a. Graded aggregate base course: eight-inch maximum lift.
   b. Crushed concrete: eight-inch maximum lift.
   c. Millings: eight-inch maximum lift.

3. Bituminous concrete for standard pavement must include one of the following:
   a. Type: Bituminous concrete base course: four-inch maximum lift.
   b. Type B: four-inch maximum lift.
   c. Type C: two-inch maximum lift.

4. Structural numbers (SN)
   a. One to 50 ADT shall require SN $\geq$ 2.42 based on California Bearing Ratio 10. Base course sections shall be equivalent to 80% of the SN; provided, however, that the topcoat shall not be less one-and-twenty-five-hundredths-inch Type C.
   b. Fifty-one to 3,000 ADT shall require SN $\geq$ 3.06 based on California Bearing Ratio 10. Base course sections shall be equivalent to 80% of the SN; provided, however, that the topcoat shall not be less one-and-twenty-five-hundredths-inch Type C.
   c. Greater than 3001 ADT: Pavement section shall be determined by a geotechnical engineer.

5. Minimum Required Paving Sections

a.	Minor Streets:	1.25” Type C 9.5 mm Superpave 1.25” Type C Intermediate Course 2.50” Type B 12.5 mm or 29 mm Superpave 8” GABC
b.	Major Streets:	1.5” 1.5” 3” 8”
c.	Collector Streets:	1.5” 1.5” 3.5” 8”

6. Milling depth shall be a minimum of twice the required depth of GABC.

7. Unless otherwise provided herein, all materials used in work governed by this section shall meet or exceed DelDOT Standards and Specifications for Road and Bridge Construction, as amended.

9.4 TRAFFIC IMPACT STUDY

A. Threshold: Per DelDOT Development Coordination Manual (DCM) or as requested by Town.

B. TIS Procedure for impact of development on existing streets:

1. Conducted by applicant's engineer, or Town at developer's cost.
2. Scoping subject to Town approval.
3. Methodology per DelDOT DCM.
4. DelDOT review.
5. DelDOT recommendations for Town streets subject to Town approval.
6. Capacity Analysis for internal intersections would be required in lieu of meeting DelDOT Entrance Manual Requirements for left and right turn lanes. Requires design report by developer's engineer.
7. Analysis to be conducted by developer's engineer subject to Town approval.
8. Roundabout designs to be accompanied by Engineer's report and subject to Town approval.

9.5 MATERIALS

A. All street construction materials and equipment shall comply with the DelDOT Standard Specifications, latest edition except as modified herein.

B. Concrete for sidewalks and curbs shall be 3,000 psi, Class C conforming to Section 3 - Concrete of these Standard specifications. Concrete for sidewalks crossing driveways shall have a minimum thickness of 6 inches and have a higher compressive strength of no less than 4,000 psi.

C. Graded aggregates shall consist of crushed stone, crushed gravel or crushed slag fragments. The aggregates shall be uniform in quality and consistency, well graded, and free of silt, clay, decomposed rock, and overburden material in accordance with ASTM D 2940. Material shall meet the following gradation requirements DelDOT Standard Specifications for Road and Bridge Construction Type B graded aggregate (Crusher Run).

D. Hot-Mix, Hot-Laid Bituminous Concrete shall be provided in accordance with the DelDOT Standard Specifications and the Development Coordination Manual.

9.6 CONSTRUCTION METHODS

A. All street construction methods shall comply with the DelDOT Standard Specifications for Road and Bridge Construction, latest edition, except as modified herein.

B. Hot-mix asphalt must be placed over crusher run and shall never be permitted to be placed directly on sub-grade of any type, including select borrow.

C. The final wearing course of hot-mix on collector streets shall not be placed until 75% of the houses are completed. Accommodation must be made such that stormwater runoff will temporarily drain into catch basins with the asphalt below the rim of the basins.

D. Prior to placing the pavement section, the subgrade shall be prepared, and proof rolled as detailed in the most recent DelDOT Specifications for Road and Bridge Construction. If the proof rolling shows the subgrade to be unstable, the Contractor shall scarify, disc, aerate or add moisture and re-compact the subgrade to the extent that when re-tested it will be stable. If, in the opinion of the Town, there are areas to be removed or undercut, they may be ordered, excavated and replaced with approved material. Equipment for proof roll shall be a fully loaded standard 10-wheel tandem dump truck or as otherwise approved by the Town. The Town may, at its discretion, request that samples be taken to generate one or more modified proctor curves followed by testing of the subgrade to verify that the soil is at least 98% of ASTM D1557, based on the proctor curve(s) generated.

E. Streets under construction shall be maintained free of standing water, and any damaged or soft pavement and subgrade shall be removed and replaced prior to installation of the final bituminous surface course. Catch basins on streets under construction shall be modified as necessary to capture and drain runoff with only the base course of asphalt in place. This is especially critical in low point areas. Details concerning the modifications shall be included on the construction drawings.

9.7 TESTING AND ACCEPTANCE

A. No subbase or base materials shall be placed until the subgrade has been approved. The subgrade shall be checked for grades by means of a string line, from grade stakes placed at intervals not to exceed 50 feet. All subgrades shall be approved by the Town before placing base course aggregate.

B. The surface of the base course shall be bladed to the cross-section as required by the Drawings and the finished surface shall be tested with a 10' straightedge and shall have tolerance of ½" in 10'.

C. No portion of the finished binder or surface course for hot-mix, hot-laid bituminous concrete shall be more than 1/4" below a template cut to the cross-section and width of the pavement, placed on the course at right angles to the center line of the road. If ordered, the base and/or wearing course shall be checked with a 10' straightedge placed parallel to the center line of the pavement. Deviations of more than 3/16" shall be corrected before acceptance by the Town.

D. Pavement shall be constructed in accordance with the contract documents. Construction review and material testing for conformance with the contract documents may be performed by a qualified material testing agency for the Town of Georgetown. Construction not in conformance with the contract documents shall be corrected by the Contractor at no additional cost to the Town.

END OF SECTION

SECTION 10 – STORM DRAINAGE SYSTEMS

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SECTION 10 – STORM DRAINAGE SYSTEMS

10.1 GENERAL

A. This section covers storm sewer pipe, precast manholes, and precast catch basins.

B. The Contractor shall furnish and install all storm drains and appurtenances as specified herein and as defined on the drawings or as directed by the Town.

C. The Contractor shall submit certifications to the Town that all pipes, fittings and joints are as specified herein.

10.2 DESIGN CRITERIA

A. Storm water runoff volumes, peak flows, hydrographs and storage volumes shall be calculated in accordance with the USDA Soil Conservation Service Technical Release 55 (TR-55), latest edition and FHWA.

B. Storm water collection and conveyance systems shall be designed in accordance with the Code of the Town of Georgetown, Chapter 194, Subdivision of Land, the Code of the Town of Georgetown Chapter 190, Street and Sidewalks, DelDOT Standard Construction Details (latest edition), DelDOT Standard Specifications for Road and Bridge Construction (latest edition), and the DelDOT Development Coordination Manual (latest edition). In the event of a conflict, the provisions of the Town Code shall control.

C. The minimum storm sewer pipe size shall be 15 inches inside diameter within all street Rights-of-Way and 12 inches outside of any street Rights-of-Way.

D. The minimum depth of cover for storm sewers shall be 15 inches from finished grade to top of pipe and as determined by pipe material and design loads, whichever is greater.

E. Sediment and storm water management facilities shall be in accordance with the Sediment and Stormwater Regulations. All erosion and sediment control practices shall be in accordance with the standards and specifications of the Delaware Erosion and Sediment Control Handbook, latest edition.

F. A Sediment and Storm Water Management Plan for all projects shall be submitted to DNREC or their delegated agency and approved before any earth-disturbing activities are initiated.

G. The 10-year storm frequency shall be used.

H. The starting elevation (tailwater) for calculating hydraulic grade line (HGL) shall be the tailwater elevation of the outfall during the 10-year storm event or the crown of the pipe (whichever is higher). The HGL shall be calculated in accordance with HEC-22.

I. The hydraulic grade line shall be at a minimum 1 foot below the grate during the 10-year storm event and below the grate rim during the 25-year storm event.

J. The gutter spread for all roads shall be less than nine (9) feet. All sags shall assume a 50% efficiency.

K. The design velocity is two (2) feet per second (fps) when flowing full.

L. The maximum spacing of all inlets shall be 300 feet.

M. Double inlets are required by the Town at low points.

N. Design engineer shall certify the design and submit stormwater management report and storm drain calculations, including a Pipe / Angle Worksheet to verify pipe cover and inlet sizes and Drainage Area Map

10.3 STORM DRAIN IMPACT STUDY

A. Threshold: All site plans and subdivisions requiring Planning and Zoning Commission approval which propose to discharge to a Town storm drain system and propose a storm water management waiver from DNREC or propose to increase runoff to the Town's storm drain system to an existing problem area (including Savannah Ditch).

B. Developer's engineer shall provide field survey and calculations to characterize and evaluate the capacities of the impacted system and submit it for Town review. Report shall indicate adequate capacity is available, or indicate offsite improvements needed along with a cost estimate of these improvements.

C. Checklist:

1. Contact information for developer and engineer.
2. Existing and proposed stormwater runoff locations and intent to discharge to Town storm drain system.
3. Evidence of known or suspected storm drain problems downstream of development. Scoping meeting may be needed.
4. Predevelopment and post-development calculations and storm drain system evaluation to show suitability or upgrades of infrastructure such that the resulting storm drain system design satisfies all the criteria included in the *DelDOT Development Coordination Manual*, latest edition. Provide construction cost estimate for offsite improvements. DE PE seal required.
5. If applicable, proposed offsite easements or use of public rights of way.

10.4 REINFORCED CONCRETE PIPE

A. Round pipe shall conform to the requirements of AASHTO M 170M. Class III pipe shall be used unless the cover is less than 12 inches; in which case the pipe shall be Class IV.

B. Elliptical pipe shall conform to the requirements of AASHTO M 270M. Class III pipe shall be used unless the cover is less that 12 inches; in which the pipe shall be Class IV.

C. A rubber gasket conforming to the requirements of ASTM C 443M shall be used to seal the joints between each successive section of pipe.

D. Pipe shall be manufactured without lifting holes and shall be handled at all times by means of slings or other methods approved prior to start of construction.

E. All pipe joints shall be water tight.

10.5 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. High Density Polyethylene (HDPE) pipe for non-pressure drainage of storm water shall comply with the requirements, test methods, dimensions and markings found in AASHTO Designations M 252 and M 294 with a maximum diameter of 48 inches. All sizes shall conform to the AASHTO classification "Type D" (which describes pipe with a smooth waterway).

B. Joints shall be bell-type and classified "water tight" in accordance with ASTM D3212 and ASTM F1417.

C. Fittings for PE pipe for non-pressure drainage of storm water shall not reduce or impair the overall integrity of function of the pipe line. Couplings shall provide sufficient longitudinal strength to preserve pipe alignment and prevent separation at the joints. Only fittings supplied or recommended by the pipe manufacturer shall be used. Neoprene or rubber gaskets shall be supplied on all fittings.

D. HDPE pipe shall be manufactured by Advanced Drainage Systems, Inc., (ADS –N12), Hancor, Inc., (Hi-Q), or approved equal and shall be installed per manufacturer’s guidelines.

10.6 PIPE AND FITTINGS

A. Pipe laying shall not begin until all stakeout and cut sheets have been approved by the Engineer.

B. The Contractor shall utilize proper and suitable tools and equipment for the safe handling and laying of the pipe and fittings in accordance with the manufacturer's standards. Pipe and fittings shall be carefully handled and lowered into the trench.

C. Should the pipe require cutting to fit in the line or to bring it to the required location, the work shall be done without extra compensation, in a satisfactory manner so as to leave a smooth end, perpendicular to the axis of the pipe.

D. Before making joints, each pipe shall be well bedded on a solid foundation and no pipe shall be brought into position until the preceding length has been thoroughly embedded and secured in place. No pipe shall be laid in wet trench conditions that preclude proper bedding or on a frozen trench or when weather conditions are unsuitable for proper installation.

E. In laying pipe, special care shall be taken to ensure that each length shall abut against the next in such a manner that there shall be no shoulder or unevenness of any kind along the inside of the pipeline.

F. No wedging or blocking will be permitted in laying any pipe; unless by written order from the Town.

G. Pipe and appurtenances shall be thoroughly cleaned before they are laid and shall be kept clean until the acceptance of the completed work. The open end shall be kept closed with a plug until the next length is laid. At the close of work each day, the end of the pipeline shall be tightly closed with an expansion stopper so that no dirt or other foreign substances may enter the line, and this stopper shall be kept in place until pipe laying is again resumed.

H. Manholes shall be installed as pipe laying progresses.

10.7 PRECAST CONCRETE MANHOLES AND INLETS

A. All catch basins, manholes and junction boxes shall be constructed as per most recent State of Delaware Department of Transportation (DelDOT) Standard Construction Details.

B. Structures shall be built at such points on the pipelines and of such form and dimensions, as are shown on the drawings or as may be directed. Structures shall be installed as pipe laying progresses and the Town may stop work entirely on laying pipe if manhole and inlet construction is delayed to such an extent as to be hazardous to construction or the public.

C. Precast reinforced concrete base riser sections shall be as manufactured by Atlantic Concrete Products, Inc., Gillespie Precast, LLC, or equal. Joints between riser sections shall be Star Seal ™ Connector or approved equal meeting or exceeding the requirements of ASTM C-923 and C-1478.

D. Lifting holes in the walls of precast reinforced concrete risers will be allowed but shall be plugged with rubber stoppers and grouted flush with face of manhole and inlet wall after installation of manhole and inlets riser sections. Not more than two (2) holes shall be cast in the walls of each riser section for the purpose of handling.

E. All flow channels shall be cast in place using 3,000 PSI concrete.

10.8 CASTINGS

A. Frames and covers or grates for structures shall be set by the Contractor as the work progresses.

B. Material, sizes, and types of frames and covers shall be as specified on the plans; and they shall be in accordance with the most recent DelDOT Standard Construction Details. Frames and covers shall be Neenah Model R-1642 heavy duty, solid lid, with as-cast T-Seal and one (1) pick hole. “Storm Sewer” shall be embossed on the lid surface. Material for frames and covers shall be in accordance with standard specifications for gray iron castings ASTM A-48 for Class 35.

C. All DelDOT approved catch basin grates can be used, except Type 2.

10.9 MANOLE AND INLET STEPS

A. Steps in structures shall be made of (3/8) three-eighths inch diameter (No.3) steel bars, ASTM Designation A-615, Grade 60, encased in polypropylene plastic. Manhole steps shall have tread ridge with retainer lug on each side.

B. Steps in structures shall be cast in place during manufacture of precast reinforced concrete risers and eccentric top sections or embedded during construction of brick manholes. Embedment length shall be suitable for minimum five (5) inch thick, precast reinforced concrete riser walls.

C. Steps in structures shall be OSHA approved and as manufactured by; M.A. Industries, Inc., Peachtree City, Georgia; Improved Construction Methods (ICM), Inc., Knoxville, Tennessee, or equal.

D. Steps in structures shall be spaced twelve (12) inches apart. The maximum spacing from top of manhole to the first step shall not exceed sixteen (16) inches.

10.10 TESTING AND ACCEPTANCE

A. Prior to base coat of pavement installation, all storm sewers shall be subject to mirror-light testing for pipe deflection and for straight and true alignment. Mirror-light testing shall be performed between catch basins and manholes, or through partially completed sections of pipe as required by the Engineer. Storm sewers with a deflected cross-section or not showing a full circle of reflected light shall not be accepted. Sections of storm water pipe determined unacceptable shall be removed and reinstalled at no additional expense to the Town.

B. Prior to topcoat of pavement installation, all storm sewers shall be subject to visual testing using closed circuit television (CCTV) equipment suitably sized for the diameter of the sewer segments being tested. CCTV survey results shall be submitted to the Town for review and approval. CCTV video inspection shall follow the below requirements:

1. All pipe inspections must be completed by a National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) certified professional.
2. The video should include identification before each run of pipe is filmed. This identification will include the project number or subdivision name, the structure number and the pipe run number corresponding to the construction plans. Inspection should begin at the inlet end and proceed downstream.
3. Post installation pipe inspection should be conducted no sooner than 30 days after backfill placement or before placement of the final lift of roadway cover.
4. Pipes must be clean at the time of inspection and all blockages which would prohibit a continuous operation removed.
5. The pipe should be dry at the time of inspection.
6. Recording shall be of a quality sufficient for ENGINEER to evaluate the condition of the sewer, locate the sewer service connections, and to verify cleaning. If ENGINEER determines that the quality is not sufficient, re-televise the sewer segment and provide a new recording and report at no additional compensation.

7. Adjust light levels, clean fouled or fogged lens, and allow vapor to dissipate from camera lights in order to produce acceptable recordings. All TV inspection recordings that do not meet the specified requirements shall be re-televised.
8. Record all information using proper NASSCO PACP defect codes and pipe ratings. The reports shall include at least the minimum amount of information required by PACP, including required PACP header information. Color still shot images of all defects encountered shall be included with each pipe segment.
9. Each pipe run must be a separate video file.
10. The video shall indicate the distance traversed along the pipe. The distance shall have an accuracy of one foot per 100 feet.
11. The camera must move through the pipe at a speed not greater than 30 feet per minute, or at a speed which allows for accurate measurements and reporting required by this guide, whichever is lower.
12. Provide sufficient lighting to produce a clear image of the full circumference of the pipe.
13. Provide a full unobstructed and centered view of the entire pipe. The view shall be centered both horizontally and vertically.
14. Stop at every joint for three (3) seconds. Film the entire circumference of each pipe joint. Film the joint in a complete counterclockwise direction followed by a complete clockwise direction.
15. The camera operator shall provide a continuous video during the CCTV process. The operator shall stop and center the camera as needed to measure and record any defects or irregularities found during the videoing. All defects shall be described in accordance with NASSCO PACP coding requirements. Irregularities shall include any questionable item such as a stain, crack, paint mark, shadow, or character change in a pipe being inspected.

END OF SECTION

SECTION 11 – SURFACE RESTORATION

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SECTION 11 – SURFACE RESTORATION

11.1 GENERAL

A. The Contractor shall restore all surfaces damaged by his or her operations to the widths and extent detailed or noted on the plans or specified herein.

B. Surface restoration in streets and roads maintained by DelDOT shall be accomplished in accordance with DelDOT Standard Specifications current at the time of plan approval, or construction, if no plan submission was required.

C. Various conditions and types of surface restoration are shown on the details. Materials and construction methods to be in accordance with the most recent DelDOT Standard Specifications.

D. Open cut of new pavement will not be allowed for 5 years after pavement installation except in emergency situations or as approved by the Town.

E. Existing pavement shall be saw cut to form a straight, clean edge for repaving. Saw cut pavement as shown on the drawings and as directed to obtain a clean pavement edge.

F. No staggered or irregular longitudinal trench repair widths shall be permitted. Repairs shall be of a uniform width and in a straight line.

G. Minimum pavement restoration width is five (5) feet including restoration along the edge of roads. Longitudinal pavement restoration within the travel lane shall be at a minimum the full width of the travel lane. Actual width shall be as detailed or as noted on the plans. Payment, where applicable, is limited to these widths. Should the Contractor damage or disturb larger areas, he or she shall replace the additional area at his or her cost.

H. Surface course and concrete sections shall be cut into manageable sections and removed and shall not be broken out.

I. Asphalt pavement over hanging undermined areas shall be cut back from the undermined area, removed, and replaced.

J. A temporary 2 inch (compacted) layer of cold patch shall be placed on all utility trenches at the end of every workday.

K. Metal plating may be used at the end point of the utility laying operation, with prior permission from the Town or DelDOT, whichever is applicable. Plates must be used to protect concrete patches during the curing process. Metal plates shall be “heeled-in” at all edges with cold patch. Metal plates are not permitted within roadways from November 1 to March 15.

L. All adjustments to existing utilities shall be made prior to installing asphalt paving. If utilities are damaged during paving operations, they shall be repaired and the asphalt installed shall be removed and replaced as necessary, at the Contractor’s expense.

M. Manhole or catch basins adjustments shall be made with brick courses, mortar layers, or composite grade rings. Screw-type multiple piece valve boxes shall be adjusted by rotating the upper section where adjustment is available, installing metal valve box adjustment rings, or replacing the valve box.

N. Pavement along the perimeter of all trenches shall be saw cut full depth and replaced from the edge of the trench to a distance one (1) foot outside the edge of the trench, or for a width as indicated on the plans, whichever is greater. In addition, there shall be a one (1) foot wide paving tie-in installed outside of the full depth pavement replacement. The paving tie-in shall consist of milling the existing asphalt pavement one (1) foot wide by two (2) inches deep around the perimeter of the paving to be restored. The topcoat of asphalt shall extend to the outside of the milled paving tie-in during the paving restoration.

O. Skewed isolated patches will not be permitted; they shall be saw cut to form a square.

P. Permissible paving temperatures and asphalt lift thicknesses shall be as set forth in the current DelDOT Standard Specifications for the specific asphalt type being installed.

Q. Catch basins, inlets, curbs, and all other appurtenances shall be adequately covered and protected prior to application of bituminous materials. No earth or bituminous materials shall be allowed to enter any storm drainage system and suitable containment provisions shall be employed to prevent surface runoff of bituminous materials.

R. The final surface except on overlays shall match approved grades or grades existing prior to construction and shall be such that a smooth transition free of abrupt changes in grade is made with adjacent pavements and/or sidewalks. No depressions or other misalignment shall obstruct, trap, or otherwise misdirect the flow of surface water drainage.

11.2 MAINTENANCE OF REFILLED EXCAVATIONS

A. The Contractor shall maintain, at his or her own expense, all refilled excavations and surfacing in proper condition as specified herein. All depressions appearing in the refilled excavation, stabilized base, or temporary paving shall be properly refilled. If the Contractor fails to make repairs within 48 hours after receipt of written notice from the Town, the Town may refill said depressions and the cost thereof shall be billed to the Contractor. In case of emergency, the Town may refill any depression or protect with barricades without giving previous notice to the Contractor, and the cost of doing so shall be billed to the Contractor.

B. The Contractor shall be responsible for any injury or damage that may result from lack of maintenance of any refilled excavation at any time.

11.3 PAVEMENT RESTORATION

A. Bituminous Surface Treatment

1. Bituminous surface treatment shall consist of one or more courses of bituminous material and aggregate as shown on the drawings.

2. Materials and methods of construction shall meet the provision of DelDOT's Standard Specifications.

B. Bituminous Pavement

1. Hot mix, hot laid bituminous concrete surface course shall consist of placing bituminous concrete courses of the specified or appropriate type on a prepared base, to the minimum compacted thickness shown on the drawings.
2. Hot mix, hot laid bituminous concrete shall meet the provisions of DelDOT's Standard Specifications.

C. Concrete Pavement

1. Concrete used in the restoration of streets and roads shall be placed to the minimum thickness shown on the drawings. A concrete base course with a bituminous concrete overlay, or a finished concrete surface course may be required.
2. Concrete pavement shall meet the provisions of Rigid Pavement, in DelDOT's Standard Specifications.
3. Concrete sidewalk, curb, curb & gutter, and driveway restoration shall meet the provisions of Section 12 of these Standard Specifications.

D. Base Course

1. GABC or recycled material sub-base shall be spread on prepared and compacted re-filled excavations to the compacted depth shown on the drawings. Materials and methods of construction shall meet the provisions of DelDOT's Standard Specifications.
2. A bituminous concrete base course shall be spread on prepared and compacted GABC sub-base to the compacted depth shown on the drawings. Materials and methods of construction shall meet the provisions of DelDOT's Standard Specifications.

11.4 TOPSOILING, SEEDING AND MULCHING

A. All disturbed areas not specified to be paved shall be topsoiled to a depth of 4 inches minimum, seeded and mulched.

B. Before placing or depositing topsoil, the subgrade shall be approved by the Engineer. The topsoil shall be placed in reasonably close conformity to the desired lines, grades, and elevations.

C. Seeding shall consist of preparing the ground and furnishing and placing all lime, fertilizer, and seed on the areas to be seeded. Seeding shall not be done during windy weather or when the ground is frozen, excessively wet, or otherwise untillable. The Town reserves the right to stop seeding operations whenever conditions are determined to be unfavorable.

D. The area to be seeded shall be thoroughly loosened to a depth of 6 inches, and if just

prior to seeding, the top 3 inches of soil is loose, friable, and free of large clods, rock, or other extraneous matter 1 inch or more in diameter, measured at the widest dimension; and if shaped to the prescribed grade, it shall be a satisfactory seedbed and require no further work. However, when the area to be seeded is partially sodded, barren, weedy, or packed and hard, any grass and weeds shall first be cut or otherwise satisfactorily removed; and the soil shall then be scarified or otherwise loosened to a depth of 4 inches. Clods and lumps shall be broken, rubbish, rocks, and other extraneous matter removed clear of the site; and the upper 3 inches shall be disked or otherwise worked into a satisfactory seedbed.

E. Limestone shall be applied at the rate of 3,000 pounds/acre. Fertilizer shall be applied according to the quantities of actual plant food/acre required for the seed mix.

F. The seeded area shall be mulched at a rate of 90 pounds per 1,000 square feet with either wood cellulose fiber mulch or straw mulch. A chemical mulch binder shall be used at the rate of 60 gallons/acre. Asphaltic-base binder shall not be permitted.

G. The following maintenance procedure shall be followed prior to acceptance:

1. Maintain surfaces and supply additional topsoil where necessary including areas affected by erosion.
2. Water to ensure uniform seed germination and to keep surface of soil damp.
3. Apply water slowly so that surface of soil will not puddle and crust.
4. Cut newly planted grass for the first time when it reaches a height of 2-1/2 inches and maintain a minimum height of 2 inches. Do not cut more than 1/3 of the blade at any mowing. Remove clippings.
5. After the first mowing, water grass sufficiently to moisten the soil from 3 inches to 5 inches deep.
6. Apply weed killer, if weeds start developing, during calm weather when air temperature is above 50 degrees.
7. Replant damaged grass areas showing root growth failure, deterioration, bare or thin spots and eroded areas.

H. Seeded areas will be accepted at the end of maintenance period when seed areas are properly established and otherwise acceptable.

END OF SECTION

SECTION 12 – SIDEWALKS, CURB & GUTTER, AND DRIVEWAYS

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SECTION 12 – SIDEWALKS, CURB & GUTTER, AND DRIVEWAYS

12.1 GENERAL

A. Contractor shall provide all labor, materials and appurtenances for construction of concrete sidewalk and curb, and curb & gutter where indicated on the drawings and as specified.

B. The Contractor shall furnish and install PVC pipe sleeves in sidewalk for street signs, where directed by the Town.

12.2 METHODS AND MATERIALS

A. All materials and construction methods shall be in accordance with the most recent DelDOT Specifications for Road and Bridge Construction. All curb and curb & gutter shall be as per most recent DelDOT Standard Construction Details.

B. All concrete shall be in accordance with DelDOT's Specifications for Road and Bridge Construction, Section 1022, Class B. Minimum ultimate compressive strength of concrete shall be 3,000 pounds per square inch at the end of twenty-eight (28) days. Submit mix design for approval. All concrete shall be air entrained.

C. The Contractor shall retain the services of an independent testing agency to perform concrete testing. He shall schedule one (1) set of test cylinders for every 20 cubic yards of concrete placed as curb and gutter or sidewalk. The testing agency shall be responsible for sample preparation, transportation, testing and submission of testing reports. Testing shall include slump test, air content, ambient temperature, concrete temperature and 7-day and 28-day compression tests. Test results shall be submitted, in duplicate, direct by the testing agency, to the Town.

D. Curb shall be depressed at all existing and proposed driveway locations in accordance with DelDOT Standard Construction Details, including proper preparation of subgrade and proper placing and spacing of joints and joint materials.

E. The Contractor shall permanently repair or replace all curbs, sidewalks, and driveways that have been removed, broken, damaged during execution of the work, or injured by settlement of any backfilled excavation at any time prior to termination of the guarantee period. The minimum allowable length for replacement of damaged curb shall be ten (10) feet.

F. The installation of new or replacement curb and sidewalk shall be in accordance with the most recent DelDOT Specifications for Road and Bridge Construction. Wheelchair curb ramps shall be installed at all street corners in accordance with the most recent DelDOT Standard Construction Details.

12.3 SUBGRADE

A. Subgrade for concrete sidewalk, curb, and curb & gutter shall be Borrow, Type C per DelDOT Standard and Specifications to at least 95% of maximum density at minus two (2) to plus two (2) percent of optimum moisture content as determined by the Modified Proctor Test ASTM D1557.

12.4 SUBBASE

A. Sub-base material for concrete sidewalk, curb, and curb & gutter shall be six (6) inches of compacted GABC, Type B per DelDOT Standards and Specifications over sub-base, compacted to 95% of ASTM D1557. Sub-base material for curb and curb & gutter shall extend from the face of the curb or gutter to six (6) inches behind the back of curb.

12.5 CURB

A. Entrance curb or any other curb within State right-of-way shall be of a type as directed by DelDOT.

B. Curb along new streets within right-of-way to be dedicated to the Town shall be integral PCC curb and gutter Type 2 or Type 3, as directed by the Town. Curb along existing streets within Town right-of-way shall match existing unless directed otherwise by the Town.

C. Curb within commercial, industrial, or institutional development and not within Town right-of-way may be any current DelDOT curb type.

D. Current DelDOT curb types not listed above may be used along streets within right-of-way to be dedicated to the Town with prior approval from the Town.

12.6 RECONSTRUCTION OF PRIVATE DRIVEWAYS

A. Saw cut existing driveways if sections are acceptable for reuse. Prior to replacement of driveways, the Contractor, Town and Owner shall review field conditions. The Owner will designate the extent of additional removal and replacement which shall not entitle the Contractor to additional compensation above the unit price bids. Upon completion of utility construction, the Contractor shall reconstruct private driveways in kind, except as follows:

1. Concrete Driveways

   a. Concrete driveways shall be replaced and reconstructed upon a properly prepared, graded and compacted sub-grade in compliance with the most recent DelDOT Specifications for Road and Bridge Construction. Four (4) inches of GABC shall be placed on top of the properly compacted subgrade. The crusher run shall be properly graded and compacted.
   b. Driveways shall be constructed to a minimum thickness of six (6) inches and shall be reinforced with six (6) inch by six (6) inch w1.4 x w1.4 wire mesh.
   c. Restoration shall provide for a smooth transition from back of sidewalk or driveway construction to undisturbed areas and shall be free of all

localized depressions or abrupt changes in grade that may trap or otherwise misdirect surface drainage or represent possible damage to vehicular travel.

2. Bituminous Concrete Driveways

a. Bituminous driveways and parking areas disturbed through the Contractor's construction operations shall be restored by a minimum of two (2) inches of hot-mix bituminous concrete pavement placed in a single lift onto a base of four (4) inches of properly prepared and compacted GABC. Commercial and residential entrances on State maintained streets shall be installed or restored in accordance with the plan details and DelDOT requirements. Match the thickness of the existing asphalt where the existing asphalt thickness exceeds required asphalt depth.

b. The hot-mix bituminous concrete surface shall conform to the most recent DelDOT Specifications for Road and Bridge Construction for Type C.

12.7 SIDEWALK CONSTRUCTION

A. Concrete sidewalks shall be replaced as required, or as directed, in accordance with the most recent DelDOT Specifications for Road and Bridge Construction and Standard Detail. Handicap ramps shall be installed in all intersections.

B. Sidewalks in areas not subject to vehicular loading shall have a minimum thickness of four (4) inches placed upon a sub-base of four (4) inches of graded and compacted GABC. The sub-grade shall be properly graded and compacted to 95% of ASTM D1557.

C. Sidewalks in vehicular loading areas shall be a minimum thickness of six (6) inches reinforced with six (6) inch by six (6) inch, w1.4 x w1.4 wire mesh. The sub-base and subgrade shall be as noted above.

D. Replacement of partial sections of concrete sidewalk, where so directed, shall be extended to the nearest existing joint in each direction.

E. Sidewalks shall be replaced to a width equal to that existing prior to start of construction and such width shall be maintained throughout the entire length of the block unless directed otherwise by the Town. In no instance shall the constructed width be less than four (4) feet. The width for installation for new sidewalk shall be five feet.

F. Sidewalk to be installed against the back of curb, the curb shall be installed prior to installing the sidewalk and it shall be allowed to cure for a minimum of 24 hours. Monolithic curb/sidewalk installation shall not be permitted in public right-of-way.

G. A broom finish shall be applied perpendicular to the direction of traffic.

END OF SECTION

SECTION 13 – LIGHTING

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SECTION 13 – LIGHTING

13.1 GENERAL

A. All lighting shall comply with the Illuminating Engineering Society of North America's Recommended Practices and Design Guidelines, latest edition.

B. All wiring shall comply with all applicable electrical codes.

C. No lights shall be installed that flash, move, revolve, rotate, scintillate, blink, vary in intensity or color, or use intermittent electrical pulsation.

D. All lighting shall be glare-free and shielded from the sky and adjacent residential properties and structures.

E. All lighting of predominantly horizontal surfaces shall be aimed straight down, have no up light, and meet full cutoff and fully shielded criteria.

13.2 STREET LIGHTING

A. All subdivision street lighting shall be coordinated with Delmarva Power's outdoor lighting program.

B. Street light poles shall be decorative cast aluminum lamp posts with Wadsworth-style bases.

C. Lighting styles for streetlights must be one of the following approved styles:

1. Granville Style without ribs or equivalent
2. Arlington Style or equivalent
3. Clearwater Style or equivalent
4. Traditionaire Style or equivalent

D. The lamps shall be 12 feet in height and have a maximum spacing of 150 feet. A lamp must be placed at every street corner and subdivision entrance, and at ends of cul-de-sacs.

E. The lamps shall be placed in all cases between the back edge of the sidewalk and the right-of-way line. The maximum distance the lamps shall be placed behind the sidewalk is one foot.

F. All wiring for streetlights shall be placed in approved conduit. All conduit shall be a minimum of 2" diameter, Schedule 40 PVC (polyvinyl chloride), except from each street light to the adjacent pull box which may be 1" diameter PVC or metal.

G. A streetlight is required at the entrance to any pedestrian pass-through. If the passthrough is longer than 75 feet, another streetlight is required at the far end. Walkways longer than 150 feet will require additional lights.

H. All subdivision streetlights shall be 100 watt LED lighting.

13.3 RESIDENTIAL LIGHTING

A. All residential lighting should be of a style compatible and consistent with the architectural style and historic context of the structure or development.

B. Residential pole mounted or wall mounted fixtures shall be limited to 8 feet in height above finished grade.

C. Building-mounted lights shall be installed below the eave line and no higher than 14 feet unless used to illuminate a second story entry, balcony, or outside stairway or door where in such case it should be no higher than 8 feet above the floor elevation to the second story.

12.4 COMMERCIAL LIGHTING

A. Exterior lights for nonresidential uses shall be shielded, shaded or directed so that light intensity and glare shall not adversely affect neighboring residential property owners or passing motorists

B. Adequate lighting of driveways, parking lots, walkways and other public and semipublic and employee areas shall be provided in all commercial, industrial and multifamily residential developments.

C. When a nonresidential use is adjacent to a residential zoning district or use, the maximum illumination shall not exceed one-tenth (0.1) foot candle at the residential property line.

D. Lighting style of both poles and fixtures must be of a style compatible with the design and architectural style of the buildings and facilities illuminated.

1. Outdoor lighting shall be no higher than 12 feet except where the lighting is for parking or vehicular circulation areas, in which case a height of no greater than 20 feet is permitted

E. A minimum light intensity of 1 foot-candle is required for all doorways and parking areas to be used at night.

F. Photometric calculations are required to be submitted to the Town to depict adequate light intensity.

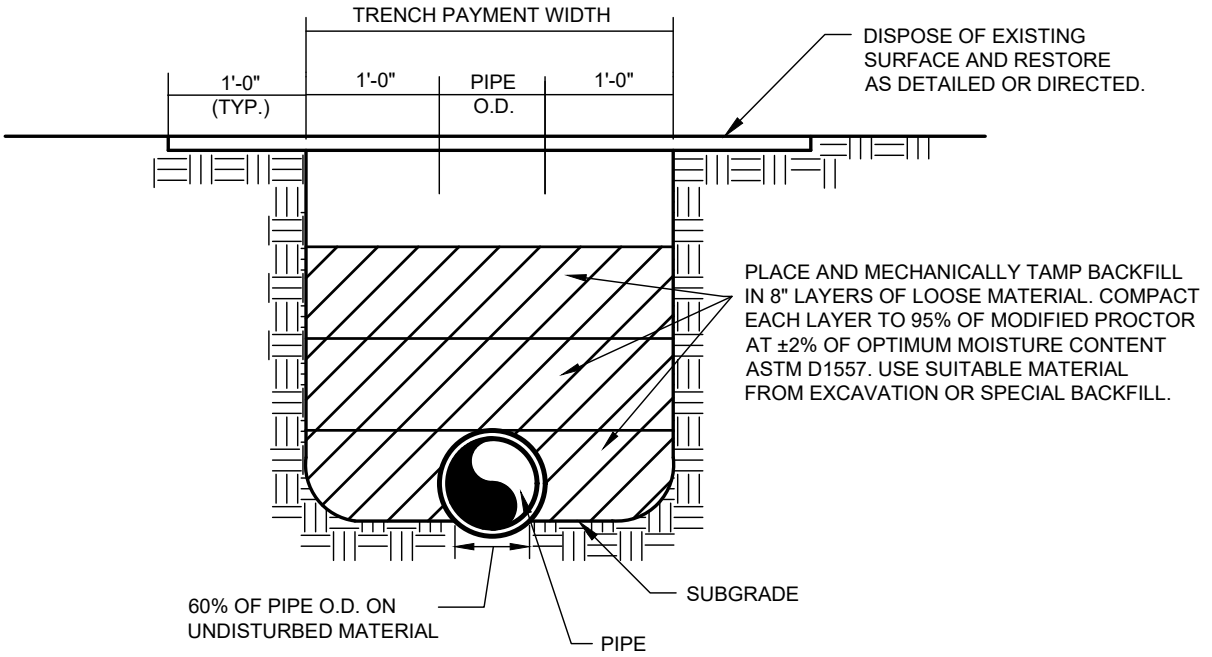
END OF SECTION

SECTION 14 – DETAILS

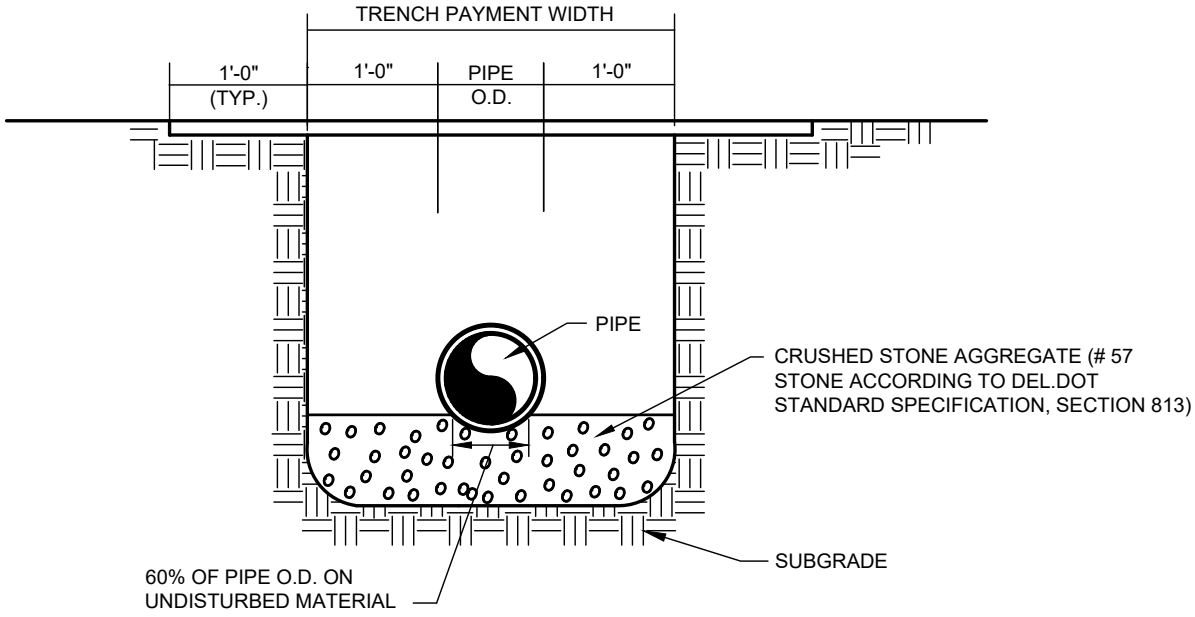
TABLE OF DETAILS

RELEVANT SECTION	DRAWING NUMBER	TITLE
2	1	Trench Backfill & Pipe Bedding Detail
3	1	Concrete Encasement Detail
4	1	Plug Detail
4	2	Tee & Wye Detail
4	3	Cross Thrust Block Detail
4	4	Horizontal Bend Detail
4	5	Vertical Downward Bend Detail
4	6	Vertical Upward Bend Detail
4	7	Moled Water Service & Restoration Detail
4	8	Fire Hydrant Detail
4	9	Encasement Detail
4	10	Single Meter Pit Detail (Prefabricated)
4	11	Single Meter Pit Detail (Prefabricated) In Driveway
4	12	Standard Dual Meter Pit (Single Lot) Detail (Prefabricated)
4	13	Tracer Wire & Valve Box Detail
4	14	Standard Dual Meter Pit (Double Lot) Detail (Prefabricated)
4	15	Water Main Crossing Utility Detail
4	16	End Cap Detail
4	17	2” Meter Setter Detail
4	18	Backflow Preventer Installation Schematic Detail
4	19	Gang Meter Pit Detail
4	20	Gang Meter Pit Detail Section View
4	21	Industrial / Commercial Meter Detail
4	22	Fire Line Backflow Preventer Detail
4	23	Automatic Blowoff Detail
5	1	Shallow Manhole Detail
5	2	Precast Concrete Manhole Detail
5	3	Inside Drop Manhole Detail
5	4	Existing Outside Drop Manhole Detail
5	5	Doghouse Manhole Detail
5	6	Typical Manhole Flow Channel Detail
5	7	Building Lateral Cleanout Detail
5	8	Deep Sewer Lateral Connection Detail
5	9	Sewer Lateral Restoration Detail
5	10	Manhole Frame & Cover Detail
5	11	Grease Trap Detail
5	12	Water – Oil Separator Detail
5	13	Pipe Cradle Detail
6	1	Wet Well & Valve Vault Typical Section
6	2A	Wet Well & Valve Vault Typical Plan
6	2B	Wet Well & Valve Vault Typical Plan

RELEVANT SECTION	DRAWING NUMBER	TITLE
6	3	In-Line Blower
6	4	Electrical Equipment Enclosure Control
6	5	Electrical Equipment Enclosure Power
6	6	Generator Pad Detail
6	7	By-Pass Pumping Connection Detail
6	8	Fence & Gate Detail
6	9	Yard Light Detail
6	10	Bollard Detail
6	11	Yard Hydrant Detail
7	1	Force Main Discharge Manhole Detail
7	2	Sewage Air Valve Manhole Detail
7	3	Buried Valve Detail Sewer
7	4	Sewer Tracer Wire & Valve Box Detail
9	1	Minor Street Typical Section
9	2	Major Street Typical Section
9	3	Dual Lane Boulevard Typical Section
11	1	Temporary Cross Road Patch Detail
12	1	Driveway Apron & Depressed Curb Detail

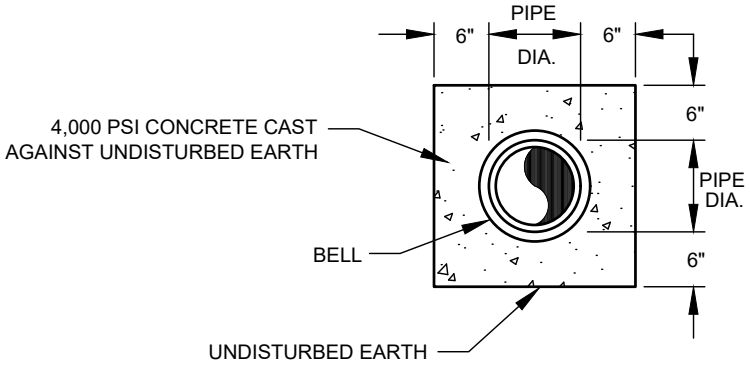


TRENCH BACKFILL



CRUSHED STONE BEDDING

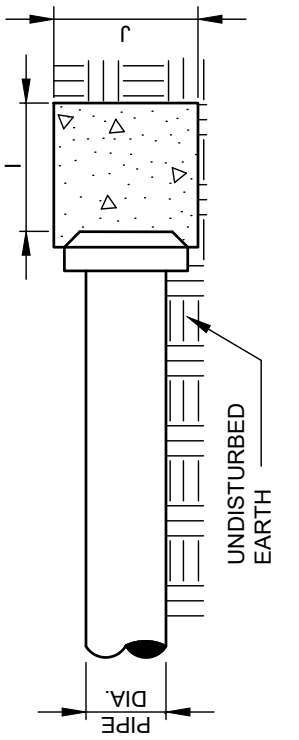
DATE: JANUARY 2025		TRENCH BACKFILL & PIPE BEDDING DETAIL NO SCALE	
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 2	DRAWING - 1



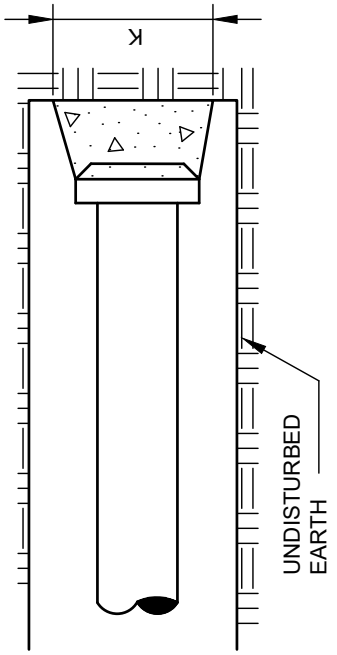
NOTES:

1. SEWER ENCASEMENT AT WATER MAIN CROSSINGS SHALL BE A MINIMUM OF TEN FEET IN LENGTH OR AS DIRECTED BY THE TOWN ENGINEER.
2. THE CROSSING SHALL BE ARRANGED SUCH THAT THE SEWER JOINTS WILL BE EQUAL DISTANCES AND AS FAR AS POSSIBLE FROM WATER JOINTS.
3. SEWER ENCASEMENT MUST ENCOMPASS ONE JOINT EACH WAY PLUS 12".

DATE: JANUARY 2025		CONCRETE ENCASEMENT DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 3 / DRAWING - 1



PROFILE



PLAN

DIMENSION SCHEDULE

PIPE DIA.	6"	8"	10"	12"	16"
I	6"	8"	8"	10"	1'-0"
J	1'-0"	1'-4"	1'-8"	2'-0"	2'-8"
K	1'-5"	1'-11"	2'-5"	2'-10"	3'-9"

DATE: JANUARY 2025

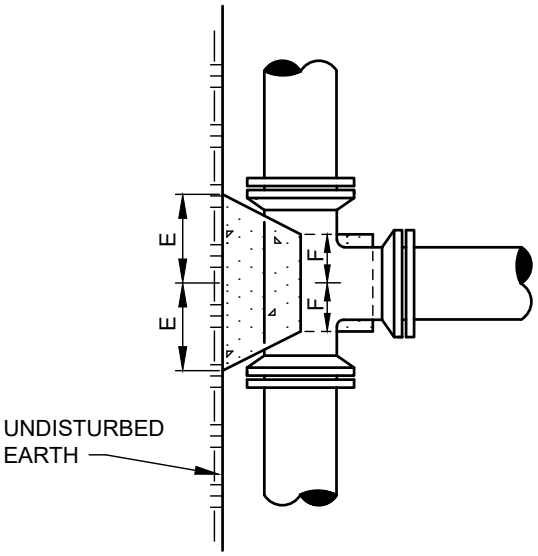
CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

Town of Georgetown DELAWARE

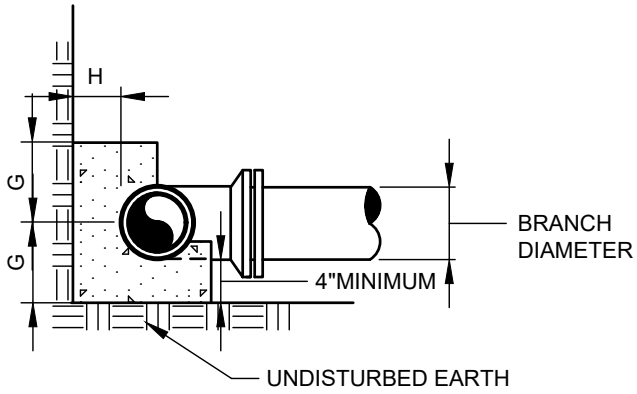
PLUG DETAIL
NO SCALE

SECTION - 4

DRAWING - 1



PLAN



PROFILE

DIMENSION SCHEDULE					
BRANCH DIA.	6"	8"	10"	12"	16"
E	8"	10"	1'-0"	1'-3"	1'-8"
F	6"	8"	8"	8"	10"
G	7"	9"	1'-0"	1'-2"	1'-6"
H	8"	9"	10"	1'-0"	1'-2"

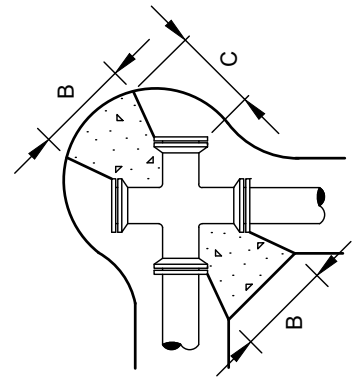
DATE: JANUARY 2025

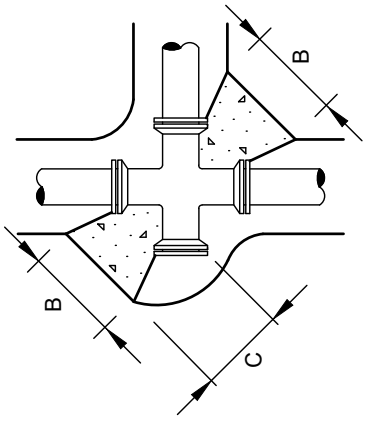
CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

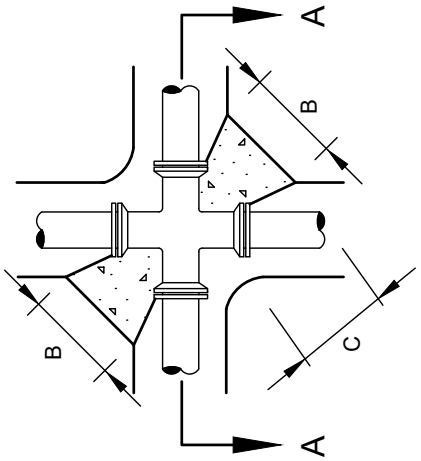
Town of Georgetown DELAWARE

TEE & WYE DETAIL
NO SCALE

SECTION - 4 | DRAWING - 2

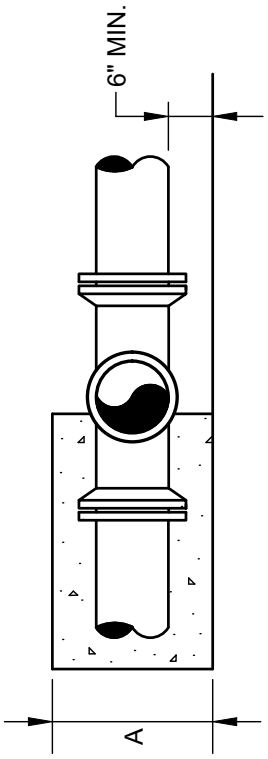






PLAN VIEW

DIMENSION SCHEDULE				
LARGEST BRANCH DIA.	6"	8"	10"	
A	1'-9"	2'-6"	3'-0"	
B	1'-2"	1'-4"	2'-0"	
C	2'-6"	MIN. OR TO UNDISTURBED SOIL.		

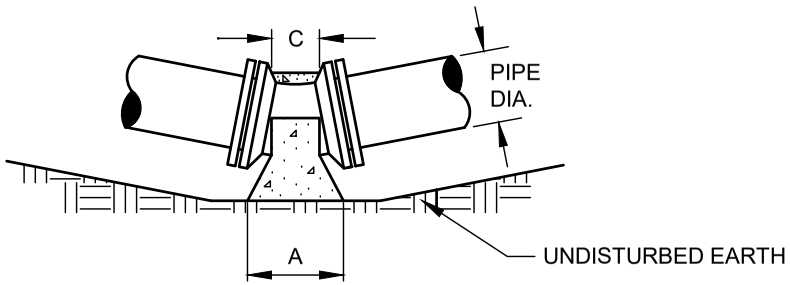


SECTION A

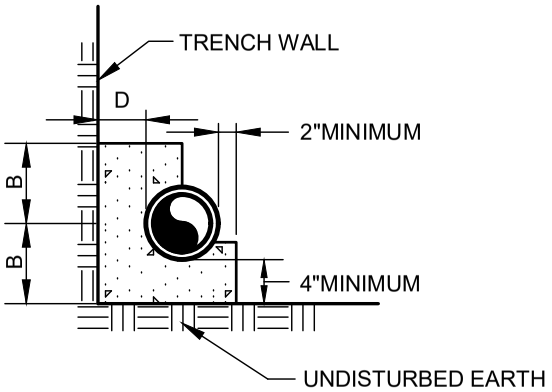
DATE: JANUARY 2025		CROSS THRUST BLOCK DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 / DRAWING - 3

CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

DATE: JANUARY 2025



PLAN



PROFILE

DIMENSION SCHEDULE										
BEND	11 1/4°					22 1/2°				
PIPE DIA.	6"	8"	10"	12"	16"	6"	8"	10"	12"	16"
A	6"	6"	10"	1'-0"	1'-4"	9"	1'-0"	1'-6"	1'-9"	2'-3"
B	7"	8"	9"	10"	1'-0"	7"	8"	9"	10"	1'-0"
C	4"	6"	6"	10"	1'-0"	4"	6"	8"	10"	1'-0"
D	7"	7"	8"	8"	9"	8"	9"	10"	11"	1'-2"
BEND	45°					90°				
PIPE DIA.	6"	8"	10"	12"	16"	6"	8"	10"	12"	16"
A	1'-3"	1'-8"	2'-1"	2'-6"	3'-4"	2'-0"	2'-6"	3'-0"	3'-6"	5'-0"
B	7"	8"	9"	1'-1"	1'-3"	6"	9"	1'-0"	1'-3"	1'-6"
C	4"	6"	8"	10"	1'-0"	4"	6"	8"	10"	1'-0"
D	8"	9"	10"	11"	1'-2"	1'-5"	1'-7"	1'-8"	1'-9"	1'-10"

HORIZONTAL BEND DETAIL
NO SCALE

SECTION - 4

DRAWING - 4

CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

DATE: JANUARY 2025

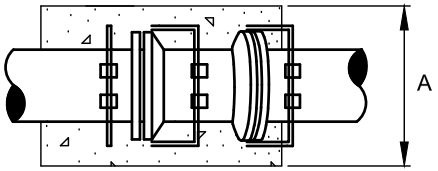
Town of Georgetown DELAWARE

SECTION - 4

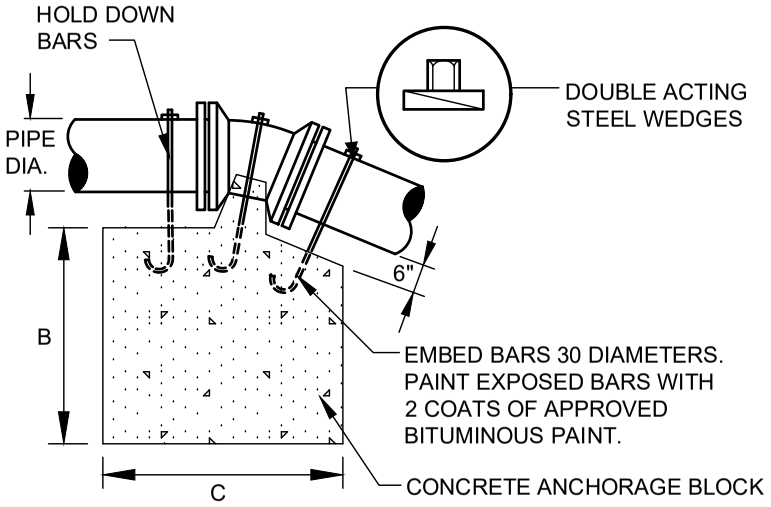
DRAWING - 5

VERTICAL DOWNWARD BEND DETAIL

NO SCALE



PLAN



PROFILE

DIMENSION SCHEDULE

BEND		PIPE DIAMETER				
		6"	8"	10"	12"	16"
11 ¼ °	A	1'-6"	1'-6"	2'-5"	3'-0"	1'-4"
	B	1'-3"	1'-9"	1'-9"	2'-0"	1'-0"
	C	2'-0"	2'-6"	2'-9"	3'-0"	4'-0"
22 ½ °	A	2'-0"	3'-4"	3'-8"	4'-0"	4'-4"
	B	1'-9"	2'-3"	2'-6"	2'-6"	2'-6"
	C	2'-6"	2'-8"	3'-10"	4'-0"	5'-6"
45°	A	2'-6"	3'-0"	4'-0"	4'-6"	5'-2"
	B	2'-6"	2'-9"	3'-0"	3'-6"	4'-6"
	C	3'-0"	4'-0"	4'-6"	4'-9"	8'-0"

BAR SCHEDULE

SIZE	REINFORCING BARS		
	11 ¼ °	22 ½ °	45 °
6"	3 #6	3 #6	3 #6
8"	3 #6	3 #6	3 #6
10"	3 #6	3 #6	3 #6
12"	3 #6	3 #6	3 #6
16"	3 #6	3 #6	3 #6

CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

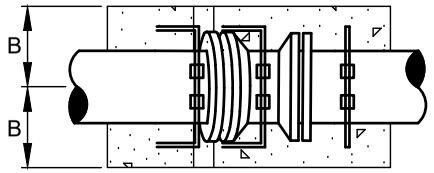
DATE: JANUARY 2025

SECTION - 4

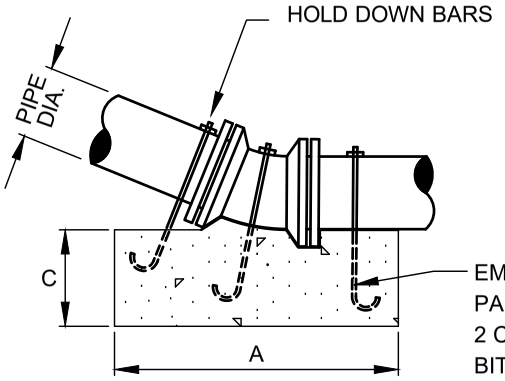
DRAWING - 6

VERTICAL UPWARD BEND DETAIL

NO SCALE



PLAN



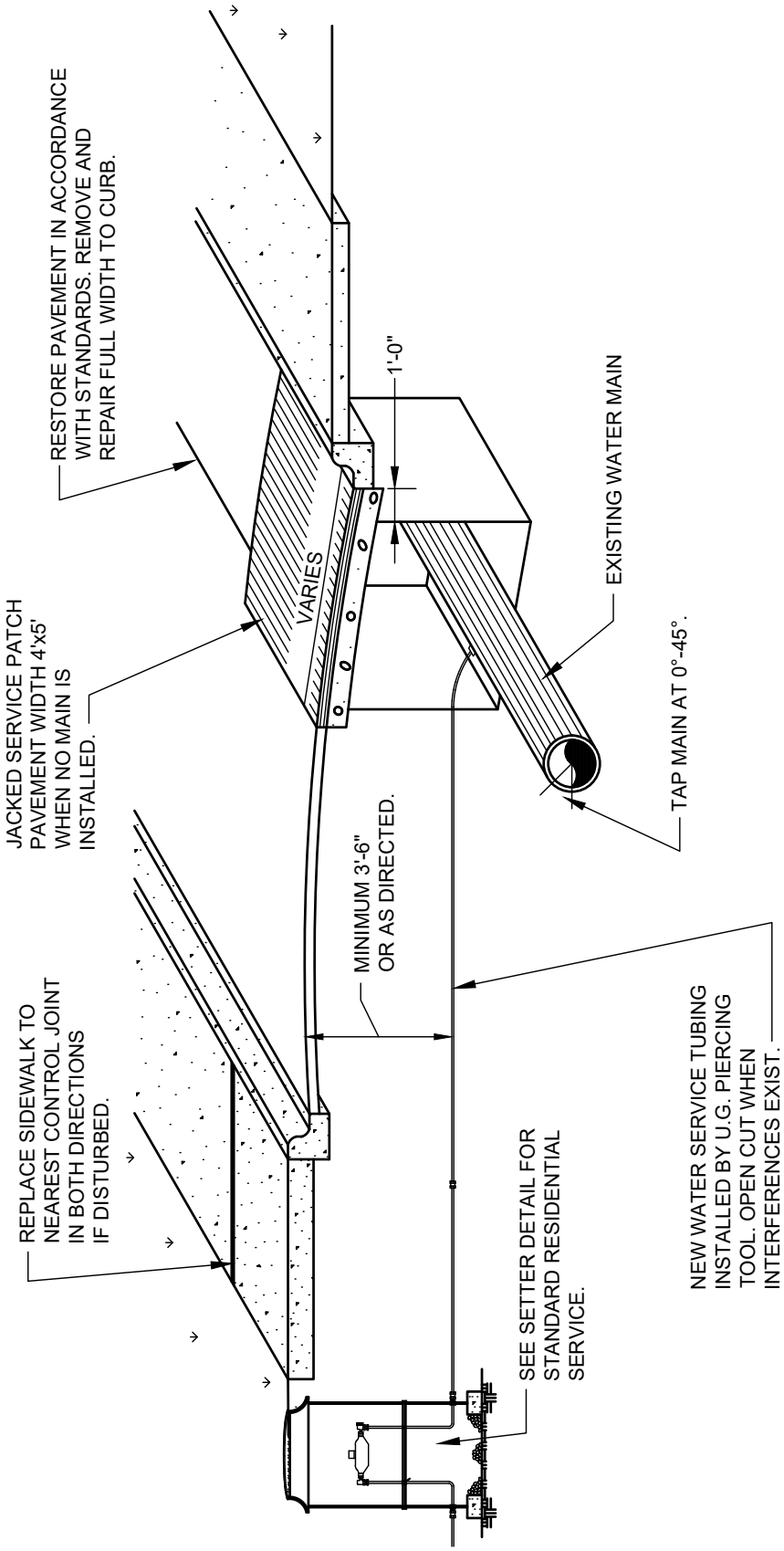
PROFILE

DIMENSION SCHEDULE

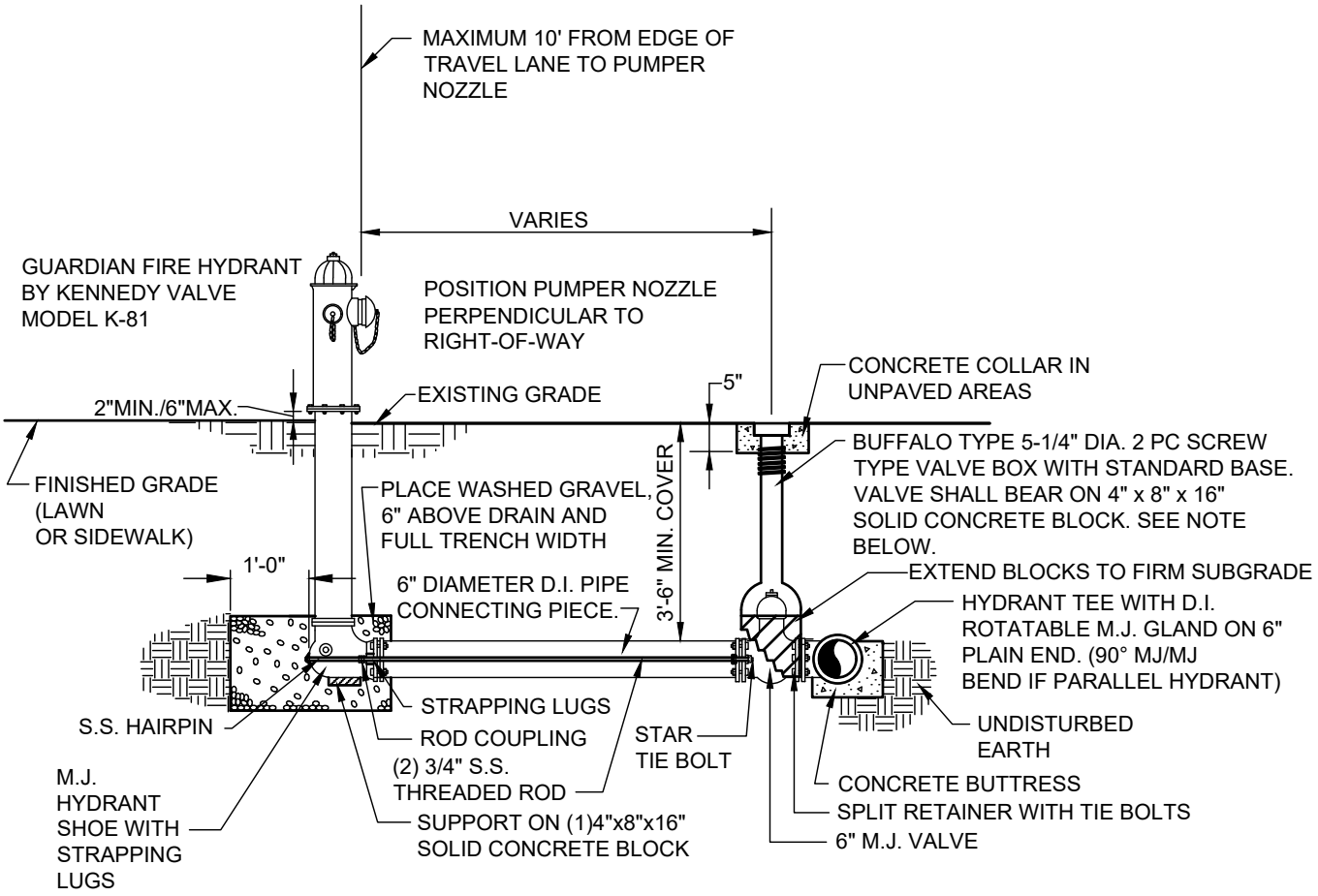
BEND		PIPE DIAMETER				
		6"	8"	10"	12"	16"
11 ¼ °	A	6"	8"	10"	1'-0"	1'-4"
	B	7"	8"	9"	10"	1'-0"
	C	7"	7"	8"	8"	9"
22 ½ °	A	9"	1'-0"	1'-6"	1'-9"	2'-3"
	B	7"	7"	8"	10"	1'-0"
	C	7"	7"	8"	8"	9"
45°	A	1'-3"	1'-8"	2'-1"	2'-6"	3'-4"
	B	7"	8"	9"	11"	1'-3"
	C	7"	8"	10"	11"	1'-3"

BAR SCHEDULE

SIZE	REINFORCING BARS		
	11 ¼ °	22 ½ °	45 °
6"	3 #6	3 #6	3 #6
8"	3 #6	3 #6	3 #6
10"	3 #6	3 #6	3 #6
12"	3 #6	3 #6	3 #6
16"	3 #6	3 #6	3 #6

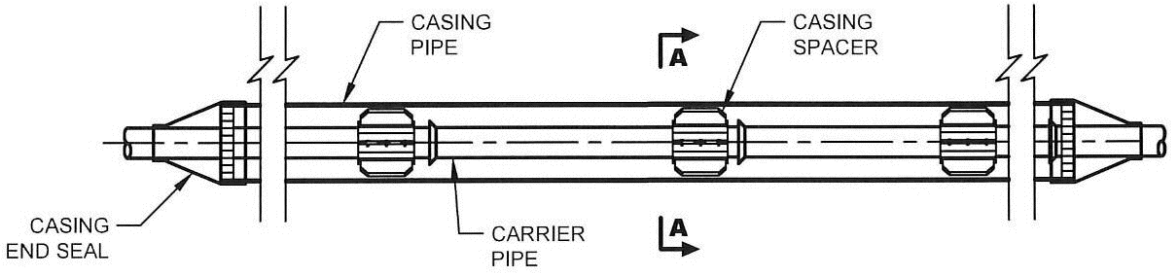


DATE: JANUARY 2025	Town of Georgetown DELAWARE	MOLED WATER SERVICE & RESTORATION DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN		SECTION - 4 | DRAWING - 7

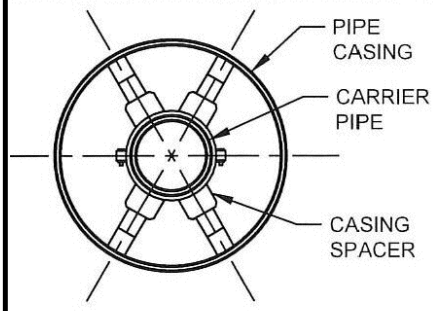


NOTE:
1. VALVE BOX BASE SHALL FIT AROUND VALVE BOX ADAPTER II, MANUFACTURED BY ADAPTER, INC. PLACED ON BONNET OF VALVE.
2. TRACER WIRE NOT SHOWN BUT REQUIRED.

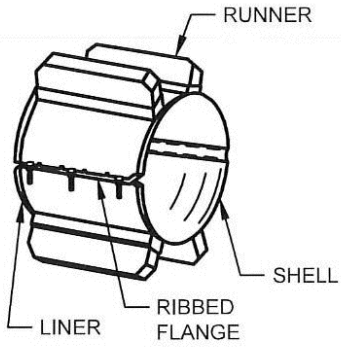
DATE: JANUARY 2025		FIRE HYDRANT DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 / DRAWING - 8



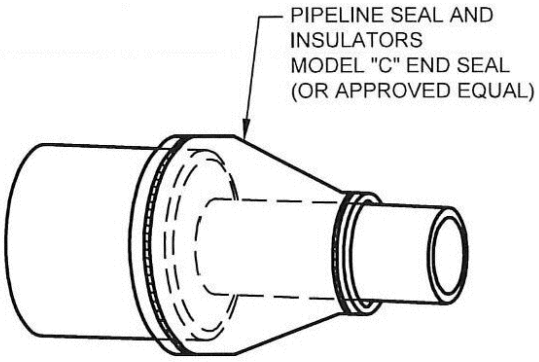
PLAN



SECTION A-A



SPACER



CASING END SEAL

CARRIER PIPE DIA. (IN)	CASING PIPE DIA. (IN)	CASING PIPE MIN. THICKNESS (IN)	NO. OF SPACERS PER 20 FT. LENGTH
4	12	.0375	3
6	16	.0375	3
8	18	0.375	3
12	22	.0375	3
16	28	.0375	3

STANDARD NUMBER OF RUNNERS REQUIRED:
UP TO 14" CARRIER PIPE - 4 REQUIRED
OVER 14" - 16" CARRIER PIPE - 6 REQUIRED

NOTES:

1. MINIMUM OD OF CASING PIPE SHALL ACCOMMODATE MAXIMUM OD OF CARRIER PIPE JOINTS AND/OR RESTRAINTS.
2. MINIMUM CASING PIPE DIAMETER AND THICKNESS SHALL BE PER TABLE UNLESS SPECIFIED BY ENGINEER.
3. IF CARRIER PIPE RESTRAINT IS REQUIRED, RESTRAINED CASING SPACERS SHALL BE USED.
4. GENERAL - ONE SPACER SHALL BE PLACED NOT MORE THAN TWO FEET FROM EACH END OF CASING. SUBSEQUENT SPACERS SHALL BE PLACED AT 6' TO 10' INTERVALS WITHIN THE CASING IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
5. CARRIER PIPE SHALL BE CENTERED WITHIN CASING BY USE OF STAINLESS STEEL CASING SPACERS.

DATE: JANUARY 2025		ENCASEMENT DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 / DRAWING - 9

CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

DATE: JANUARY 2025

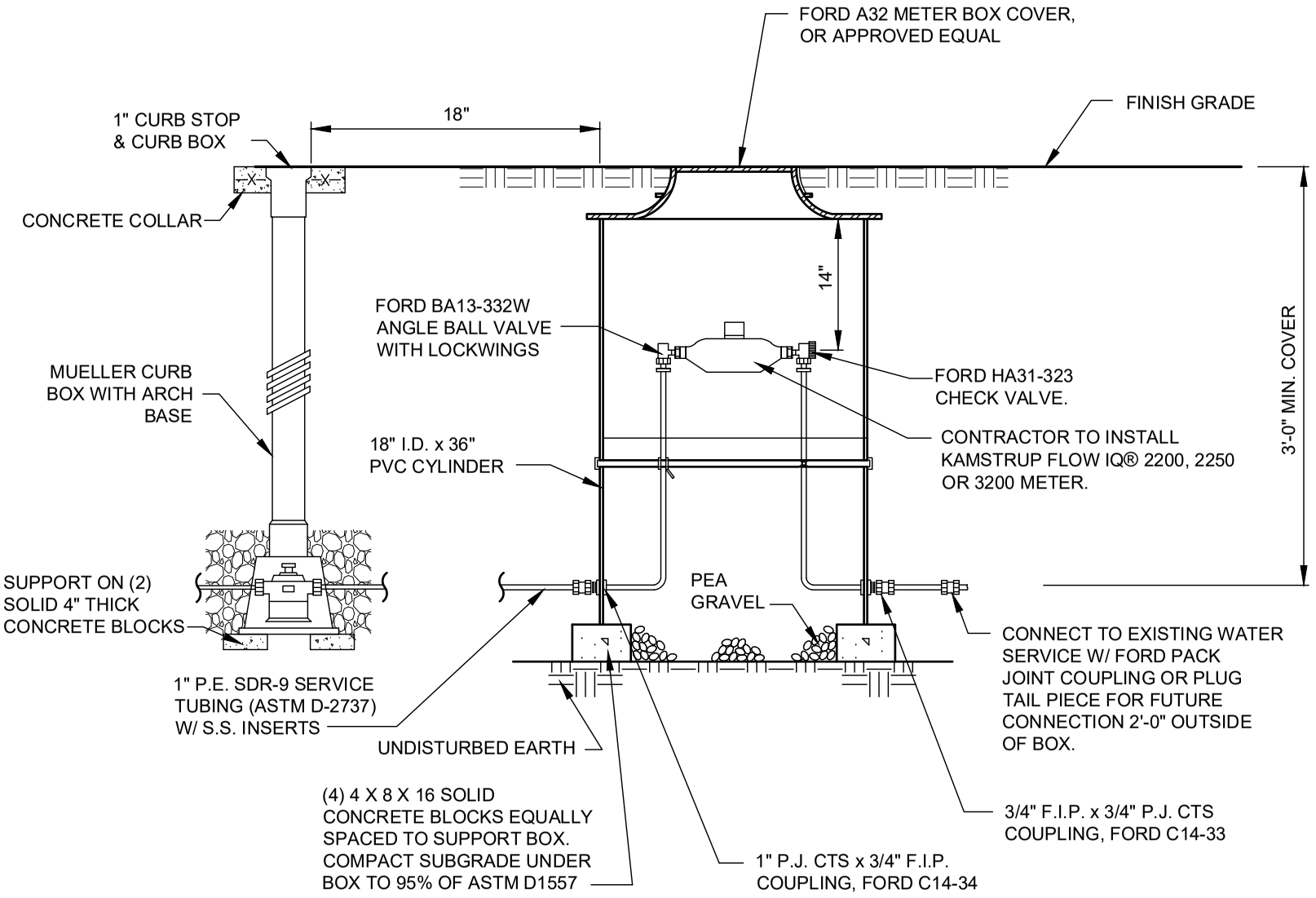
SECTION - 4

DRAWING - 10

SINGLE METER PIT DETAIL (PREFABRICATED)

NO SCALE

THIS DETAIL NOT TO BE USED
WITHOUT PRIOR AUTHORIZATION
FROM THE TOWN



CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

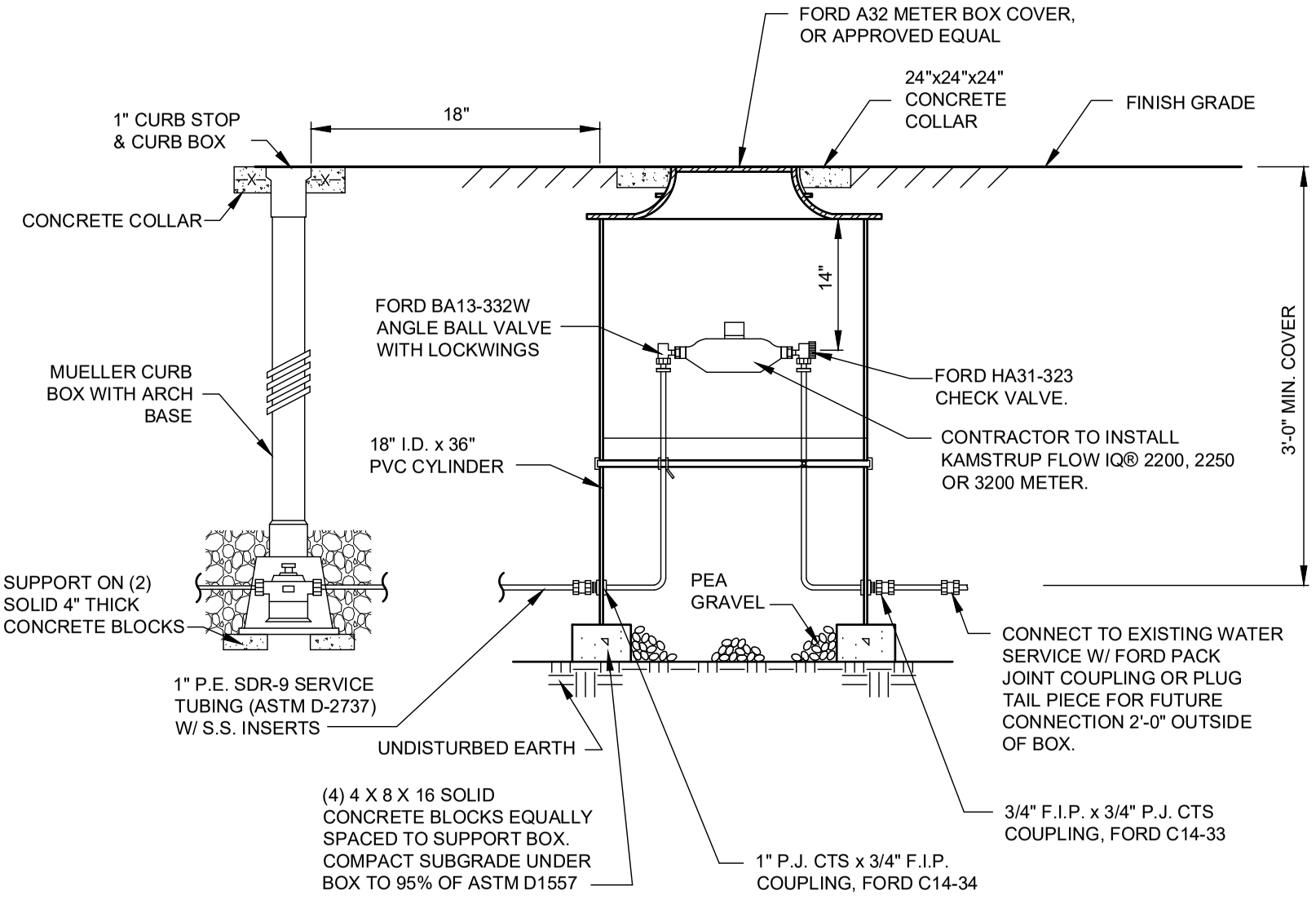
DATE: JANUARY 2025

SECTION - 4

DRAWING - 11

SINGLE METER PIT DETAIL (PREFABRICATED)
IN DRIVEWAY
NO SCALE

THIS DETAIL NOT TO BE USED
WITHOUT PRIOR AUTHORIZATION
FROM THE TOWN



CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

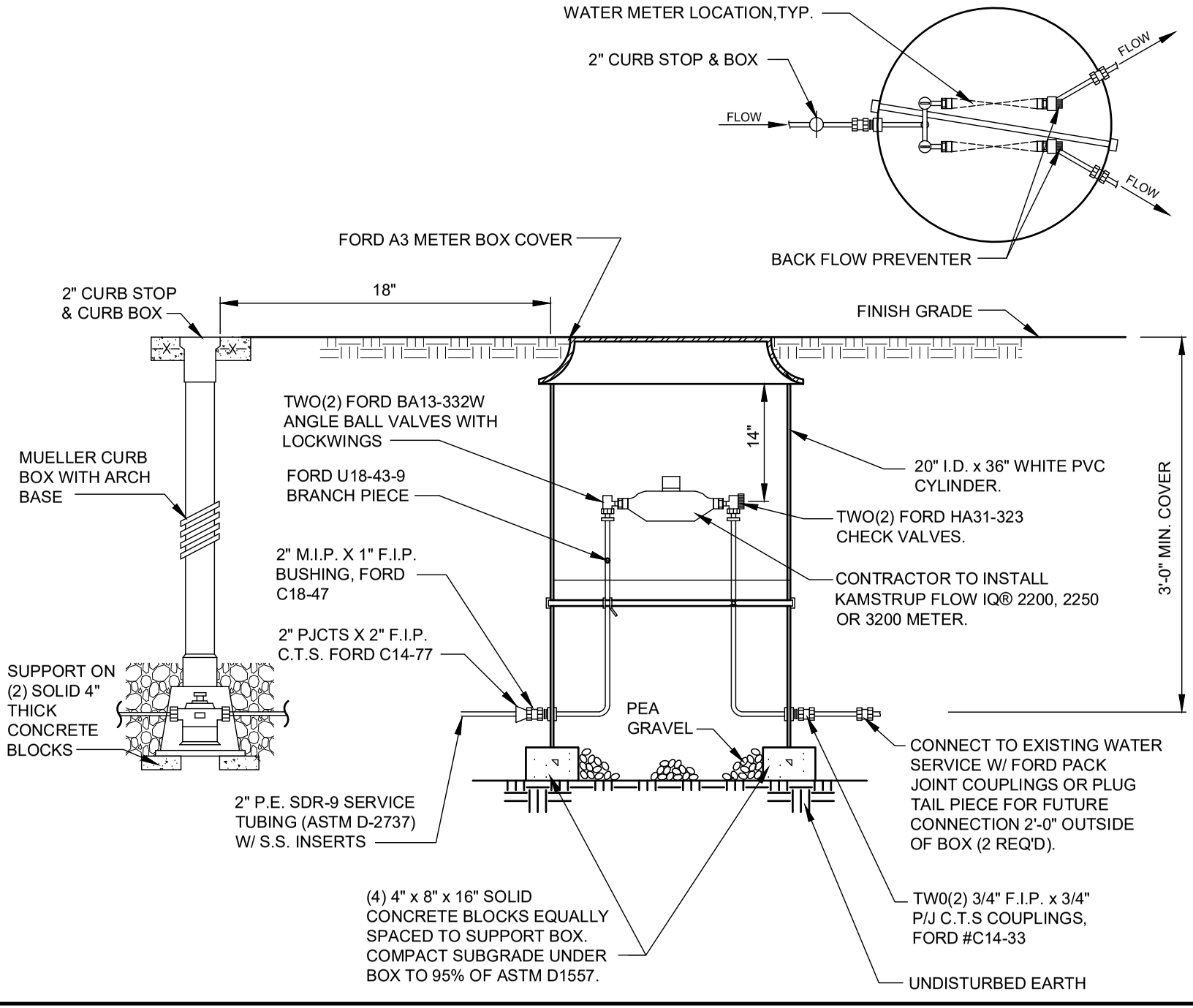
DATE: JANUARY 2025

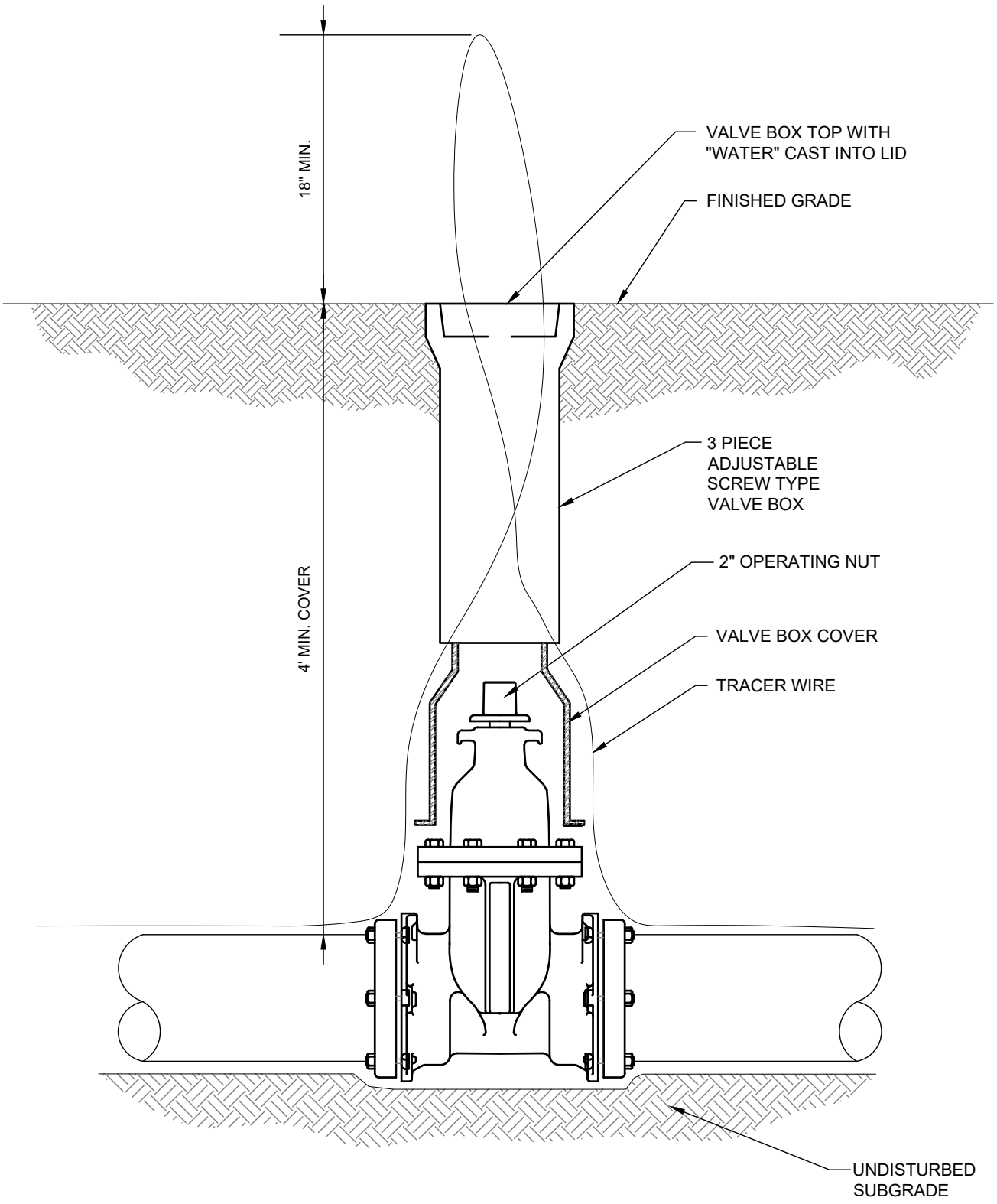
Town of Georgetown DELAWARE

SECTION - 4

DRAWING - 12

STANDARD DUAL METER PIT (SINGLE LOT)
DETAIL (PREFABRICATED)
NO SCALE





DATE: JANUARY 2025		TRACER WIRE & VALVE BOX DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 / DRAWING - 13

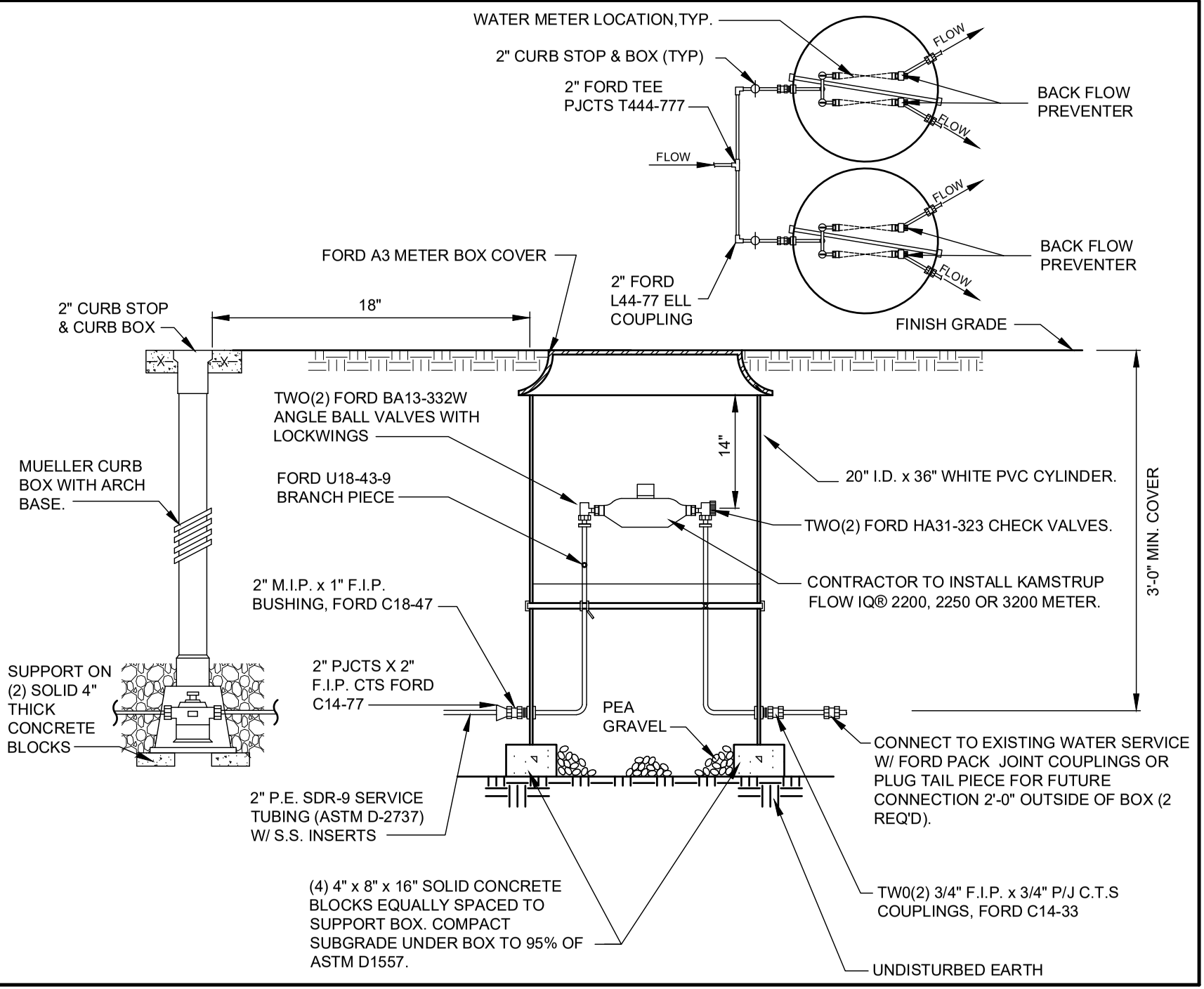
CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

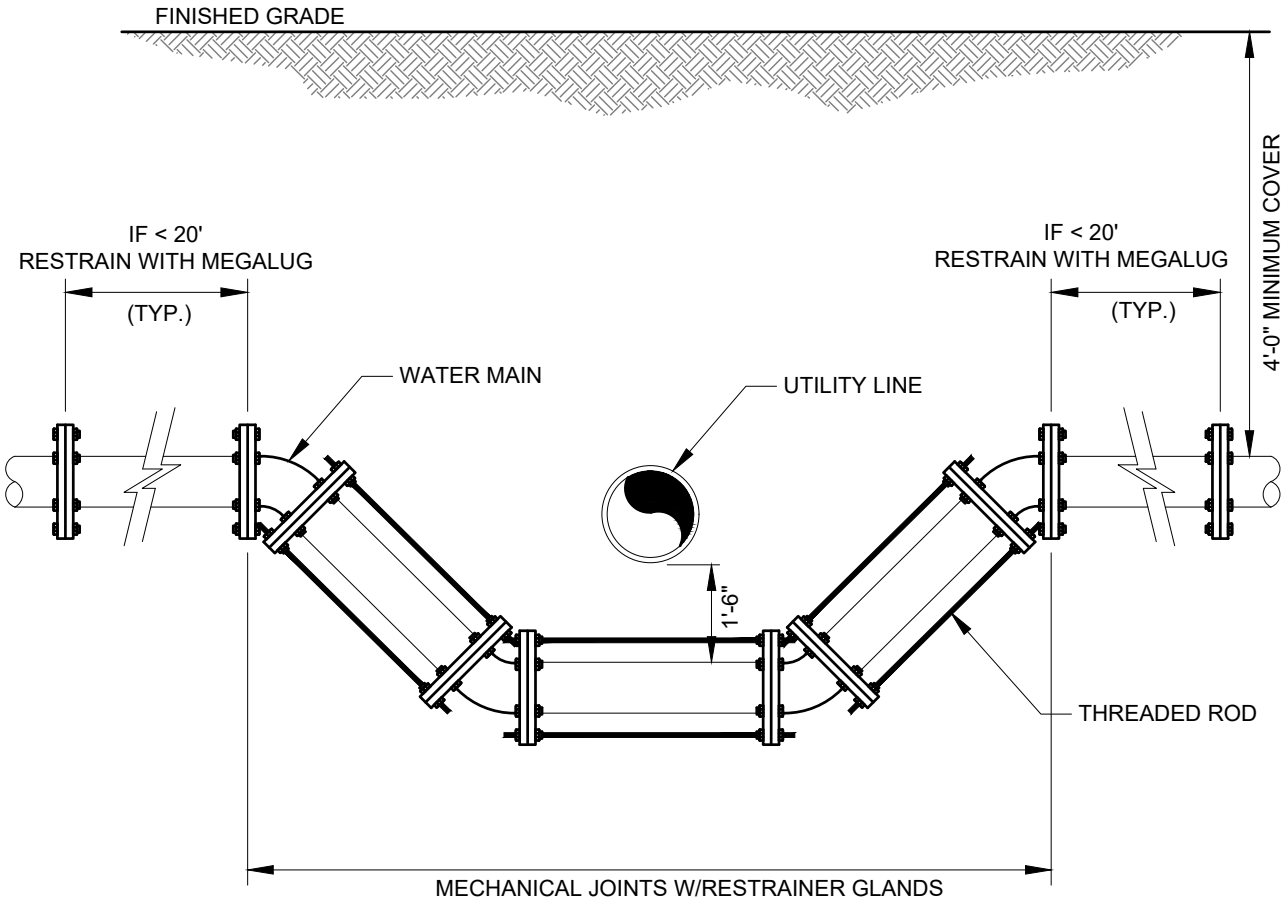
DATE: JANUARY 2025

STANDARD DUAL METER PIT (DOUBLE LOT)
DETAIL (PREFABRICATED)
NO SCALE

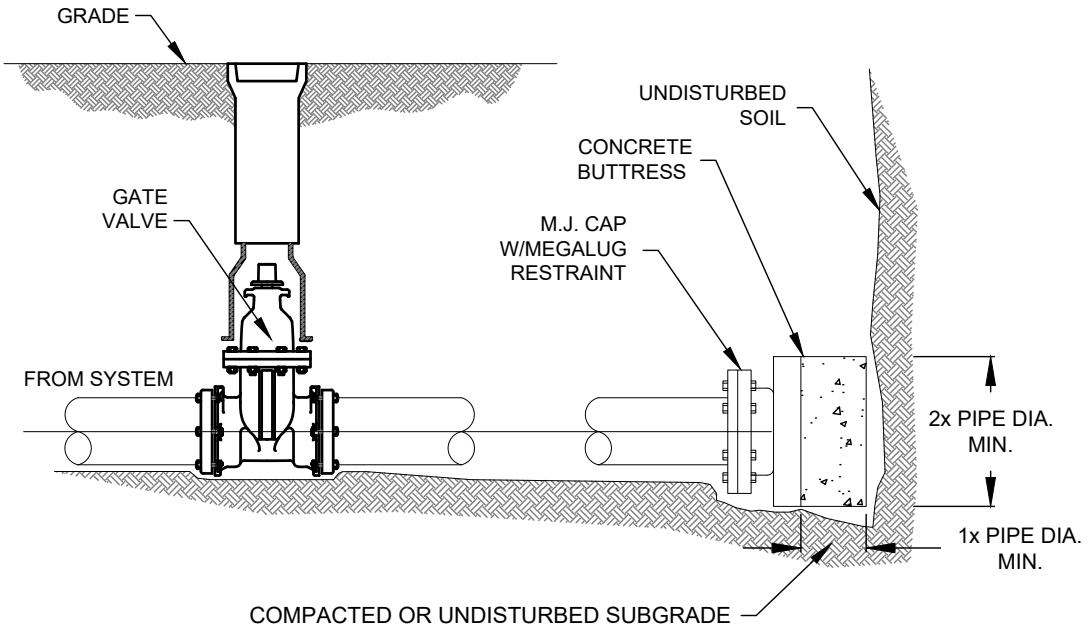
SECTION - 4

DRAWING - 14

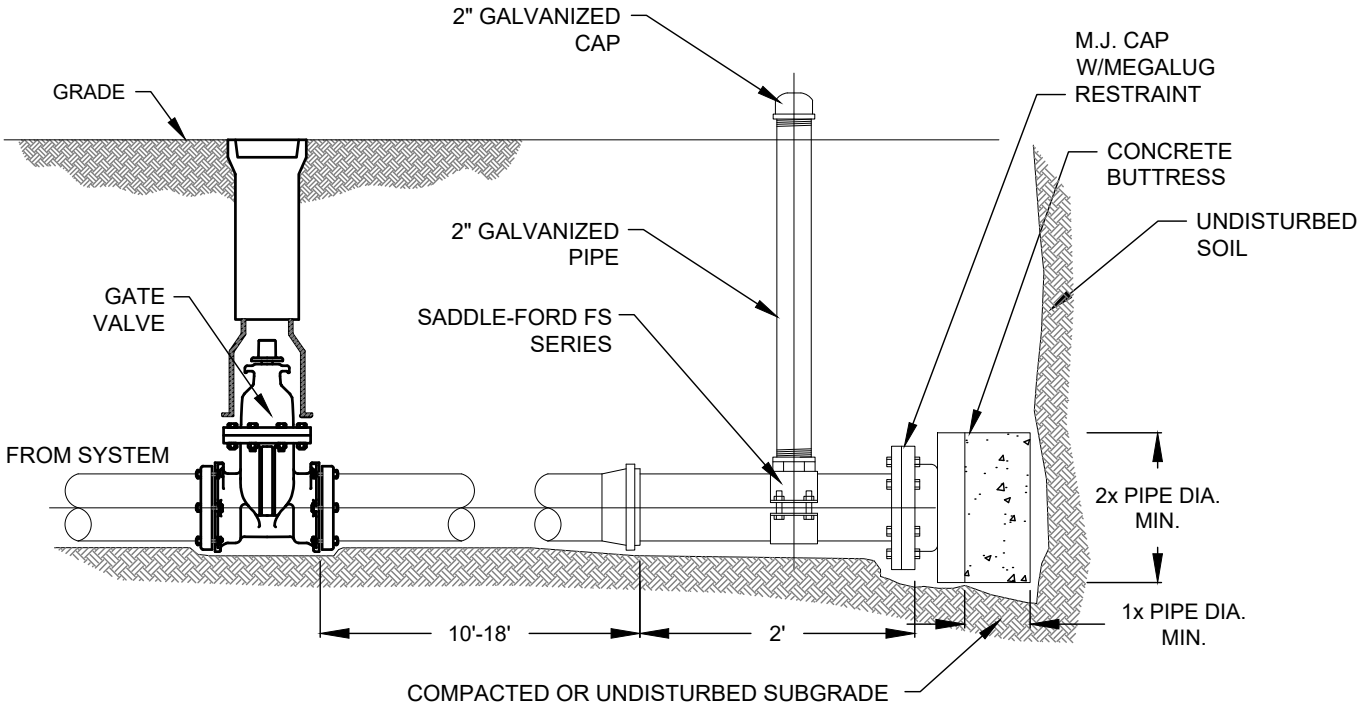




DATE: JANUARY 2025		WATER MAIN CROSSING UTILITY DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 / DRAWING - 15

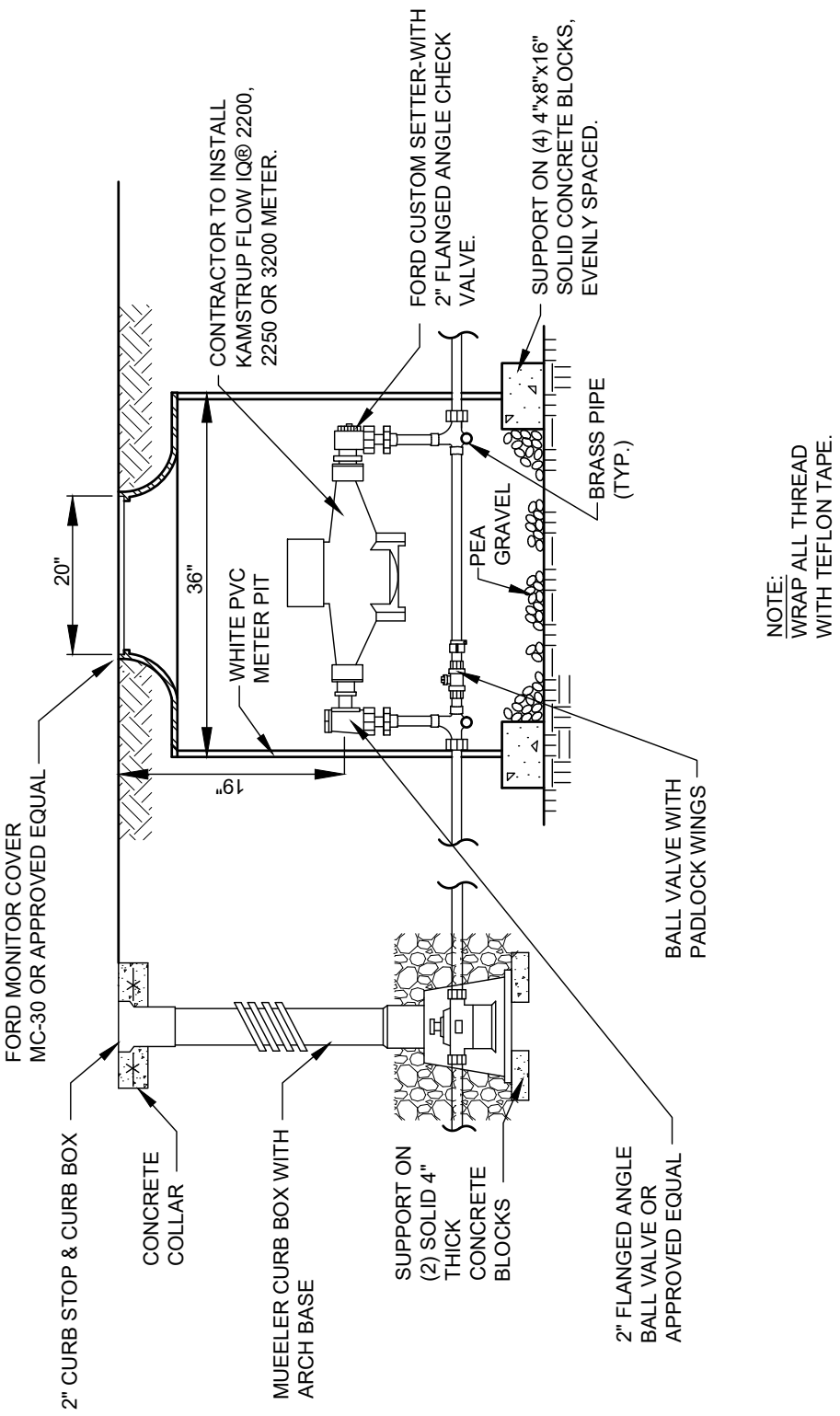


DETAIL WITHOUT TEMPORARY BLOW-OFF

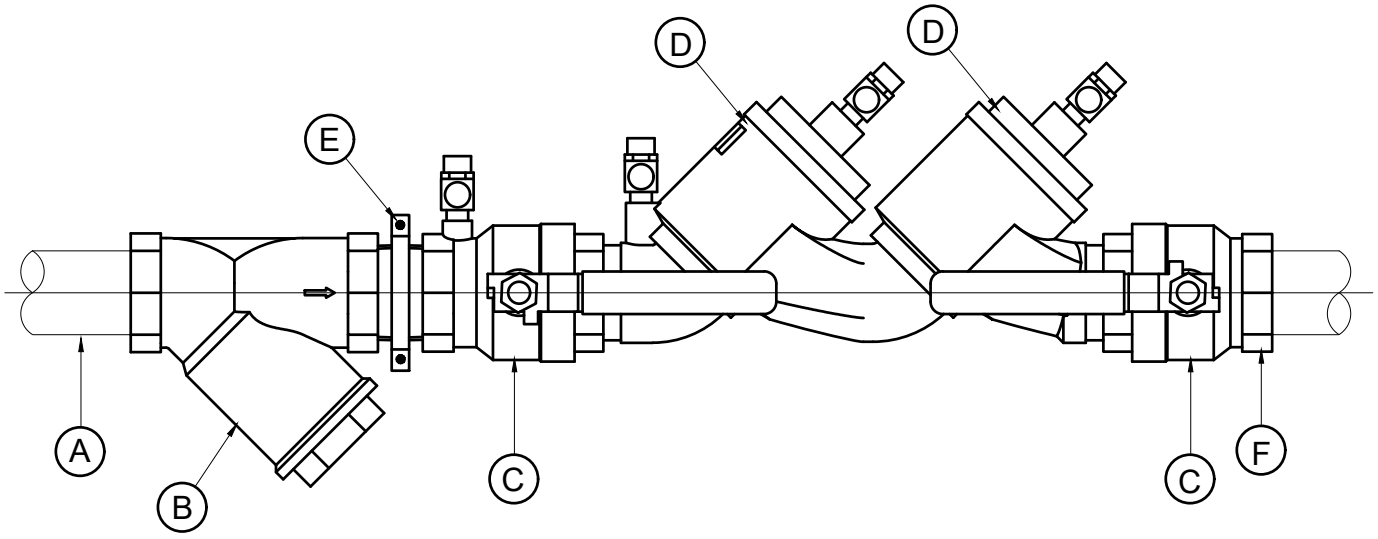


DETAIL WITH TEMPORARY BLOW-OFF

DATE: JANUARY 2025		END CAP DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 | DRAWING - 16



DATE: JANUARY 2025		2" METER SETTER DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 / DRAWING - 17



A - COPPER OR PVC SERVICE CONNECTION FROM THE TOWN WATER MAIN & METER

B - BRONZE STRAINER

C - BRONZE BALL VALVE, THREADED (TYPICAL 2)

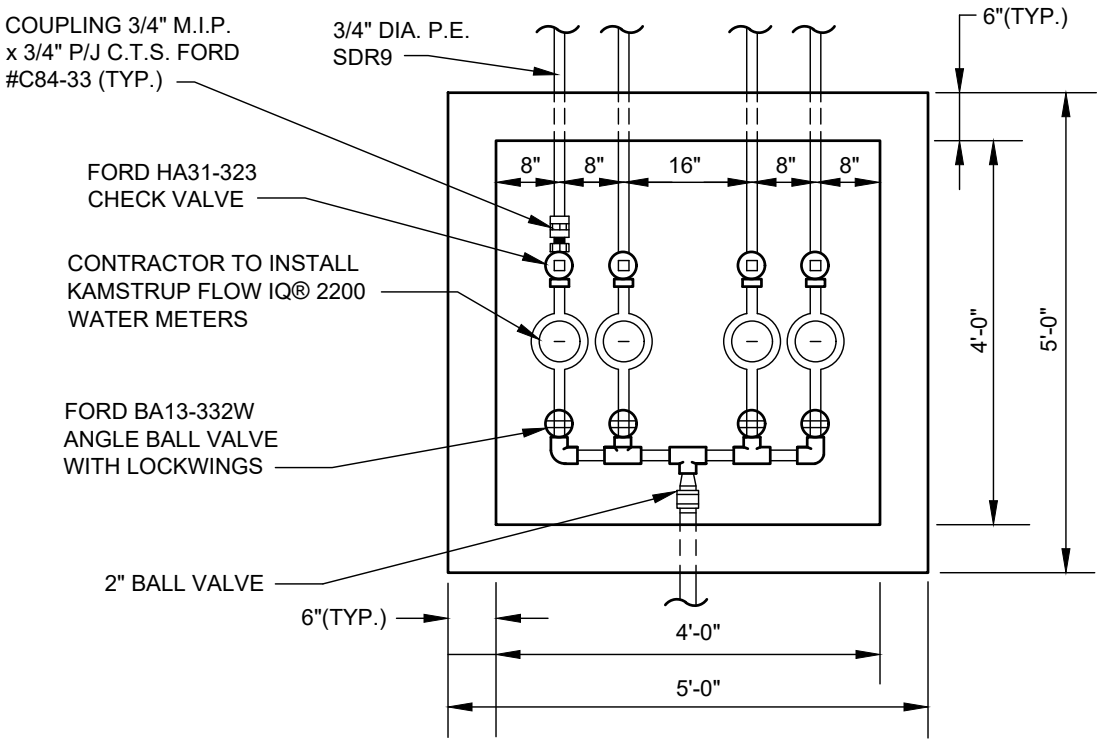
D - REDUCED PRESSURE ZONE BACKFLOW PREVENTER (MALE THREAD CONNECTION)
SIZE: ACCORDING TO EXISTING TUBING SIZE

E - WALL BRACKETS OR FLOOR STANDS (AS PER MANUFACTURERS RECOMMENDATION)

F - COPPER OR PVC PLUMBING CONNECTION

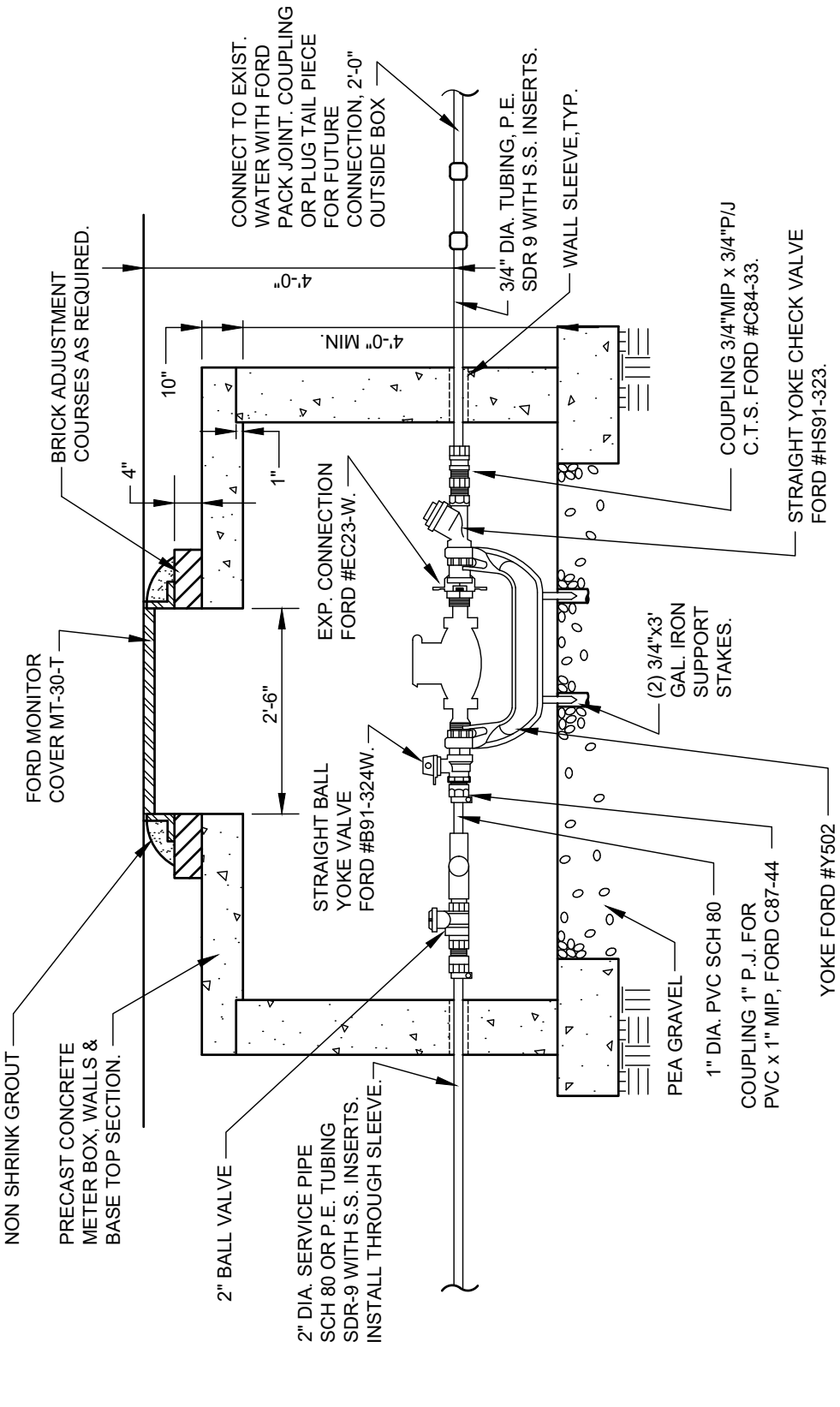
BACKFLOW PREVENTERS SHALL BE ZURN MODEL 375AST OR 975XL3

DATE: JANUARY 2025	Town of Georgetown DELAWARE	BACKFLOW PREVENTER INSTALLATION SCHEMATIC DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN		SECTION - 4 / DRAWING - 18



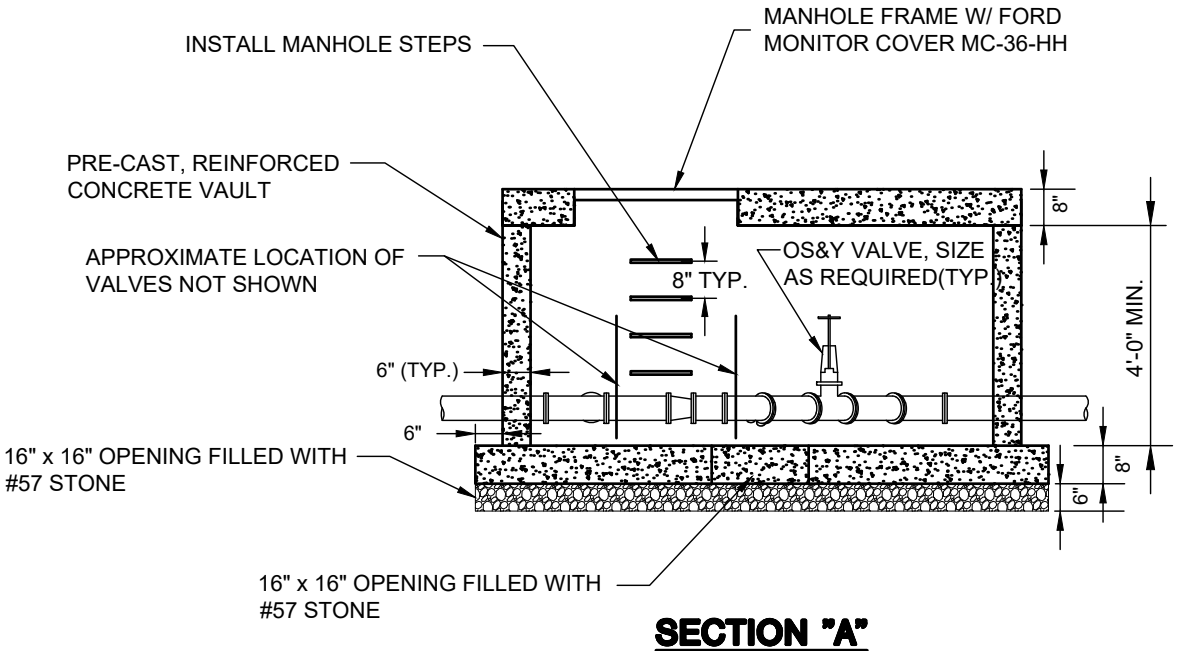
ALL F.I.P SCH 80 PVC FITTINGS SHALL BE SS REINFORCED TYPE BY SPEARS.

DATE: JANUARY 2025		GANG METER PIT DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 / DRAWING - 19

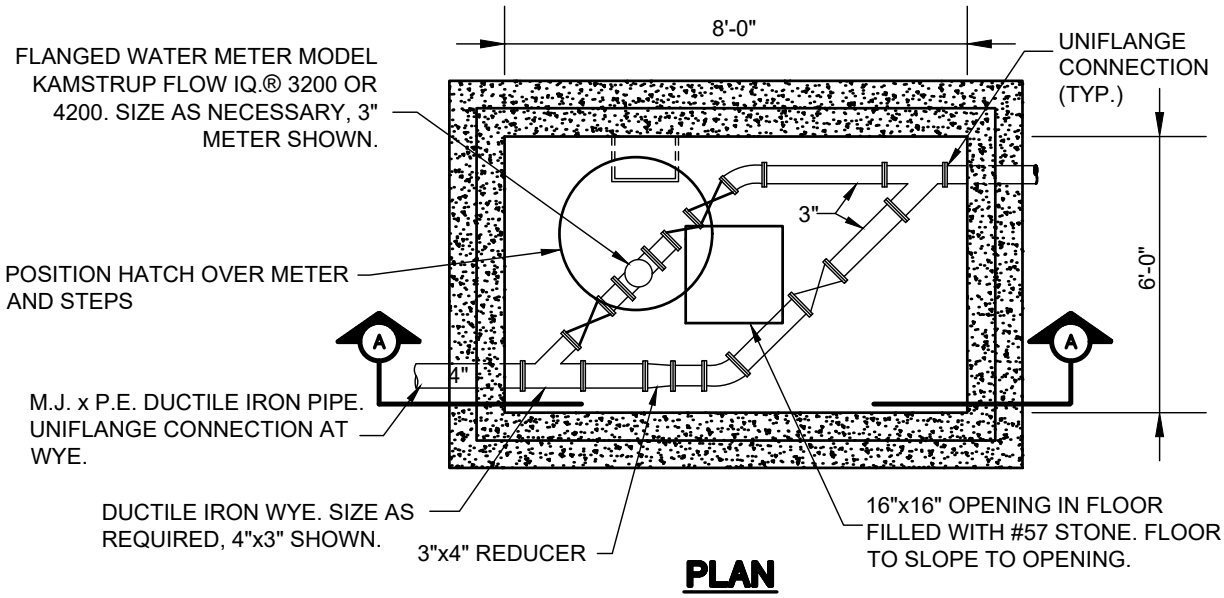


NOTE
USE FORD MONITOR COVER MC-30-HH IF LOCATED IN TRAFFIC BEARING AREA

DATE: JANUARY 2025		GANG METER PIT DETAIL SECTION VIEW NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 / DRAWING - 20



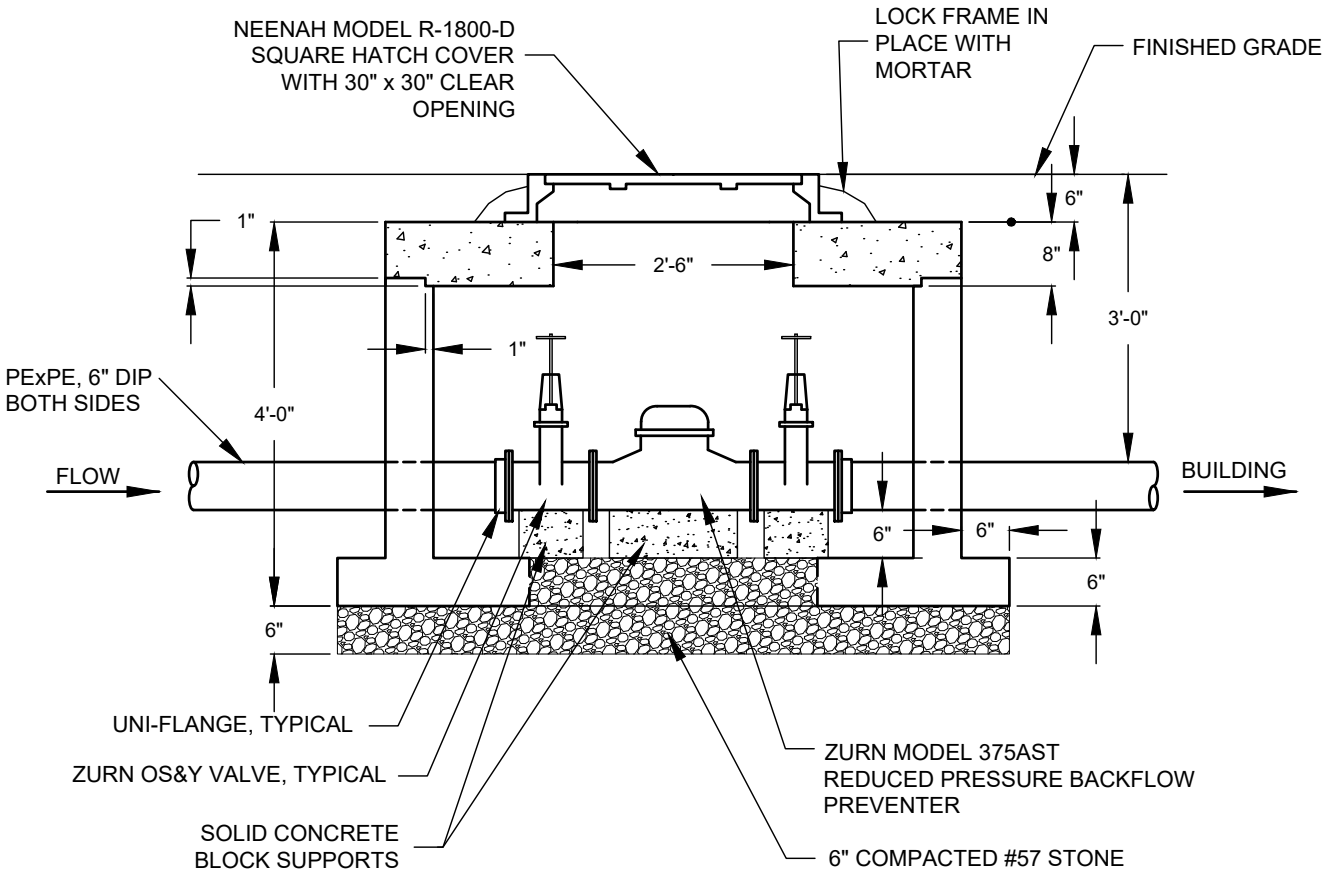
SECTION "A"



PLAN

NOTE:
1. WRAP ALL THREAD WITH TEFLON TAPE.
2. SUPPORT PIPE ON EITHER SIDE OF VALVES WITH ADJUSTABLE STAINLESS STEEL PIPE SUPPORTS.
3. ADJUST SIZE OF VAULT AS NECESSARY FOR LARGER METERS AND SUBMIT TO TOWN FOR REVIEW.

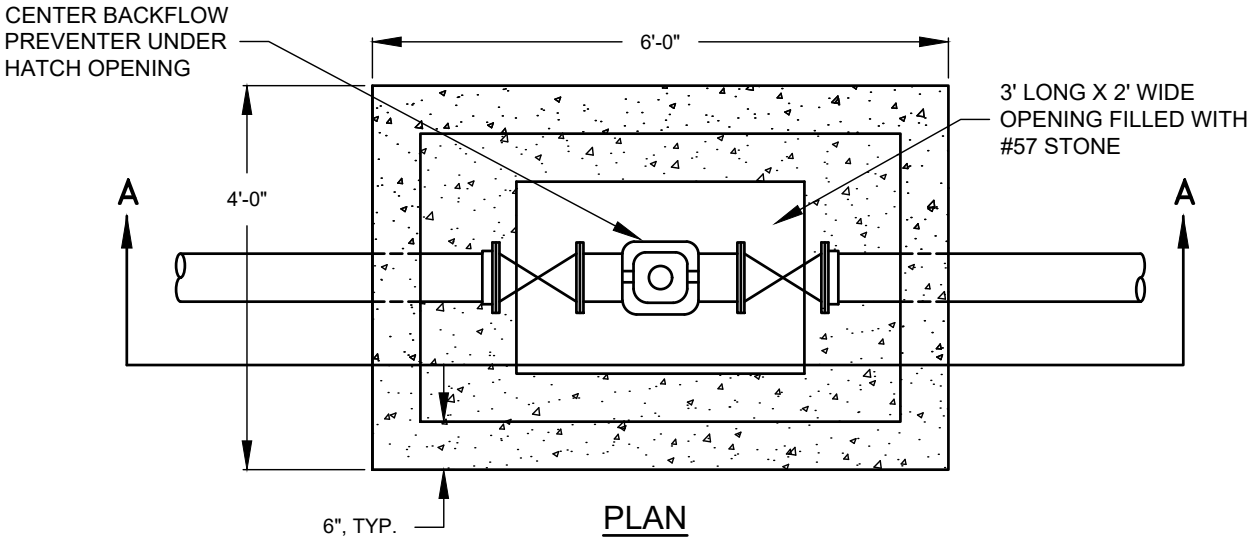
DATE: JANUARY 2025		INDUSTRIAL / COMMERCIAL METER DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 / DRAWING - 21



SECTION A-A

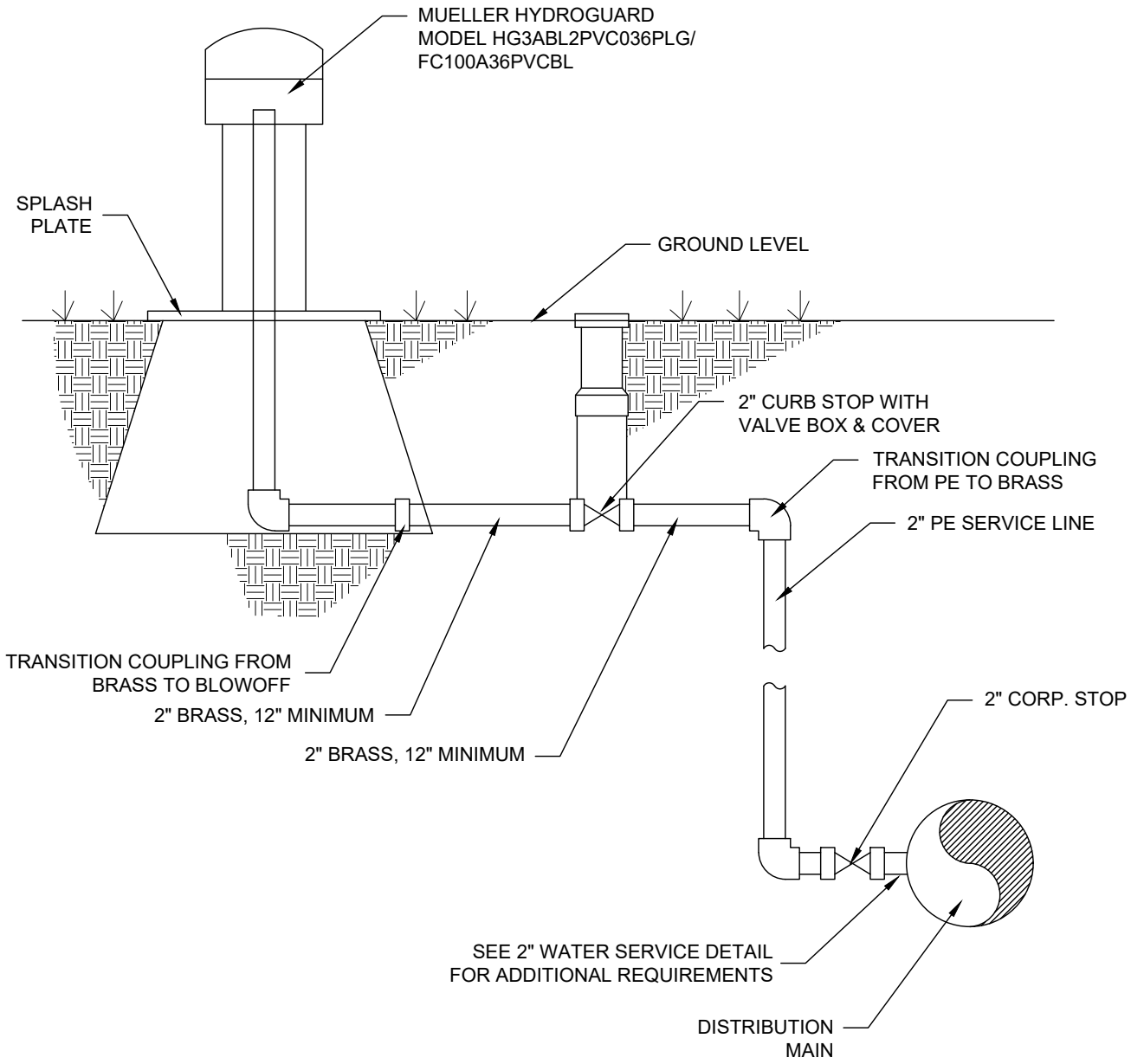
NOTES

1. DETECTOR CHECK WITH VALVE MAY BE LOCATED INSIDE THE BUILDING EQUIPMENT ROOM WITHOUT A VAULT WITH TOWN APPROVAL.
2. CONTRACTOR SHALL USE STAINLESS STEEL NUTS AND BOLTS ON ALL FITTINGS IN VAULT.
3. TOWN HAS THE RIGHT TO INSPECT THE VAULT AS IT FINDS NECESSARY. OWNER TO FURNISH MAINTENANCE RECORDS UPON REQUEST.

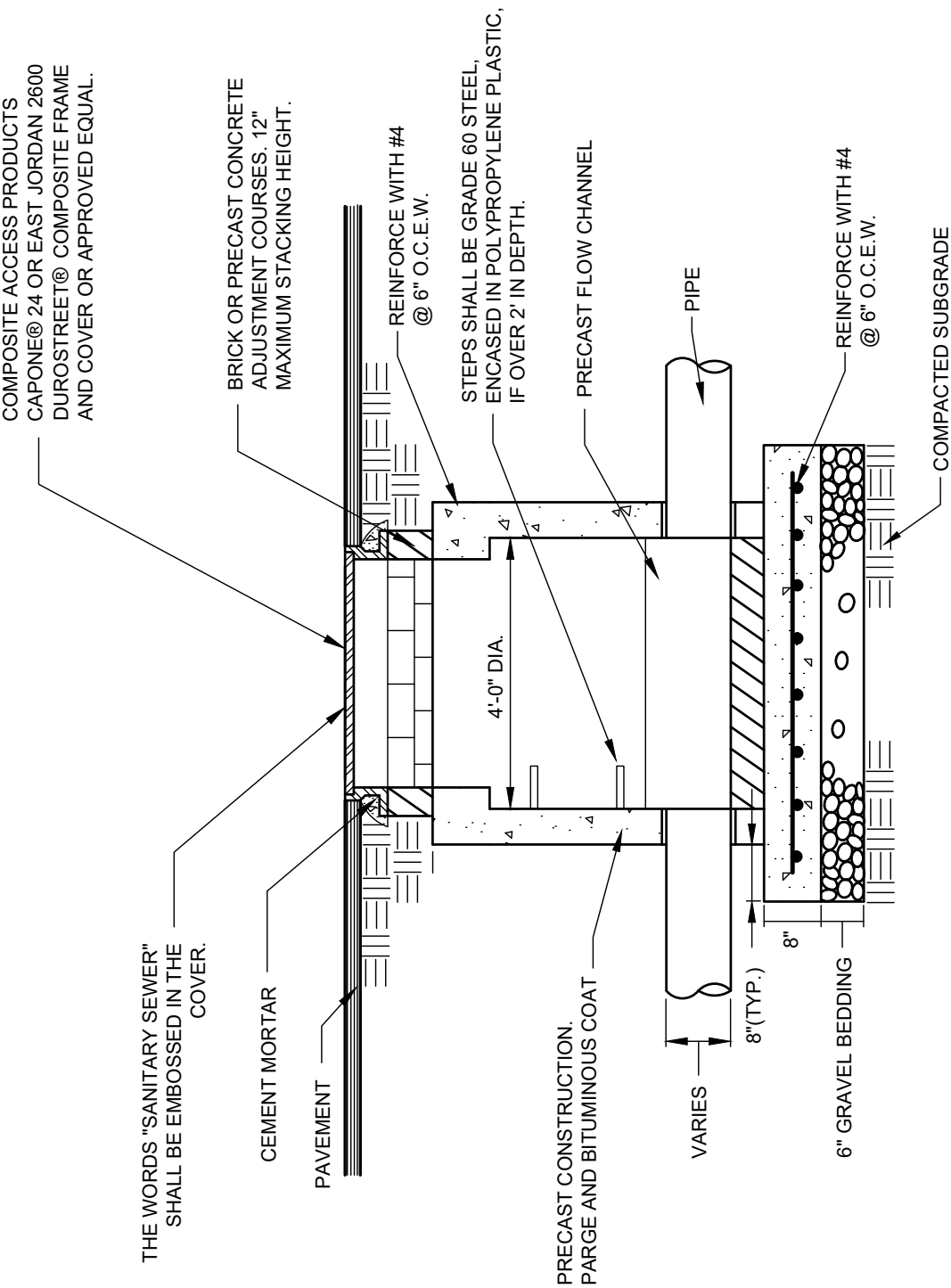


PLAN

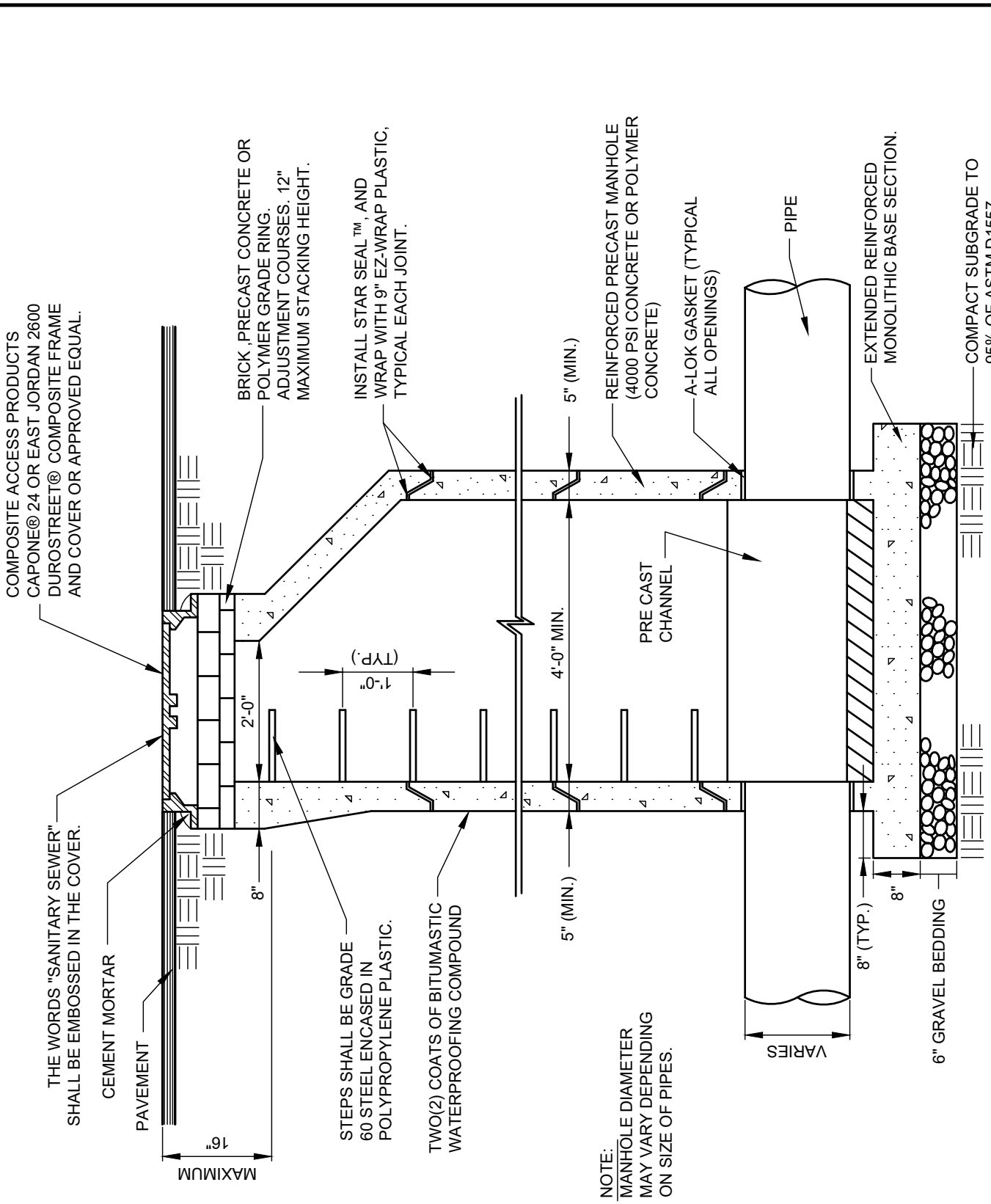
DATE: JANUARY 2025		FIRE LINE BACKFLOW PREVENTER DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 / DRAWING - 22



DATE: JANUARY 2025		AUTOMATIC BLOWOFF DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 4 | DRAWING - 23



DATE: JANUARY 2025	Town of Georgetown DELAWARE	SHALLOW MANHOLE DETAIL NO SCALE	
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN		SECTION - 5	DRAWING - 1



DATE: JANUARY 2025		PRECAST CONCRETE MANHOLE DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 5 / DRAWING - 2

CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

DATE: JANUARY 2025

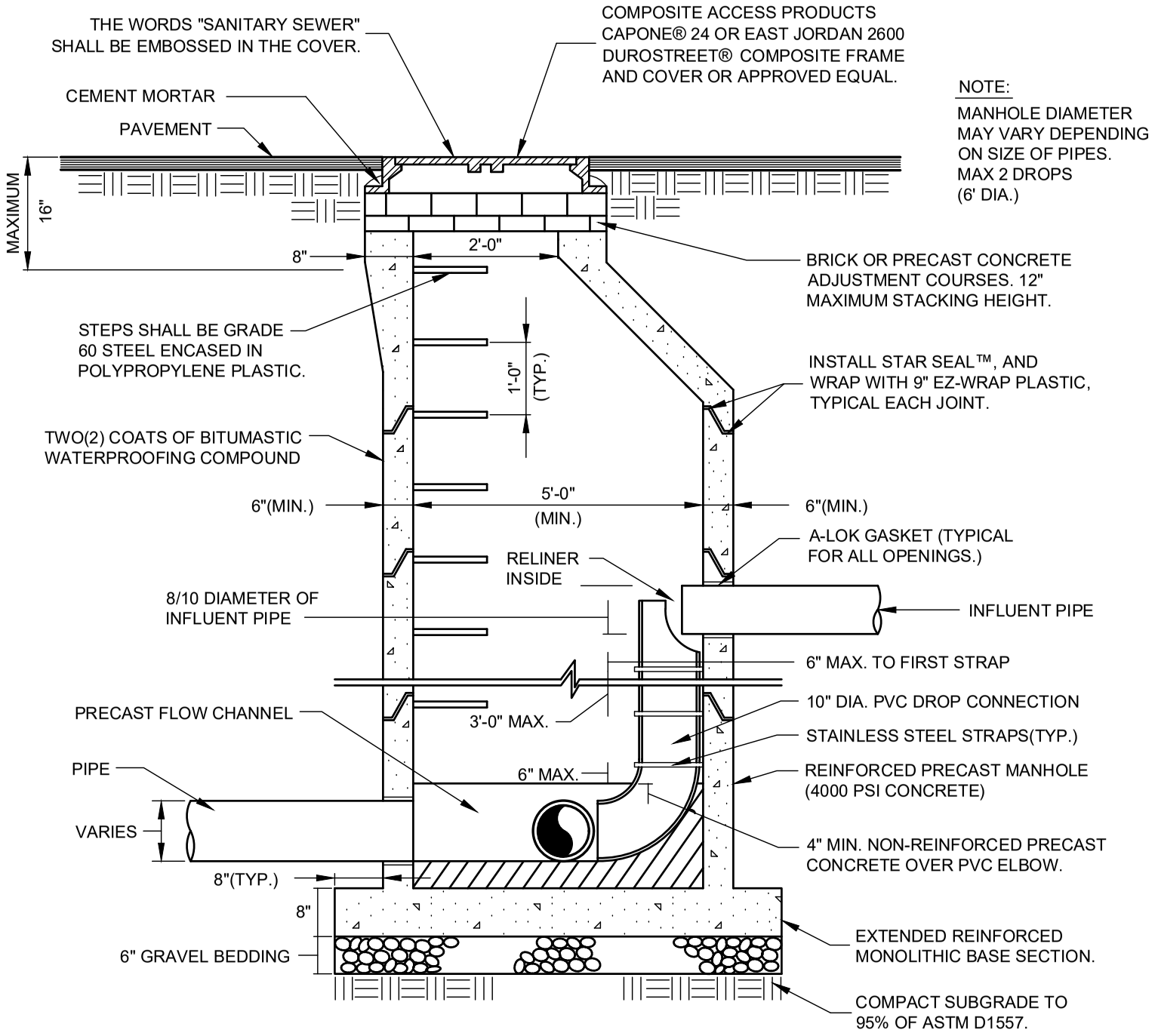
Town of Georgetown
DELAWARE

SECTION - 5

DRAWING - 3

INSIDE DROP MANHOLE DETAIL

NO SCALE



NOTE:
MANHOLE DIAMETER MAY VARY DEPENDING ON SIZE OF PIPES. MAX 2 DROPS (6' DIA.)

CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

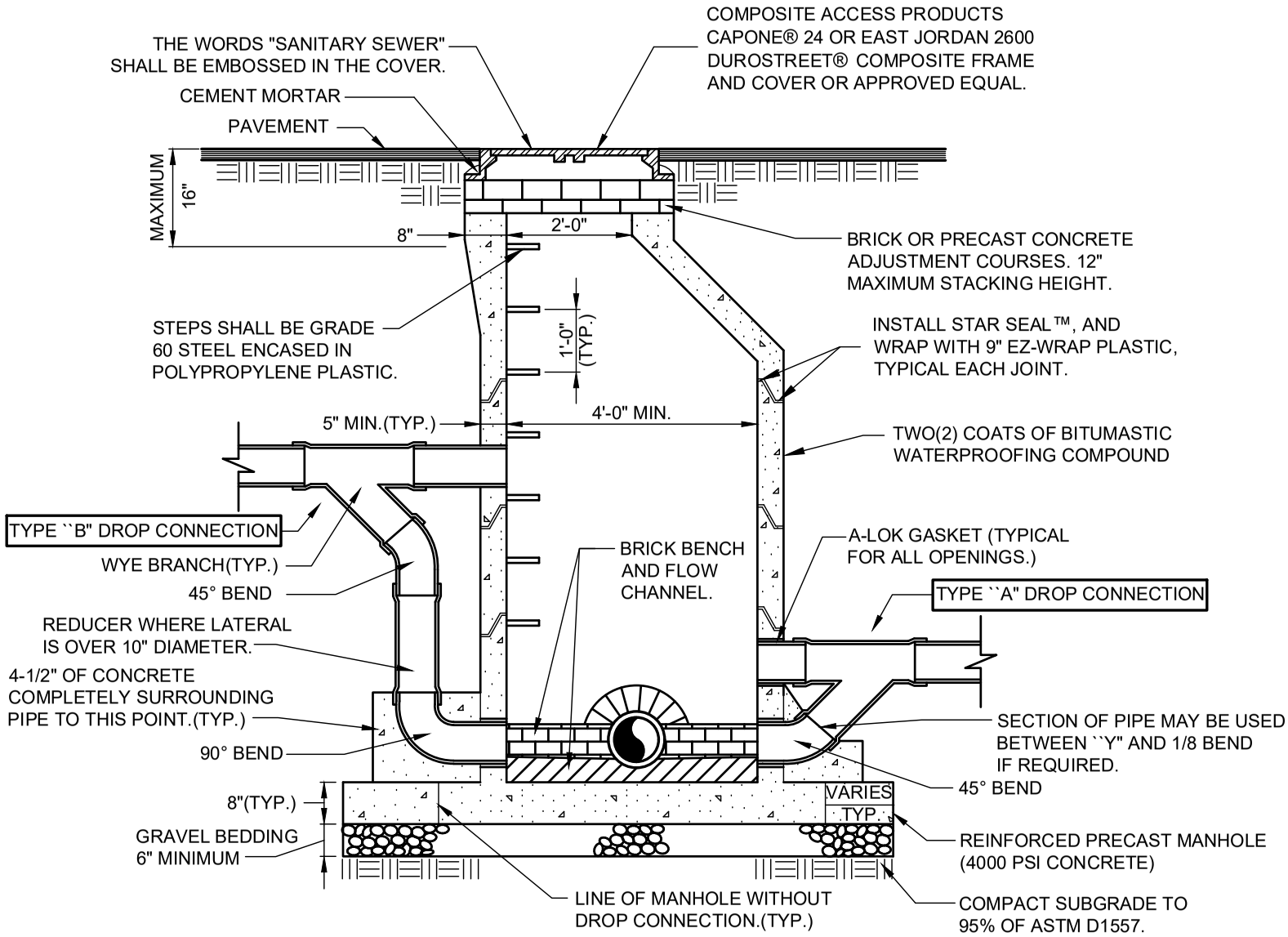
DATE: JANUARY 2025

SECTION - 5

DRAWING - 4

EXISTING OUTSIDE DROP MANHOLE DETAIL

NO SCALE



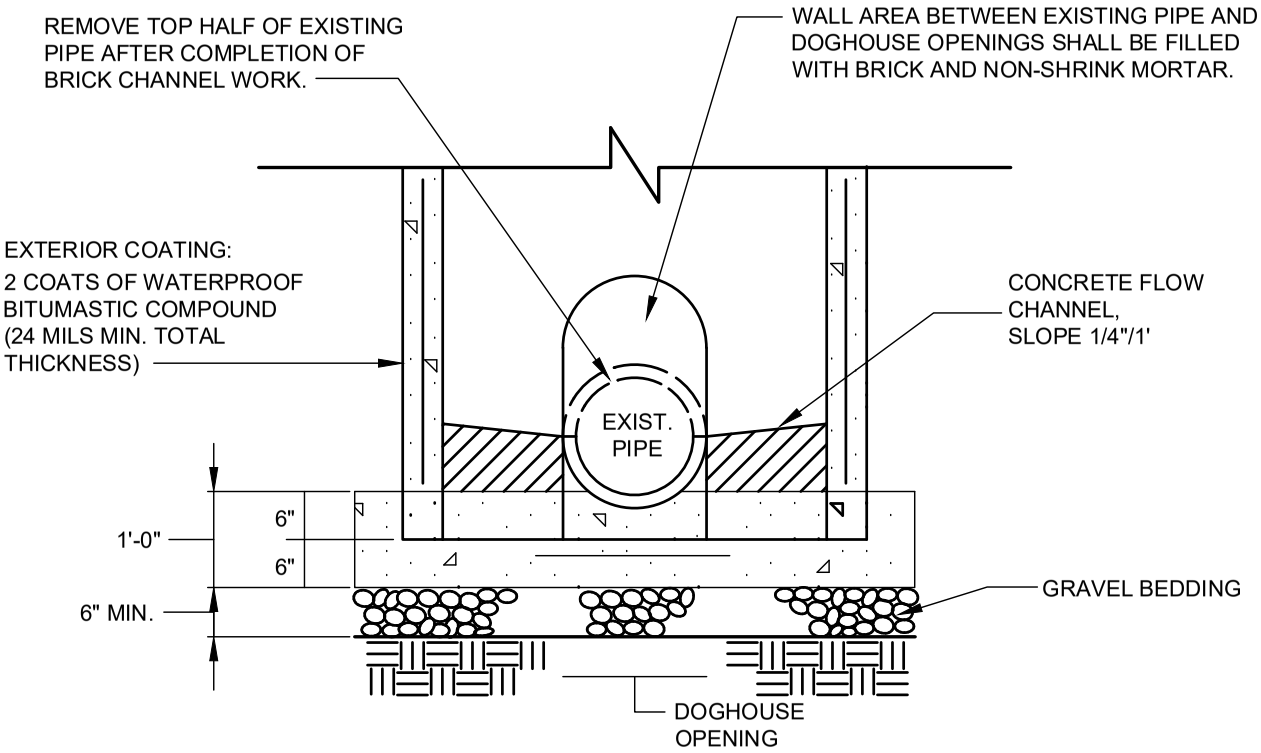
DROP CONNECTIONS

SIZE OF SEWER	TYPE "A"		TYPE "B"
	MAX.DROP	MIN.DROP	MIN.DROP
6" OR 8"	3'-9"	1'-9"	3'-9"
10"	4'-0"	2'-0"	4'-0"
12"	6'-0"	2'-6"	6'-0"

ONLY WHEN CONNECTING TO A EXISTING MANHOLE

CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

DATE: JANUARY 2025



NOTES:

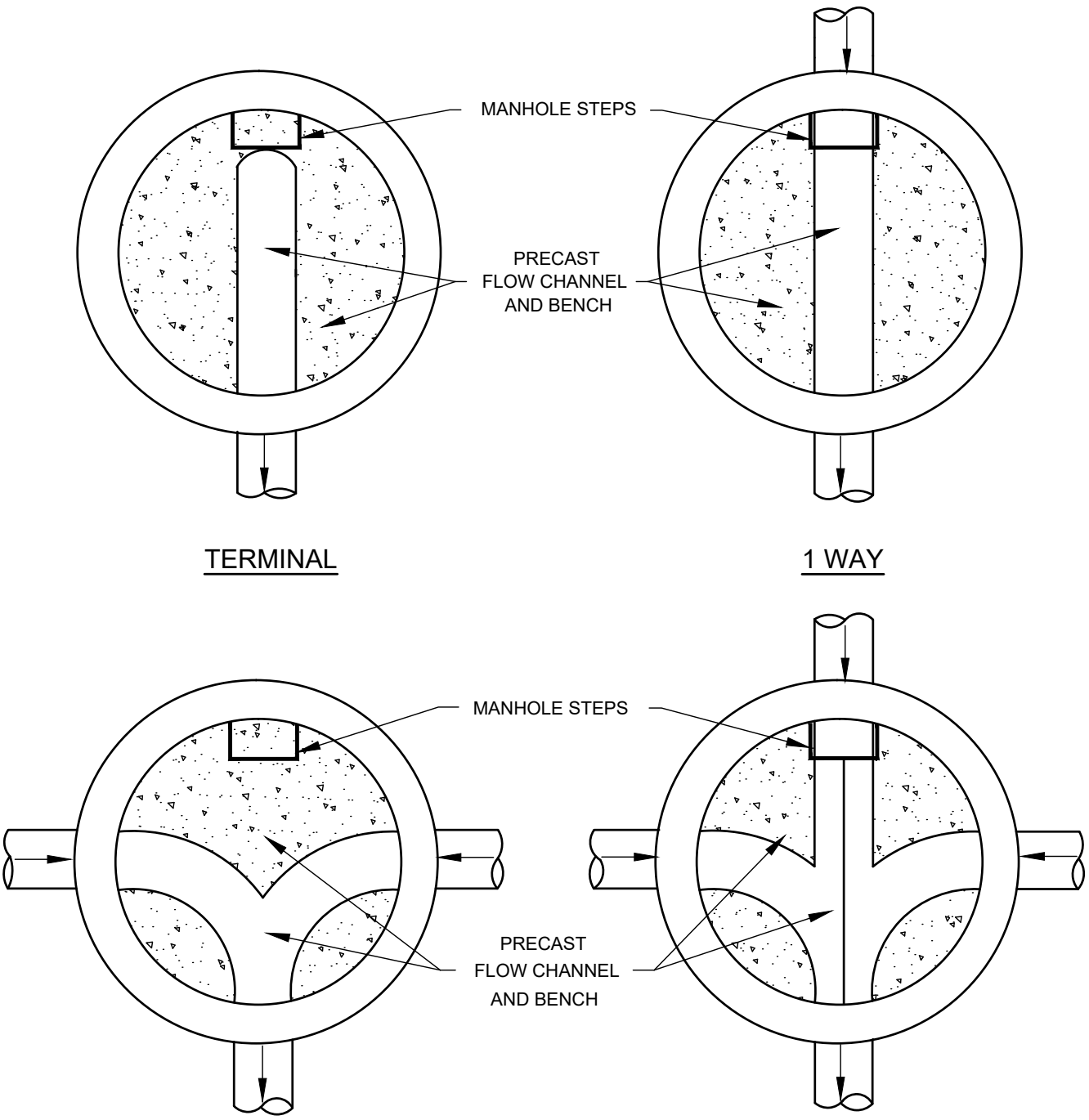
1. CONCRETE COMPRESSIVE STRENGTH SHALL BE 4,000 P.S.I.
2. MANHOLE SHALL CONFORM TO ASTM-C478, LATEST REVISION.
3. ALL PORTIONS OF MANHOLE SHALL BE CONSTRUCTED AS DETAILED FOR PRECAST CONCRETE MANHOLE.

SECTION - 5

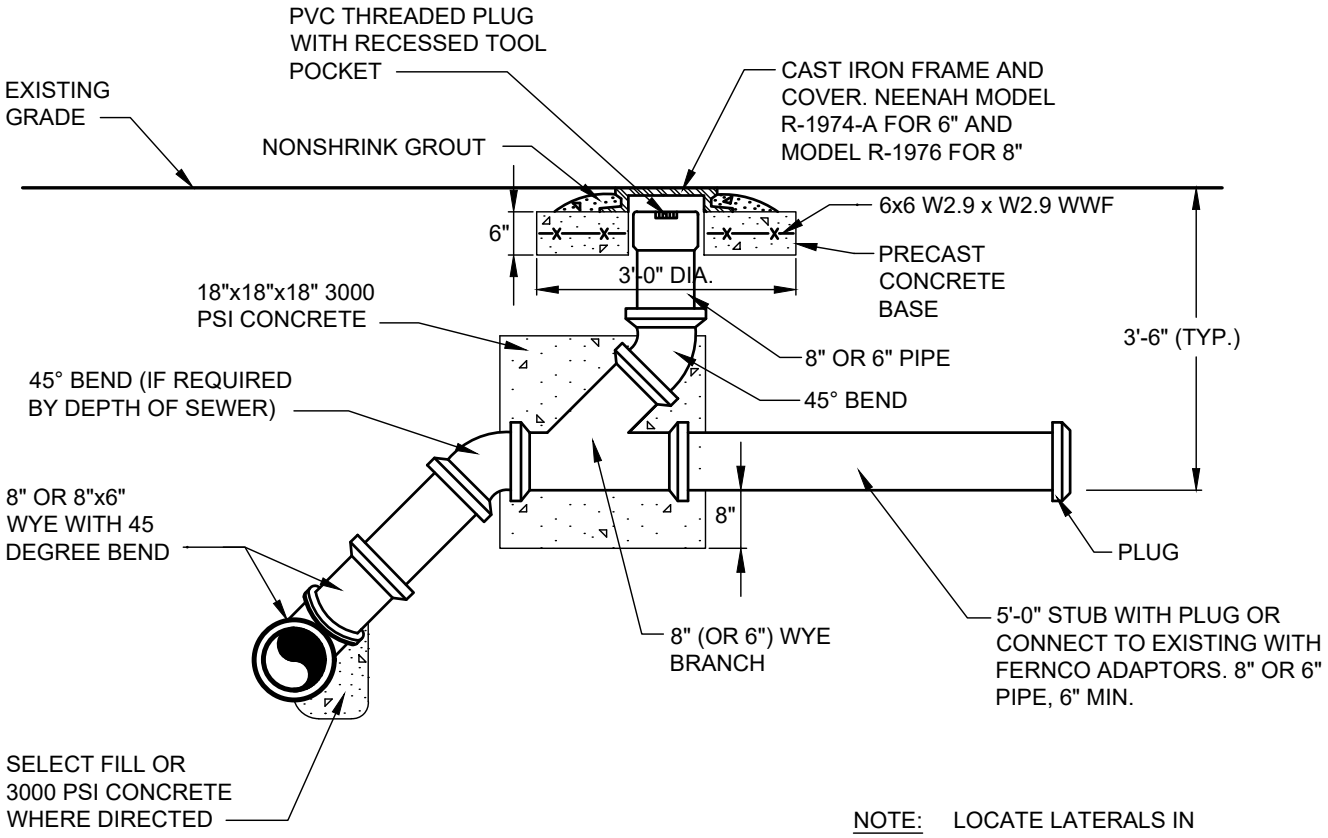
DOGHOUSE MANHOLE DETAIL

NO SCALE

DRAWING - 5

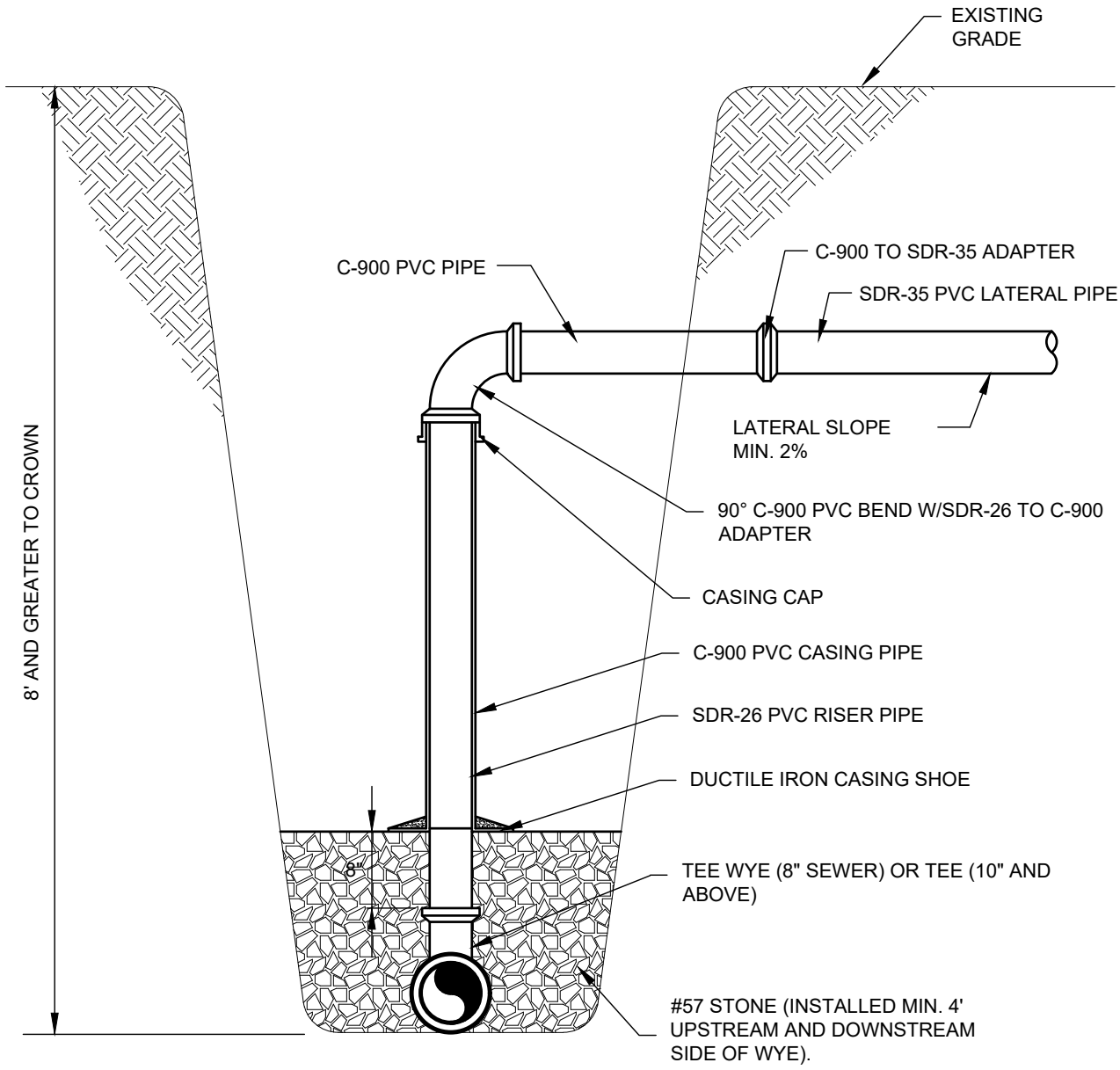


DATE: JANUARY 2025		TYPICAL MANHOLE FLOW CHANNEL DETAIL NO SCALE	
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 5	DRAWING - 6

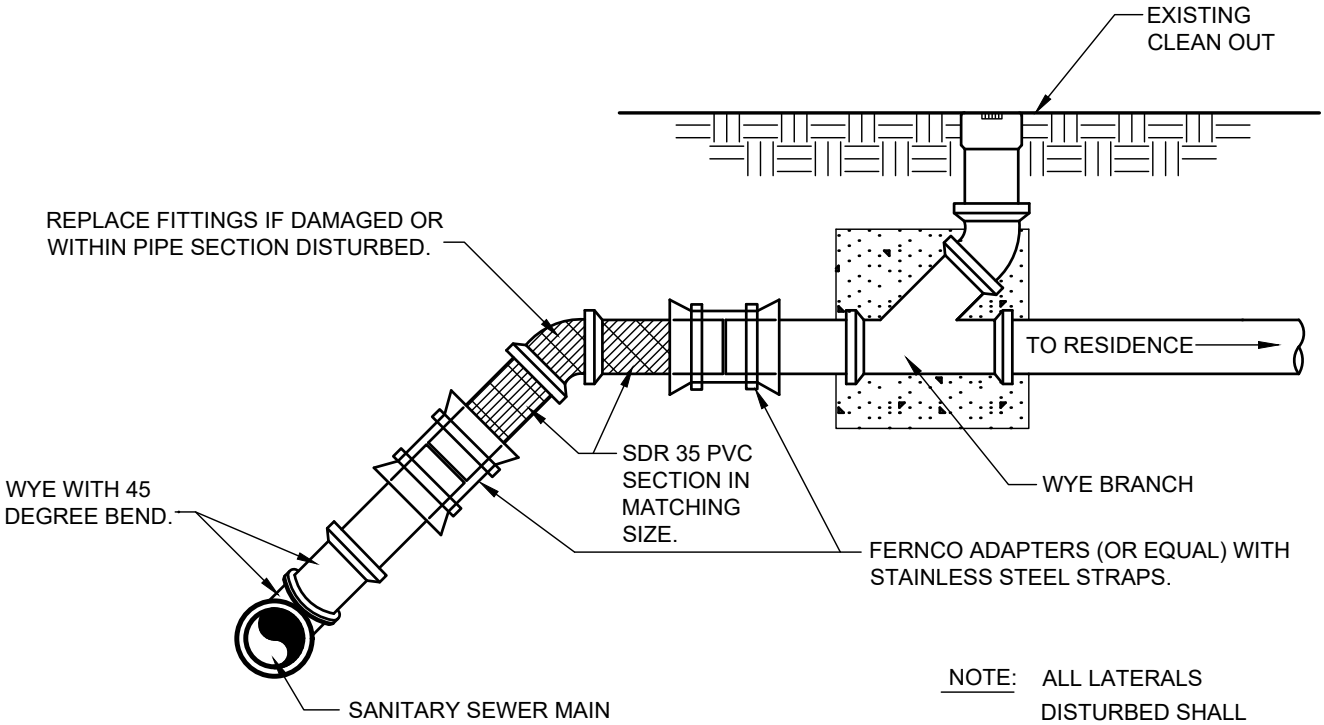


NOTE: LOCATE LATERALS IN FIELD AS DIRECTED BY TOWN OF GEORGETOWN.

DATE: JANUARY 2025		BUILDING LATERAL CLEANOUT DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 5 / DRAWING - 7



DATE: JANUARY 2025		DEEP SEWER LATERAL CONNECTION DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 5 | DRAWING - 8



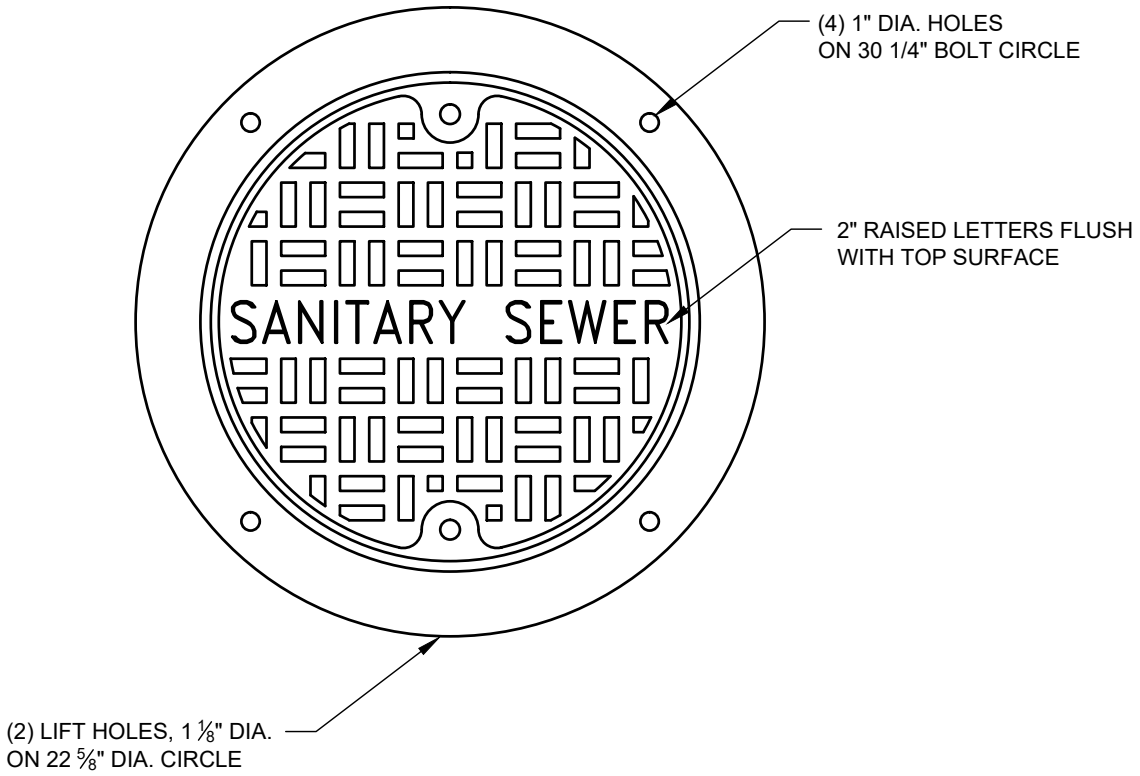
NOTE: ALL LATERALS DISTURBED SHALL BE REPAIRED BY THE CONTRACTOR.

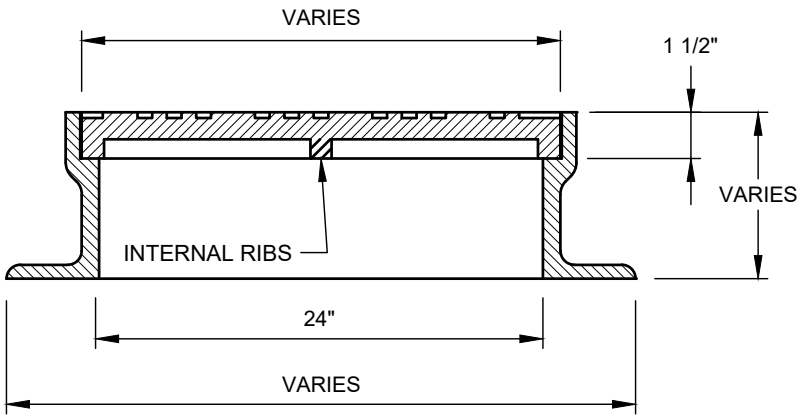
DATE: JANUARY 2025		SEWER LATERAL RESTORATION DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 5 / DRAWING - 9

NOTES:

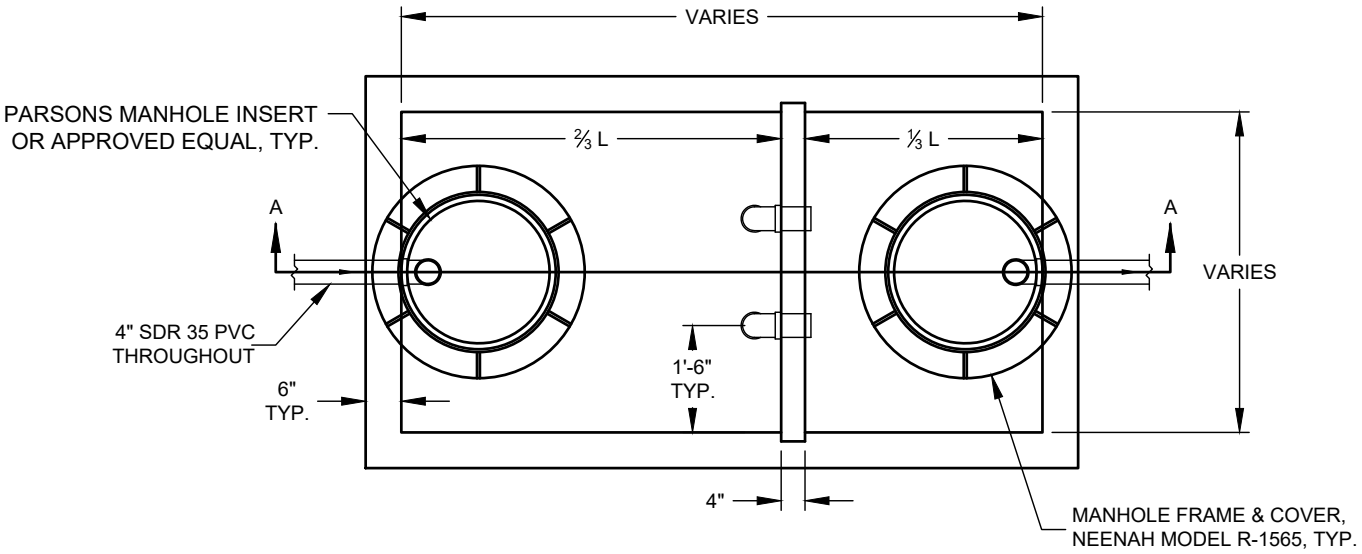
1. FRAME AND COVER SHALL BE COMPOSITE ACCESS PRODUCTS CAPONE® 24 OR EAST JORDAN 2600 DUROSTREET® COMPOSITE FRAME AND COVER OR APPROVED EQUAL WATER TIGHT ASSEMBLY.

2. MATERIAL - FIBER REINFORCED POLYMER

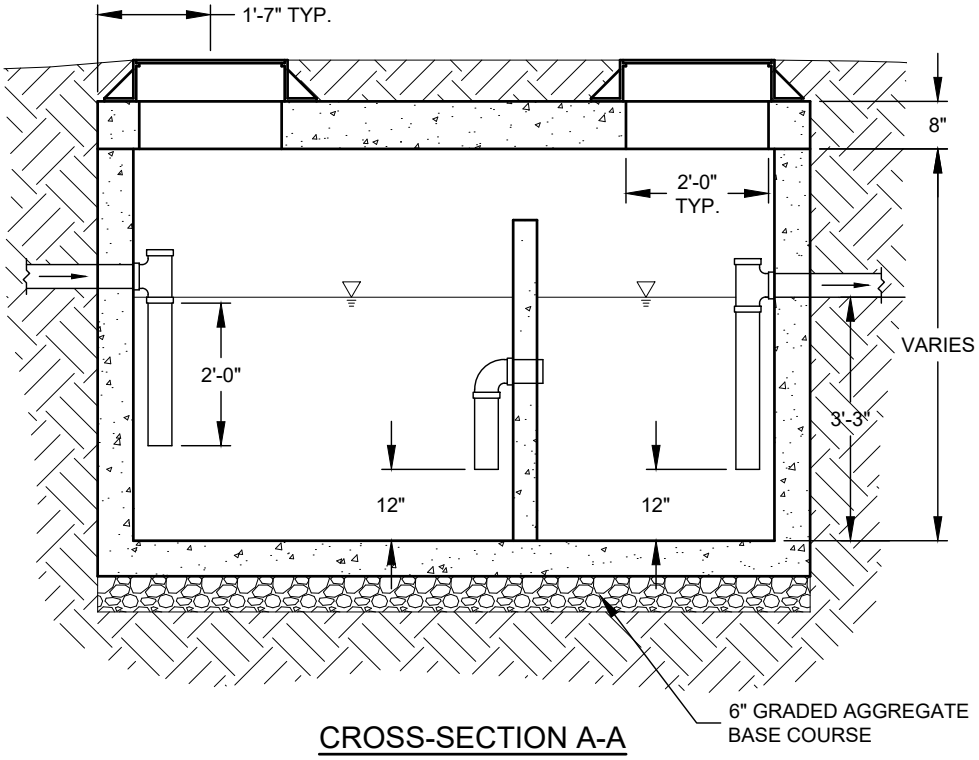




DATE: JANUARY 2025		MANHOLE FRAME & COVER DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 5 / DRAWING - 10



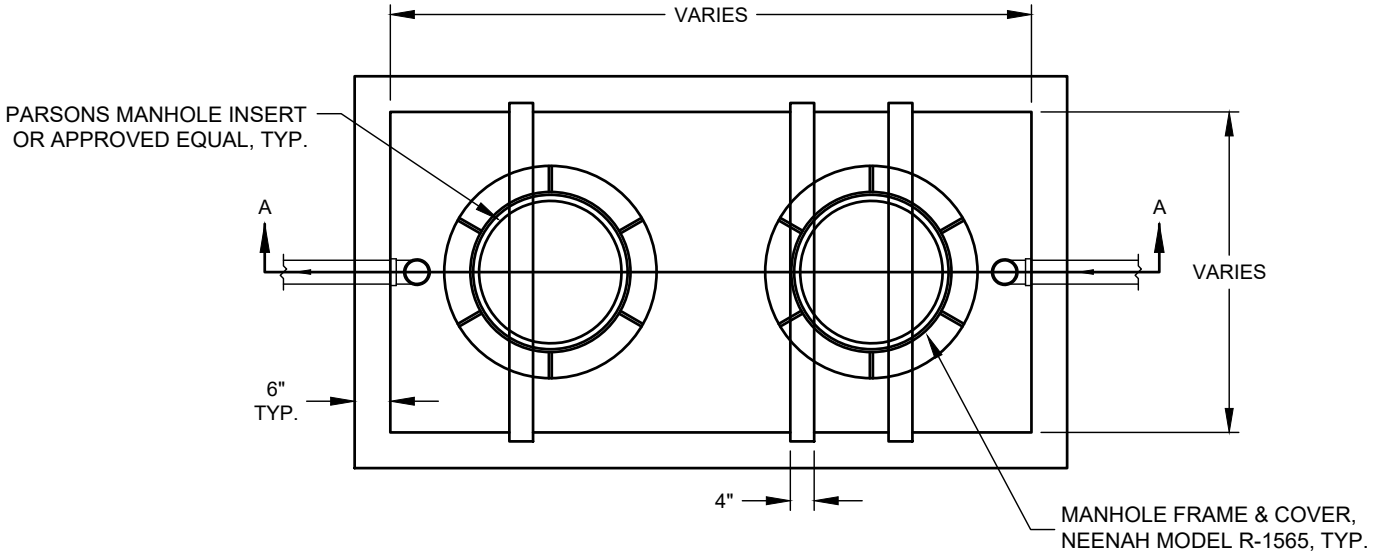
PLAN VIEW



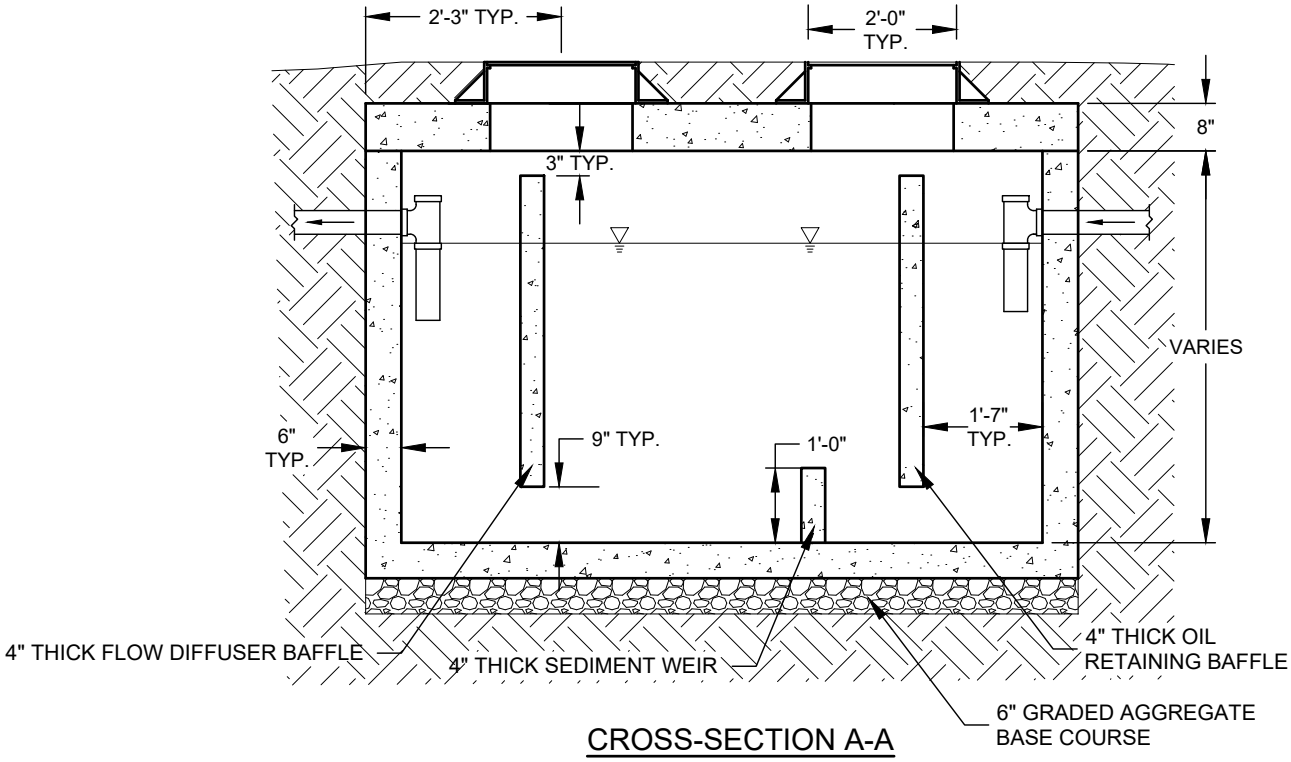
CROSS-SECTION A-A

NOTES:
1. GASKETS FOR PIPE PENETRATIONS SHALL BE A-LOK OR APPROVED EQUAL, CAST-IN-PLACE.
2. REINFORCEMENT FOR TOP SHALL BE SUITABLE FOR H-20 LOADING IF VAULT IS IN TRAFFIC AREA.
3. REINFORCEMENT OF BOTTOM, SIDES AND TOP SHALL BE INDICATED ON SHOP DRAWING SUBMISSION. ALL REINFORCEMENT SHALL MEET DELDOT REQUIREMENTS.
4. FLOATATION CALCULATIONS SHALL BE SUBMITTED WITH SHOP DRAWING SUBMISSION.
5. ALL CONCRETE SHALL BE 4,000 PSI.

DATE: JANUARY 2025		GREASE TRAP DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 5 / DRAWING - 11



PLAN VIEW

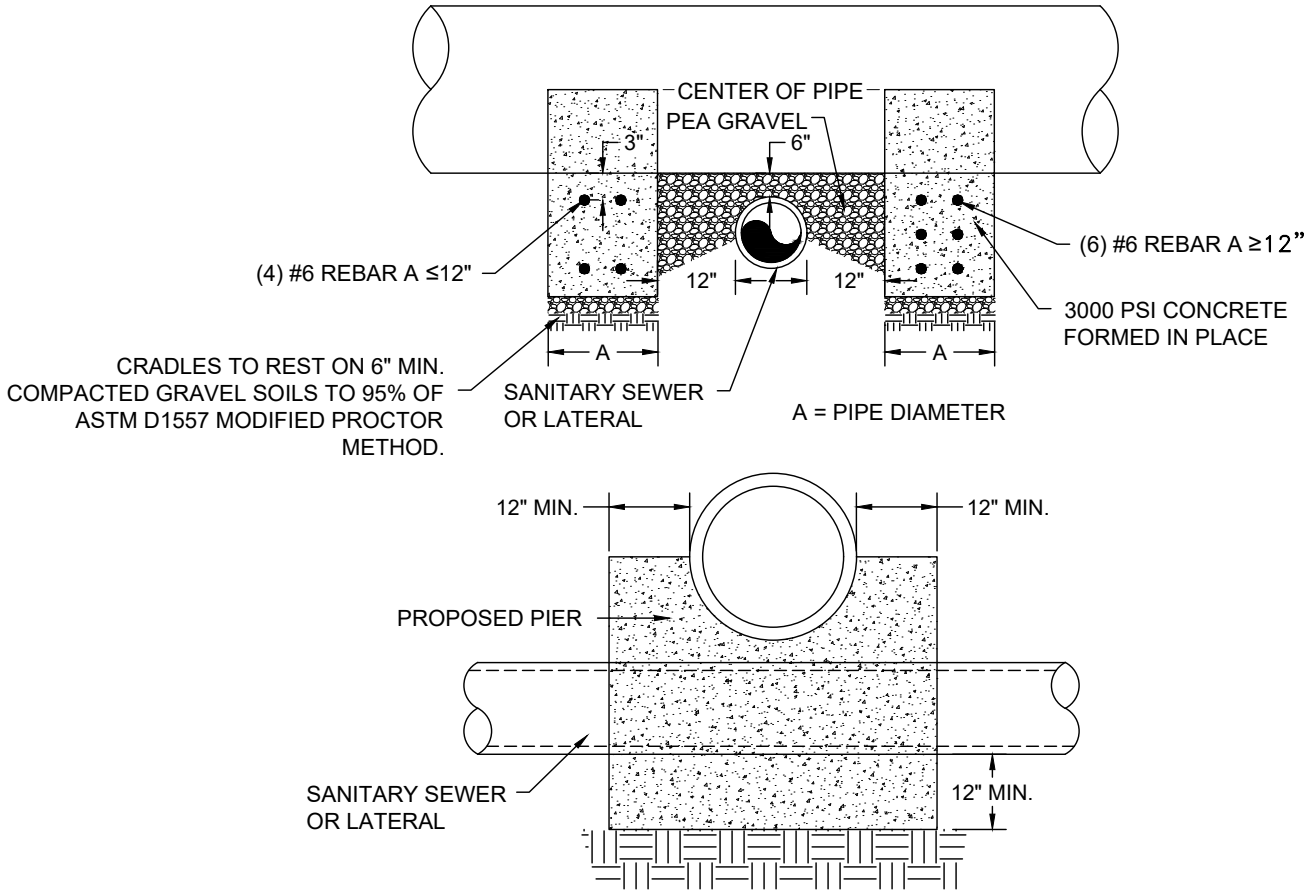


CROSS-SECTION A-A

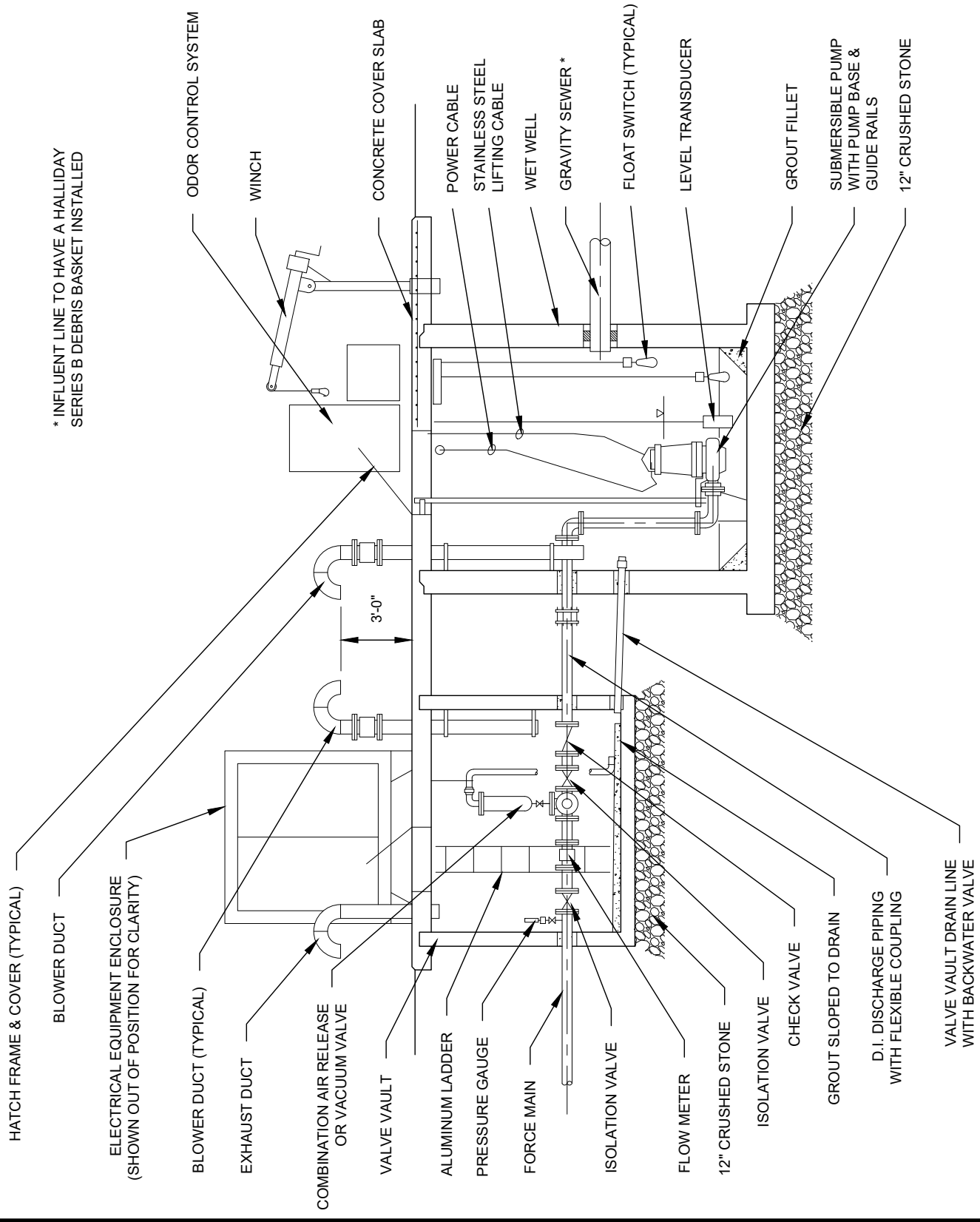
NOTES:

1. GASKETS FOR PIPE PENETRATIONS SHALL BE A-LOK OR APPROVED EQUAL, CAST-IN-PLACE.
2. REINFORCEMENT FOR TOP SHALL BE SUITABLE FOR H-20 LOADING IF VAULT IS IN TRAFFIC AREA.
3. REINFORCEMENT OF BOTTOM, SIDES AND TOP SHALL BE INDICATED ON SHOP DRAWING SUBMISSION. ALL REINFORCEMENT SHALL MEET DELDOT REQUIREMENTS.
4. FLOATATION CALCULATIONS SHALL BE SUBMITTED WITH SHOP DRAWING SUBMISSION.
5. ALL CONCRETE SHALL BE 4,000 PSI.

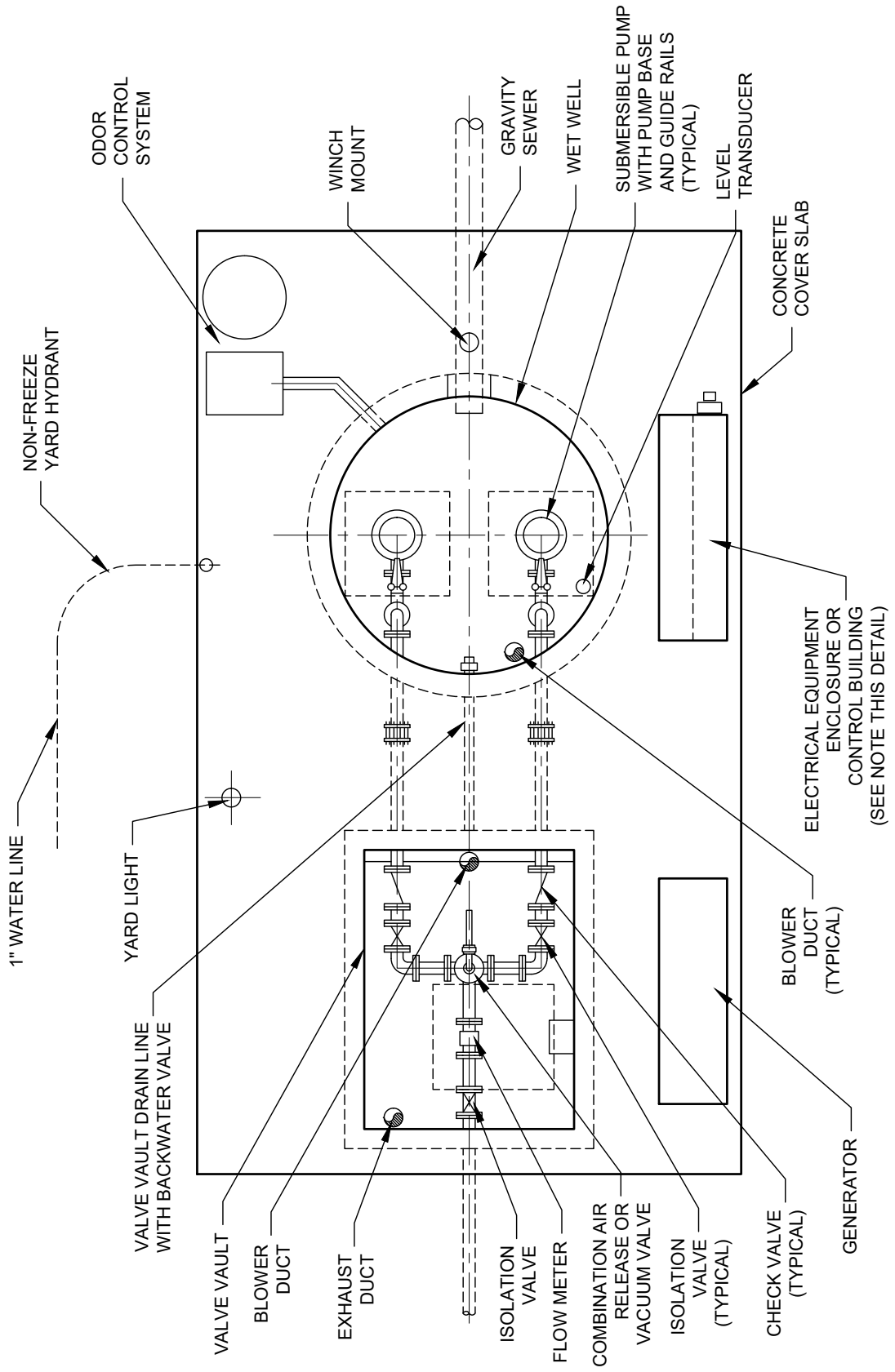
DATE: JANUARY 2025		WATER - OIL SEPARATOR DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 5 / DRAWING - 12



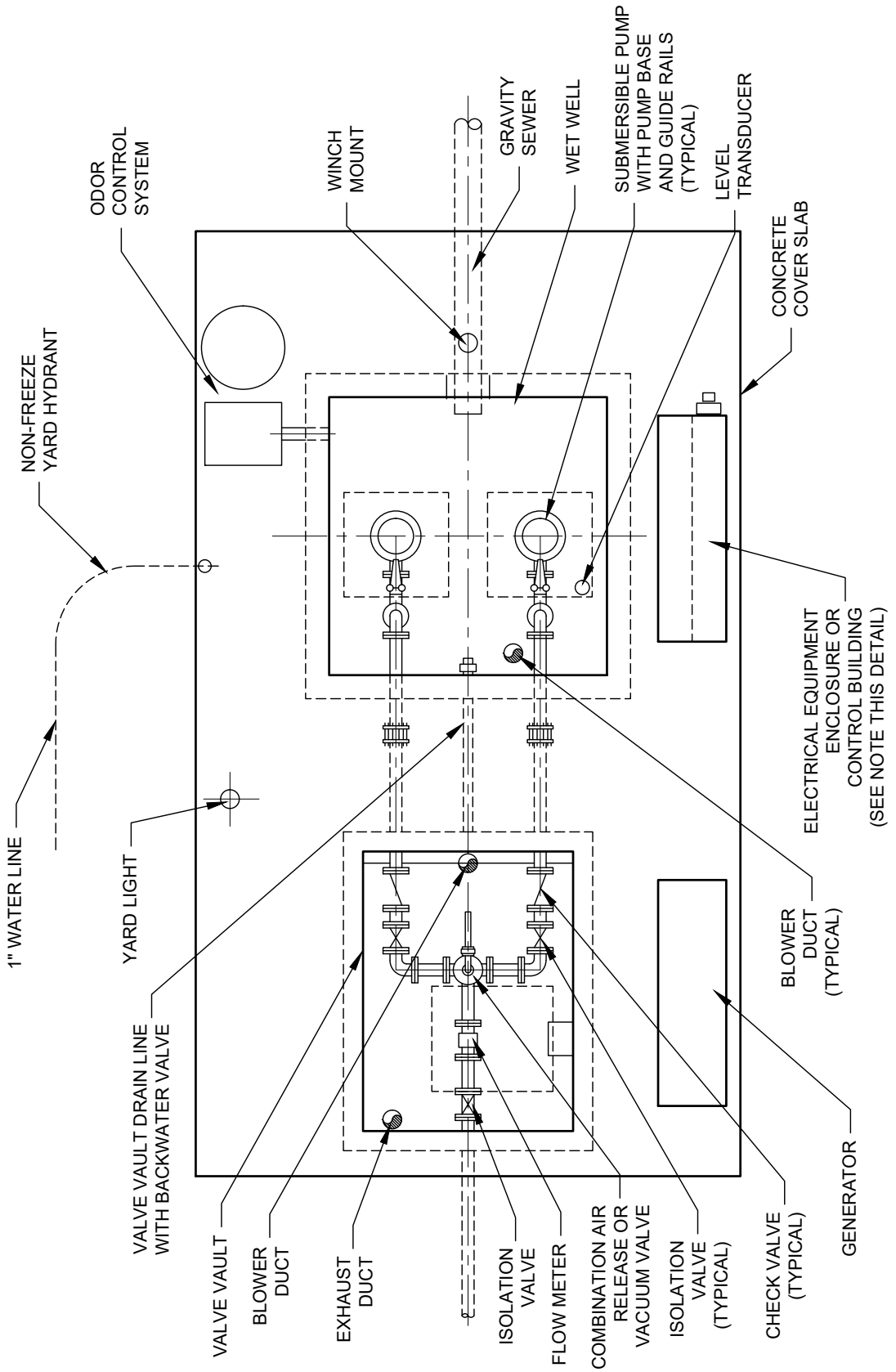
DATE: JANUARY 2025		PIPE CRADLE DETAIL NO SCALE	
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 5	DRAWING - 13



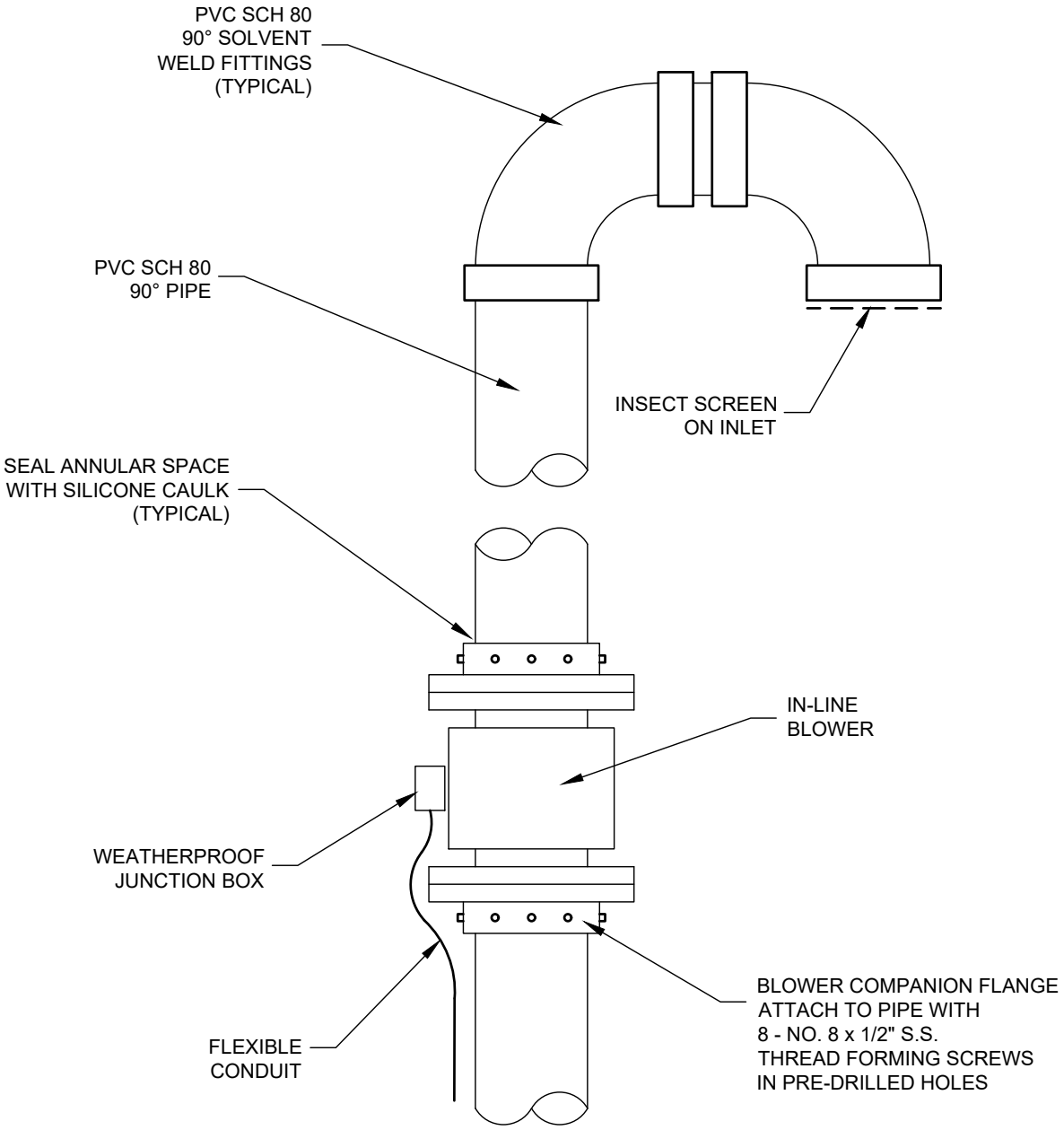
DATE: JANUARY 2025		WET WELL & VALVE VAULT TYPICAL SECTION NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 6 / DRAWING - 1



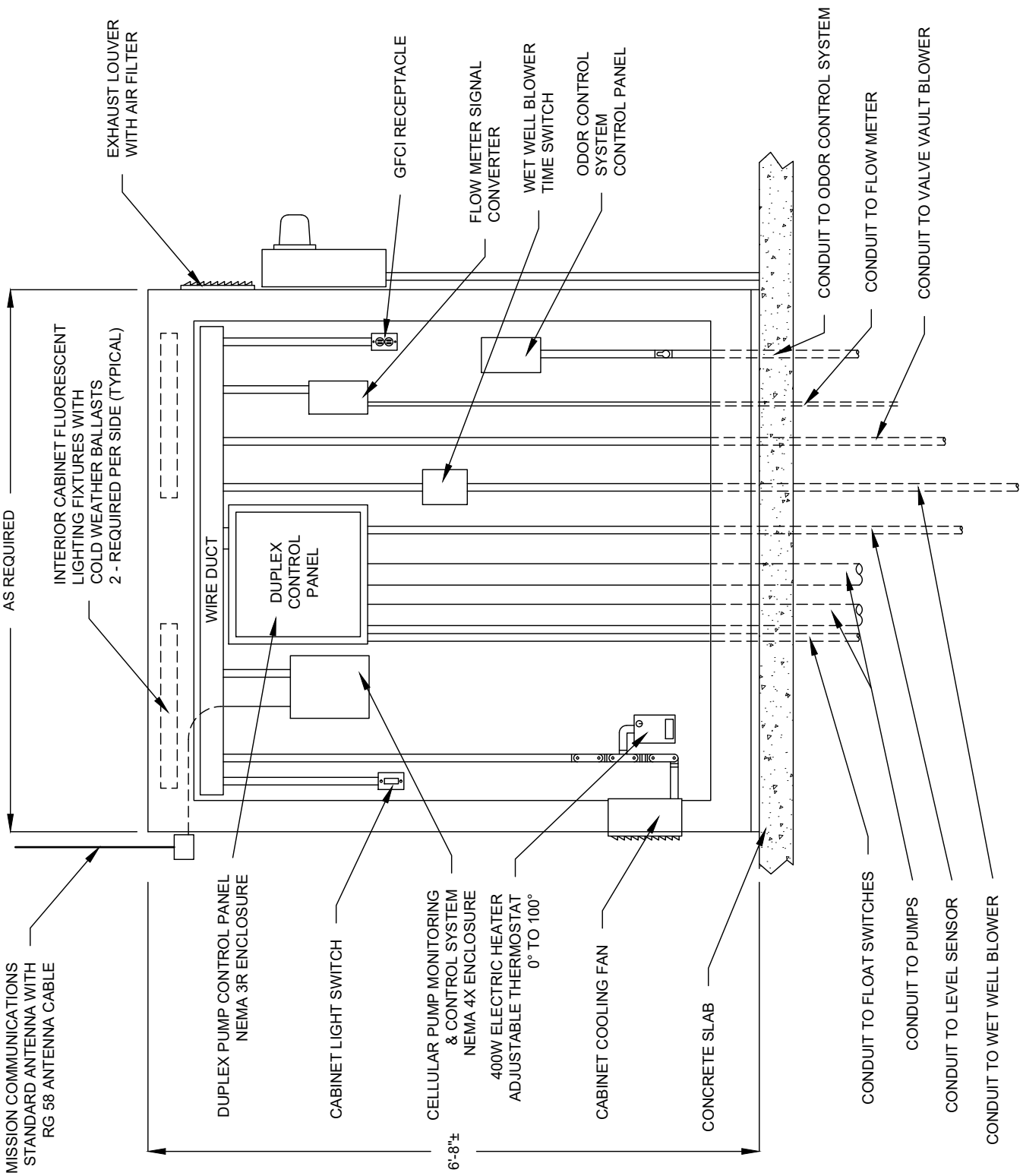
DATE: JANUARY 2025		WET WELL & VALVE VAULT TYPICAL PLAN NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 6 / DRAWING - 2A



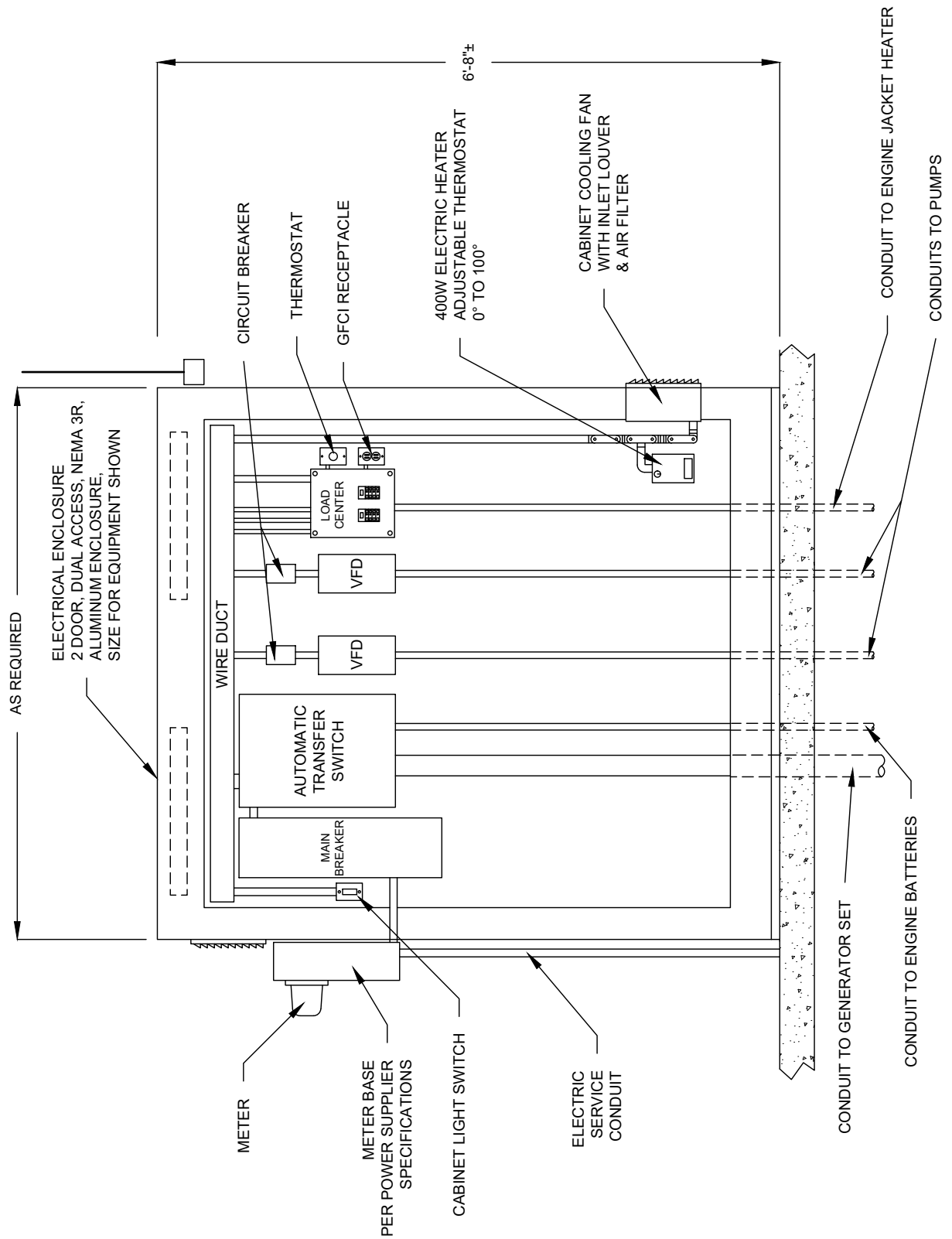
DATE: JANUARY 2025		WET WELL & VALVE VAULT TYPICAL PLAN NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 6 / DRAWING - 2B



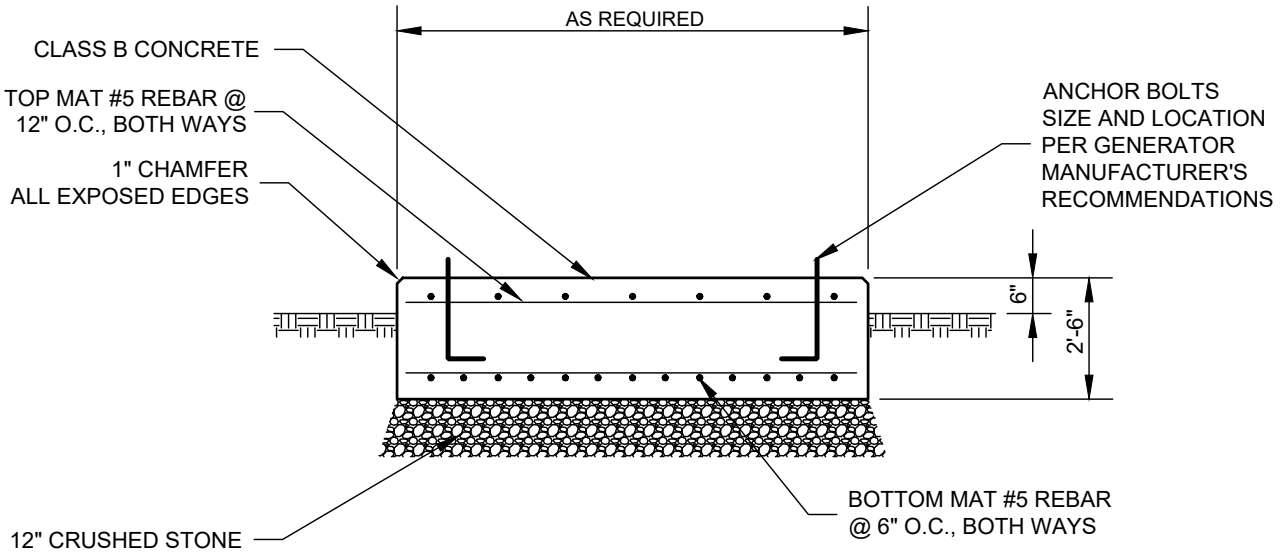
DATE: JANUARY 2025		IN-LINE BLOWER NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 6 / DRAWING - 3

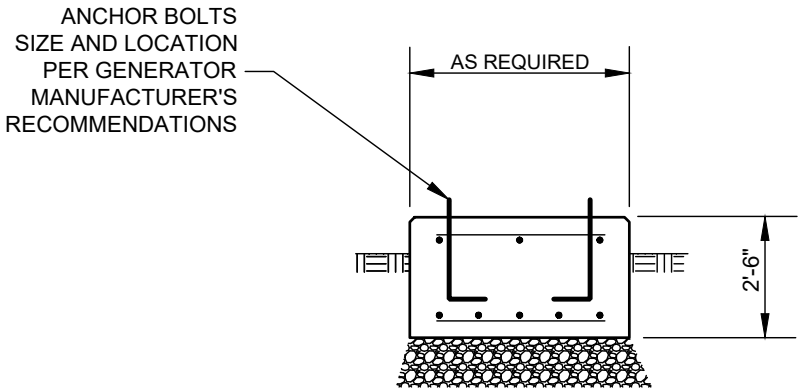


DATE: JANUARY 2025		ELECTRICAL EQUIPMENT ENCLOSURE CONTROL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 6 / DRAWING - 4

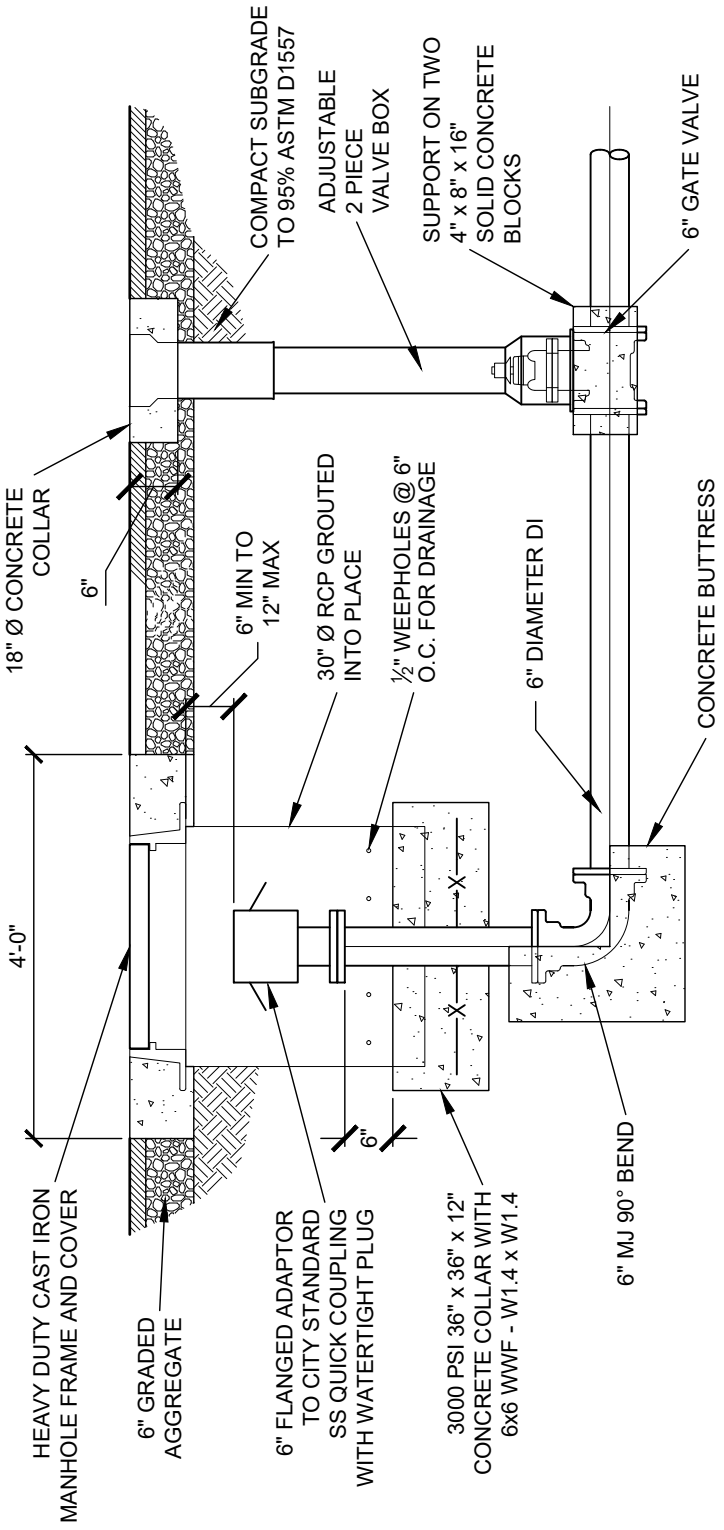


DATE: JANUARY 2025		ELECTRICAL EQUIPMENT ENCLOSURE POWER NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 6 / DRAWING - 5



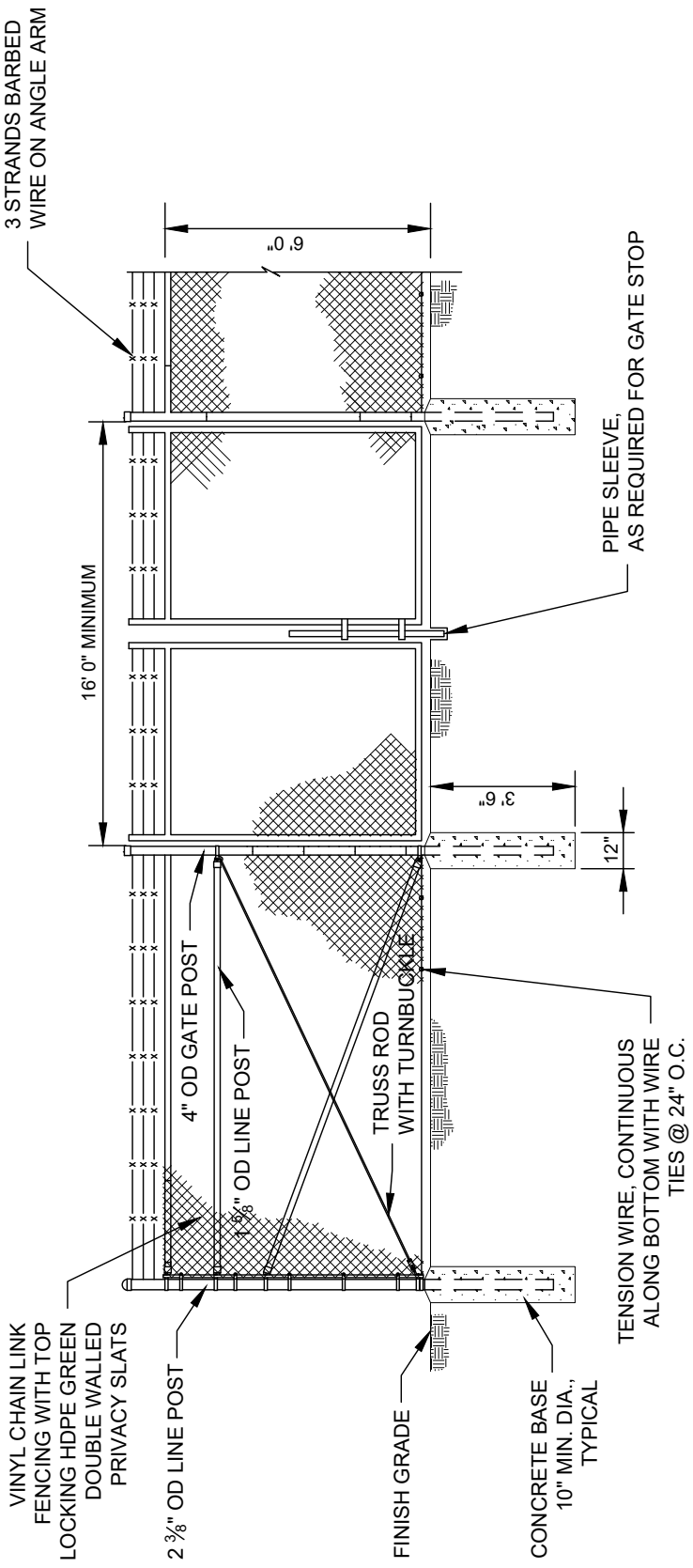


DATE: JANUARY 2025		GENERATOR PAD DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 6 / DRAWING - 6

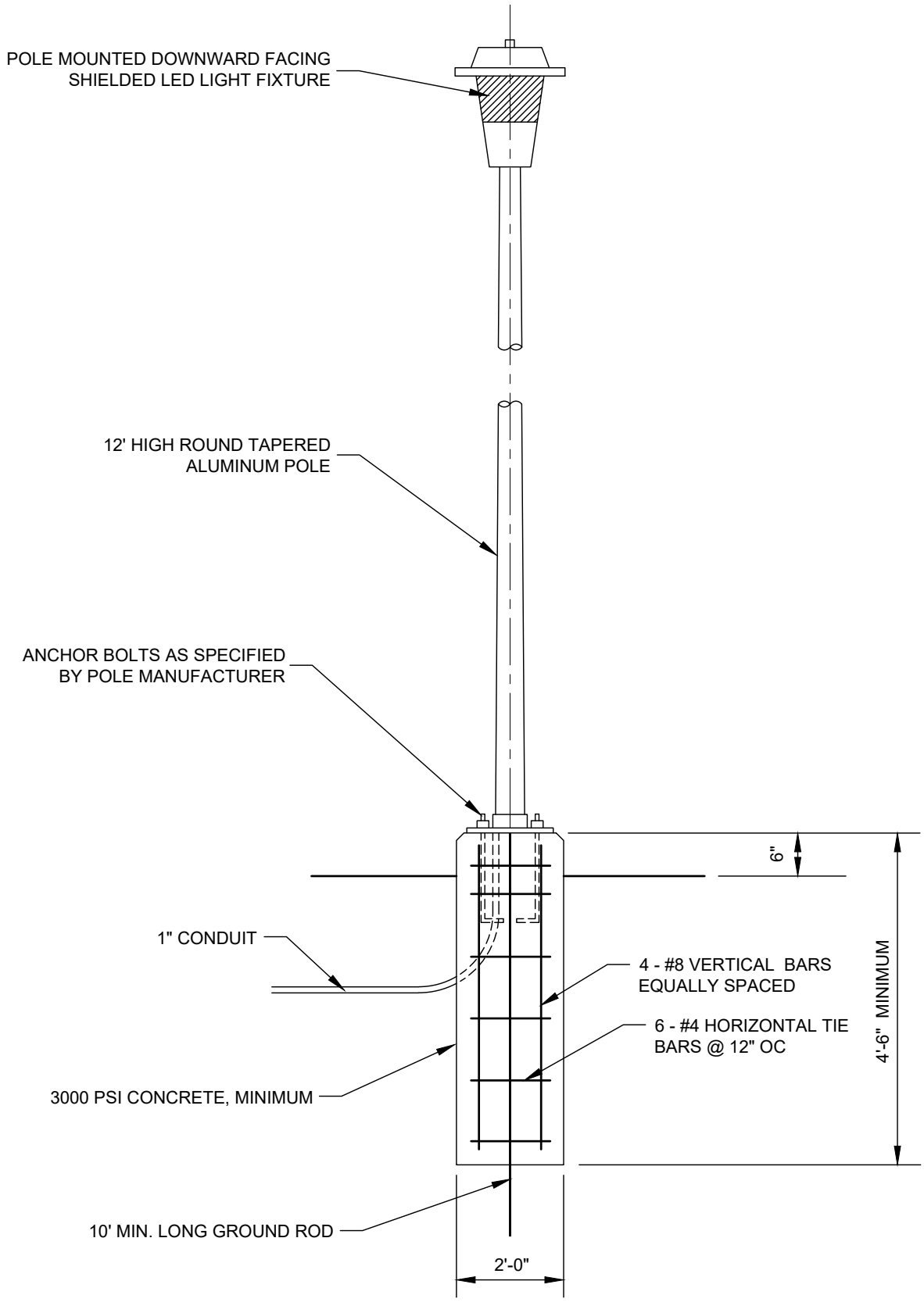


NOTE:
PROVIDE PROTECTIVE COATING ON ALL EXTERIOR SURFACES.

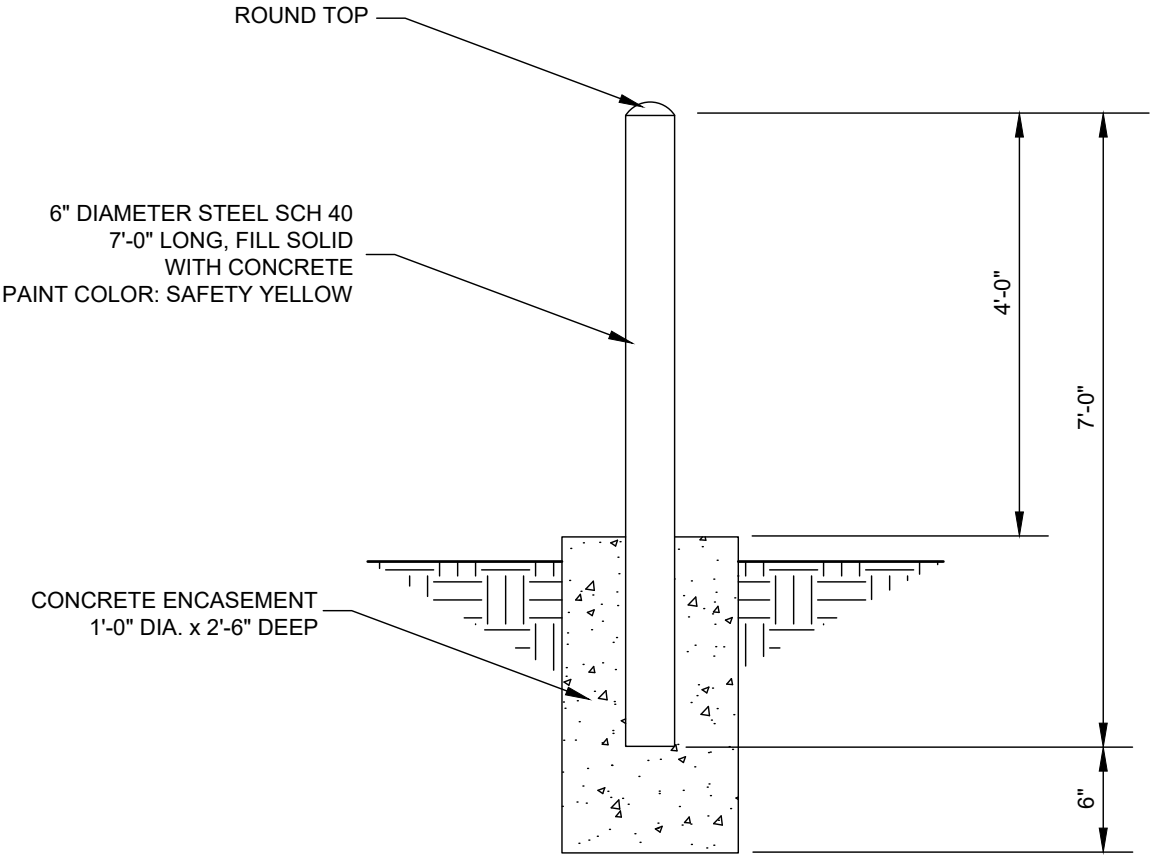
DATE: JANUARY 2025		BY-PASS PUMPING CONNECTION DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 6 / DRAWING - 7



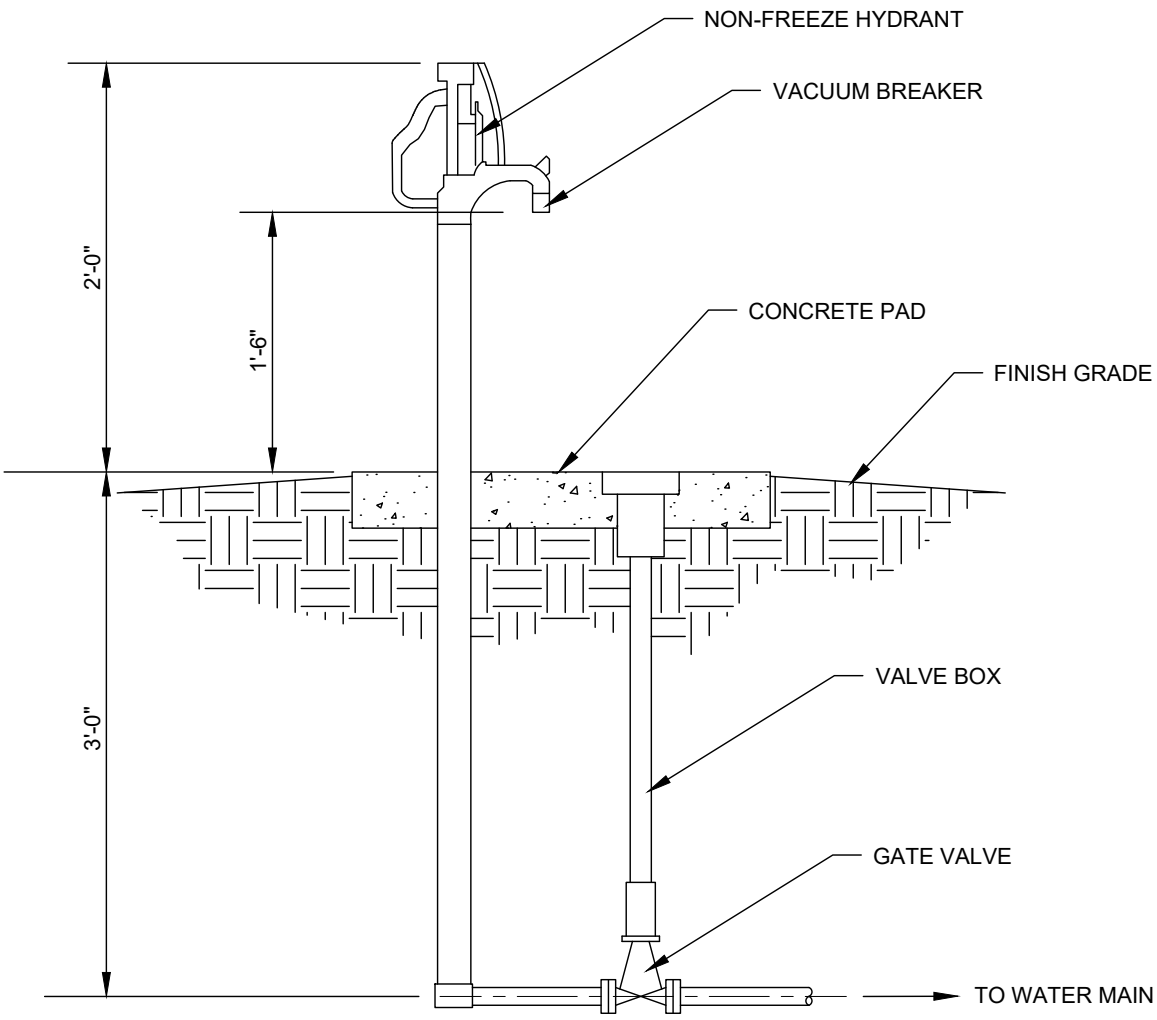
DATE: JANUARY 2025		FENCE & GATE DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 6 / DRAWING - 8



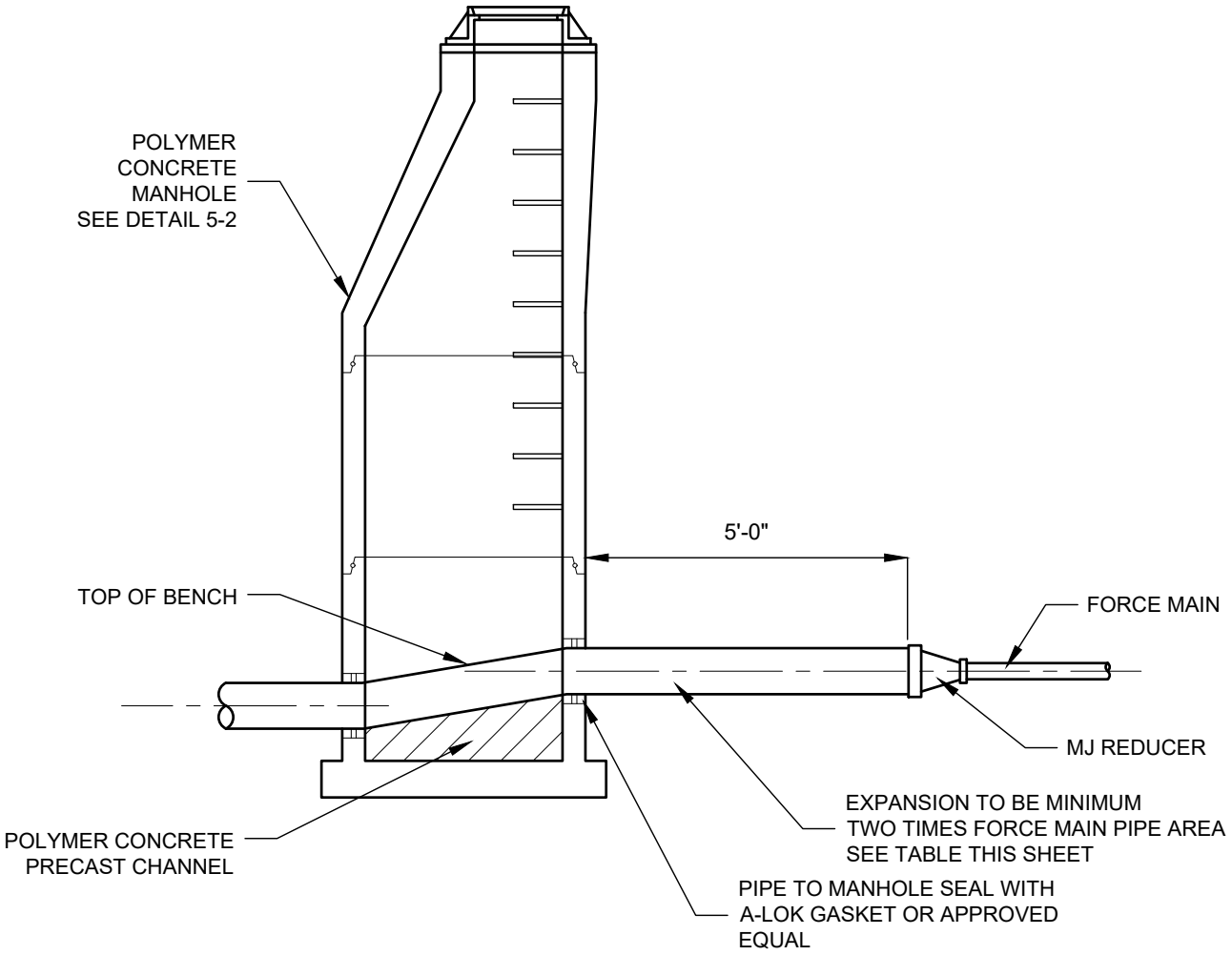
DATE: JANUARY 2025		YARD LIGHT DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 6 / DRAWING - 9



DATE: JANUARY 2025	Town of Georgetown DELAWARE	BOLLARD DETAIL NO SCALE	
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN		SECTION - 6	DRAWING - 10



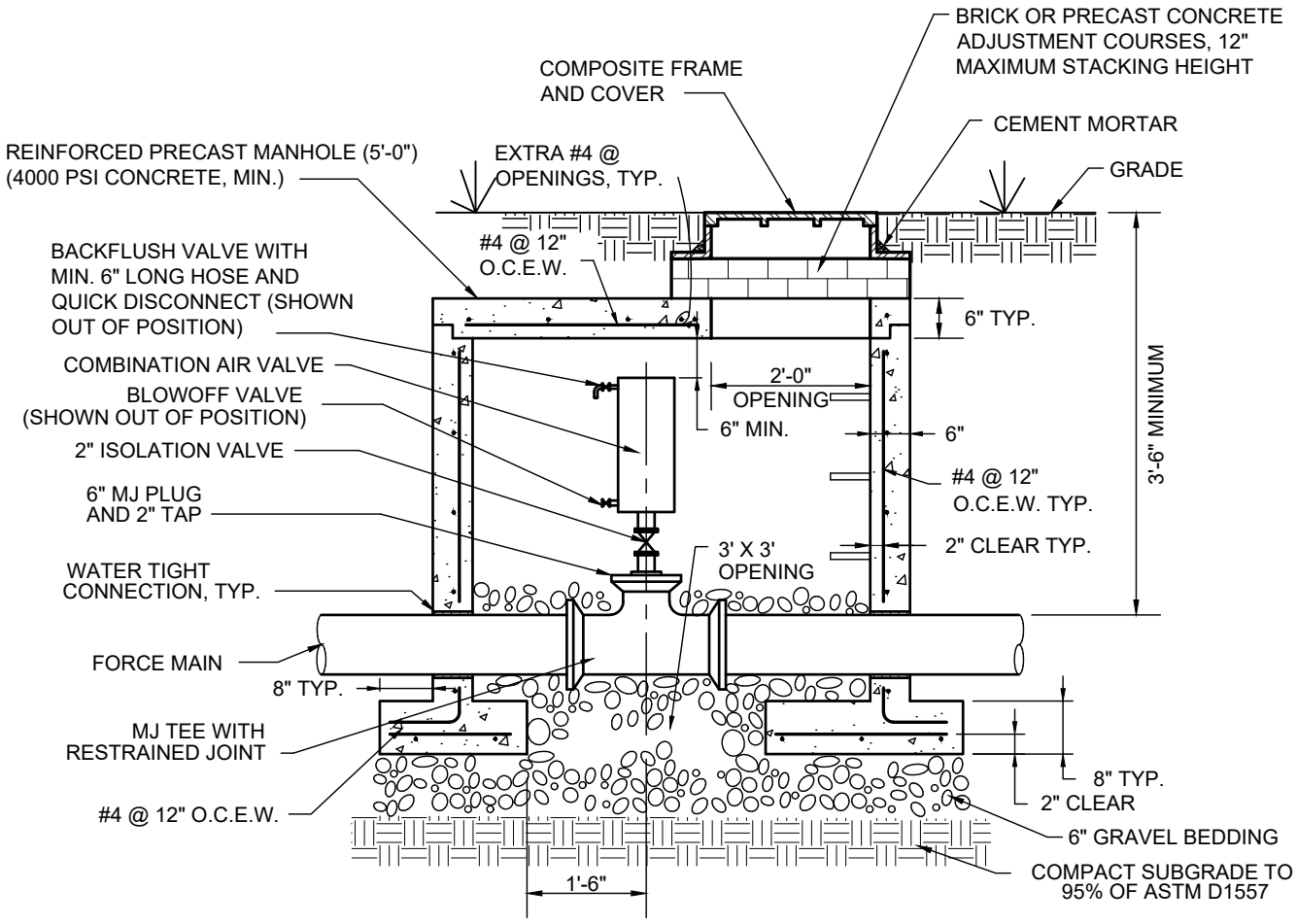
DATE: JANUARY 2025		YARD HYDRANT DETAIL NO SCALE	
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 6	DRAWING - 11



FM DIA, (INCHES)	DIA, EXP. (INCHES)
4	6
6	10
8	12
10	14
12	18
14	20

NOTE:
FORCE MAIN DISCHARGE MANHOLE SHALL BE CONSTRUCTED OF ALL POLYMER CONCRETE OR POLYMER COMPONENTS. NO PORTLAND CEMENT SHALL BE ALLOWED AS PART OF THIS MIX.

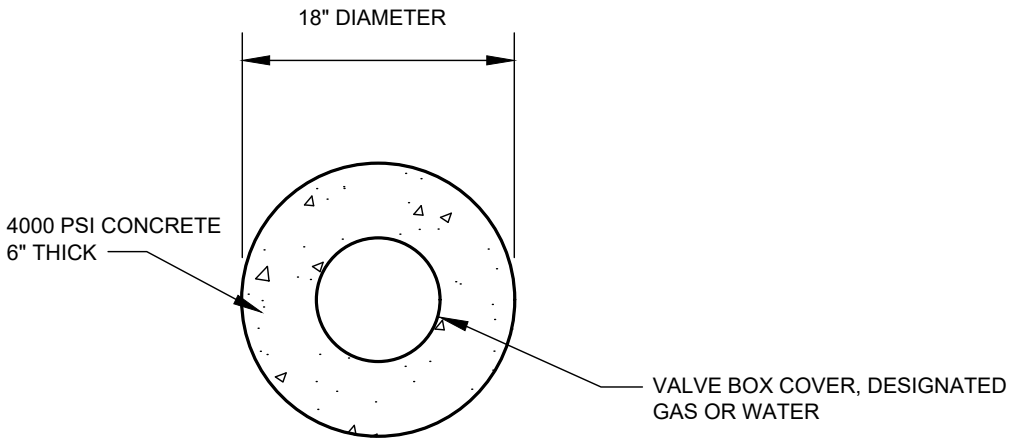
DATE: JANUARY 2025		FORCE MAIN DISCHARGE MANHOLE DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 7 / DRAWING - 1



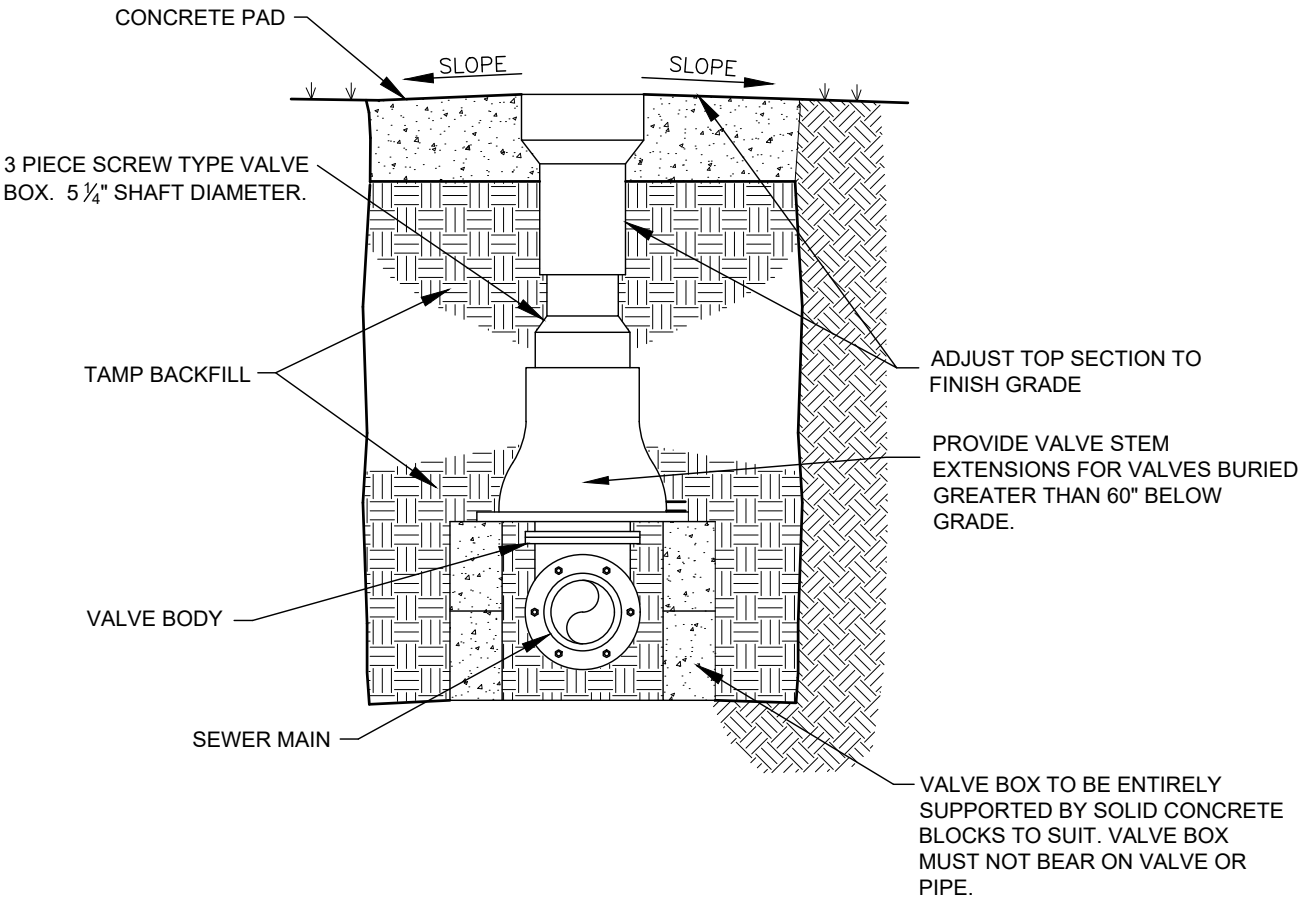
NOTE:
NON-TRAFFIC BEARING

NOTE:
PROVIDE PROTECTIVE COATING ON ALL EXTERIOR SURFACES.

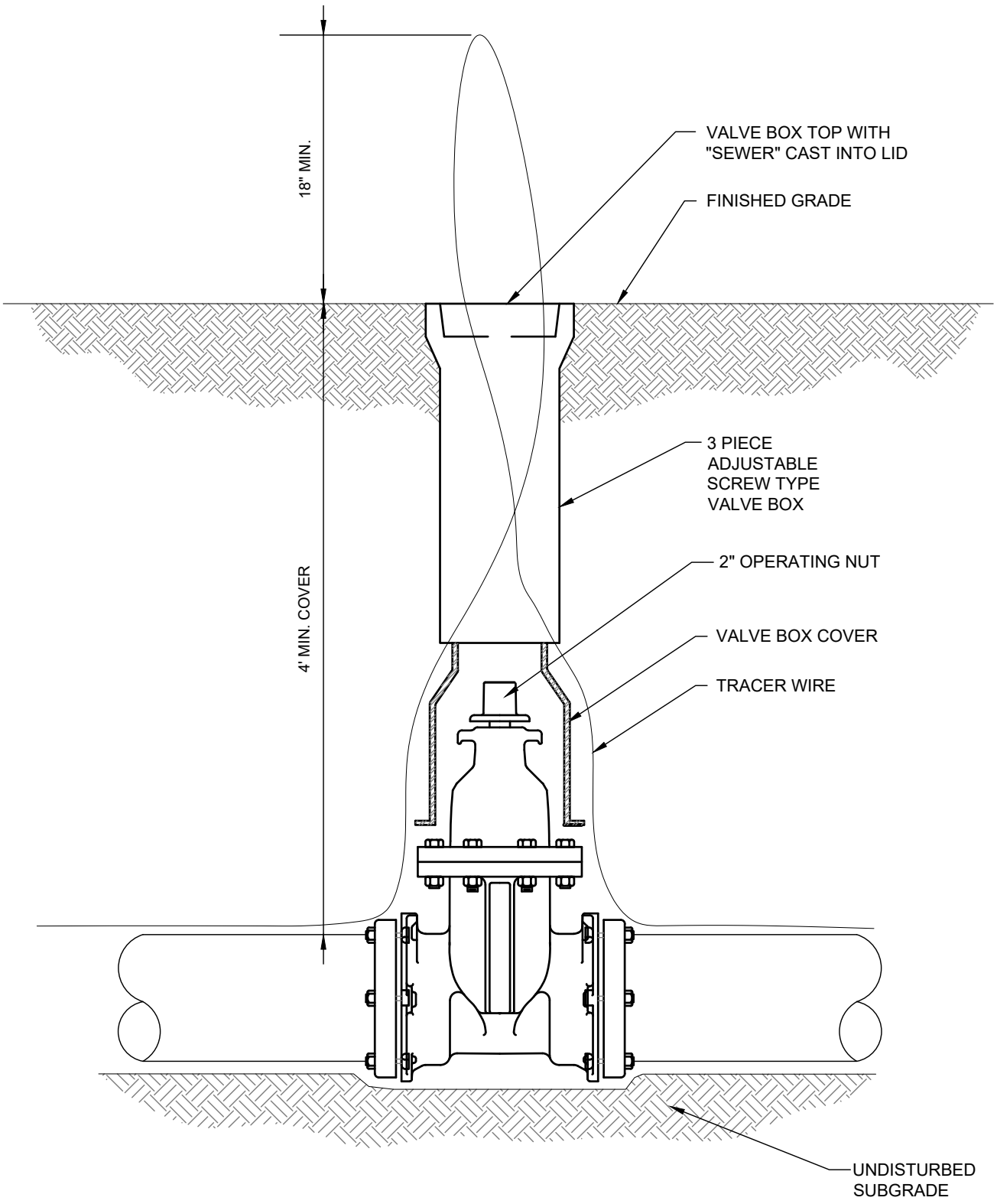
DATE: JANUARY 2025		SEWAGE AIR VALVE MANHOLE DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 7 | DRAWING - 2



SURFACE CONCRETE PAD FOR VALVE BOXES



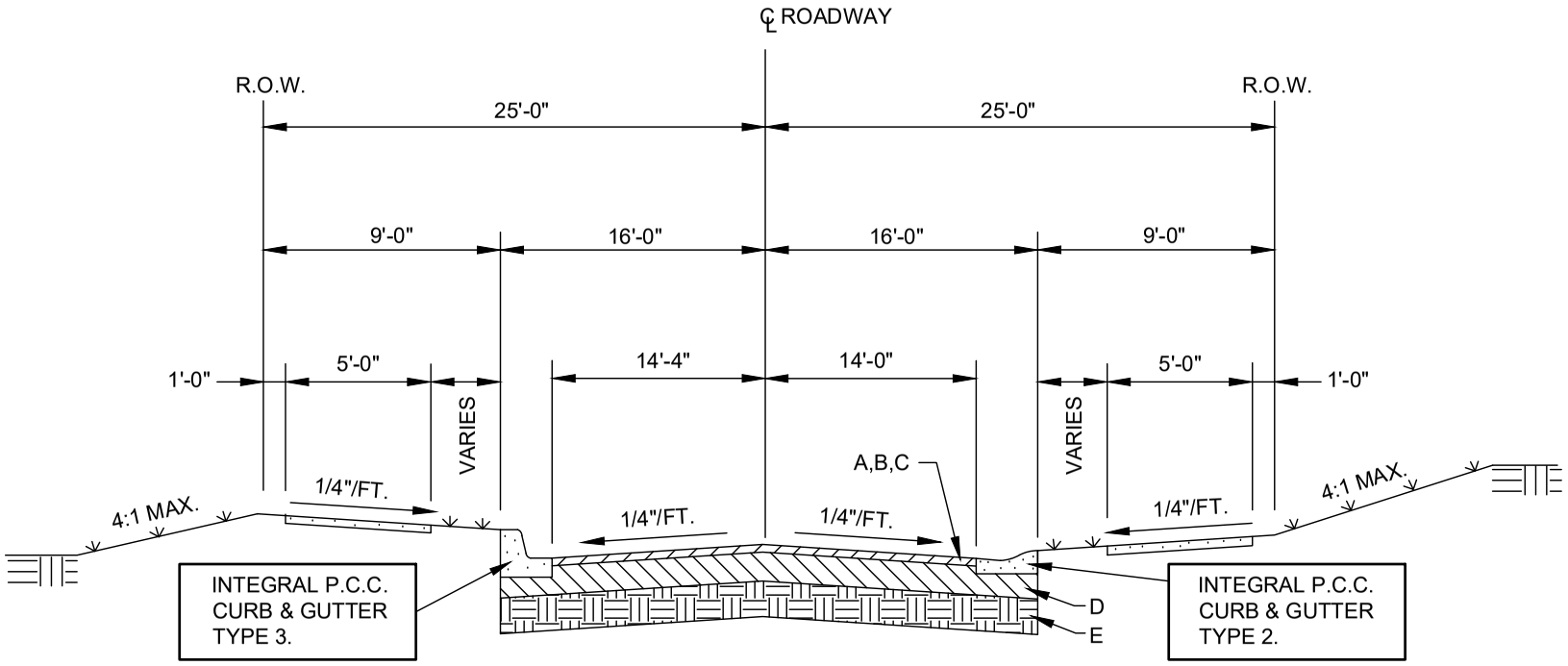
DATE: JANUARY 2025		BURIED VALVE DETAIL SEWER NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 7 / DRAWING - 3



DATE: JANUARY 2025		SEWER TRACER WIRE & VALVE BOX DETAIL NO SCALE	
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN	Town of Georgetown DELAWARE	SECTION - 7	DRAWING - 4

CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

DATE: JANUARY 2025



NOTES:

1. ↓ ↓ ↓ 6" TOPSOIL SEED AND MULCH.
2. REFER TO SECTION 12 FOR CURB AND SIDEWALK DETAILS AND SPECIFICATIONS.
3. REFER TO SECTION 9 FOR PAVING SECTION DESIGN.

A - TYPE C HOT MIX ASPHALT SURFACE COURSE

B - TYPE C HOT MIX ASPHALT INTERMEDIATE COURSE

C - TYPE B HOT MIX ASPHALT BASE COURSE

D - GRADED AGGREGATE BASE COURSE (CRUSHER RUN), COMPACTED TO 98% OF ASTM D1557. MODIFIED PROCTOR METHOD AND 8" COMPACTED DEPTH.

E - APPROVED SUBGRADE COMPACTED TO 95% OF ASTM D1557.

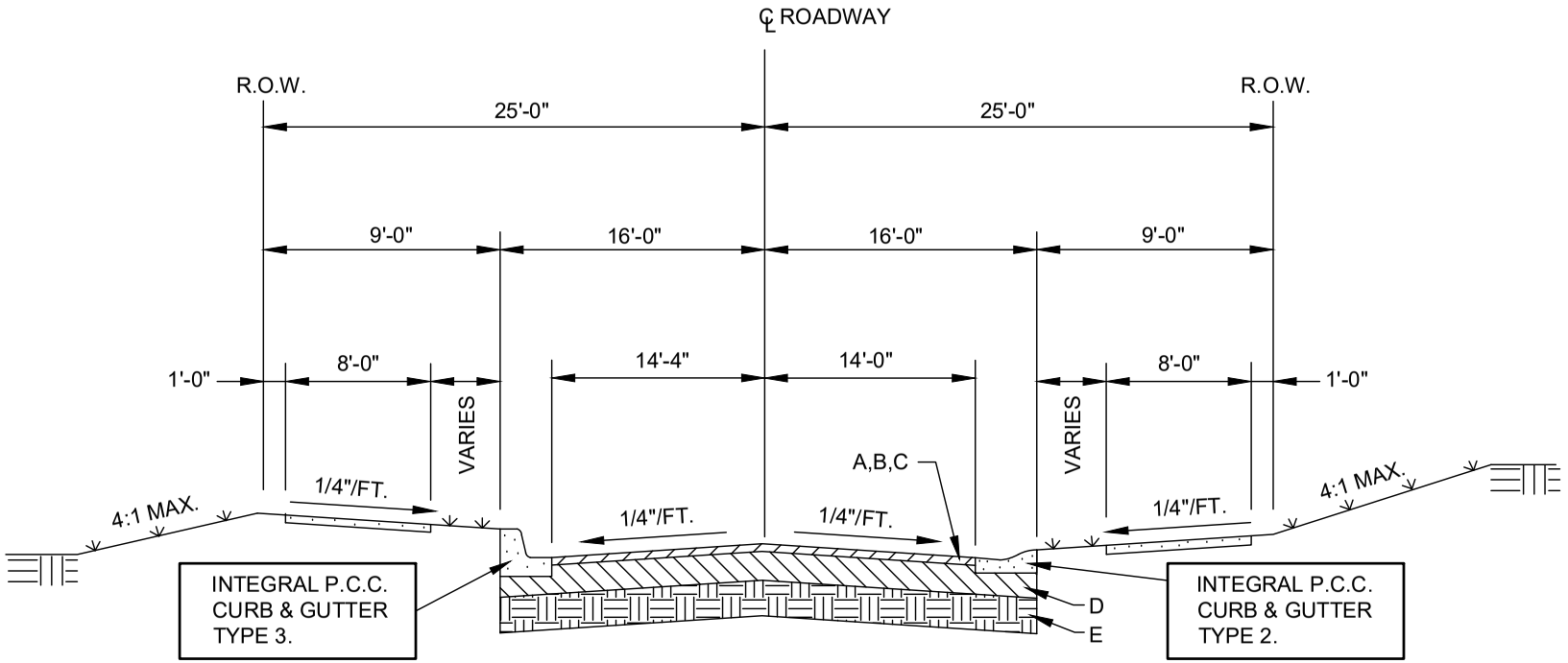
MINOR STREET TYPICAL SECTION
NO SCALE

SECTION - 9

DRAWING - 1

CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

DATE: JANUARY 2025



NOTES:

1. ↓ ↓ ↓ 6" TOPSOIL SEED AND MULCH.
2. REFER TO SECTION 12 FOR CURB AND SIDEWALK DETAILS AND SPECIFICATIONS.
3. REFER TO SECTION 9 FOR PAVING SECTION DESIGN.
4. NO RESIDENTIAL DRIVEWAY ACCESSES UNLESS APPROVED BY THE TOWN.

A - TYPE C HOT MIX ASPHALT SURFACE COURSE

B - TYPE C HOT MIX ASPHALT INTERMEDIATE COURSE

C - TYPE B HOT MIX ASPHALT BASE COURSE

D - GRADED AGGREGATE BASE COURSE (CRUSHER RUN), COMPACTED TO 98% OF ASTM D1557. MODIFIED PROCTOR METHOD AND 8" COMPACTED DEPTH.

E - APPROVED SUBGRADE COMPACTED TO 95% OF ASTM D1557.

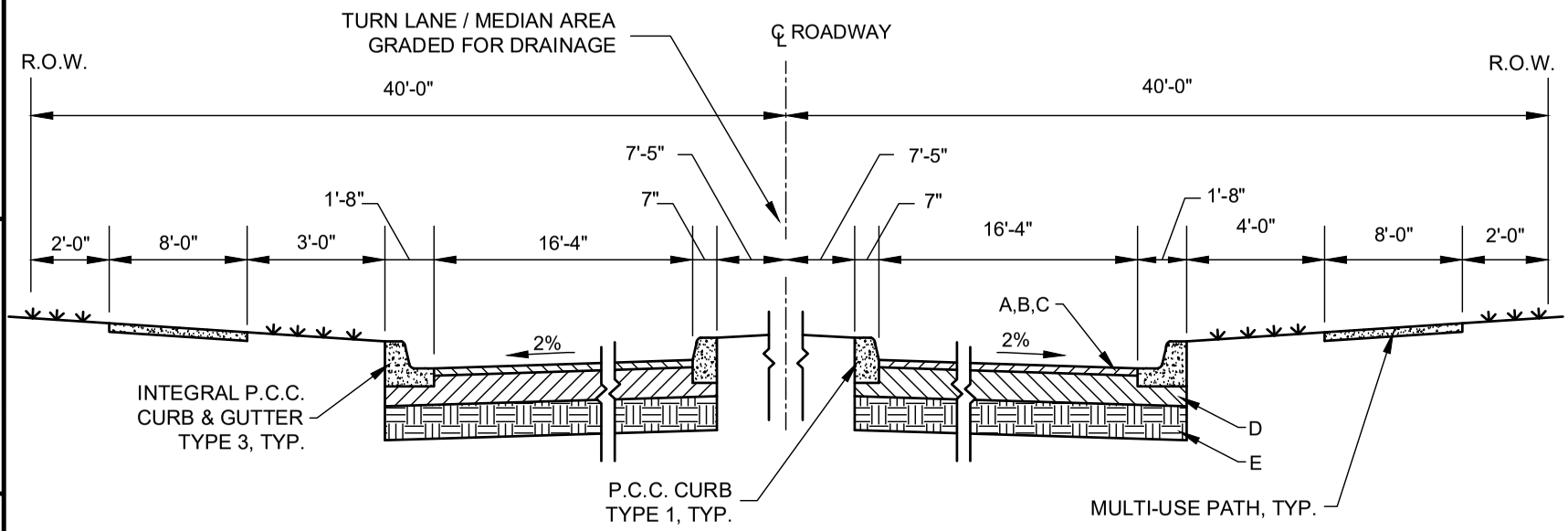
MAJOR STREET TYPICAL SECTION
NO SCALE

SECTION - 9

DRAWING - 2

CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

DATE: JANUARY 2025



NOTES:

1. ↓ ↓ ↓ 6" TOPSOIL SEED AND MULCH.
2. REFER TO SECTION 12 FOR CURB AND SIDEWALK DETAILS AND SPECIFICATIONS.
3. REFER TO SECTION 9 FOR PAVING SECTION DESIGN.
4. NO RESIDENTIAL DRIVEWAY ACCESSES UNLESS APPROVED BY THE TOWN.
5. A 10' WIDE STRIPED TRAVEL LANE TO BE PROVIDED

A - TYPE C HOT MIX ASPHALT SURFACE COURSE

B - TYPE C HOT MIX ASPHALT INTERMEDIATE COURSE

C - TYPE B HOT MIX ASPHALT BASE COURSE

D - GRADED AGGREGATE BASE COURSE (CRUSHER RUN), COMPACTED TO 98% OF ASTM D1557. MODIFIED PROCTOR METHOD AND 8" COMPACTED DEPTH.

E - APPROVED SUBGRADE COMPACTED 95% OF ASTM D1557.

Town of Georgetown DELAWARE

SECTION - 9

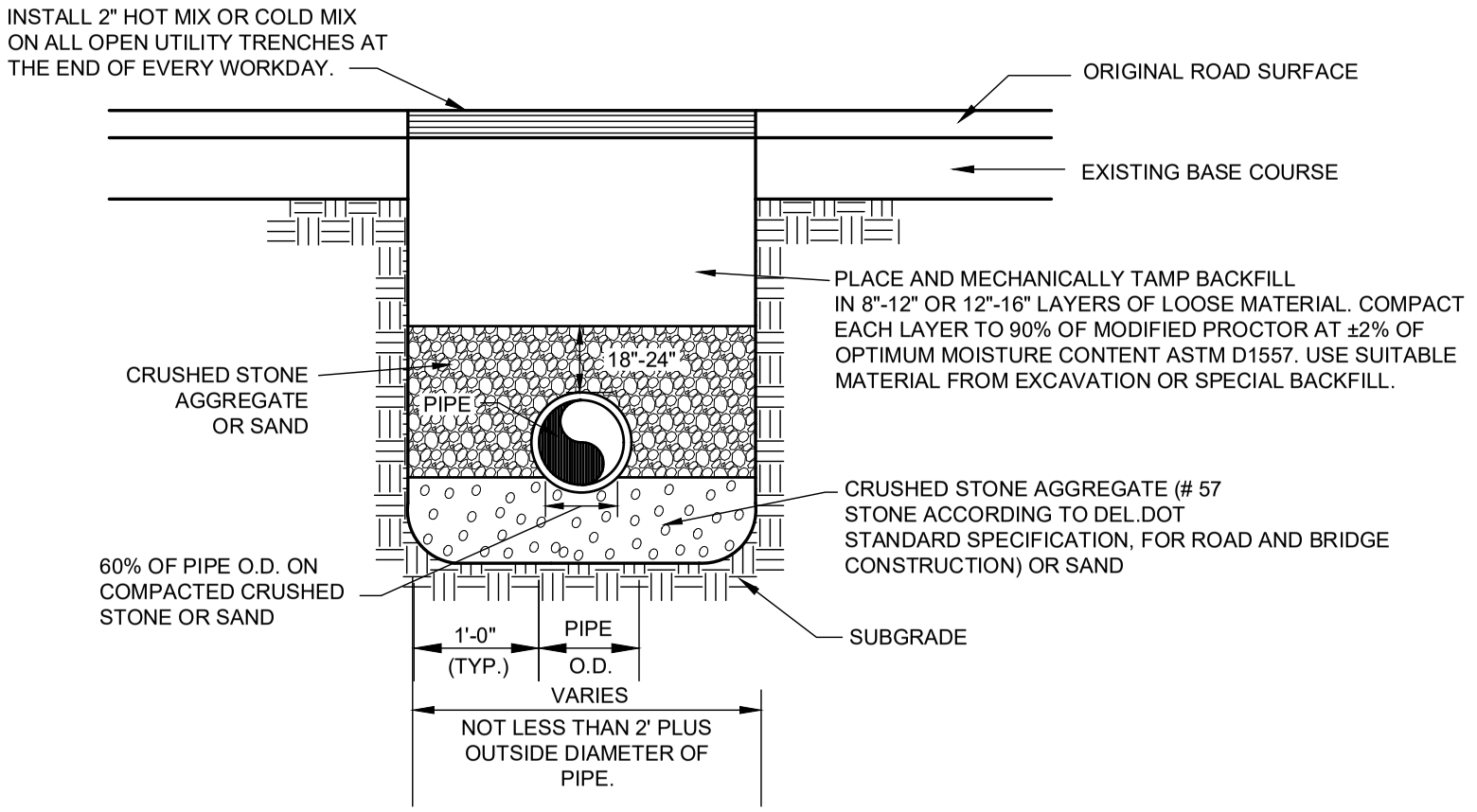
DRAWING - 3

DUAL LANE BOULEVARD TYPICAL SECTION

NO SCALE

CONSTRUCTION STANDARDS
TOWN OF GEORGETOWN

DATE: JANUARY 2025



NOTES:

1. METAL PLATING MAY BE USED AT THE END POINT OF THE LAYING OPERATION WITH PRIOR APPROVAL FROM THE TOWN AND/OR DELDOT. ALL PLATE EDGES SHALL BE "HELD-IN" WITH COLD PATCH.

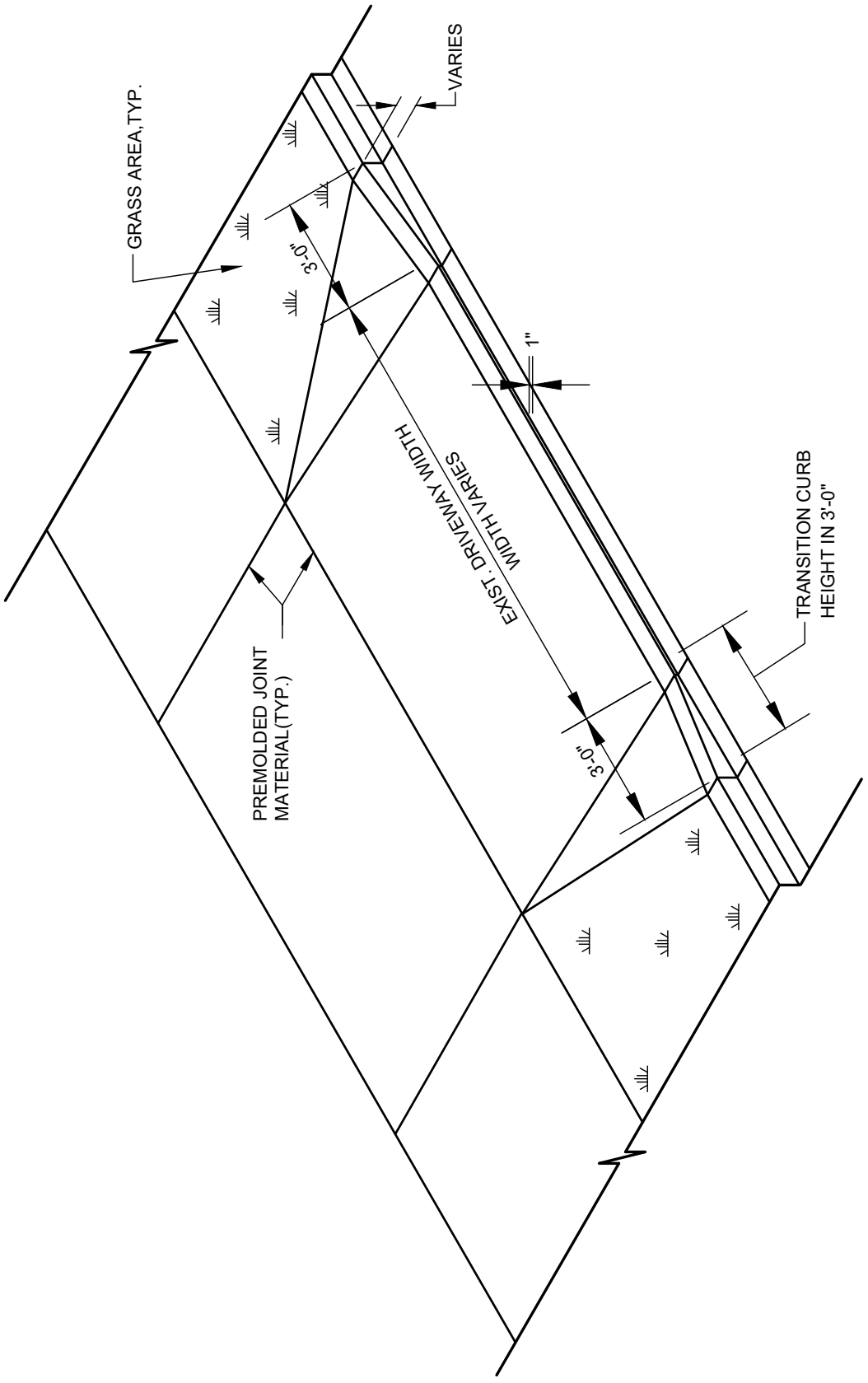
2. TEMPORARY PATCHING SHALL BE REQUIRED FOR WORK PERFORMED ON ALL ROADS WITHIN TOWN OR STATE RIGHTS-OF-WAY.

TEMPORARY CROSS ROAD PATCH DETAIL

NO SCALE

SECTION - 11

DRAWING - 1



NOTE:
1. REFER TO CURRENT DELDOT CURB & GUTTER, AND SIDEWALK DETAILS AND FOR ADDITIONAL REQUIREMENTS.
2. DRIVEWAY APRONS AND SIDEWALK IN TRAFFIC AREAS SHALL BE SIX (6) INCHES THICK AND SHALL BE REINFORCED WITH SIX (6) INCH BY SIX (6) INCH W1.4 BY W1.4 WIRE MESH.

DATE: JANUARY 2025	Town of Georgetown DELAWARE	DRIVEWAY APRON & DEPRESSED CURB DETAIL NO SCALE
CONSTRUCTION STANDARDS TOWN OF GEORGETOWN		SECTION - 12 | DRAWING - 1