



TOWN OF BERLIN, MARYLAND

DESIGN AND CONSTRUCTION STANDARDS FOR
WATER, SEWER, AND ROADWAY SYSTEMS

DBF #0050A002



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PREFACE

The following design standards, specifications and accompanying details are made available to private contractors and developers as standards to be complied with for use on all utility or street construction within the incorporated area of the Town of Berlin. They are binding and must be closely observed. Any exceptions or alterations must be obtained in writing from the Mayor and Council. The Town Engineer shall review exceptions or alterations requested and make recommendations to the Town. These standards apply to all infrastructure to be maintained by the Town.

Developers shall review and execute a Public Works Agreement with the Town of Berlin during the construction drawing review phase. The construction drawings shall include a note stating that all work shall be in accordance with these Town Standards, the Public Works Agreement, and Codes of the Town of Berlin. The developer shall submit a final plat delineating all property lines, right-of-ways, and all easements for review by the Town and Engineer. The plat shall be recorded after obtaining of all permits, execution of the Public Works Agreement, approval of allocation application, Engineer approval of construction drawings, storm water approval, payment of fees, posting bonds, and establishment of escrow account. It is understood that the Developer or Property Owner shall reimburse the Town for all costs incurred for coordination, planning, engineering reviews, legal review, construction phase services, inspection services, and etcetera, as necessary to facilitate the proposed project.

All persons constructing water and sewer services shall comply with the current edition of the Worcester County Plumbing Board "Plumbing Regulations" and obtain all permits required by that agency and all other authorities having any jurisdiction over the work.

GENERAL CONDITIONS

1. DEFINITIONS OF TERMS

- A. Whenever in these documents, the following terms or pronouns in place of them 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 Engineer” and “as required by the Engineer”

“Contractor”

Party responsible for constructing a utility or roadway, acting for the Developer either directly, or through his agents or employees.

“Designer” or “Design Engineer”

Consultant Engineer for the Developer or his duly authorized representative.

“Developer”

Person or persons contracting for work which will be connected to or made part of Town of Berlin utilities or roads system.

“Drawings”

All drawings or reproduction of drawings, pertaining to the work under the contract, which are furnished or approved by the Engineer.

“Engineer” or “Town Engineer”

Consultant Engineer for the Town of Berlin or his duly authorized representative.

“General Conditions”

Provisions that establish and pertain to the legal responsibilities between the parties involved in the work, namely Town and Developer.

“Guarantee Bond”

The form of security to warrant any repairs or expenses incurred by the Town during the warranty period, due to malfunction or failure of the work installed by a developer.

“Payment Bond”

The form of security that guarantees that subcontractors and suppliers will be paid the monies that they are due, in case Developer fails to pay.

“Performance Bond”

The form of security to be approved by the Town of Berlin, furnished by the Developer and his surety.

“Shop Drawings” or “Submittals”

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 illustrated 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.

“Subcontractor”

Any individual, firm or corporation who contracts with the Contractor to perform part or all of the latter’s contract.

“Surety”

The body corporate, approved by the owner, which is bound with and for the Contractor who is primarily liable, and which engages to be responsible for his acceptable performance of the work for which he has contracted.

“Resident Project Representative”

An authorized representative of the Town or Engineer assigned to make any and all necessary observations of the work performed and materials and/or equipment furnished by the Contractor.

“Town Standards”

The Town Standards shall be *Town or Berlin, Maryland Construction Standards and Specifications for Water, Sewer and Streets* (latest edition) and any other applicable Town Codes and Ordinances that are adopted and published by the Town of Berlin.

“Town of Berlin” or “Town”

Town of Berlin, Worcester County, Berlin, Maryland

2. PERMITS, FEES AND NOTICES

- A. The Contractor or Developer shall pay taxes, royalties, and fees, and secure licenses that are required, during the time of contract, by local, county, state and federal laws, ordinances, rules, codes and regulations for the legal performance of the contract. Impact fees or connection fees assessed by the Town shall be paid prior to the start of any construction.
- B. The developer is responsible for all Town costs related to engineering services, studies, reviews or other related expenses; this is inclusive of costs for preliminary engineering through acceptance.

- C. The Contractor shall perform the work in accordance with notices issued by public authorities having jurisdiction over the work.
- D. If the Contractor performs work, knowingly or ignorantly, contrary to requirements of local, county, state and federal laws, ordinances, rules, codes and regulations, he shall assume full responsibility therefore and shall bear all costs of suits, actions and damage resulting from his illegal work performed.

3. INDEMNIFICATION OF THE TOWN

- A. The Contractor and Developer shall indemnify and hold harmless the Town of Berlin and the Engineer, and all who represent them, from and against claims, damage, losses and expenses arising out of the Contractor's performance of the work, provided such claim damage, loss and expense are attributable to:
 - (1) Bodily injury, sickness, disease or death, or to injury to tangible property, including the loss of use resulting therefrom, and
 - (2) Fault or Negligence of the Contractor or his subcontractors and others directly related to the project or both.

4. UNAUTHORIZED WORK

All connections to Town maintained utilities shall be approved by Town or Town Engineer. Work performed without Engineer's approval of lines and grades, work performed beyond the lines and grades shown on the drawings or as given, except as herein provided, and extra work performed without written authority, will be considered as unauthorized and at the expense of the Contractor. Work so performed may be ordered, by the Engineer removed and replaced at the Contractor's expense.

5. COOPERATION OF CONTRACTOR AND REPRESENTATIVE

The Contractor shall give the work his constant attention to facilitate the progress thereof and shall cooperate with the Engineer and Town of Berlin. The Contractor shall have at all times a competent and reliable representative on the work, authorized to receive orders and act for him.

6. LAWS TO BE OBSERVED

The Contractor and Developer 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 shall see that his subcontractors likewise meet this requirement. He shall indemnify, and hold harmless, the Town and his representatives against claims and liabilities arising from Contractor and subcontractor violations of such laws, ordinances, rules, regulations, decrees, and orders, whether such violations be by the Contractor or any Subcontractor, or an of their

agents and/or employees.

7. LINES, GRADES AND ELEVATIONS

- A. The Developer will indicate necessary bench marks and reference points, from which the Contractor shall lay out the lines, grades, and elevations of the work and shall conform its work thereto.
- B. The Contractor shall provide for approval by the Engineer, line and grade stakeout required for proper execution of the work as specified.
- C. The Contractor shall furnish the Engineer, at least five days prior to the start of construction, two record copies of line and grade stakeout data for approval. The furnishing of such record data shall in no way release the Contractor from his responsibility for the completeness and accuracy of stakeout work necessary for construction.
- D. All survey and stakeout work shall be done by qualified personnel subject to the approval of the Engineer.
- E. All proposed sewer cleanouts, hydrants, and water meter assemblies shall be field located by the Contractor prior to the start of construction. Notice shall be given to the Engineer to observe the location and make any adjustments deemed necessary.

8. SANITARY PROVISIONS

The Contractor shall provide and maintain in a neat and sanitary condition such sanitary conveniences and accommodations for the use of his 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.

9. 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 the 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 Engineer.
- B. The Developer and his Contractor shall be responsible for installation of all traffic signage and roadway striping in accordance with MD-SHA or the authority ultimately obtaining jurisdiction over the roadway.

- C. 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 hydrant.
- D. Gutters and storm drain inlets shall be kept unobstructed at all times.

10. BARRICADES, DANGER, WARNING, AND DETOUR SIGNS

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. The Contractor shall detour traffic and shall furnish and maintain all detour signs required to direct traffic over the entire route of the detour.

11. CONTRACTOR'S RESPONSIBILITY FOR WORK

Until the final acceptance of all the work shall be recommended by the Engineer and indicated in writing by the Town, the work shall be under the charge of and care of the Developer/Developer and his Contractor. They 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 maintain, rebuild, repair, restore, and make good, at his own expense, all destruction of, injuries, or damage to the work or any of the above causes before its final completion and acceptance shall be indicated in writing by the Engineer.

12. CONTRACTOR'S SUBMITTALS

- A. Contractor shall submit shop drawings, material certifications, samples and test reports to the Developer's Designer, Town, and Town Engineer for review and comment for all fabricated items and construction materials required for the work, unless otherwise directed by the Engineer. Furnish six (6) copies of each submittal for the Engineer's approval. Electronic submittals shall be an acceptable alternate. Comments or approvals must be received from the Developer's Designer prior to approval by the Engineer. The Contractor shall not order materials until receiving submittal approval.
- B. At completion of the project, before it is turned over the Town, and prior to testing, Contractor shall provide four sets of operation and maintenance manuals of all equipment incorporated into the work. He shall provide spare parts, and test procedures in printed form to cover the scope of the project.
- C. Contractor and manufacturers' representatives of all equipment utilized in the work shall meet at the project to assure proper start-up.

13. TEST OF SAMPLES OF MATERIALS

Tests of materials shall be made at the Developer's or 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 their expense. The Contractor shall cooperate with and assist the Town in taking samples and packing them for shipment to a laboratory.

14. 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.
- B. Representative preliminary samples of materials may be requested by the Engineer for examination or testing, or both. Materials may be further inspected by the Engineer during preparation and construction of the work; and materials found to be substandard will be rejected.
- C. Contractor shall submit to Engineer samples of alternate materials that require laboratory testing. Such materials shall not be incorporated into the work until Engineer states, in writing, that materials meet requirements of the specifications.

15. AUTHORITY OF ENGINEER

The Engineer shall, in all cases, determine the amount or quantity, quality and acceptability of the work and materials. He shall decide on all questions in relation to said work and the performance thereof.

16. AUTHORITY AND DUTIES OF RESIDENT PROJECT REPRESENTATIVE

Resident Project Representative (R.P.R.'s) employed by the Town or Engineer shall be authorized to observe all work done and materials furnished. Such observation may extend to all or any part of the work and to the preparation or manufacture of the materials to be used. An R.P.R. may be stationed on the work to report to the Engineer as to the progress of the work and the manner in which it is being performed; also to report whenever it appears that the materials furnished and work performed by the Contractor fail to fulfill the requirements of the Town Standards or approved plans. No inspection, or any failure to inspect, at any time or place, however, shall relieve the Contractor from his obligation to perform all the work strictly in accordance with the requirements of the specifications. The R.P.R. shall perform such other duties as are assigned to him by the Town Engineer. He shall not be authorized to revoke, alter, enlarge, relax or release any requirements of these specifications, nor to approve or accept any portion of work, nor to issue instruction contrary to the Town Standards, drawings or specifications. The R.P.R. shall in no case act as foreman or perform other duties for the Contractor, nor interfere with the management of the work by the latter.

17. INSPECTION OF MATERIALS AND WORK

The Contractor shall furnish the Town and Engineer with every reasonable facility for ascertaining whether or not the work as performed is in accordance with the requirements and intent of the specifications and contract. If the Town or Engineer requests it, the Contractor, shall remove and/or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined proved unacceptable, the removing, replacing and/or making good the parts removed shall be the Contractor's expense.

18. DEFECTIVE MATERIALS AND WORK

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 own expense.

19. FAILURE TO REMOVE AND RENEW DEFECTIVE MATERIALS AND WORK

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 Engineer 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 Developer's expense. Expenses incurred by the Town in making these removals, renewals, or repairs, which the Contractor has failed or refused to make, shall be paid by the Developer or may be charged against the "Performance Bond" or other deposit.

20. RESTORATION OF EXISTING FEATURES

The Developer or his contractor shall be responsible for restoration of any damage to any existing natural or man-made features to pre-construction conditions. This includes asphalt, curb and gutter, sidewalk or grassed areas and any features thereon, whether public or private.

21. CLEAN-UP

- A. The Contractor shall, at his own expense, keep the sites of his operations clean during construction and remove all rubbish as it accumulates.
- B. Upon failure of the Contractor to keep the sites of his 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 charging the costs thereof to the Developer.

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

22. TEMPORARY SUSPENSION OF WORK

The Engineer shall have the authority to suspend the work, wholly or in part, for such period or periods as he may deem necessary, due to unsuitable weather, or other such 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 documents. 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 impeded the traveling public unnecessarily nor become damaged in any way, and he shall take every precaution to prevent destruction, damage or deterioration of the work performed, provide suitable drainage by opening ditched, shoulder drains, etc., and erect temporary structures where necessary. The Contractor shall not suspend the work without authorization. Neither the failure of the Engineer to notify the Contractor to suspend the work on account of bad weather or other unfavorable conditions, nor permission by the Engineer 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.

23. GUARANTEE

Guarantee Bond shall be of 10% of the total cost of construction, unless otherwise noted by Public Works Agreement. The Developer hereby guarantees all of the work for a minimum period of two (2) years after the date of completion and final acceptance thereof by the Town as follows:

- A. Against all faulty materials and against all imperfect, careless, and unskilled workmanship.
- B. 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 contract documents.
- C. That all structures shall be watertight and leak proof at every point and in every particular.
- D. The Developer 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, or fails to perform as specified, or all of these.

- E. No use or acceptance by the Town of Berlin 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 Developer's failure to comply with his obligations, shall impair in any way the guarantee obligations assumed by the Developer under these documents.
- F. It is understood and agreed that in the event the Developer fails to correct, or repair any work under the contract which may be found to be improper or imperfect, or otherwise fails to fulfill the terms of the Guarantee, the Town may purchase materials, tools, and equipment, and employ labor, or let a contract as required to perform the necessary corrective work by the Town shall be charged against the Guarantee Bond.

24. COOPERATION WITH OTHER CONTRACTORS

- A. The Contractor and Developer shall cooperate with and so conduct his operations as not to interfere with or injure the work of other contractors or workmen employed by the Town. He shall promptly make good, at his own expense, any injury or damage which may be done by him or his 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 Engineer when necessary to facilitate the work of such other contractors or workmen.

25. AS-BUILT PLANS

Upon completion of installation of all water, sewer and stormwater management facilities and prior to any paving, the Developer shall deliver to the Town for review (3) printed sets of as-built drawings and a copy in AutoCAD (2000 or later) on CD, showing all actual construction. Water, Sewer, Stormwater and electrical utilities shall be shown with stations and measured locations to all manholes, cleanouts, laterals, meters, service connections, electric meters/boxes, and all stormwater management facilities including structures, outfalls, etc. As-builts for stormwater management ponds and other excavated stormwater facilities shall be submitted to Town following construction, prior to restoration, for Town and Town Engineer review.

Prior to initiation of paving operations, as-built drawings shall be submitted for review. All as-built drawings shall be reviewed, signed and sealed by a Licensed Surveyor or a Professional Engineer. If discrepancies exist between the approved design and as-builts, the Developer's designer shall certify in written that the constructed sewage or stormwater management system will operate as designed. Prior to proceeding with paving, Developer must have written authorization from Town.

The Town will not grant Certificates of Occupancy until the As-Built Plans have been received and reviewed by the Town and Town's Engineer.

26. WORK IN MARYLAND HIGHWAY RIGHT-OF-WAY

The Developer and his Contractor shall construct all work in Maryland Department of Transportation right-of-way within permit requirements issued by that agency to the Town of Berlin. The Developer shall supply all information requested by the Town to make application on his behalf.

27. PROJECT ADMINISTRATION AND INSPECTION BY THE TOWN / ENGINEER

The Town of Berlin shall, based on size and scope of a project, require administration and inspection by a Town agent on construction activities. Project administration may include (but is not limited to) planning assistance, coordination meetings, infrastructure/utility evaluations, design correspondence, plan & plat reviews, meetings, testing coordination, construction administration, inspection, as-built reviews, and project closeout. Inspection may include the following.

- A. Supplemental Public Works Department inspection.
- B. Part time inspection by RPR.
- C. Full time inspection by RPR.

The Developer shall pay all costs for project planning, permitting, review, construction administration and inspection services and shall create an escrow account with the Town to cover these costs, prior to the start of any plan reviews or Town permitting. The amount of the escrow account shall be set at 10% of the anticipated value of work that effects the Town's infrastructure, existing or future. This value shall be estimated by the Developer's designer/contractor, and reviewed and approved by the Town. The Developer is responsible for paying all administration and inspection costs which may be required during the course of planning, design and construction, for engineering or legal consulting costs, as determined by the Town.

28. FINAL PAVING

Final surface course of pavement in a new development shall be installed within 6 months of issuance of the first occupancy permit in the development in accordance with Town of Berlin Zoning Code.

29. DESIGN PARAMETERS

Section 1 of these standards provides requirements for design of water, sewer, and road systems. These provisions shall not preclude requirements of the State of Maryland Department of Environment, Maryland Department of Natural Resources, the Maryland Department of Transportation, Worcester County Development Review and Permitting,

Worcester County Fire Marshal, Worcester County Forest Conservation, Worcester County Soil Conservation District, and Worcester County Plumbing Standards. The Developer's Engineer shall conform to the more stringent requirements. He shall also obtain any other permits required by the State, County or local authorities having jurisdiction.

30. APPROVAL/CERTIFICATION BLOCKS

These are the minimum requirements of the approval/certification blocks:

- A. A block for the signature and date of the Town Engineer, stating that the plans have been reviewed for general conformance with the latest edition of the Town Standards and that the review shall not relieve the contractor from his obligation to perform all work in accordance with all standards and requirements of the authorities having jurisdiction over the work.
- B. A block for the signature and date of the Property Owner/Developer, stating that to the best of their knowledge the plans have been developed in general conformance with all applicable agreements, laws and regulations of the agencies having jurisdiction over the work and specifically with the Town Standards, Town Code and the executed Public Works Agreement.
- C. A block for signature and date of the Design Engineer certifying that they are a registered engineer in the state of Maryland and that the information shown on drawings has been prepared under their supervision and to the best of their knowledge and belief represents good engineering practices as required by the **latest edition of the Town Standards and all** applicable laws of the State of Maryland. Certification shall provide the license number and expiration date of the registration.

END OF SECTION

SECTION 1 – DESIGN PARAMETERS

DESIGN PARAMETERS FOR WATER DISTRIBUTION SYSTEMS

1.01 GENERAL

- A. Where existing primary mains are to be extended for a residential or commercial development, the Developer is responsible for tapping or connecting existing mains for extension purposes. Developer shall hire a contractor approved by the Town of Berlin and pay all costs with the extension. The Developer is also responsible for installation of all service lines within the development inclusive of curb stops and meter assemblies.
- B. Where a primary Town owned water main exists and new services from it are required for service to structures, the Town of Berlin or a contractor hired by the Town shall install service lines, corporation stops and meter assemblies to the property line. Developers or their Contractor shall make no taps to existing mains, unless approved by Town and under supervision of Town personnel. Costs for permits and installation of service by Town will be as per ordinance.

1.02 PROJECT DRAWINGS

The developer and his engineer are responsible for preparation of detailed drawings. These drawings must be approved by the Town Engineer.

A. TITLE SHEET

- 1. Title of Project and Address.
- 2. Phase of Project, if necessary.
- 3. Developers' Name and Address.
- 4. Design Engineers Name and Address.
- 5. Drawing Index.
- 6. Approval Block for Town Engineer's signature and date.
- 7. Vicinity Map showing location of Project within the Town. Typical scale shall be one inch equals 1000 feet.
- 8. Location Map if Drawings are for one phase of the Development.
- 9. Design Engineer's Seal and Signature.
- 10. Design Engineer's certification of supervision and professional registration.
- 11. Certification by the Property Owner/Developer approving the Drawings.
- 12. Certification by a Professional Wetlands Scientist for Wetland Determination if hydric soils are present.

B. HORIZONTAL PLAN (WATER MAINS)

- 1. 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.
- 2. North Arrow shall be shown.

3. The existing and proposed legend.
4. All necessity utility notes.
5. Location, elevation, and description of all the Project Bench Marks.
6. Location and sizes of all proposed water lines with stations.
7. Locations of proposed valves, fittings, and fire hydrants.
8. Property lines and ownership, with details of easements where required.
9. Location of all proposed structures and buildings.
10. Beginning and end of proposed construction.
11. Location of proposed service lines.
12. Locations of all other drainage facilities and public utilities.
13. Locations of all existing water mains, valves, hydrants, services, etc.
14. Provide profiles for all utility crossing.

C. DETAILS (WATER MAINS)

Standard Construction Details as shown in the Standard Detail Section of this Booklet shall be included on the drawings where applicable.

1.03 DESIGN CAPACITY

- A. 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.
7. Hydrant test or hydraulic field conditions determined by the developer.

B. WATER SERVICE LINES

Individual water service

s shall be installed to each unit in a residential or commercial subdivision including separate corporation stop, service line, meter assembly, etc. Town maintained water service valves and meters shall be accessible from outside the building. Residential buildings with two or more stories and more than eight (8) units per story may utilize a single meter if a single owner or condominium association is responsible for payment of water and sewer services. All meters shall be appropriately sized in accordance with the manufacturer's recommendations. Should the building ownership or usage change, the Town reserves the right to require alterations to bring the utility service into accordance with Town Standards. Each unit of a non-residential facility shall have a separate meter, unless otherwise approved in writing by the Town. Gang meter pits are acceptable. Facilities considered to be institutional (i.e. hospitals, schools, prisons) shall be permitted to utilize a single meter. Multi-unit facilities shall be

charged minimum monthly fees per unit served. Service lines sizes shall be designed by the developer for the use intended.

1.04 DESIGN SIZE

A. PRESSURE

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 20 psi at the discharge elevation of the closest hydrant at all points in the distribution system under all conditions of flow. The minimum fire flow required by the Town for new development in residential areas shall be 1,000 gallons per minute. The Town Engineer shall verify this flow by system modeling. Developers shall bear all cost to the analysis plus all improvements to existing distribution, storage, etc. as required to comply with Town requirements for capacity, flow, and pressure. The normal working pressures in the distribution system are in the range of 45 to 55 psi.

B. DIAMETER

The minimum size of water main for providing fire protection shall be 8-inch diameter. Circulation loops shall be a minimum of 6-inch diameter. Larger mains will be required if necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure.

C. SMALL MAINS

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

1.05 DEPTH OF WATER MAINS

Minimum depth of water mains shall be 3'-6" as measured from the top of the pipe to finished grade.

1.06 VALVES

Sufficient valves shall be provided on the water mains for isolation during repairs. Valves should be located at not more than 500 foot intervals in commercial districts and at not more than one block or 800 foot intervals in other districts. Also, valves shall be placed at all main branch connections.

1.07 FIRE HYDRANTS

Location and spacing of hydrants should generally be provided at each street intersection and at intermediate points between intersections as required. Generally, hydrant spacing may range from 400 to 600 feet depending on the area being served. Fire hydrants shall

be installed a minimum of 7 feet and a maximum of 10 feet from the curb unless authorized in writing by the Town. If a swale is present along the street the hydrant shall be in front of the swale, unless this places the hydrant within 10 feet of a travel lane, in which case the hydrant locations shall be determined based on a site specific analysis by the Town, Town Engineer, and Berlin Volunteer Fire Department. Hydrants shall not be installed outside of the public right-of-way or utility easement, unless authorized by the Town and property owner.

1.08 SERVICE METERS

Each service connection, except fire service shall be individually metered. Fire services shall be installed with a detector check meter system. All costs and fees associated with purchasing and installing any meter shall be reimbursed by the developer or the property owner, including an installation and administration fee in the amount of 10% of the material costs for the meter and appurtenances supplied and installed by the Town.

1.09 DEAD ENDS

Dead ends mains are not acceptable. If permitted due to extreme conditions, hydrants shall be placed at the end of all dead end lines. Blow-offs shall not be substituted for hydrants.

1.10 SEPARATION OF WATER MAINS AND OTHER UTILITIES

A. HORIZONTAL SEPARATION

Water mains shall be laid at least 10 feet horizontally from existing or proposed gravity sanitary sewer and forcemains. Water service laterals and sewer laterals shall be separated a minimum of ten (10) feet horizontally regardless of depth, unless otherwise approved. Water mains shall be laid at least 5 feet horizontally from existing or proposed storm drains or gas mains.

B. VERTICAL SEPARATION

1. Water mains crossing sewers shall be laid to provide a minimum vertical distance of eighteen (18) inches between the outside of the water main and the outside of a sewer, force main or gas main. Water utility shall be installed above sewer utility where possible. At crossings one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes or forcemain may be required.
2. Water mains crossing storm drain and all other utilities shall be laid to provide a minimum vertical separation of twelve (12) inches between the outside of the water main and the outside of a stormdrain or other utilities. At crossings one full length of water pipe shall be located so both joints will be as far from the utility as possible.

C. SEWER MANHOLES

No water pipe shall pass through or come within five (5) feet any part of a sewer manhole.

D. SPECIAL CONDITIONS

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, concrete encasement shall be required to be installed a minimum of five (5) feet each side of the crossing point on the lowest utility.

1.11 FIRE SERVICE AND SPRINKLER SYSTEMS

A. GENERAL REQUIREMENTS

All residential dwellings shall have sprinkler systems as required by the current building codes. The design, permitting, construction, inspection, testing, and approval of fire services and sprinkler systems shall be the responsibility of the certified fire protection engineer engaged by the property owner or design engineer. The property owner or design engineer shall be responsible for obtaining approval from all agencies having jurisdiction over the work, including the Town of Berlin and Worcester County Fire Marshal's Office, as required by law.

B. RESIDENTIAL FIRE SERVICE

The certified fire protection engineer shall submit, at a minimum, a plan of the proposed connection to the Town's water system, meter vault location, and service entrance to dwelling. Sketch shall denote all equipment materials, types, sizes, and proposed manufacturers, including methods for isolation and backflow prevention. Certified fire protection engineer shall also submit a floorplan and report showing the adequacy of the designed system for the dwelling. Report shall be signed and sealed by the certified fire protection engineer. All connections to the Town water system shall be made by a Maryland Licensed Plumber.

C. COMMERCIAL FIRE SERVICE

Commercial fire service connections shall follow Section 1A – Design Parameters for Water Distribution Systems and shall include detailed drawings. Where required, all designs shall incorporate proper potable water service materials, isolation valves, and backflow prevention devices. Certified fire protection engineer shall also submit a floorplan and report showing the adequacy of the designed system for the dwelling. Report shall be signed and sealed by the certified fire protection engineer. During construction material submittals and Town inspection will be necessary. The Town shall be notified a minimum of 30 days in advance of the start of work.

DESIGN PARAMETERS FOR SANITARY SEWERS

1.12 GENERAL

- A. Where existing sewer mains are to be extended for a residential or commercial development, the developer is responsible for connections to existing sewers or manholes and extensions as required. Developers shall hire a contractor approved by the Town of Berlin and pay all costs associated with the extension. The developer shall install sewer laterals with cleanouts to each lot in the pipe laying process.
- B. Where a Town owned sewer main exists and new laterals from it are required for service to structures, the Town of Berlin or a contractor hired by the Town shall install laterals and cleanouts to the property line. Developers or their contractor shall make no lateral connections to existing mains. Costs for permits and installation of service by Town will be as per ordinance.
- C. Laterals shall be constructed in accordance with Worcester County Plumbing Standards. The building drain should connect to the sewer lateral at a location not more than 3 feet outside of the building foundation. The building drain would be permitted to penetrate the foundation above the top of footing. From a point beginning 3 feet beyond the building foundation to the property line cleanout, maintain a minimum of 18-inch cover. Should the street sewer depth or existing cleanout depth not allow 18-inch minimum cover, an exception would be considered, or fill would be required in the affected area. Lateral extensions from the cleanout to the house shall conform with County Plumbing Regulations with respect to grade and intermediate cleanout requirements. Connections to existing cleanout stacks will be reviewed by the Town and Town Engineer upon written request by Property Owner. All laterals shall be installed perpendicular to the receiving gravity sewer to each property.

1.13 PROJECT DRAWINGS

- A. TITLE SHEET
 - 1. Title of Project and Address.
 - 2. Phase of Project, if necessary.
 - 3. Developers' Name and Address.
 - 4. Design Engineers Name and Address.
 - 5. Drawing Index.
 - 6. Approval Block for Town Engineers' signature and date.
 - 7. Vicinity Map showing location of Project within the Town of Berlin. Typical scale shall be one inch equals 1000 feet.
 - 8. Location Map if Drawings are for one phase of the Development.
 - 9. Design Engineers Seal and Signature.
 - 10. Design Engineer's Certification of supervision and professional registration.
 - 11. Certification by the Owner/Developer approving the Drawings.

12. Design calculations and daily flows with total number of units, lots and etc.
13. Certification by a Professional Wetlands Scientist for wetlands determination if hydric soils are present.

B. HORIZONTAL PLAN (SANITARY SEWER)

1. The scale shall be one inch equals 50 feet for large Projects.
2. North Arrow shall be shown.
3. The existing and proposed legend.
4. All necessity utility notes.
5. Location, elevation, and description of all the Project Bench marks.
6. Location, sizes, type and slope of all sanitary sewer lines with stations corresponding to the profiles.
7. Locations of all manholes with grades between any elevation of flow line, and all invert elevations.
8. Property lines and ownership, with details of easements where required.
9. Location of all proposed structures and buildings with unit numbers.
10. Beginning and end of proposed construction.
11. Location of proposed laterals, wyes, etc.
12. Locations of all other drainage facilities and public utilities.
13. Proposed manhole numbers and cleanouts and proposed lot numbers.
14. All existing sanitary sewer facilities (i.e. manholes and pipelines) shall be shown and labeled.

C. PROFILES (SANITARY SEWERS)

1. The horizontal scale shall be identical to the Horizontal Plan and vertically, 1 inch equals 2 feet for small projects and up to 1 inch equals 5 feet for large projects.
2. Profile of existing and proposed ground surface.
3. Profile of sanitary sewer showing, type and size of pipe, slope, manholes, and concrete encasement (if any). Designate manhole diameters if other than 48 inches.
4. Location of all other drainage facilities and public utilities crossing sanitary sewer lines.

D. DETAILS (SANITARY SEWERS)

Standard construction details as shown in the Standard Detail Section of this Booklet shall be included on the construction drawings where applicable. Details for construction other than the Standard Details shall also be shown on the project drawings.

1.14 DESIGN CAPACITY

- A. 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.

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

1.15 DESIGN FLOW

A. PER CAPITA FLOW

The sanitary sewer system shall be designed on the basis of an average daily flow of sewer of 250 gallons per day equivalent dwelling unit.

B. PEAK DESIGN FLOW

Sanitary sewers shall be designed on a peak flow basis using a peak design flow of 4 times the average daily flow.

1.16 MINIMUM SIZE

A. SANITARY SEWER MAINS

The required size of sanitary sewer mains will vary with the character and size of the Development. The minimum size for sanitary sewer main is eight (8) inches.

B. LATERAL CONNECTIONS

House cleanouts are required for use with all laterals unless a written waiver is received from the Town Engineer.

Each individual dwelling unit a 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, with minimum slope of 1%.

1.17 DEPTH OF SEWER

Minimum depth of sewer mains shall be three (3) feet as measured from the top of the pipe to finished grade. Any piping not meeting the required minimum depth shall be concrete encased.

1.18 SEPARATION OF SANITARY SEWERS

A. VERTICAL SEPARATION

1. Sewer crossing watermain shall be laid to provide a minimum vertical distance of eighteen (18) inches between the outside of the water main and the outside of a sewer or forcemain. Water utility shall be installed above sewer utility where possible. At crossings one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes or forcemain may be required.
2. Sewer crossing storm drain and all other utilities shall be laid to provide a minimum vertical separation of twelve (12) inches between the outside of the sewer and the outside of a stormdrain or other utilities. At crossings one full length of sewer pipe shall be located so both joints will be as far from the utility as possible.
3. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, concrete encasement shall be required to be installed a minimum of five (5) feet each side of the crossing point on the lowest utility.

1.19 SLOPES

All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second, based on Mannings formula. If possible, pipe slopes should be increased above minimum slope in locations where pipes will carry functional flow.

Using an “n” value of 0.012 for P.V.C., the following are the minimum slopes which are allowed.

Sewer (inches)	Size	Minimum Slope (ft. per 1,000 ft.)
8		0.30
10		0.22
12		0.18
15		0.14
18		0.11
24		0.08

Using an “n” value of 0.013 for Ductile Iron Pipe, the following are the minimum slopes which are allowed.

Sewer (inches)	Size	Minimum Slope (ft. per 1,000 ft.)
8		0.40
10		0.28
12		0.22
15		0.15
18		0.12
24		0.08

1.20 MANHOLES

A. 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.

B. CLEANOUTS

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

C. DROPS

A drop pipe should be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the flow channel should be filleted to prevent solids deposition.

D. MINIMUM DIAMETER

The minimum diameter of manholes shall be 48 inches. Larger diameters are required for inside drop connections in new construction. A minimum access diameter of 24 inches shall be provided.

E. FLOW CHANNELS

The flow pipe channel through manholes should be made to conform in shape and slope to that of the sewers. The top of the brick 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 the influent pipe to the effluent pipe. Precast flow channel shall be accepted as an alternate to brick and mortar channel. No onsite alterations shall be accepted in precast structures.

1.21 GREASE TRAPS

- A. 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 required by the facility's function, as determined by the Town. Maintenance is the responsibility of the property owner. The property owner shall submit to the Town an annual maintenance plan and contract with a local hauler defining these responsibilities for inspection and pump-out as required. Maintenance records shall be made available to the Town

on a quarterly basis. If property usage changes or ownership changes hands, Town may require a study to determine the grease trap requirements. Inside grease trap interceptor devices shall not be acceptable.

B. Capacity of grease traps shall be determined based on the specific application.

The following formula shall apply:

1. RESTAURANTS

$$(D) \times (GL) \times (ST) \times \frac{(HR)}{4} \times (LF) = \text{Size of dual compartment tank, gallons}^a$$

Where:

- D = Number of seats in dining area
- GL = Gallons of wastewater per meal, normally 5 gal
- ST = Storage capacity factor - minimum of 1.7
- HR = Number of hours open
- LF = Loading factor -
 - 1.0 major highway
 - 1.0 recreational areas
 - 0.8 main highways
 - 0.5 Town center

2. HOSPITALS, NURSING HOMES, OTHER TYPE COMMERCIAL KITCHENS WITH VARIED SEATING CAPACITY:

$$(M) \times (GL) \times (ST) \times (2.5) \times (LF) = \text{Size of dual compartment tank, gallons}^a$$

Where:

- M = Meals per day
- GL = Gallons of wastewater per meal, normally 4.5
- ST = Storage capacity factor - minimum of 1.7
- LF = Loading factor -
 - 1.25 garbage disposal & dishwashing
 - 1.0 without garbage disposal
 - 0.75 without dishwashing
 - 0.5 without dishwashing & garbage disposal

^a Minimum size dual compartment grease tank should be 1000 gal.

Thus, for a restaurant with a 75-seat dining area, an 8 hour per day operation, a typical discharge of 5 gal. per meal, a storage capacity factor of 1.7 and a loading factor of 0.8, the size of the grease interceptor is calculated as follows:

$$(75) \times (5) \times (1.7) \times \frac{(8)}{(4)} \times (0.8) = 1,020 \text{ gal.}$$

Other design considerations include: facilities for insuring that both the inlet and outlet are properly baffled; easy manhole access for cleaning; and inaccessibility of the trap to insects and vermin.

DESIGN PARAMETERS FOR SEWAGE PUMPING STATIONS AND FORCE MAINS

1.22 PROJECT DRAWINGS

A. TITLE SHEET

1. Title of Project and Address.
2. Phase of Project, if necessary.
3. Developers' Name and Address.
4. Design Engineers Name and Address.
5. Drawing Index.
6. Approval Block for Town Engineers signature and date.
7. Vicinity Map showing location of Project within the Town of Berlin. Typical scale shall be one inch equals 1000 feet.
8. Location Map if Drawings are for one phase of the Development.
9. Design Engineer's Seal and Signature.
10. Design Engineer's Certification of supervision and professional registration.
11. Certification by the Owner/Developer approving the Drawings.
12. Certification by a Professional Wetland Scientist for wetland determination if hydric soils are present.

B. SITE PLAN (PUMPING STATIONS)

1. The scale shall be a maximum 1 inch equals 20 feet. Deviation from this scale shall be approved by the Town engineer prior to preparation of the drawings.
2. North Arrow shall be shown.
3. The existing and proposed legend.
4. All necessity utility notes.
5. Location, elevation, and description of all the Project Bench Marks. (Use U.S.G.S. mean sea level as Datum)
6. Location and sizes of all sanitary sewer lines and force mains with stations corresponding to the profiles.
7. Locations and numbers of all manholes with elevations of inverts and rims.
8. Metes and bounds for property lines which ownership is to be deed to the Town with details of any easements where required.
9. Location of all proposed structures and buildings for example the equipment cabinet, transformers, generator, etc.
10. Beginning and end of proposed construction.
11. Location of all other drainage facilities and public utilities.
12. Existing and proposed contours and any related landscaping.
13. All existing sanitary sewer facilities (i.e. manholes and pipelines) shall be shown.
14. Pump and system curves showing the system's flow and total dynamic head for both proposed and future demands.
15. The transfer of ownership for the lands where the pump station is

constructed shall be made to the Town prior to the Beneficial Occupancy acceptance by the Town of the project where such station is to be owned and operated by the Town. The developer shall furnish a 2 year warranty and pay all maintenance fees for the station for the warranty period as assessed by the Town or required by the Public Works Agreement. Maintenance fees paid by the developer shall exclude electricity. The developer shall post a bond or letter of credit with the Town in the amount of 100% of the station construction cost as security for Town incurred costs during the warranty period.

C. HORIZONTAL PLAN (FORCE MAIN)

1. The scale shall be a maximum of 1 inch equals 50 feet. Deviation from this scale shall be approved by the Town Engineer prior to preparation of the drawings.
2. North Arrow shall be shown.
3. The existing and proposed legend.
4. All necessity utility notes.
5. Location, elevation, and description of all the Project Bench marks. (Use U.S.G.S. mean sea level as Datum)
6. Location and sizes of all sanitary sewer lines and force mains with stations corresponding to the profiles.
7. Locations and numbers of all manholes with elevations of inverts and the top of each manhole.
8. Property lines and ownership, with details of easement where required.
9. Location of all proposed structures and buildings, for example the equipment cabinet, transformers, generator, etc.
10. Beginning and end of proposed construction.
11. Location of all other drainage facilities and public utilities.
12. Existing and proposed contours and any related landscaping.
13. All existing sanitary sewer facilities (i.e. manholes and pipelines) shall be shown.
14. Location of proposed force main discharge manholes and air release valves where applicable.
15. Location of bends, buttresses, and encasements.

D. PROFILES (FORCE MAINS)

1. The horizontal scale shall be identical to the force main plan. Vertical scales shall be 1/10 of the horizontal scale and shall equal 5 feet of large projects.
2. Profiles of existing and proposed ground surface over the centerline of the pipe with elevations at the top of manholes and air release vaults and at the flow line.
3. Profiles of force main showing pipe size, slope, manholes, air release vaults, bends, and any necessary concrete encasements.
4. Minimum force main cover shall be 3'-6" measured from the top of pipe to proposed grade.

5. Location of all other drainage facilities and public utilities crossing the force main.

E. DETAILS (PUMP STATIONS AND FORCE MAINS)

1. Standard Construction Details are shown in the Standard Details Section of this Booklet. They shall be included on the drawings where applicable.
2. Dimensional detail of air release valve and manhole as appropriate to size of equipment, depth of force main and location.

1.23 DESIGN CAPACITY

In determining the required size and capacity of the pumping station and force mains the following factors should be considered.

- A. Maximum hourly, average, and peak daily domestic sewage flows.
- B. Topography of area.
- C. At no place on the pump curve should the horsepower rating of the pump motor be exceeded.
- D. The volume of the wet well between the start elevation and the stop elevation of a single pumping cycle.
- E. The calculations for design of the pump station shall accompany the Project's Drawings, when submitted to the Town Engineer for review.

1. PER CAPITA FLOW (Qa)

$$Qa \text{ (GPM)} = \text{EDU's} \times 250 \text{ GPD}$$

2. PEAK DESIGN FLOW (Qp)

$$Qp \text{ (GPM)} = \frac{Qa \times 4}{1440}$$

3. WET WELL VOLUME (Vmin)

$$Vmin = \frac{t \times Qp}{4}$$

Vmin = Minimum volume between lead pump "on" and "off"
t = Pumping Cycle (minimum 7 minutes)

- F. An Electrical Service Load Form shall be submitted to the Town Electrical Department for each pump station for review during design.

1.24 FORCEMAINS

- A. Force mains shall be sized for a minimum flow velocity of 2.5 feet per second and a maximum of 8.0 feet per second. Calculations shall use the internal diameter of the product specified, rounded to the nearest 0.1". All force mains, not for the sole use of grinder stations, shall have a minimum diameter of 4".
- B. Designer shall use Hazen-Williams equation and shall plot system curves for new pipe, using C=140 for PE or PVC pipe or C=130 for ductile iron pipe, and minimum static head condition. Secondly, plot for old pipe, using C=120 for PE or PVC pipe or C=100 for ductile iron pipe, and the maximum static head condition.
- C. Construction materials must be approved in writing by the Town of Berlin or the Town's Engineer.
- D. Force mains shall be designed to prevent unnecessary high points. Air release valves shall be utilized at all high points and as required for long flat sections. Depth of forcemain at high points with the air release valve installed shall be sufficient to accommodate the equipment with top of manhole flush with grade in pavement, shoulders or traffic ways.
- E. Force mains may be designed using HDPE for directional bores or entire force main if approved for specific project.

1.25 PUMP STATIONS - GENERAL

- A. Minimum Flood Elevation - Sewage pump station structures and electrical and mechanical equipment shall be protected from physical damage by placing the top slab a minimum of 1' above the 100 year flood elevation. Sewage pump stations should remain fully operational during all weather conditions.
- B. Accessibility - The pump station shall be readily accessible by maintenance vehicles during all weather conditions. The facility should be located off the traffic way of streets and alleys. Ease of Maintenance shall be considered when the layout of site is considered.
- C. Pump stations shall be designed for the specific hydraulic conditions of the sewage system in question. The pump station design shall be signed and sealed by the Developer's Professional Engineer and certified by the station manufacturer. Plans and details shall be submitted to the Town of Berlin for review.
- D. The wet well shall be designed to resist buoyancy forces while the wet well is empty.
- E. The wet well shall be inspected for leakage prior to being placed in use.

Inspection shall be performed while the pump station has been empty for a minimum of 24 hours.

- F. Pump stations shall meet all Maryland Department of the Environment requirements in addition to these standards. The Developer and his Contractor shall obtain all permits and determinations from all Local, County, State, and Federal agencies having jurisdiction over the work.
- G. Material and equipment submittals shall be submitted to the Town of Berlin for review. An Operation and Maintenance manual shall be prepared by the Contractor and submitted for review prior to final acceptance.
- H. The Developer or his agent shall supply to the Town of Berlin a spare sewage pump sized identically to the pumps that are being supplied with the pump station.
- I. Pump stations serving 50 or more EDU's shall have an emergency power generator with automatic transfer switch. Generator shall be properly sized to power both sewage pumps and all other loads connected to the generator. Generator design shall be per manufacturer's recommendations as approved by the Engineer.

1.26 PUMP STATION SIZING

- A. An E-One grinder pump station shall be provided when the peak design flow is less than 20 GPM, or as required by the Town of Berlin. For flows less than 250 gallons per day a simplex unit can be utilized and for flows greater than 250 gallons per day a duplex unit shall be utilized. Equipment and installation shall be in accordance with the manufacturer's requirements and recommendations. At no point shall a simplex station be utilized to serve more than one structure or residence. E-One pump station manufacturer shall confirm hydraulic conditions of pump station and discharge force main system.
- B. A duplex grinder pump station shall be provided when the peak design for the pump station is between 20 GPM – 100 GPM, or as required by the Town of Berlin. Equipment and installation shall be in accordance with the manufacturer's requirements and recommendations.
- C. An at-grade Gorman-Rupp duplex pump station shall be provided when the peak design for the pump station exceeds 100 GPM, or as required by the Town of Berlin. Equipment and installation shall be in accordance with the manufacturer's requirements and recommendations.

1.27 DUPLEX GRINDER AND AT GRADE SUCTION LIFT PUMP STATIONS

- A. Wet Wells
 - 1. Duplex Grinder Station

- a. The wet well shall be a minimum diameter of 5' and be constructed of 5,000 psi reinforced pre-cast concrete. The wet well shall have a 360° cement hopper bottom.
- b. Grinder stations shall be equipped with a pump lifting assembly constructed of 316 stainless steel.
- c. The hatch shall be a double door hatch sized to provide adequate room for the removal of the submersible grinder pumps.
- d. Top slab shall be sized and arranged to allow for routine maintenance to the pump station.
- e. A stilling well shall be used to protect the level control transducer.

2. At-Grade Suction Lift Station

1. The wet well shall be designed with adequate capacity to minimize frequent starting of the pumps causing wear and heat buildup and minimize septic conditions that can occur from excessive detention times.
2. The wet well shall be a minimum of 6' in diameter and be constructed of 5,000 psi reinforced pre-cast concrete. The wet well shall have a 360° cement hopper bottom sloped toward the suction pipes.
3. Top slab shall be sized and arranged to allow for access during routine maintenance to the pump station.
4. The access hatch shall have a minimum 2'-0" x 2'-0" clear opening
5. A stilling well shall be used to protect the level control transducer.
6. Pump Stations 15' and deeper shall have a stainless steel support beam to minimize suction and discharge pipe motion. The suction and discharge piping shall be secured to the support beams with stainless steel straps.
7. Suction piping shall be PVC – Discharge piping shall be flanged ductile iron. If a priming loop is required by the Town of Berlin or Manufacturer, the discharge shall be supported at the bottom of the wet well.

B. Ventilation

1. A powered external positive ventilation fan designed to provide 30 air changes per hour when the hatch is opened and 2 air changes per hour under normal operating conditions.
2. Blower and vent shall be placed in such a location that allows for easy access to the pump enclosure.

C. Pumps

1. Duplex Grinder Station
 - a. The station shall be a duplex grinder pump station with submersible

pumps as manufactured by Hydromatic with auto reversing feature, or approved equal. Pumps and equipment shall be installed per the manufacturer's requirements.

- b. Pump motors shall be sized to be non-overloading at any point on the operating curve.
- c. Each pump shall be designed to handle flows in excess of the calculated peak flow.

2. At-Grade Suction Lift Station

- a. The station shall be a duplex pump station as manufactured by Gorman-Rupp including fiberglass hood, internal heater and non-clog pumps capable of passing a 3" sphere.
- b. Each pump shall be designed to handle flows in excess of the calculated peak flow.
- c. Pump motors shall be sized to be non-overloading at any point on the operating curve.

D. Site and Appurtenances

1. Water service shall be provided via a 1" sanitary frost proof yard hydrant, with a residential meter assembly.
2. A separate emergency by pass system in a concrete pit shall be supplied. Piping to be 4" with quick disconnect coupling and isolation valve. Quick disconnect coupling to be 12" from surface under the lid assembly.
3. A 6' high security fence with barbed wire, privacy slats and a lockable gate shall be installed.
4. The driveway shall be configured to allow for an unobstructed access to all equipment.
5. Duplex Grinder Station - Discharge piping shall be ductile iron from the wet well through the valve vault and then transitioning to PVC force main.

E. Flow Meter

A flow meter shall be installed in a concrete meter vault. Meter shall be sized for the flow and rated for continuous submergence. The flow meter shall be TigerMag, Siemens or approved equal. Meter vault shall be minimum 3' diameter with cast iron frame and cover.

F. Electrical

1. Generator

- a. The generator set shall be a diesel and sized so that both pumps and controls can operate simultaneously.
- b. Generator shall have a sub-base fuel storage tank with a minimum of 3 days of storage.

- c. Generator shall have an enclosure rated for outdoor use. The enclosure shall meet all Federal, State and local regulations for noise.
- d. Generator shall be equipped with an automatic transfer switch.
- e. Generators shall meet all Federal, State and Local regulations regarding emissions.

2. Controls

- a. All control functions and logic shall be as listed herein and as shown on the standard details.
- b. A redundant high water float shall be utilized to operate automatic redundant pump controls, back-up high level alarm and external alarms with a manual reset.
- c. A pressure transducer shall be utilized for pump controls, level alarms and external alarm with manual reset.
- d. All controls shall be clearly labeled.
- e. Controls shall be as recommended and provided by the manufacturer of the pump station, but include a minimum of:
 - i. Pump HOA with On/Off indication
 - ii. Alternation with dedicated Lead/Lag assignment
 - iii. Local indication of the station flow rate
- f. Controls and panels shall have a minimum NEMA 4X rating and be constructed of Stainless Steel.
- g. An external light High Pressure Sodium (HPS) with HOA control shall be supplied. The automatic function shall be operated by a photoelectric light sensor.

3. SCADA

- a. The SCADA equipment shall be HighTide Technologies Model HTT-900.
- b. The dialer shall be capable of notifying operators via text, email or phone call for alarm conditions and display non-alarm functions on a password protected web based viewing.
- c. The dialer shall be capable of displaying number of pump on/off cycles per day, pump run times, average drawdown times, average gallons per minute for each pump, total flow (gallons), daily flow (gallons), average daily influent flow (gallons per minute).
- d. The monthly fee for the dialer service shall not be a function of the number of alarm conditions, phone calls or information exchange transactions.
- e. A toll-free number shall be provided to receive a current alarm status report and to acknowledge alarms.

DESIGN PARAMETERS FOR STREETS

1.28 GENERAL

- A. Where a developer proposes to construct public streets in the Town of Berlin, such streets shall be designed to the Standards defined herein. Streets shall be designed and constructed to Town Standards and conveyed to the Town upon acceptance.
- B. Worcester County Soil Conservation District shall issue permits required for erosion control. The Town of Berlin shall review and approve stormwater management. Stormwater Management requirements are in addition to those defined herein.
- C. Submit stormwater calculations demonstrating that stormwater systems will convey a 10-year storm without surcharging inlets beyond 8 feet of an inlet.

1.29 PROJECT DRAWINGS

A. TITLE SHEET

- 1. Title of Project and Address.
- 2. Phase of Project, if necessary.
- 3. Developers' Name and Address.
- 4. Design Engineers' Name and Address.
- 5. Drawing Index.
- 6. Approval block for Town Engineer's signature and date.
- 7. Vicinity Map showing location of Project within the Town of Berlin. Typical scale shall be 1 inch equals 1000 feet.
- 8. Location Map if drawings are for one phase of the development.
- 9. Design Engineer's or Surveyor's Seal and Signature.
- 10. Design Engineer or Surveyor's certification of supervision and professional registration.
- 11. Certification by a Professional Wetland Scientist for wetland determination if hydric soils are present.

B. HORIZONTAL PLAN

- 1. 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.
- 2. North Arrow shall be shown.
- 3. The existing and proposed legend.
- 4. All necessary utility notes.
- 5. Location, elevation and description of all Project Bench Marks referenced to, and using, NAVD 88 monuments.
- 6. Property Owner data, and location of all property lines, lot lines, lot numbers and easements.
- 7. Location of all existing and proposed structures and buildings with unit

numbers.

8. Beginning and end of proposed construction, including phase limits.
9. Existing and proposed street names.
10. Drainage pipe, culverts, swales with inverts, slopes and spot elevation and pipe material.
11. Existing and proposed contours (minimum 1 foot vertical intervals) with major vegetation noted, within the areas of development and extending to off-site areas impacted by construction and related activities.
12. Stationing of roads with curve data, points of tangent and curve.
13. Curbing locations with type denoted plus top and bottom elevations at all intersection fillets, elevation changes and minimum 100 foot intervals.
14. Spot elevations and expanded views for all cul-de-sacs, valley gutter and street reconstruction areas.
15. Location of all proposed street signs provided in a Street Signage Plan. Plan shall follow Town Code requirements.

C. PROFILE

1. Scale shall match plan horizontally. Vertical scale shall be one-tenth (1/10) of the horizontal scale.
2. Drainage pipe, pond, and outfall data.
3. Vertical curve information.
4. Street Name.
5. Stationing, with centerline grades for existing and proposed. Stationing should be at 50 foot intervals and shall include high points, low points, intersection points and transition points.

D. DETAILS

1. Street cross section.
2. Curbing type.
3. Entrance plan.
4. Storm drainage details.
5. Storm drain profiles to comply with sanitary sewer plan requirements.

1.30 LAYOUT, RIGHT-OF-WAY AND STREET DESIGN

- A. The arrangements of street shall be such as to provide for the appropriate extension of existing streets.
- B. The residential minimum right-of-way width shall be measured from lot line to lot line and shall be in accordance with the current edition of the Town Code Section for Subdivision of Land.
 1. Major Collectors: 60'
 2. Minor Collectors: 50'
 3. Alley: 20'
 4. Internal roads, alleys, driveways, aisles and parking area in business and

industrial developments shall be designed and built to satisfy the requirements of the Town of Berlin.

5. Cul-de-sac – 100' Diameter.
 6. Any development must have a traffic study performed by Licensed Professional Engineer for review by the Town and the Town's Engineer, unless the requirement is waived.
- C. Grades of arterial and collector streets shall not exceed six percent (6%). No street shall have a minimum grade of less than five tenths of one percent (0.5%). Streets shall have a minimum cross slope of 2% (1% with Cul-de-sacs). The minimum curb grade within cul-de-sac is three tenths of one percent (0.3%).
 - D. Horizontal curves for major collector streets shall be a minimum of 300 feet. Minor collector shall be a minimum of 100 feet.
 - E. Street intersections shall be as nearly at right angles as is possible and in no case shall be less than sixty (60) degrees. The block corners at intersections shall be rounded at the curb line with a curve having a radius of not less than twenty feet (20') for minor collectors and not less than twenty-five feet (25') for major collector streets. Larger radii may be required dependent upon usage.
 - F. Street jogs with center line offsets of less than one hundred twenty-five feet (125') shall be prohibited.
 - G. A tangent, at least one hundred feet (100') along, shall be introduced between reverse curves on major collector streets.
 - H. When connecting street lines deflect from each other at any point by more than ten (10) degrees they shall be connected by a curve with a radius of not less than one hundred feet (100') for minor streets and three hundred feet (300') for arterial and collector streets.
 - I. All changes in grade, totaling 1% or greater, shall be connected by vertical curves of sufficient radius to provide a smooth transition and proper sight distance. The minimum length for a vertical curve is 80 feet.
 - J. Dead-end streets (cul-de-sac) of a permanent nature if approved, shall not be longer than six hundred (600) feet as measured from centerline intersection to center point of cul-de-sac and shall provide a turnaround at the end with a minimum radius of forty (40') feet of pavement and fifty (50') feet of right of way.
 - K. If a dead-end street is of a temporary nature, a similar temporary turn around shall be provided and provisions made for future extension of the street and reversion of the excess right-of-way, to the adjoining properties.
 - L. 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 town approval.

- M. Residential street widths shall meet the following standards:
 - 1. Major Collector: 36 feet paved
 - 2. Minor Street: 24 feet paved
 - 3. Access Street: 20 feet paved
- N. Concrete right-of-way monuments shall be set at each change in direction along the approved right-of-way.

1.31 STORM DRAIN SYSTEMS

- A. The design of storm drain systems shall be in accordance with drainage criteria of the Maryland State Highway Administration rules and regulations for subdivision streets.
- B. Double inlets shall be installed in all low points with 300 feet or more contributing street length.
- C. The Developer's Designer shall prepare and submit a storm drainage report and calculations to the Town or Town Engineer.

SOILS INVESTIGATION AND PAVEMENT DESIGN

1.32 SOILS INVESTIGATION

- A. The Developer of a proposed subdivision where roads will be conveyed to the Town of Berlin shall employ the services of an Engineer to perform a subsurface investigation for the purpose of obtaining information needed to design the proper pavement section.
- B. The design Engineer shall employ a Geotechnical Engineer registered in the State of Maryland 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 guide lines and methods will be followed when performing the field work.
 - 1. Borings shall be accomplished by using the 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 500 feet apart, with a minimum of two (2) borings per street.
 - 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. 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 the 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 D421).

2. Method of Particle-size analysis of soils (ASTM Designation D422).
 3. Amount of material in soils finer than the number 200 sieve (ASTM Designation D1140).
 4. Method for laboratory determination of water content of soils (ASTM Designation D2216).
 5. Classification of soils for engineering purposes (ASTM Designation D2487).
 6. Test method for liquid limit, plastic limit, and plasticity index of soils (ASTM Designation D4318) when required.
- E. Methods which deviate from any of the above procedures must be submitted to the Town of Berlin for approval.
- F. Results of the soil investigation submitted to the Town of Berlin should 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. Test results of all laboratory tests performed.
 4. A profile view of each street with borings plotted to scale showing the ASTM classification of soils encountered.

1.33 SUBDIVISION PAVEMENT DESIGN

- A. Subdivision streets shall be designed based on the following standards and practices.
- B. The applicable details show typical sections for residential streets, based on the following definitions:
1. Access Street – A street which will serve not more than 20 dwelling units.
 2. Minor Street - A street which will serve less than 150 dwelling units.
 3. Major Collector Streets - A street serving between 150 and 300 dwelling units.
- C. The design of pavement section for streets shall be based on the type of soils as determined by the soils investigation, the anticipated number of units utilizing the streets, and utilization of streets by construction traffic. Soils investigation shall be performed in accordance with Section 1.22 of these Specifications.
- D. The required structural numbers are shown in the attached tabulations.
- E. All streets shall be constructed a minimum of 1.5 inches of bituminous surface course (9.5mm superpave), 2.5” of bituminous base course (19mm superpave) and 6 inches of compacted graded aggregate sub-base course shall be used.
- F. Prior to placing the pavement and graded aggregate section, the subgrade shall be prepared and proof rolled as detailed in the Department Standard Specifications.

If the test rolling shows the subgrade to be unstable, the contractor shall scarify, disc, aerate or add moisture and recompact the subgrade to the extent that when retested it will be stable. If, in the opinion of the Engineer, there are areas to be removed or undercut, they may be ordered, excavated and replaced with approved material.

- G. The total minimum required structural number based on the number of units using the street are as follows:

Required Structural Number

<u>No. of units</u>	<u>Good Soil</u>	<u>Poor Soil</u>
1-50	1.70	2.70
51-100	2.00	2.90
101-200	2.50	3.30
201-300	2.90	3.70
Over 300	N/A	N/A

NOTE: Good soils consist of soils within the A-1, A-2, and A-3 AASHTO Soil classifications.

Poor soils consist of all other soils classification.

- H. The pavement section of street built to serve a future area of development shall be increased in strength to serve both the present and future traffic loads. If such a street must also serve construction traffic of future development, the pavement section shall again be increases in strength as follows:

<u>No. of Units Proposed For Future Development Area</u>	<u>Increase in Structural Number</u>
1-100	0.48
100-300	0.80

- I. Following is the list of structural numbers used to obtain a pavement section thickness which will meet or exceed the minimum required structural number shown above.

<u>Use</u>	<u>Material</u>	<u>Structural Number for Inch Thickness</u>
Surface Course	Bituminous Concrete	0.40
Base Course	Bituminous Concrete	0.40
Sub-base Course	Graded Aggregate	0.14
	Select Borrow	0.08

- J. In situations where vehicular traffic utilizes the roadway prior to installation of the surface course, the initial paving section shall be increased to meet or exceed the required structural number. The required structural number shall meet traffic design for residential traffic and construction traffic, as managed by the developer.
- K. The above design procedure is not applicable for streets serving over 300 units.

END OF SECTION

SECTION 2 – CONSTRUCTION STANDARDS

GENERAL EXCAVATION AND EMBANKMENT

2.01 GENERAL

The Contractor shall perform all excavation, embankment, compaction, and grading necessary to construct streets, sidewalks, curbing, and miscellaneous items. Excavation and embankment shall be performed in accordance with the following Maryland Department of Transportation Standard Specifications:

<u>Section</u>	<u>Paragraphs</u>
101	101.01 through 101.03.07
201	201.01 through 201.04
202	202.01 through 202.01.10
203	203.02 (reference Section 916)
204	204.01 through 204.03.08

2.02 EXCAVATION

- A. Excavate existing streets and all other areas as required to obtain subgrade elevations necessary for construction of new work as detailed.
- B. Material from excavation meeting specifications for embankment may be refused for embankment. The Contractor shall obtain, and pay for, testing to verify suitability of material for reuse. Material unsuitable for reuse, or in excess, shall be disposed of by the Contractor at a location approved by the Engineer or as directed by the Owner.

2.03 EXCAVATION AND REFILL BELOW SUBGRADE LINE

- A. If unstable material is encountered below subgrade line as shown on Typical Street Cross Section, it shall be removed to the extent directed and backfilled and compacted with select backfill material from excavation or borrow.
- B. See Street Pavement Section of these specifications.

2.04 EMBANKMENT

- A. The Contractor shall construct, where necessary or as directed, with suitable excavated or select borrow material, embankment to the subgrade line elevation for new construction. Select borrow conforming to Maryland Department of Transportation Section 916.01.01 from off-site source shall be furnished and

placed.

- B. Material to be placed as embankment shall meet the requirements of Maryland Department of Transportation Section 203 and 204. Contractor to submit certifications on material proposed to be furnished.

2.05 COMPACTION

- A. Select backfill and embankment shall be placed in lifts not exceeding 8" loose thickness and compacted to 95% of maximum dry density as determined by ASTM D-1557, at or near optimum moisture content.
- B. See Street Pavement Section of these specifications.

EXCAVATION AND BACKFILL FOR PIPELINES AND STRUCTURES

2.06 GENERAL

- A. The Contractor shall perform all excavation, backfilling, grubbing and grading required for construction and installation of pipelined, structures and appurtenances. Excavation shall include removal of pavement, concrete, rock, earth and debris, regardless of character. Trenches and excavation shall be sheeted, shored or braced by the Contractor, as necessary to allow construction and provide safe working conditions. Additionally, the Contractor shall be responsible for maintaining a dry excavation by dewatering. He shall also support and protect existing utilities and structures encountered in the work, provide traffic control, disposal of surplus and unsuitable excavated materials and restore backfilled areas as required by the drawings and specifications.
- B. The Contractor is responsible for direct or indirect damage to existing structures, pipelines, conduits, poles, wires of every description in the vicinity of his work whether above or below ground, or that may be encountered in trench or structure excavation. This responsibility shall include the cost of protection by sheeting, bracing, hand excavation, when warranted, and the expense to repair or replace any existing facility damaged directly or indirectly by construction activities under this contract, whether such facility is or is not shown on the drawings.
- C. The Contractor shall verify the location and inverts of all existing utilities at the various points of connection and/or crossing prior to starting any work. Any discrepancies in locations or inverts shall be brought to the attention of the Engineer in order that the designs may be adjusted accordingly. Damages suffered or additional costs incurred by the Contractor as a result of his failure to conform to the requirements of this paragraph shall be the sole responsibility of the Contractor. Forty-eight (48) hours notice shall be given prior to connections to existing Town utilities. Connections shall be completed by the Contractor and witnessed by the Town in such a manner as the Town or Town Engineer may direct and the associated expense shall be born by the Developer. All service connections to Town water or sewer system shall be made by a Maryland Licensed Plumber.
- D. Excavation and backfill, within an area State agency has jurisdiction, shall be done in accordance with requirements and provisions of the permits issued by the agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these specifications.

2.07 PIPELINE TRENCH EXCAVATION

- A. The Contractor shall excavate, maintain and backfill all excavation necessary for completing the work. Unless otherwise specified or approved, excavation shall be open cut.

- B. Trenches shall be excavated to the necessary width and depth, as shown on the drawings and as required for the safe installation of the utility, etc.
- C. The sides of the trenches shall be practically plumb and shall not be sloped unless approved in writing by the Engineer. Trench sides shall be supported or sheeted as required to protect pavement surfaces, curbing, utilities, etc. and as required for safety. Safety regulations shall be as required by State safety codes and OSHA.
- D. In paved areas, the Contractor shall remove the paving only as necessary for the excavation of the trench as detailed. Pavement edges at the trench shall be cut neat and straight prior to the start of any excavation. Should the Contractor disturb or damage pavement for a greater width than necessary or should pavement damage result from cave-ins, settlement, etc., he shall replace such paving at his own expense.
- E. The excavation of all trenched shall be fully completed at least twenty (20) feet in advance of pipe laying, unless otherwise authorized or directed. The Engineer may require the backfilling of open trench, over completed pipelines, or ahead of the pipe laying operation, if in his judgement such action is necessary.
- F. Should work be stopped for any reason and any excavation is left open for an unreasonable length of time, the Contractor shall refill the excavation at his own expense if so directed, and shall not reopen the excavation until he is ready to complete the facility. Should the Contractor refuse or fail to refill any excavation completely within 24 hours after proper notice, the Town shall do the work and expenses resulting shall be assessed to the Developer.
- G. The Contractor shall complete excavation as nearly as practicable to the lines of the pipeline to be installed and as detailed. All cavities in the bottom of the trench shall be filled to the required level with compacted crushed stone or gravel.
- H. Excavated materials shall be graded, hauled, stored, and protected as such material found suitable will be required for backfilling, repaving or other purposes. Material classified as unsuitable shall be disposed of by the Contractor.
- I. Excavated materials shall not be placed on private property, unless written permission is obtained from the property owner.
- J. The Contractor shall be responsible for any damage to curb, gutter, sidewalk, traffic control devices, and pavement material. Any damage resulting directly or indirectly shall be replaced in kind by the Contractor without additional compensation. The reuse of disturbed curb, gutter or sidewalk is prohibited. New sections shall be installed to the nearest undisturbed control joint.

2.08 PIPELINE TRENCH BACKFILL

- A. Materials excavated from the trench shall be used for trench backfill, provided

that, in the opinion of the Engineer, the excavated material is suitable for this purpose. Backfill material shall be free from large lumps and stones having any dimension greater than two (2) inches.

- B. Suitable material, as approved by the Engineer, shall be carefully deposited in the trench by methods which will not damage or disturb the pipeline or structure, and shall be solidly tamped around the pipe or structure. Backfill material shall be placed in 6-inch layers to a point at least one foot above the pipeline crown. Compaction shall be accomplished by mechanical tampers. Care shall be taken in the use of mechanical tampers not to injure or move the pipeline or to cause the pipe to be supported unevenly. The remainder of the trench may be backfilled and compacted in 8-inch layers. Each layer shall be mechanically tamped for the full trench width.
- C. All backfill material shall be compacted to 95% of maximum density at optimum moisture content as determined by the Modified Proctor Test ASTM D1557, Method A. Materials containing an excess of moisture shall be permitted to dry until the moisture content is within the specified range. Materials too dry shall be wetted until the moisture content is in the specified range.
- D. No compacting shall be done when the material is too wet to be compacted properly. At such times the work shall be suspended until the backfill materials have dried out sufficiently to permit proper compaction or such other precautions shall be taken as may be necessary to obtain proper compaction. The Contractor is responsible for hauling, storing and drying of excavated material to be used in backfill operations.
- E. The Engineer may make compaction tests at the Developers expense, of the backfilled trenches at any time during construction or upon completion of the backfill operations. If the results of any tests show that backfills do not meet the specified compaction, the Contractor shall at his own expense, correct the condition as directed by the Engineer.
- F. The Contractor shall, at his own expense, maintain all refilled excavation in proper condition. Trench surfaces shall be reshaped when necessary. If the Contractor fails to make repairs within 24 hours after receipt of written notice from the Owner, the Owner may refill said depression wherever necessary and the cost of doing so will be assessed to the Developer. The Contractor shall be responsible for any injury or damage that may result from lack of maintenance of any refilled excavation at any time prior to final acceptance.
- G. All unauthorized excavations made by the Contractor shall be immediately backfilled in accordance with the requirements of the specifications for trench backfill at the Contractor's expense.
- H. After completion of backfilling, all material not used shall be disposed of as approved by the Engineer, and all places on the line of the work shall be left clean and in good condition. This cleaning up shall be done by the Contractor. If he

fails to do this work within a reasonable time after receipt of notice, it will be performed by the Owner, and the cost will be assessed the Developer.

- I. No backfill shall be placed against new concrete masonry structures until properly cured. In the case of concrete, test reports must indicate that a 2500 psi compressive strength exists.
- J. The contractor shall exercise caution in backfill and compaction to prevent damage to structures.

2.09 EXCAVATION FOR STRUCTURES

- A. Excavate for structures, walls, foundations, footings, etc., to the depth and width required for construction and stripping of forms. Structural excavation shall consist of the excavation of all earth, rock, boulders, existing concrete and masonry foundations and walls, and all other materials encountered regardless of type, which the Contractor may encounter.
- B. Excavated materials shall be segregated as they are excavated, with the suitable and unsuitable material being piled separately. All suitable material shall be used for backfill. All unsuitable material shall be removed, at the Contractor's expense, and disposed of at a location approved by the Engineer. No excavated material shall be deposited at any time so as to endanger partly finished structures either by direct pressure, or indirectly by overloading banks contiguous to the operation.
- C. The Contractor shall be responsible for the condition of all excavations made by him. All slides and caves shall be removed without extra compensation, at whatever time and under whatever circumstances they may occur.
- D. The provisions of Section 2.07 shall also apply to Excavation for Structures.

2.10 BACKFILL FOR STRUCTURES

- A. Backfill around structures with suitable material from the excavation to the original surface grades shown on the plans or defined by the Engineer. If additional material is needed to fill around the structure, Select Backfill shall be furnished and placed by the Contractor.
- B. No backfill shall be placed against new concrete or masonry structures until properly cured. In the case of concrete, test reports must indicate that a 3000 psi compressive strength exists.
- C. Backfill shall be placed in six (6) inch layers and compacted by mechanical tampers. Compaction shall conform with Section 2.08, Paragraphs c. through e.
- D. The Contractor shall exercise caution in backfill and compaction to prevent damage to structure. Structures and utilities in areas to be paved shall be set so

that the top slab and/or frame and cover are 1/8" to 3/8" below final pavement surface grade.

2.11 EXCAVATION BELOW SUBGRADE AND GRAVEL REFILL

Materials below the excavation limit for pipelines and structures (below subgrade), which in the judgment of the Engineer should be removed, shall be removed as directed. All spaces created by the removal of unsuitable material below subgrade shall be refilled and compacted with crushed stone or gravel meeting the grading requirements of ASSHTO, M43, No. 67, and Maryland Department of Transportation Specification Section 901, Table 901A.

2.12 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 pipeline shall commence when groundwater is first encountered and shall be continued until such time as backfill has been completed. No concrete footings or floors shall be laid in water nor shall water be allowed to rise over them until the concrete or mortar has set at least 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 Engineer. Water shall be disposed of in such a manner as not to be a menace to the Public Health.
- D. In the event the Contractor's Dewatering Operations affect any water supplies within the project area, the Contractor shall take whatever steps are required to provide uninterrupted water service.
- E. The Contractor shall remove any siltation deposits in storm sewer systems, resulting from his dewatering or construction operations. He shall also be responsible for conveyance of dewatering flows and for erosion and sediment control.

2.13 SHEETING, SHORING AND BRACING

- A. The Contractor shall furnish and install all sheeting, shoring and bracing necessary to insure safe working conditions and to prevent damage to public and private property structures. If the sheeting, shoring, or bracing is not of proper quality or is not properly placed to insure safe working conditions and to prevent property damage, the Contractor shall remedy such inadequacy at his own

expense as may be directed by the Engineer. Sheeting, shoring, and bracing shall be removed as backfilling progresses, except as such locations as the Engineer may direct or approve it to be left in place.

- B. The Contractor shall cut off any sheeting left in place, at least eighteen (18) inches below finished grade, and shall remove the material cut off.
- C. Where necessary, in quicksand, soft ground, or for the protection of any structure or property, sheeting shall be driven to such depth below the bottom of the trench as may be required to protect all existing and/or proposed work.
- D. A trench box is an acceptable alternative to sheeting, shoring or bracing providing such boxes conform to safety codes in effect for the project.

2.14 SELECT BACKFILL

- A. Should the Contractor encounter unsuitable material during excavation, he shall remove and dispose of such material.
- B. Should sufficient suitable material from excavations on the project not be available for backfill, the Contractor shall furnish Select Backfill upon approval of the Engineer. Select Backfill shall conform to Maryland Department of Transportation Section 916.01.01.
- C. The Contractor shall furnish certification that his borrow meets the specified requirements.

2.15 TEMPORARY PAVING

- 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 Maryland State Highways, County Roads, and all other areas over which the States or County exercise jurisdiction, all temporary and permanent pavement restoration shall be done in accordance with the permit requirements of these agencies.

WATER MAINS AND APPURTENANCES

2.16 GENERAL

- A. The Contractor shall furnish and install water mains, valves, hydrants, corporation stops, house service piping and appurtenances as specified herein and as defined on the drawings or as directed by the Engineer. Provide all necessary adaptors for connection to existing mains. The Contractor shall have the option of using either ductile iron or PVC pipe. Note: ductile iron pipe shall be utilized for the following instances: repair of existing mains, construction of hydrant leads from the main line to the hydrant boot, within the limits of pipeline installation by bore and jack method, wherever restrained joints are required, when watermains are installed with less than 10' horizontal distance from sanitary sewer and the joints are encased in concrete, or as required by the Engineer.

2.17 DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe shall be manufactured in accordance with ANSI/AWWA C151/A21.51, latest edition, and shall be thickness Class 50 or greater as required.
- B. Pipe and fittings shall have an external standard asphaltic coating approximately 1 mil thick.
- C. Pipe and fittings shall have an internal cement lining in accordance with latest revision of ANSI/AWWA C104/A21.4.
- D. All fittings and specials shall be ductile iron and shall be mechanical joint with a 350 psi pressure rating conforming to ANSI/AWWA C153/A21.53 and C111/A21.11. Wall thickness shall be equal to class 56 ductile iron pipe.

2.18 EXPOSED DUCTILE IRON PIPE AND FITTINGS

- A. Exposed ductile iron pipe shall be flanged, Class 53 and be manufactured in accordance with ANSI/AWWA C115/A21.15, latest edition.
- B. Exposed pipe and fittings shall have standard external asphaltic coating approximately 1 mil thick. Pipe and fittings shall have an internal cement lining in accordance with the latest revision of ANSI/AWWA C104/A21.4 and ANSI/AWWA C110/A21.10, latest edition.
- C. All exposed fittings and specials shall be cast or ductile iron with a 350 psi pressure rating and marked in conformance with ANSI/AWWA C110/A21.10, latest edition. Flanges shall be Class 125 in accordance with ANSI B16.1.

2.19 POLYVINYL CHLORIDE PIPE AND DUCTILE IRON FITTINGS

- A. Polyvinyl Chloride (PVC) pipe shall be an acceptable alternate.

- B. PVC pipe, used for water main construction, shall equal or exceed the requirements of AWWA C909. It shall be manufactured in standard lengths not exceeding 20 feet. It shall have outside diameters equal to cast iron pipe (IPS). The pipe shall be rated for a working pressure of at least 150 psi.
- C. PVC pipe with integral bell be plain end design shall be connected by push-on method and shall utilize an elastomeric O-ring gasketed joint, that meets or exceeds the requirements of ASTM D-3139 and F477. Pipe ends shall be beveled.
- D. Fittings used with PVC pipe shall be ductile iron as specified in Section 2.17 (D) of this section.
- E. The Contractor shall provide all necessary adaptors for connecting PVC pipe to cast iron fittings and valves or other pipelines. Adaptors shall be as recommended by the pipe manufacturer. Adaptors shall be rated for a working pressure of 200 psi.
- F. Whenever restrained joints are called for on the drawings, Mega-Lug restrainers shall be used or equal.
- G. Polyvinyl chloride pipe shall be delivered and stockpiled in unit pallets, and stored on a flat surface. No stacking of pallets 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.
- H. Cracked, crazed or deformed sections of pipe will be unacceptable and will not be permitted for installation. Bowed section of pipe will be unacceptable and installation of pipe which has bowed, whether or not the bow has been corrected, will not be permitted for installation.

2.20 GATE VALVES & BOXES

- A. Gate valves shall be resilient seat type, in accordance with AWWA C515. Valves shall have a non-rising stem (NRS) with buried service operator. Valve bodies and bonnets shall be ductile iron epoxy coated on the inside per AWWA C550.
- B. Stem and wedge nuts shall be bronze. Stems shall sealed by at least two O-rings. Seals shall be replaceable with the valve fully open and while subject to the rated pressure.
- C. Wedge shall be constructed of ductile iron fully encapsulated in synthetic 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 be molded in

place and bonded to the ductile iron portion. Wedge shall seat against accurately formed seating surfaces in the valve body.

- D. Waterway shall be smooth and shall have no depressions or cavities in seat area where foreign material can lodge and prevent closure or seating.
- E. Gate valves shall be Mueller A2360 series or equal by American Flow Control.
- F. Provide each gate valve with a 5-1/4 inch diameter Buffalo screw type valve box with "Water" cast in the lids. All boxes for 4, 6, and 8 inch valves shall be equipped with a #6 round base. 10 inch valves shall be used with #8 valve box base. Valve boxes shall be adjustable between 2'-4" and 3'-4" except when deeper settings are required. Valve boxes shall be as manufactured by Bingham and Taylor. Valve box lid shall be MP-VBC-RP7360-B90 as manufactured by Argonics. Lid shall be polyurethane and provide a tight seal with notches for removal, and a magnet for locating.
- G. Provide heavy duty socket valve operating wrenches as follows:
 - For 1 to 10 valves, 1 wrench;
 - For 11 to 30 valves, 2 wrenches;
 - For greater than 30 valves, 3 wrenches.

2.21 FIRE HYDRANTS

- A. Fire hydrants shall be American Flow Control Model B-62-B-5, Mueller A-423 or Kennedy K81D. Hydrants shall be compression type with a 5-1/4 inch main valve opening, two 2-1/2 inch hose nozzles, one 4-1/2 inch pumper nozzle, and a 6 inch mechanical joint hub base. Hydrant seats shall be provided with bronze to bronze threaded connections.
- B. 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. They shall meet the requirements of AWWA Standard C-502.
- C. Hydrant leads shall be ductile iron pipe as specified in Section 2.17 of this section.
- D. A sworn certificate of inspection and testing shall be furnished by the manufacturer. Install hydrants with restraint system as detailed on the drawings.
- E. All hydrants to be furnished with non-kinking chains on the 2-1/2 inch nozzles.
- F. Hydrants shall open by turning the operating nut counterclockwise.
- G. Fire hydrants to receive 1 coat of primer and 2 coats of safety yellow paint in accordance with Federal Standard 595A. The final coat shall be field applied after the hydrant has been installed.

H. Provide hydrant operating wrench and repair kit, as follows:

For 1 to 5 hydrants, 1 wrench
For 6 to 12 hydrants, 2 wrenches
For greater than 12 hydrants, 3 wrenches
and 1 repair kit for every 3 hydrants (minimum of 1 kit)

2.22 FIRE MAINS

- A. Fire mains requested for building insurance purposes shall be of ductile iron or PVC construction with proper joint restraints. Each fire main or sprinkler shall be equipped with a backflow preventer.
- B. Backflow preventers shall be Ames Model 3000SS complete with $\frac{5}{8}$ " x $\frac{3}{4}$ " bypass meter or alarmed flow switch downstream of the backflow valve. Provide one OS&Y gate valve on each side of the backflow preventer. The fire and low flow meters shall be specifically sized for the application. Meters shall be Radio Read with Touch Read capabilities in accordance with sections 2.29 and 2.30.
- C. Backflow preventer shall be in a below ground vault or within a mechanical room accessible from the exterior door to said room. Internal systems shall be accessible to the Berlin Water and Sewer Department.
- D. Town personnel shall purchase and supply backflow preventer. Unless otherwise directed by the Town, contractor shall install the backflow preventer and Town personnel shall inspect the installation prior to approval for usage. All costs associated with purchasing and supplying the backflow preventer shall be reimbursed by the developer.

2.23 TAPPING SLEEVE AND VALVE

- A. Tapping sleeves shall be of all stainless steel construction including sleeve, bolts and nuts. Sleeves shall wrap 360° around the pipe with gridded full circumference gasket. Units shall be FAST Model by Ford Meter Box Co. or Powerseal.
- B. Tapping valves shall be cast iron Fig. 950X, by Kennedy or American Flow Control.
- C. Install tapping sleeve and valve per manufacturer's recommendations.

2.24 LAYING WATER MAINS, FITTINGS AND APPURTENANCES

- A. Water main pipe, fittings, and valves shall be installed per manufacturer's printed instructions. Care shall be taken to insure that no joints are made with unevenness or rough edges. Pipeline deflection must be kept below the manufacturer's limitations

- B. All piped shall be bedded on a solid foundation prior to backfilling. Defects due to settlement shall be corrected by the Contractor at his own expense. Bell holes shall be dug sufficiently large to receive same.
- C. Pipe and fittings shall be kept clean until final acceptance of the work. All open pipe ends shall be provided with plugs to keep dirt, water and other materials from entering. This plug shall be kept in place when actual pipe laying is not in progress.
- D. Excavation and backfill for water mains and appurtenances shall be per Section 2.16 – 2.33 of these specifications.
- E. Install no pipe on frozen or frost penetrated subgrade. When directed, the Contractor shall install pipe on artificial foundations. Such foundation may consist of gravel or concrete and shall be to the dimensions and in the same manner directed by the Engineer.
- F. Pipeline detectable tape shall be installed continuously along all water mains. The tape shall be installed directly above the water main and 12 inches from the ground surface. The tape shall be Lineguard Type II Detectable Tape as manufactured by Lineguard, Inc. of Wheaton, Illinois, or equal. The tape shall be a minimum of two inches wide, blue in color, imprinted with the words, “CAUTION: WATER LINE BELOW”, and be capable of being detected with inductive methods.
- G. Pipeline tracer wire shall be THHN/THWN 12 gauge solid copper conductor insulated with a high molecular weight polyethylene (HMWPE) coating. Tracer wire shall be installed with sufficient length inside valve boxes and meter pits to allow for connection at ground surface.
- H. All concrete required to construct buttresses behind plugs, tees, bends and other fittings and anchorages beneath vertical bends shall be placed as directed and/or as shown on the details.

2.25 INSTALLING FITTINGS, HYDRANTS, GATE VALVES AND VALVE BOXES

- A. 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 Engineer.
- B. A valve box shall be carefully placed over the bonnet of each gate valve with the top at the finished surface of the street, sidewalk or at such other elevation as the Engineer shall direct. It shall be set exactly plumb. In tamping the backfill around the box special care shall be taken to keep the box plumb and to have it firmly supported on two 4-inch thick solid concrete blocks so as to avoid settlement. 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. Place gravel in and around valve box bases to provide for drainage.

- C. Ductile iron pipe with ductile iron fittings shall be used exclusively throughout the hydrant assembly.

2.26 INSTALLATION OF WATER MAINS BY THE DIRECTIONAL BORING METHOD

A. GENERAL:

1. Installation of the Polyethylene water main shall be by the directional boring method to the limits indicated on the drawings and as specified herein.
2. Polyethylene carrier/casing pipe roadway crossings are allowed with the concurrence of the permitting agency having road jurisdiction. The design engineer shall submit connection details for approval.
3. Polyethylene pipe shall be plain end for fusion welding conforming to ASTM F 714 and ASTM D 3035. Minimum pressure rating shall be 160 psi. Minimum SDR shall be 11.0 for carrier pipe and SDR 17.0 for casing pipe.
4. Molded fittings will conform to ASTM F 714. End sections of Polyethylene piping in direction bore shall have an AWWA C-207 Class D flange end butt fusion welded to polyethylene main. Flange shall be drilled to standard 125 pound template.

B. OPERATING EXPERTISE:

1. The Contractor must demonstrate expertise in trenchless methods by providing a list of ten utility references for whom similar work has been performed in the last two years. The references shall include a name and telephone number where contact can be made to verify the Contractor's capability. The Contractor must provide documentation showing successful completion of water main projects used for reference. Conventional trenching experience will not be considered applicable.
2. The directional boring equipment shall be the GuideDril system manufactured by UTILX Corporation's Flow Mole service or approved equal.

C. DRILLING EQUIPMENT

1. The system must be remotely steerable and permit electronic monitoring of tunnel depth and location. The system must be able to control the depth and directional of the pipe and must be accurate to a window of ± 2 inches.
2. The system must be capable of turning 90 degrees in a 35 foot radius.
3. The system shall utilize a fluid-cutting process, using a liquid clay such as bentonite. This clay must be totally inert and pose no risk to the environment or water main.
4. Liquid clay shall remain in the tunnel to increase stability of the tunnel

- and provide a lubricant to reduce frictional drag when the pipe is installed.
5. Spoils shall be recovered by use of a vacuum system mounted on a vehicle for removal of the spoil to an approved spoils site. Spoils shall not be discharged into sewers or storm drains.
 6. The equipment must be capable of completing the boring in a single bore.
 7. Equipment must be fitted with a permanent alarm system capable of detecting an electrical current. The system will have an audible alarm to warn the operator when the drill head nears electrified cables.

D. SAFETY:

1. All crews are to be provided with grounded safety mats, heavy gauge ground cables with connectors, hot boots and gloves to minimize the risk of electrocution.
2. Upon completion of boring and pipe installation, the Contractor will remove all spoils from the starting and termination pits. The pits are to be restored to the original condition.

2.27 BORING AND JACKING OF WATER MAINS

- A. Where possible, an approach trench shall be excavated far enough to provide a jacking face of at least three (3') feet from a pavement surface. This open face shall be shored securely to prevent slipping or raveling of the face.
- B. Boring pits shall be large enough to contain all necessary equipment and tools. Adequate provision shall be made for the removal of excavated material.
- C. A substantial backstop of heavy timber or steel beams shall be provided to take the thrust of the jack or boring equipment.
- D. As material is excavated or bored ahead of the pipe, the pipe shall be jacked in to follow this excavation. The distance dug ahead of the pipe shall not exceed six inches (6").
- E. The installation of casing pipe and the boring or excavation shall be done simultaneously.
- F. Voids between the sleeve and excavation shall be filled by pressure grouting.
- G. Cement shall be used to seal the pipe ends between the carrier pipe and sleeve.
- H. A one (1") inch PVC pipe shall be installed in the downgrade seal to permit drainage.
- I. Steel pipe sleeve shall be furnished in the diameter shown on the plans and shall conform to the requirements of AWWA C-200; Grade B pipe shall be used. The pipe, including field connections, shall be coated with bitumastic compound, inside and outside. Pipe wall thickness for sleeves shall be standard thickness.

All joints for casing pipe shall be made by continuous weld completely around the perimeter of the pipe in accordance with AWWA C-206.

- J. Carrier pipe shall be as required by the plans and specifications.
- K. Use runners or cradles to support the pipe in the casing. A minimum of two supports is needed per joint of pipe providing a maximum span of 6.25 feet for PVC pipe lengths of 12.5 feet or less. The maximum span between supports for pipe lengths of 19 to 20 feet must not exceed 7.5 feet. Prefabricated support shall be approved by Engineer and installed per manufacturer's requirements.

2.28 DISINFECTION OF WATER MAINS

- A. Upon completion of water main construction, disinfect main and appurtenances. Disinfection shall be done in accordance with ANSI/AWWA C-651, latest edition. Contractor shall submit a plan of disinfection for approval by the Engineer.
- B. After the applicable retention period, the heavily chlorinated water shall be flushed from the main. This water shall be discharged to the sanitary sewer system. Only after water leaving the main is no higher in chlorine concentration than normal drinking water will a discharge to storm drains be allowed. Convey flushed water to discharge point in a closed system.
- C. Affidavits of compliance certifying the water sampled from the water mains to be free of coliform bacteria shall be submitted to the Engineer. The contractor is responsible for requesting tests from the State Health Department.
- D. The contractor shall place in each length of pipe, hydrant, hydrant branch and other appurtenances, a sufficient amount of HTH tablets to insure adequate disinfection treatment of the main after its completion. Tablets shall be fastened to the inside top of every length of pipe as laid, using gasket cement known as "Permatex No. 2".
- E. The contractor will be held entirely responsible for securing a minimum residual chlorine content of 5 p.p.m. at the extremities of the mains after twenty-four (24) hours or more contact with the full water pressure on the main.
- F. Water for filling the mains shall be introduced at a velocity of less than 1 foot per second in order to permit the HTH or Perchloron to completely dissolve and have a reasonable uniform distribution throughout the mains. It is the intent of this Specification to require a sufficient amount of chemical to be equivalent to a dosage of 50 p.p.m. of chlorine.
- G. After the chlorine has been in contact with the mains or storage units for twenty-four (24) hours or longer, samples collected from the extremities of the mains shall indicate a residual chlorine content of 5 p.p.m. or more.

- H. If less than 5 p.p.m. residual chlorine is indicated, the system shall be drained and the disinfection treatment repeated.
- I. If samples collected at the extremities indicate a residual chlorine of 5 p.p.m. or more, the system shall be flushed until there is only a normal chlorine residual (1.0 p.p.m. or less) present, as determined by the DPD Method Test. Samples of water shall be collected from various points along the line, by the State Health Department for bacteriological analysis. If satisfactory bacteriological results are obtained, the lines may then be allowed to be placed in service. A copy of all test results shall be submitted to the Engineer. ANSI/AWWA C-651 requires two (2) sets of satisfactory bacteriological tests conducted a minimum of 24 hours apart.

2.29 WATER MAIN TESTING

- A. The Contractor shall furnish all equipment, labor and materials, including water, pumps, compressors, stopwatch, gauges, and meters as approved by the Engineer for testing. The Engineer shall determine the amount of main to be tested at any one time and reserves the right to separate the installation into several test sections. All tests must be witnessed by the Engineer or Owner.

B. PRESSURE TEST

After the pipe has been laid, all newly laid pipe or any valved section thereof, shall be subjected to a hydrostatic pressure of 125 psi.

1. Test Pressure shall:
 - Be of at least two hour duration.
 - Not vary by more than \pm five (5) psi.
2. Pressurization. Each valved section of the pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under the test and corrected to the elevation of the test gage, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner.
3. Air Removal. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants. If permanent air vents 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 all corporation cocks shall be removed and plugged, or left in place at the discretion of the Owner.
4. Examination. All exposed pipe, fittings, valves, hydrants and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves or hydrants that are discovered following the pressure test shall be repaired or replaced with same material and the test shall be repeated until it is satisfactory to the Owner.

2.30 HOUSE SERVICES

- A. For all new residential or commercial developments not currently serviced on a Town distribution main, the Developer is responsible for furnishing and installing all corporation stops, service pipe, meter pits and appurtenances as indicated on the Standard Details, and specified herein. Town personnel shall purchase and install all water meters after the water service and meter pit have been installed and inspected. All costs associated with purchasing and installing any meter shall be reimbursed by the developer.
- B. The Contractor shall provide all tools, equipment and accessories required for tapping ductile iron water mains and installing water services. All underground service lines, valves and fittings shall conform to ANSI/AWWA C800-84 and ANSI/NSF Standards for Public Water Supplies.
- C. Detectable tape approved by the Engineer, shall be placed directly over all water services during backfilling operation so magnetic detection of service lines may be utilized in future by the Owner.
- D. Standard water service lines from the water main to the meter as maintained by the Town shall be 1 inch polyethylene tubing, SDR 9, CTS with stainless steel inserts for all pipe connections. Private service lines from the meter to the house or business may be polyethylene tubing, SDR 9, CTS. Polyethylene service lines shall conform to AWWA C901 and ASTM D-2737. Bury on service tubing shall be a minimum of 32 inches and a maximum of 36 inches. Water service lines shall be separated from sewer lateral by ten (10) feet clear space, unless otherwise approved.
- E. Corporation stops shall be Mueller H-15008 with AWWA tapped threads on inlet and compression outlet 1 inch for polyethylene tubing. Service saddles shall be used to tap PVC mains 6 inch diameter and smaller. Saddles shall be double-strap, stainless steel clamp with AWWA tapered inlet threads. Saddle shall be Ford, Model FS323, or approved equal. Use Teflon tape for threaded service connections. Do not torque saddles without pressure in the main. Cutting tools shall be of the hollow, shell bit type that retains the pipe coupon for removal. Use Mueller drilling machine or approved equal. On multiple taps, space corporation stops as recommended by pipe manufacturer.
- F. Where service lines are placed under new or existing streets, each line shall be placed in a 2-inch diameter Schedule 40 PVC sleeve for future access and replacement.
- G. Meter pit and assembly shall be as detailed herein. No meter pit shall be placed in driveways or paving. Pits shall be 18" diameter PVC (sono-loc) to a length required for pipe bury requirements. Meter setter shall be Ford VHH272-7W with dual check valve outlet and 3/4 inch angle valves with lock wings and saddle

nut. Meter setter heights shall be selected so that the meter depth is 24" to grade. Meters shall be Sensus Radio Read with Touch Read capabilities (AMR) type 3/4" x 5/8". Pit cover shall be cast iron Ford C32-T factory drilled for touch read module. Install meter pit out of traffic areas as close as possible to property line, outside of street right-of-way.

- H. Install a curb stop and box ahead of each meter. Curb stop shall be 1 inch Mueller P-25155N (Minneapolis top thread). Curb box shall be Argonics Speedy Sleeve Poly Curb Box system, part number MP-PCB-SM31518W-B90. The system shall have Minneapolis style polyurethane curb box with 1-1/2" schedule 80 PVC pipe fit. Lid and upper portion shall be the Speedy Sleeve polyurethane repair sleeve with embedded magnet and snap plug cap system with notches. The sleeve shall be 18" long and fit 1-1/2" schedule 80 PVC. Contractor shall provide and install schedule 80 PVC extension pipe between the assembly.

2.31 COMMERCIAL SERVICE

- A. For tapping ductile iron or PVC pipe use Ford Model FS323 double strap, stainless steel service saddle with 2-inch AWWA tapered inlet threads. Corporation valve shall have male AWWA tapered inlet by compression coupling outlet. Use Teflon tape for threaded service connections. Saddles shall not be torqued without water pressure in main.
- B. Service valves shall be Mueller, 2-inch, Model P-25155N (Minneapolis top thread). Couplings shall have male NPT thread by CTS pack joint and be Mueller, Model H-15428 or V-15440.
- C. Curb box shall be Argonics Speedy Sleeve Poly Curb Box system, part number MP-PCB-SM31518W-B90. The system shall have Minneapolis style polyurethane curb box with 1-1/2" schedule 80 PVC pipe fit. Lid and upper portion shall be the Speedy Sleeve polyurethane repair sleeve with embedded magnet and snap plug cap system with notches. The sleeve shall be 18" long and fit 1-1/2" schedule 80 PVC. Contractor shall provide and install schedule 80 PVC extension pipe between the assembly.
- D. Service tubing shall be 2-inch SDR-9 polyethylene (CTS). Service lines shall be installed within a 4" SCH 40 PVC sleeve for all road crossings.
- E. Meter pits shall be white PVC pipe, 30 inches in diameter and 38 inches deep. Pit shall be able to withstand a vertical crush load of 3000 pounds and be able to withstand a side load with a maximum 5% deflection of 80 pounds per linear foot of length. Cover shall be Ford Monitor Cover No. MC-30T with 20 inch, double, extra heavy duty cover with hole drilled to accommodate touch read sensor housing.
- F. Setters shall be Ford custom type with 1½ or 2-inch flange angle check valve, 1½ or 2-inch flange angle ball valve plus bypass ball valve with padlock wings.

- G. Meter shall be Sensus, 1½ or 2-inch, flanged, Radio Read with Touch Read capabilities (AMR), waterproof, sealed at facility. Town personnel shall purchase and install all water meters after the water service and meter pit have been installed and inspected. All costs associated with purchasing and installing any meter shall be reimbursed by the developer.

2.32 INSTALLING SERVICE PIPE, METER ASSEMBLIES AND APPURTENANCES

- A. All service pipe shall be carefully inspected for damaged areas. All damaged pipe shall be replaced so that each service consists of a continuous, unspliced pieces of polyethylene pipe. Pipe installed during hot weather shall be allowed to contract to normal length before backfilling. Pipes and fittings shall be bedded on a solid foundation.
- B. Fittings and valves shall be kept clean, handled carefully and installed according to the manufacturer's recommendations, with stainless steel inserts for all polyethylene pipe connections. The contractor shall confirm compatibility of all piping, fittings, valves, and connections prior to ordering materials.
- C. Where relocation or extension of an existing service line is directed by the Town, new service line shall be installed and located as directed by the Town.
- D. Service lines in street shall be installed by open cutting, utilizing hand excavation methods as specified in Section 3, unless otherwise approved by the Town.
- E. All piping and appurtenances shall be kept in a clean and sanitary condition. A chlorine solution shall be kept on hand and used for cleaning purposes. Service piping, connections and fittings shall all be made watertight and shall be tested at operating pressure from the corp stop to the meter pit. Any leaks thus detected shall be properly repaired by the Contractor.

2.33 GANG METER PITS (Up to five (5) Meters)

- A. All service lines connecting gang meter pits to water mains shall be Polyethylene Tubing, SDR9, (CTS). The manifold in the pit shall be type L hard copper soldered joint fittings per ASTM B88.
- B. The gang meter assembly shall be installed in a precast concrete meter vault. The service pipe or tubing has to be installed in a sleeve.
 - 1. For tapping ductile iron pipe or AWWA C909 PVC pipe use Ford, Model FS323, stainless steel double strap service clamp with 2 inch tapered inlet threads. Use Teflon tape for threaded service connections. Do not torque saddles or sleeves without water pressure in main.
- C. Service valves shall be Mueller, 2-inch, Model P-25155N (Minneapolis top thread). Couplings shall have male NPT thread by CTS pack joint and be Mueller, Model H-15428 or V-15440. Curb box shall be Argonics Speedy Sleeve

Poly Curb Box system, part number MP-PCB-SM31518W-B90. The system shall have Minneapolis style polyurethane curb box with 1-1/2" schedule 80 PVC pipe fit. Lid and upper portion shall be the Speedy Sleeve polyurethane repair sleeve with embedded magnet and snap plug cap system with notches. The sleeve shall be 18" long and fit 1-1/2" schedule 80 PVC. Contractor shall provide and install schedule 80 PVC extension pipe between the assembly.

- D. The setting shall be as detailed on the plans. Use for each meter at the pit Ford yoke check valve HS91-323 and a Ford expansion connection EC-23-W. Couplings for connecting to service tubing shall be as required.
- E. Cover shall be Ford Monitor cover #30 with 20-inch lid and 30-inch inside diameter.
- F. If installation of meter pit in traffic area cannot be avoided, install 30"x38" oversized pit with Ford setter and heavy duty cover lid.

SEWER PIPE, FORCE MAINS AND APPURTENANCES

2.34 GENERAL

- A. The Contractor shall furnish all material and shall construct the pipe lines and all required appurtenances at the locations and to the lines, slopes and elevations shown on the drawings.
- B. All gravity sewer pipe shall be polyvinyl chloride (PVC) pipe, as specified in this section. Force main shall be ductile iron pipe or PVC pipe, as specified in this section.
- C. The Contractor shall submit certifications to the Engineer that all pipe, fittings and joints are as specified herein.
- D. Following construction, Contractor shall flush debris from all sewer facilities.
- E. Town of Berlin requires that no condensate drains be connected to the Town's sewer system.

2.35 POLYVINYL CHLORIDE SEWER PIPE AND FITTINGS

- A. PVC pipe, used for sewer and lateral construction, shall equal or exceed the requirements of ASTM D3034 and shall have a minimum standard dimension (SDR) ratio of 35 and the minimum pipe stiffness, as tested in accordance with ASTM D2412, shall be 45 when measured under 5 percent deflection at 73 degrees Fahrenheit. Pipe shall be manufactured with integral wall bell and spigot joints in standard lengths not exceeding 20.0 feet in accordance with ASTM D3212.
- B. All PVC pipe and fittings shall utilize an elastomeric O-ring gasketed joint assembled in accordance with the manufacturer's recommendations. Gasket shall conform to ASTM F477.
- C. An acceptable alternate for pipe used for lateral construction shall be PVC pipe meeting the requirements of ASTM D-1785, schedule 40. It shall be manufactured in standard lengths, not exceeding 20 feet and have an outside diameter equal to iron pipe (IPS). Pipe shall be manufactured with beveled ends acceptable for use with solvent weld joints. Coordinate connection to existing piping and provide fittings and adapters necessary to make the connections.
- D. PVC wye branches, pipe stoppers and other fittings shall be manufactured in accordance with the same specifications and shall have the same thickness, depth of socket, and annular space as the pipe. Tee fittings will not be permitted for use. Wye branches shall be complete pipe sections. Saddles will not be permitted for use.
- E. PVC pipe shall be delivered and stockpiled in unit pallets. Stacking of pallets

above 5 feet in height will not be allowed. If pipe is stockpiled for more than 30 days prior to installation in the trench, it must be suitably covered with reflective material to protect the pipe from ultra-violet rays emanating from sunlight. Do not use plastic sheets. Allow for air circulation under covering.

- F. Bowed section of pipe will be unacceptable and installation of pipe which has bowed, whether or not the bow has been corrected, will not be allowed.

2.36 FORCE MAIN PIPE AND FITTINGS

A. DUCTILE IRON PIPE

1. Ductile iron pipe shall be manufactured in accordance with ANSI/AWWA C151/A21.51, latest edition, and shall be thickness Class 50 or greater as required.
2. Pipe and fittings shall have a standard asphaltic coating approximately 1 mil thick.
3. Pipe and fittings shall have an internal cement lining in accordance with latest revision of ANSI/AWWA C104/A21.4.
4. All fittings and specials shall be ductile iron and shall be mechanical joint with a 350 psi pressure rating conforming to ANSI/AWWA C153/A21.53 and C111/A21.11. Wall thickness shall be equal to class 56 ductile iron pipe.

B. POLYVINYL CHLORIDE PIPE

Pipe shall be manufactured by meeting the requirements of C-909, (DR-18 and colored green) or ASTM-D-2241, SDR-21 pressure Class 200. Pipe shall be manufactured in lengths not exceeding 20 feet. Pipe shall utilize push-on joints. Fitting shall be Class 200. Ductile iron fittings per AWWA C-110 or C-153.

- C. Pour concrete thrust blocks according to the details on all horizontal or vertical pipe bends.
- D. The force mains shall be tested per Section 2.29 (B). The Contractor shall make any and all repairs at his expense that may be necessary until the testing requirements have been met.
- E. Force mains may also be constructed by means of HDPE piping; see Section 2.26 for material specifications and installation methods. Should Town of Berlin approve, the Contractor may use HPDE piping for the entire force main. This approval will be given on a project specific basis.

2.37 PIPE INSTALLATION

- A. Pipe and fittings shall be carefully handled and lowered into the trench. Special care shall be taken to insure 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 pipe.

- B. Before pipe is place, the bottom of the trench shall be carefully shaped to fit the lower part of the pipe exterior with reasonable closeness for width of at least 60% of the pipe width. 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 on secured in place. Any defects due to settlement shall be made good by the Contractor.
- C. Proper and suitable tools and appliances for the safe and convenient handling and laying of pipe shall be used.
- D. 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.
- E. The pipes shall be thoroughly cleaned before they are laid and shall be kept clean until the acceptance of the completed work. The open ends of all pipe lines shall be provided with a stopper carefully fitted so as to keep dirt and other substances from entering. This stopper shall be kept in the end of the pipe line at all times when laying is not in actual progress.
- F. All concrete required to support and reinforce wye branches, bends and other fittings shall be placed as directed, in accordance with the Town Standards.
- G. Backfill materials shall be hand placed and mechanically tamped in six inch layers, placed uniformly on both sides of the pipe, to a point at least one foot above the pipe crown. Each layer shall be thoroughly compacted for the full trench width and under, around and over the pipe.
- H. Pipeline detectable tape shall be installed continuously along all sewer mains. The tape shall be installed directly above the pipe and 12 inches from the ground surface. The tape shall be Lineguard type II Detectable tape as manufactured by Lineguard, Inc. of Wheaton, Illinois or equal. The tape shall be a minimum of two inched wide, imprinted with the words “CAUTION: SEWER LINE BELOW” and be capable of being detected with inductive methods.
- I. Pipeline tracer wire shall be THHN/THWN 12 gauge solid copper conductor insulated with a high molecular weight polyethylene (HMWPE) coating. Tracer wire shall be installed with sufficient length inside valve boxes and meter pits to allow for connection at ground surface.
- J. For refill of the remaining trench depth, refer to “Excavation and Backfill” Section of these specifications.
- K. Refer to Section 2.26 for directional bore requirements.

2.38 BORING AND JACKING OF SANITARY SEWER

- A. Where possible, an approach trench shall be excavated far enough to provide a jacking face of at least three (3') feet from a pavement surface. This open face shall be shored securely to prevent slipping or raveling of the face.
- B. Boring pits shall be large enough to contain all necessary equipment and tools. Adequate provision shall be made for the removal of excavated material.
- C. A substantial backstop of heavy timber or steel beams shall be provided to take the thrust of the jack or boring equipment.
- D. As material is excavated or bored ahead of the pipe, the pipe shall be jacked in to follow this excavation. The distance dug ahead of the pipe shall not exceed six inches (6").
- E. The installation of casing pipe and the boring or excavation shall be done simultaneously.
- F. Voids between the sleeve and excavation shall be filled by pressure grouting.
- G. Cement shall be used to seal the pipe ends between the carrier pipe and sleeve.
- H. A one (1") inch PVC pipe shall be installed in the downgrade seal to permit drainage.
- I. Steel pipe sleeve shall be furnished in the diameter shown on the plans and shall conform to the requirements of AWWA C-200; Grade B pipe shall be used. The pipe, including field connections, shall be coated with bitumastic compound, inside and outside. Pipe wall thickness for sleeves shall be standard thickness. All joints for casing pipe shall be made by continuous weld completely around the perimeter of the pipe in accordance with AWWA C-206.
- J. Carrier pipe shall be as required by the plans and specifications.
- K. Use runners or cradles to support the pipe in the casing. A minimum of two supports is needed per joint of pipe providing a maximum span of 6.25 feet for PVC pipe lengths of 12.5 feet or less. The maximum span between supports for pipe lengths of 19 to 20 feet must not exceed 7.5 feet. Prefabricated support shall be approved by Engineer and installed per manufacturer's requirements.

2.39 LAYING PIPE IN FREEZING WEATHER

No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when the Engineer 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.

2.40 ARTIFICIAL FOUNDATION

Whenever directed, the Contractor shall lay pipe upon an artificial foundation which he shall construct. Such foundation may consist of gravels or of concrete; all to be of the form and dimensions and placed according to the detail or in the manner required by the Engineer.

2.41 TESTING

A. Gravity sewer to be tested in accordance with the following:

1. Contractor shall furnish all labor, tools, materials, and equipment, including water, pumps, compressors, stopwatch, gauges, and meters, subject to the approval of the Engineer for testing in accordance with these specifications.
2. The Engineer shall be notified in advance of all tests, and all test shall be conducted to his entire satisfaction.
3. The gravity sewer mains shall be mirror tested and gravity sewer mains with laterals shall be video and air tested; as follows:

a. **MIRROR TEST:**

Upon completion of pipe laying and backfilling to a point at least two (2) feet above the crown of the pipe, the Engineer will conduct a mirror test to check for defects, excess deflection, leakage, and for horizontal or vertical misalignment. Mirror testing shall consist of reflecting sunlight or artificial light via mirrors through the completed section of pipeline, which, in order to be accepted, shall be true and straight in horizontal and vertical alignment to allow for the full passage of the reflected light.

b. **VIDEO INSPECTION:**

Upon completion of the pipe laying operation, complete with manholes and flow channels, all sanitary sewer mains shall be video inspected in a high-resolution color format. This includes recording of each video for documenting conditions observed. Digital media format shall be as agreed to by the Town. All accumulation of sediment and debris or misalignments shall be removed and all defects be corrected prior to acceptance of the sewers impacted. The cost of video inspection shall be the responsibility of the Contractor or Developer. Video inspection of sewer laterals may be required if low pressure air testing fails or evidence of damage during sewer main video inspection.

c. **LEAK TESTING USING AIR**

- i. Sewers shall be tested in sections of not more than 400 foot lengths unless otherwise approved by the Engineer. Each section shall be tested immediately upon completion thereof. Each section shall meet the air pressure drop

- limitations specified herein.
- ii. All material and labor required for leakage tests shall be furnished by the Contractor.
 - iii. Sewers shall be tested using the low-pressure air method in accordance with the requirements of ASTM C-828 and the Uni-Bell Plastic Pipe Association recommendations, based upon the Ramseier test time criteria. Procedural and equipment details shall be submitted to the Engineer prior to acceptance of its use for testing.
 - iv. If the test time for the designated size and length, elapses before the test pressure drops 0.5 psig, the section undergoing the test shall have passed.
 - v. If the pressure drops 0.5 psig before the appropriate test time has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test. Contractor shall determine at his own expense the source or sources of leakage and he shall repair or replace all defective materials and/or workmanship to the satisfaction of the Engineer. The completed pipe installation shall then be retested and required to meet the requirements of this test.
 - vi. Groundwater elevation shall be considered and air pressure shall be adjusted accordingly. The average vertical height of groundwater above the pipe (in feet) shall be divided by 2.31. This number (in psi) shall be added to the test pressure (3.5 psi). In no case shall a test pressure exceed 9.0 psi.
 - vii. The initial pressure shall be raised to 4.0 psi. The pressure of the line and temperature of the air shall be allowed to stabilize. This may take 2 to 5 minutes depending on the pipe size. The Contractor shall reduce the pressure to 3.5 psi prior to starting the timed test. Measured time from 3.5 psi to 3.0 psi shall conform with the following tabulation.

SPECIFICATION TIME REQUIRED FOR A 0.5 PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATE FOR Q = 0.0015

1 Pipe Dia. (in.)	2 Min. Time (min:sec)	3 Length for Min.Time (ft)	4 Time for Longer Length (sec)	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:83	9:58	11:24
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54

2.42 SEWER MANHOLES

A. GENERAL

1. All sanitary sewer manholes shall be precast reinforced concrete.
2. Manholes shall be built at such points on the pipe lines and of such form and dimensions as are shown on the drawings or as may be directed. Manholes shall be built as pipe laying progresses and the Engineer may stop work entirely on the laying pipe if manhole construction is delayed to such an extent as to be hazardous to construction or the public.
3. Manhole frames and covers shall be installed on grade to match the slope of the paved surface. Use brick or pre-manufactured devices, approved by the engineer, to build up from cone to grade as required to match the slope of the frame and cover to the slope of the paved surface.

B. PRECAST REINFORCED CONCRETE MANHOLES

1. Precast reinforced concrete risers, eccentric cones and bases shall be in conformance with ASTM Designation C 478. Joints between riser sections shall be fitted with an "O" ring rubber gasket, meeting the requirements of ASTM Designation C 445. Installation of risers shall be in accordance with manufacturer's recommendations under the supervision of the Engineer.
2. Precast reinforced concrete base and riser sections shall be as manufactured by Atlantic Concrete Products Company, Virginia Precast Corporation, or equal.
3. Interior and exterior joint spaces of all manhole risers shall be filled prior

to application of the exterior waterproofing. The interior joint shall be mortared. The exterior joint may be mortared or filled with a joint filler compound. Said compound shall be Sikaflex Concrete Mix or equal.

4. Lifting holed 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 wall after installation of manhole riser sections. Not more than two hole shall be cast in the walls of each riser section for the purpose of handling.
5. The exterior surface of all precast manholes shall receive a minimum two coat application of a 68 percent solids coal tar type protective coating. The total average dry film thickness shall measure 24 mils with no single measurement to be less than 20 mils. Surfaces shall be prepared in accordance with the manufacturer's instructions and coatings applied in the field in a manner acceptable to the Engineer. The coating material shall be Bitumastic Super Service Black manufactured by Koppers Co., Inc., Pittsburgh, Pennsylvania, Tar-Jet Super Black manufactured by Pennsbury Coatings Corp., New Britain, Pennsylvania, or approved equal.
6. All pipe-to-manhole connections in the precast manhole shall be made by means of an integrally cast flexible connector which shall be Lockjoint flexible manhole sleeve as manufactured by Interpace Corp., Parsippany, New Jersey, or A-Lok flexible manhole gasket as manufactured by A-Lok Corp., Trenton, New Jersey or equal.
7. Manhole stubs shall extend 4 feet outside of the manhole wall unless otherwise detailed. The stub end shall be plugged.

C. FLOW CHANNELS

1. Manhole flow channels and benches shall be constructed of "SS" sewer brick with care taken to secure smooth and even surfaces with full special mortar joints. Channel sections shall be built up to true line and radius, and curved section shall provide a uniform transition in the flow direction.
2. Materials and construction of flow channels shall be in accordance with appropriate section for materials so used, as hereinafter specified.
3. Precast concrete flow channels shall be an acceptable alternative. Channels shall provide a smooth transition between pipe inverts and shall be properly aligned with sewer mains.

D. CONCRETE

All cast-in-place concrete for cradles, encasements, blocking, etc. shall have a minimum compressive strength of 3,000 psi at 28 days. Concrete for precast flow channels shall be per Section 2.42 (C) noted above.

E. BRICK

1. Brickwork shall be limited to flow channel and bench construction and frame adjustment courses. No other brick shall be used in manhole construction.

2. All brick shall conform to the “Standard Specifications for Sewer Brick”, ASTM Designation C 32, Grade SS, except that the maximum absorption for the average of five bricks shall not exceed 10 percent; and the individual brick maximum shall not exceed 14 percent.

F. MORTAR

1. Cement shall be in accordance with the “Standard Specifications for Portland Cement”, ASTM Designation C 150 for Type II.
2. Sand shall be composed of sharp, angular, silicious grains, coarse, or graded from fine to coarse with the coarsest grains predominating, and sensibly free from clay, loam, dirt, mica, organic matter, or other impurities. Sand containing more than 5 percent by weight of foreign material shall not be used. This limit may be changed for special classed of work if hereinafter specified. Sand exhibiting more than an acceptable amount of fine matter or impurities may be required to be washed after delivery on the work or shall be rejected altogether. Sand for mortar shall be screened to reject all particles of a greater diameter than 1/4-inch and shall not contain more than 5 percent by weight of a very fine material.
3. Unless hereinafter specified otherwise, all mortar shall be compressed of cement and sand of the character above specified. The proportion of volume shall be one part of cement to two of sand. One volume of cement shall be 94 pounds net. One volume of sand shall be 0.9 cubic feet, the sand not being packed more closely than by throwing it into a box in the usual way. Mortar shall be fresh mixed in small batches for the work in hand. Tight boxes or platforms made for the purposes shall be used. The sand and cement shall be thoroughly mixed dry, in the proper proportions, until a uniform color has been produced, whereupon a moderate dose of water shall be added, so as to produce a stiff paste of the proper consistency.
4. Sand obtained from the excavation shall not be used.

G. LAYING BRICK

1. All brickwork shall be laid by competent professionals.
2. All brick shall be laid in a full bed of mortar with all vertical and horizontal joints filled solid with mortar.
3. Joints shall be not less than 3/8-inch or more than 1/2-inch wide except as otherwise specified in (E) below.
4. No brickwork shall be laid when the temperature is below 40 degrees or when the indications are for lower temperatures within 24 hours. The contractor shall take such measures as may be approved to prevent brickwork from being exposed to freezing temperatures for a period of not less than five days after laying.
5. Special care shall be taken in laying brick in inverts of manholes to insure a uniform flow of water through the sections. In such locations, joints shall not exceed 1/16-inch in thickness and each brick shall be laid in full mortar bed with joints on bottom side and end made in one operation. No

grouting or working in of mortar after laying the brick will be permitted.

H. MANHOLE STEPS

1. Manhole steps shall be made of 3/8 inch diameter (No.3) steel reinforcing bars, ASTM Designation A615, Grade 60, encased in polypropylene plastic. Manhole steps shall have notched tread ridge with retainer lug on each side.
2. Manhole steps shall be cast in place during manufacture of precast reinforced concrete manholes or placed in brick manholes during construction. Embedment length shall be suitable for minimum 5 inch thick, precast reinforced concrete riser walls.
3. Manhole steps shall be OSHA approved and as manufactured by M.A. Industries, Inc., Peachtree City, Georgia, ICM, Inc., Jacksonville, Arkansas, or equal.
4. Manhole steps shall be spaced 12 inches apart. The maximum spacing from top of manhole to the first step shall not exceed 16 inches.

I. MANHOLE FRAMES AND COVERS

1. Frames and covers shall be set by the Contractor as the work progresses. The frame shall be well bedded in mortar.
2. Frames and covers shall be East Jordan Iron Works cover model 1544C and frame model 1545Z1, containing the words "SANITARY SEWER" in 2" raised letters. Material for frames and covers shall be in accordance with standard specifications for gray iron castings ASTM A-48 for Class 30. Minimum weights shall be 142 lb for frames and 180 lb for cover. Manhole covers shall include 2-1 inch pickholes. Slotted pickholes shall not be allowed.

J. MANHOLE INSERTS

Inflow protector manhole inserts shall be installed in manholes as designated on the project plans. Manhole covers shall contain a gas relief valve able to relieve at a pressure of 1 pound or less and capable of sealing on dirt and small debris. The cover and valve body shall be manufactured from corrosion proof material suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with wastewater collection systems. The inflow protector manhole covers shall be watertight HDPE inserts as manufactured by Parson Environmental Products, Inc.

K. TESTS

If inspection reveals any visible leakage or seepage in any manhole, the Contractor will be required to accomplish such remedial measures as may be directed by the Engineer. Caulking or patching of interior manhole surfaces will not be acceptable.

PUMP STATIONS AND APPURTENANCES

2.43 GENERAL

- A. The Developer shall furnish and install all pump stations and appurtenances as specified herein and as defined on the drawings or as directed by the Engineer. Provide all necessary adaptors for connections to existing mains.
- B. Pump stations shall be designed for the specific hydraulic conditions of the sewage system in question and signed and sealed by the Developer's Professional Engineer and certified by the station manufacturer. Plans and details shall be submitted to the Town of Berlin for review.
- C. Pump Stations shall meet all Maryland Department of the Environment requirements in addition to these specifications. The Developer and his Contractor shall obtain all permits and determinations from all Local, County, and State agencies having jurisdiction over the work.
- D. Material and equipment submittals shall be submitted to the Town of Berlin for review. An Operation and Maintenance Manual shall be prepared by the Contractor and submitted for review prior to final acceptance.
- E. A simplex or duplex E-One grinder station shall be provided when the peak design for the pump station is less than 20 GPM, or as required by the Town of Berlin. Equipment and installation shall be in accordance with the manufacturer's requirements and recommendations. Grinder stations shall be manufactured by the Environmental One Corporation, Baltimore, Maryland.
- F. A duplex grinder pump station shall be provided when the peak design for the pump station is between 20 GPM – 75 GPM, or as required by the Town of Berlin. Equipment and installation shall be in accordance with the manufacturer's requirements and recommendations.
- G. Gorman-Rupp duplex, at-grade, vacuum prime pump station shall be provided when the peak design for the pump station exceeds 75 GPM, or as required by the Town of Berlin. Equipment and installation shall be in accordance with the manufacturer's requirements and recommendations.
- H. The Developer or his agent shall supply to the Town of Berlin a spare sewage pump sized identically to the pumps that are being supplied with the pump station
- I. For wet wells 5 feet in diameter and larger, pump stations shall be equipped with a removable rail-mounted trash basket installed to collect debris from the gravity sewer discharge pipe.

2.44 OBSTRUCTIONLESS ELECTROMAGNETIC FLOWMETER

- A. The magnetic flowmeter shall be microprocessor-based and wafer design to be installed between flanges. It shall indicate, totalize, and transmit flow in full pipes.
- B. The magnetic flowmeter shall utilize DC bi-polar pulsed coil excitation, operating at frequencies up to 100 Hz and automatically re-zeroing after every cycle.
- C. The accuracy shall be at least 0.5% of flow rate over a 33:1 turndown at all flow rates above 1 fps. Accuracy shall be verified by calibration in a flow laboratory traceable to the U.S National Institute of Standards and Technology.
- D. The flow sensor liner shall be Polyurethane lined. The field coils shall be completely encapsulated in polyurethane to prevent any entry of moisture to the coils. The flow meter shall be fully welded. The meter housing and flowmeter sensor shall retain a NEMA-4X rating. The flow sensor coil housing shall be steel and withstand 500 PSI external pressure in all conditions.
- E. The electronics shall be remote mounted. The flowmeter transmitter shall be furnished in a NEMA-4X enclosure box, with a character, 2-line 16 digit backlit display and sufficient cable to meet site layout requirements. Cable shall not be spliced in the field. A 2-line, 16-character backlit alphanumeric display shall indicate user-defined flow units and total flow. All menu advice and commands shall be visible on this display.
- F. The flowmeter shall be suitable for operation at temperatures from -40°F to 180°F and at pressures from full vacuum to 300 psi. Flow meter shall be capable of operating in submerged conditions.
- G. The preamplifier input impedance shall not be less than 1012 ohms. External ultrasonic electrode cleaners shall not be acceptable.
- H. Available outputs shall be 1) Isolated analog 4-20 mA into 800 ohms (standard); 2) two flow alarms; 3) fault, with open collector; 4) Positive Zero Return (PZR) for external relay contacts.
- I. Low flow cutoff shall be selectable from 0-9% of full span and there shall be two flow alarms settable from 0-99% of span.
- J. The flowmeter shall allow menu selection and program changes to be made from outside the housing via Hall-effect sensors. It shall not be necessary to remove covers, panels or fasteners to accomplish calibration or program changes. The meter software shall incorporate password protection and prevent inadvertent program changes. A hand held programmer is not acceptable.
- K. The meter shall feature dedicated non-volatile sensor memory which shall contain all the characteristics of the sensor (i.e. calibration factors. coil frequency, gain

settings) as well as user defined parameters on site. This memory shall facilitate automatic transfer of pre-programmed data to new electronics in the event of a transmitter fault, without requiring renewed calibration/ programming. Totalized flow and programmed configuration shall be maintained in memory for the meters lifetime.

- L. All printed circuit boards shall be contained in a single easy plug-in, easy plug out module which is interchangeable with electronics from any size meter without requiring any testing or programming.
- M. The flowmeter shall have a diagnostic feature which will provide a display message and fault output in case of a sensor failure, programming error or empty pipe condition.
- N. The Flowmeter shall have a switching power supply having an operating range from 77 - 265 Vac 50/60 Hz (12-60 Vdc). Power consumption shall not exceed 20 VA.
- O. The flowmeter manufacturer shall have meters of the DC pulse type in similar flowing mediums for a minimum of ten years.
- P. Flowmeters used for raw and potable water shall have a polyurethane coating.
- Q. The flowmeter shall be a Tigermag model as manufactured by Sparling Instruments, Inc., or Siemens, Model MAG 5100 W flow meter with Model MAG 6000 transmitter or approved equal.
- R. Should the flow meter be subjected to flooding conditions, then the transmitter shall meet IP 68 Standard or the transmitter must be installed in a manner that will not be subjected to flooding.

2.45 VENT SET CENTRIFUGAL EXHAUST FAN

- A. Furnish and install centrifugal industrial exhaust fan Type 7-BISW, Arrangement 10, as manufactured by Greenheck, or equal.
- B. Units shall be constructed with corrosion resistant steel housing and coated with two coats of enamel paint on the inside and outside of fan. Color to be selected by the Town of Berlin.
- C. Unit inlet and outlet shall be slip connection. Provide fan inlet with hot dip galvanized steel bird screen.
- D. Unit shall be provided with a 1/2" drilled and tapped hole at the lowest point of the fan scroll to facilitate condensate drainage.

- E. Fan wheel shall be backwardly inclined non-spark aluminum and direct connected to the motor shaft, with a rotation necessary to force the required air flow into the wet well.
- F. Unit shall be provided with all-weather cover over motor and drive. Complete, assembled unit shall be suitable for outdoors installation. Provide corrosion resistant coatings.
- G. Motors shall be ball bearing totally enclosed, type TEFC (fan-cooled).
- H. Furnish vibration isolators of the type recommended by fan manufacturer, suitable for concrete pad mounting.
- I. Flexible 6" dia. pipe connections shall be furnished on fan outlet.

2.46 VENTILATION PIPING

All ventilation piping shall be schedule 40 PVC per ASTM D-1785 or ductile iron. Minimum burial depth shall be 2.5' to top of pipe.

2.47 E-ONE GRINDER STATIONS

A. GENERAL DESCRIPTION

1. Where approved in advance, and where gravity sewer service cannot be achieved without a pumping station, grinder pump stations may be used for a dwelling or commercial building generating no more than 300 gpd for the model 2012 and 600 gpd for model 2014.
2. The grinder pump station(s) shall be completely factory built and tested, each consisting of a grinder pump suitably mounted in a fiberglass basin, pump removal system, shut-off valve, anti-siphon valve, and check valve assembled within the basin, remote electrical alarm/disconnect panel, and all necessary wiring and controls. The pump(s) shall be semi-positive displacement type grinder pump(s). For ease of serviceability, all pump motor/grinder units shall be of like type and horse power throughout the system. Grinder pump system including controls shall be Environment One products.
3. One grinder pump shall be utilized for each dwelling unit. Duplex stations are acceptable for commercial facilities under common ownership.

B. WARRANTY

The grinder pump station(s), including alarm/disconnect panel(s), shall be warranted from any defect in material and/or factory workmanship for a period of twenty-four (24) months from the date of installation. Repair or parts replacement required as a result of such defect will be made free of charge during this period upon return of the defective parts or equipment to the manufacturer or its nearest authorized service center.

C. OPERATING CONDITIONS

The pump(s) shall be capable of delivering 9 gpm at 138 feet TDH (60 psig). The pump(s) shall also be able to operate at lower heads without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create an apparent head.

D. GRINDER

1. The grinder will be of the rotating type with a stationary hardened and ground chrome steel shredding ring spaced in accurate close annular alignment of the driven impeller assembly, which shall carry two hardened type 400 series stainless steel cutter bars. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects", such as paper, wood, plastic, glass, rubber and the like, to fine particles which will pass freely through the passages of the pump and the discharge piping.
2. These requirements shall be accomplished by the following, in conjunction with the pump:
 - a. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
 - b. The maximum flow rate through the cutting mechanism must not exceed 4 feet per second. This is a critical design element to prevent jamming and as such must be adhered to.
 - c. The inlet shroud shall have a diameter of no less than 5 inches. Inlet shrouds that are less than 5 inches in diameter will not be accepted due to their inability to maintain the specified 4 feet per second maximum inlet velocity which by design prevents unnecessary jamming of the cutter mechanism and eliminates blinding of the pump by large objects blocking the inlet shroud.
 - d. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.

E. ELECTRIC MOTOR

The motor shall be a 1 HP, 1725 RPM, 240 volt, 60 hertz, 1 phase, capacitor start, ball bearing, air-cooled induction type with a low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application.

F. TANK

1. The tank shall be a wetwell/drywell design constructed in high density polyethylene, with a grade selected to provide necessary environmental stress cracking resistance with PVC factory installed closet inlet flange to accept a PVC DWV pipe of the size shown on the drawings. The accessway shall be custom molded of fiberglass reinforced polyester resin and have a stainless steel padlock - keyed per Town Requirements.
2. All discharge piping shall be constructed of 304 series stainless steel and terminate outside the accessway bulkhead with a stainless steel, 1-1/4 inch female NPT fitting. The discharge piping shall include a stainless steel ball valve rated for 200 psi.
3. The accessway shall include a single NEMA 6P electrical quick disconnect (EQD) for all power and control functions, factory installed with accessway penetrations warranted by the manufacturer to be watertight. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts. The accessway shall also include a 2 inch PVC vent to prevent sewage gases from accumulating in the tank.
4. The station shall have all necessary penetrations molded in and factory sealed. To ensure a leak-free installation, no field penetrations shall be acceptable.

G. CHECK VALVES

The pump discharge shall be equipped with factory installed, gravity operated, flapper-type integral check valve built into the stainless steel discharge pipe. Working parts will be made of 300 series stainless steel and fabric reinforced synthetic elastomer. The valve body shall be a high gloss injection molded part made of PVC type I-II.

H. ANTI-SIPHON VALVE

The pump discharge shall be constructed in a positively-primed flooded suction configuration. The pump shall be equipped with a factory installed, integral anti-siphoning air relief valve, in the discharge piping immediately below the check valve. This valve will automatically open when the pump is off.

I. CONTROLS

1. The location of the control/alarm panel shall be coordinated at each property with the property Owner and the Town of Berlin. The panel cover will be attached with stainless steel tamperproof fasteners.
2. Non-fouling wastewater level detection for controlling pump operation shall be accomplished by an integral air-bell level sensor connected through air-tight tubing to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater. High-

level sensing will be accomplished in the manner detailed above by a separate air-bell and pressure switch of the same type.

3. All controls, panels and the assembly shall be UL Listed.

J. ALARM/DISCONNECT PANEL

1. Each grinder pump station shall include a NEMA 4X, UL listed ALARM/DISCONNECT PANEL (MOD T260) suitable for exterior wall mounting. The enclosure shall be manufactured of thermoplastic to assure corrosion resistance. The enclosure shall include a hinged cover with stainless steel padlock, keyed per Town requirements.
2. The Alarm/disconnect Panel shall include a visual alarm device with alarm sequence as follows:
 - a. When liquid level in sewage wet-well rises above alarm level, visual alarms will be activated.
 - b. Visual alarm remains illuminated until sewage in wet-well returns to normal operating level.
3. The visual alarm shall be a red fluted lens at least 2-5/8" in diameter and 1-11/16" in height. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain rain proof integrity.

K. WIRING

It shall be the responsibility of the Contractor's Electrical Subcontractor to furnish and install all equipment and wiring for the grinder pump station in compliance with the appropriate national and local codes, the manufacturer's recommendations, and the Contract Documents, as necessary to provide an operational grinder station, including: coordination with the power company and property Owner; determining and making the necessary modifications to the existing electrical service and meter box; and coordinating inspection and certification by a certified electrical inspection agency.

L. FACTORY TEST

Each grinder pump core shall be submerged and operated for 5 minutes (minimum). Included in this procedure will be the testing of all ancillary components. Certified test results shall be supplied showing the operation of each grinder pump at three (3) different points on its curve, with the maximum pressure no less than 60 psi.

M. INSTALLATION

Installation shall be per manufacturer's recommendations.

N. START-UP

The service of a trained factory-authorized technician shall be provided by the manufacturer to inspect the installation and assist in start-up.

Upon completion of the installation, perform the following test on each station in the presence of a Town representative.

1. Make certain the discharge shut-off valve is fully open. This valve must not be closed when the pump is operating. In some installations, there may be valve(s) at the street main that must also be open.
2. Turn on the alarm power circuit.
3. Fill the wet well with water to a depth sufficient to verify the high level alarm is operating. Shut off water.
4. Turn on pump power circuit. Initiate pump operation to verify automatic “on/off” controls are operative. Pump should immediately turn on. Within one (1) minute alarm light will turn off. Within three (3) minutes the pump will turn off.
5. Record voltage and amperage readings to verify proper electrical conditions are met.
6. Upon completion of the start-up and testing, submit to the Town the manufacturer’s start-up authorization form describing the results of the tests performed for each grinder pump station tested bearing the signature of the manufacturer’s authorized technician. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed.

O. SPARE CORE

The manufacturer will supply a minimum of one (1) spare grinder pump core and components, plus one (1) spare grinder pump core and components for each 8 pumps installed. Components to be provided include all operation control levels, sensors, check valve, anti-siphon valve, pump/motor unit, and grinder.

P. MANUALS

Supply minimum of four (4) copies of Operation and Maintenance Manuals to the Town or as directed by Town or Engineer.

Q. EASEMENTS

Submit for approval 3 copies of covenants or maintenance easements. Covenants or maintenance easements shall provide right of entry of Town personnel and equipment as required to maintain or replace all above and below grade components.

R. OWNER RESPONSIBILITIES

The Property Owner shall assume ownership of the complete system components

including panels, wiring and station. Property owner is responsible to maintain easements, maintain electrical service to panels, and maintain house sewer lateral from house to pump station. Property owner is responsible to pay for all power consumption.

2.48 DUPLEX GRINDER AND AT GRADE SUCTION LIFT PUMP STATIONS

A. WET WELL

1. The wet well shall be constructed of 5,000 psi pre-cast concrete. The wet well floor shall be sloped to direct solids to the suction pipes.
 - a. Duplex grinder pump station wet well shall have a minimum of 5 feet in diameter.
 - b. At-grade suction lift pump station wet well shall have a minimum of 6 feet in diameter.
2. Top slab shall be constructed of 4,000 PSI concrete. Two test cylinders shall be collected and tested by a state approved lab.
3. The access hatch shall be a 2'-0" x 2'-0" clear opening, 300 psf rated Halliday hatch with stainless steel hardware and lock, with aluminum plate construction.
4. All wet well hardware shall be 316 stainless steel, unless otherwise noted.
5. Two (2) coats of waterproof bitumastic compound shall be applied to all buried concrete riser structures.
6. All concrete riser sections shall to have resilient seal joints with hydraulic cement applied to exterior.
7. Top slab shall be sized and arranged to allow for routine maintenance to the station and be a minimum of one foot above the 100 year flood plain.
8. A stilling well shall be used to protect the level control transducer, which sends a signal to the control panel. The stilling well shall be 8" schedule 80 PVC pipe drilled with a 2" holes at 6" spacing alternating on either side of the pipe. A minimum of 3 stainless steel straps shall be used to support the stilling well.
9. A Neenah cast access box, Model R-1976, shall be cast into the top slab to access the transducer.
10. Provide one spare pump shaft seal, volute gaskets and impeller/grinder.

B. DUPLEX GRINDER PUMPS (20-100 GPM)

1. The station shall be a duplex grinder pump station with pumps manufactured by Hydromatic or approved equal.
2. Pump shall have a reversing feature to minimize to allow the cutters to operate in reverse.
3. Pump motors shall be sized to be non-overloading at any point on the operative curve.

4. The pump lifting assembly shall be 316 stainless steel including lifting chain (no cable shall be allowed), lifting bale, guide bars, supports and all other required hardware.
5. A separate valve vault shall be utilized just outside the wet well. The valve vault shall include check valves and ball valves on each discharge line joined with a tee. The meter shall be located within the valve vault or in a separate vault.
6. Check Valves shall be a minimum of 3" inside diameter, ductile iron body, with a rubber flapper.
7. Isolation valves shall be full port stainless steel ball valves with a minimum inside diameter of 3".
8. A flexible coupler shall be utilized on the discharge between the wet well and valve vault.
9. Conduit shall be used to protect the controls and power supply from the wet well to the control panel.
10. Discharge piping shall be ductile iron from the wet well through the valve vault and then transitioning to Polyvinyl Chloride Pipe or HDPE piping per Section 2.36 or Section 2.26, respectively.

C. AT GRADE SUCTION LIFT PUMPS (100 GPM +)

1. The station shall be a duplex pump station as manufactured by Gorman-Rupp including fiberglass hood, internal heater and non-clog pumps capable of passing a 3 inch sphere.
2. Pump motors shall be sized to be non-overloading at any point on the operative curve.
3. The pumps joined with a tee, 3-way plug valve, and check valves on each discharge (as provided by the station manufacturer), all under the fiberglass enclosure.
4. Suction piping shall be SCH 80 PVC – Discharge piping shall be ductile iron then transitioning to Polyvinyl Chloride Pipe or HDPE piping per Section 2.36 or Section 2.26, respectively. If a priming loop is needed, the discharge shall be supported at the bottom of the well.
5. Pump Stations 15' and deeper shall have a stainless steel support beam to minimize suction and discharge pipe motion.

D. ELECTRICAL

1. GENERATOR

- a. The generator set shall be a diesel 4 cycle 1,800 RPM, 60 Hz manufactured by Onan. The generator will be sized so that both pumps can operate with controls simultaneously. The engine shall be EPA Mobile Off-Highway Certified.
- b. Documentation must be provided by the manufacture demonstrating satisfactory prototype testing as well as proof that the generator set has been factory tested to 0.8 PF.
- c. Generator shall have an alarm and status display.

- d. Generator shall have thermostat controls and water jacket heater.
- e. Generator shall have a UL listed/CSA and certified 10 amp voltage regulated battery charger located at the transfer switch.
- f. Generator shall have a heavy duty steel base with a dual wall sub-base fuel storage tank with a minimum of 3 days of storage.
- g. Generator shall have an enclosure rated for outdoor use and be insect, bird and rodent proof.
- h. Generator shall be equipped with an automatic transfer switch and set-mounted critical grade silencer.
- i. The supplier shall provide a 2 year warranty and shall service the generator set within the warranty period.
- j. The generator shall have an exercise system to run the generator under a load.
- k. The housing shall be an outdoor sound attenuating housing that allows the generator to operate under full load. The enclosure shall reduce sound level while operating at full load to 72 dBA at 7 meters (or at current Federal, State and Local requirements.)
- l. The generator manufacturer's representative shall provide a two hour load bank test during start-up of the unit.
- m. The generator manufacturer's representative shall be on site for startup and a minimum of an additional two hours for training.

2. CONTROLS

- a. Set point controller using a pressure transducer for level measurement shall be provided by the pump manufacturer.
- b. Redundant floats to operate automatic pump controls and high level alarm and external alarms with manual reset.
- c. A Dwyer PBLT2-15-60 pressure transducer for level measurement.
- d. Single tube strip fixture with low temp ballast at top of electrical board.
- e. Flow meter signal wiring shall be run to control panel in conduit per manufacturer's recommendations.
- f. Pump run-time hour meters shall be provided for redundancy.
- g. All controls shall be clearly labeled.
- h. Controls and panels to be mounted to an aluminum back plate as shown in the standard details using a NEMA 4X cabinet with 2" SCH 40 steel posts. Control panel and back board shall be mounted so that there is a 4 foot height to the center of the control panel. Control panels shall be UL listed, being so labeled and shall conform to their requirements.
- i. An external light (HPS) with HOA control.

3. SCADA

- a. The SCADA equipment shall be HighTide Technologies Model HTT-900.

- b. The dialer shall be capable of notifying operators via text, email or phone call for alarm conditions and display non-alarm functions on a password protected web based viewing.
- c. The dialer shall be capable of displaying number of pump on/off cycles per day, pump run times, average drawdown times, average gallons per minute for each pump, total flow (gallons), daily flow (gallons), average daily influent flow (gallons per minute).
- d. The monthly fee for the dialer service shall not be a function of the number of alarm conditions, phone calls or information exchange transactions.
- e. A toll-free number shall be provided to receive a current alarm status report and to acknowledge alarms.
- f. Monitored and reported items are:
 - i. Pump #1 Running
 - ii. Pump #2 Running
 - iii. Low Level Alarm
 - iv. High Level Alarm
 - v. Monitor Wet Well Level
 - vi. Monitor Pump #1 Amps
 - vii. Monitor Pump #2 Amps
 - viii. Redundant float by-pass switch on
 - ix. Generator trouble
 - x. Station GPM (gallons per minute) flow rate and Totalizer

E. SITE AND APPURTENANCES

- 1. Water service provided via Woodford S3 Sanitary frost proof yard hydrant for wash down.
- 2. Separate emergency by pass system in a concrete pit. Piping to be 4” with quick disconnect coupling and isolation valve. Quick disconnect coupling to be less than 12” from surface under the lid assembly.
- 3. A 6’ high security fence with barbed wire, privacy slats and lockable gate shall be installed. Privacy Slat colors shall be chosen by the Town of Berlin.
- 4. The site shall be graded to a minimum of one foot above the 100-year flood plain.
- 5. Air release/vacuum valves for sewerage shall be installed at forcemain high points per Town of Berlin standards.
- 6. Right-of-Way or utility easements shall be granted to the Town of Berlin for site access, station maintenance, and collection/ transmission utility lines.

F. START-UP AND TESTING

- 1. Hydro-Static Pressure Test Force Main at 125 psi.
- 2. Pump Flow/Meter Accuracy Testing
- 3. Generator, Controls, SCADA & Alarms

4. O&M Manual
5. Manufacturer Training
6. Record Drawings

G. EMERGENCY POWER

Pump stations serving 50 or more EDU's shall have an emergency power generator with automatic transfer switch. Generator shall be properly sized to power both sewage pumps and all other loads connected to the generator. Generator design shall be per manufacturer's recommendations as approved by the Engineer.

STORM DRAINS AND APPURTENANCES

2.49 GENERAL

- A. This section covers precast catch basins, manholes and storm drain pipe.
- B. The Contractor shall furnish all labor, materials, and appurtenances necessary to complete all storm drain construction shown on the drawings.
- C. The contractor shall submit certifications to the Engineer that all pipe, fittings and joints are as specified herein.
- D. Following construction, Contractor shall flush debris from stormwater management facilities.

2.50 CATCH BASINS AND ENDWALL

- A. Catch basins shall be constructed per Maryland Department of Transportation Book of Standards for Highway and Incidental Structures, except as modified on the drawings. Catch basins, frames, and grates shall be Type “WR” or “Type WRM” as noted on the plans.
- B. Catch basins shall be precast concrete construction. Concrete utilized in endwall and other poured-in-place structures shall have a compressive strength of 3000 psi, while precast concrete shall have a compressive strength of 5000 psi in 28 days. Poured-in-place concrete shall be in accordance with Maryland Department of Transportation Standard Section 902 for mix No. 2.
- C. Where corrugated or HDPE pipes enter inlets, a waterproof seal shall be obtained. In addition to internal grouting of the annular space between the pipe and inlet, form an external concrete collar 8” in all directions of the connection point. Collars shall be poured in place only.

2.51 PRECAST CONCRETE MANHOLES

- A. Manholes shall be constructed of precast reinforced concrete. Flow channels shall be brick. Submit shop drawings for precast concrete manholes.
- B. Precast manholes shall be fabricated in accordance with ASTM C-478. Joints between riser sections shall include an “O” ring rubber gasket conforming to ASTM C-443. Parge exterior joints with mortar or an approved joint filler.
- C. Pipe openings in precast manholes shall be provided with integral resilient seal joints conforming to ASTM C-443.
- D. Manhole frames and covers shall conform to Section 2.42 (I), except containing the words “STORM WATER”.

- E. Manhole frames and covers shall be installed on grade to match the slope of the paved surface. Use brick or pre-manufactured devices, approved by the engineer, to build up from cone to grade as required to match the slope of the frame and cover to the slope of the paved surface.
- F. Manhole frames and covers shall be set by the Contractor as the work progresses. The frame shall be embedded in mortar.

2.52 BRICK AND MORTAR FOR CATCH BASINS AND MANHOLES

- A. Brickwork shall be limited to flow channel and bench construction and frame adjustment courses. No other brick shall be used in catch basin or manhole construction.
- B. All brick shall conform to the “Standard Specifications for Sewer Brick”, ASTM C-32, Grade SS.
- C. Mortar shall be in accordance with the “Standard Specifications for Portland Cement”, ASTM C-150 for Type II.

2.53 INLET GRATES

- A. Inlet gratings shall conform with the details shown on the plans and/or the Maryland State Highway Administration Standard Specifications and Standard Details as appropriate.

2.54 REINFORCED CONCRETE PIPE

- A. Concrete pipe and fittings shall be furnished in accordance with ASTM Designation C-76, Reinforced Concrete Culvert Storm Drain and Sewer Pipe.
- B. Pipe shall be manufactured without lifting holed and shall be handled at all times by means of slings or other methods approved prior to the start of construction.
- C. Pipe manufactured shall meet the applicable strength requirements contained in ASTM Designation: C-76, Reinforced Concrete Culvert, Storm Drain and Sewer Pipe, minimum circumferential reinforcement shall be as prescribed in Class III. Where depth of cover is less than two feet, Class IV, Wall A pipe shall be used. Where depth of cover is less than 15 inches, Class IV, Wall B pipe shall be used. In roadways, only Class IV pipe will be allowed.
- D. Joints shall include a rubber “O” Ring Gasket conforming to ASTM C-443.

2.55 CORRUGATED METAL PIPE (CMP)

- A. Corrugated metal pipe shall be galvanized steel, asphalt coated, 14 gauge. Pipe shall be fabricated in accordance with the “Standard Specifications for Corrugated Metal Culvert Pipe”, AASHTO M-36.

- B. Joints shall be made with “standard” corrugated circumferential bands. They conform to AASHTO M-36.

2.56 HDPE PIPE

Storm drain shall be ADS N-12 WT dual wall pipe per ASTM F2648 for pipe and fittings, or approved equal. Joints shall meet ASTM 3212 and ASTM C 969. In non-paved areas minimum cover shall be 24" and in paved areas minimum cover is 12" measured to the bottom of the bituminous concrete.

2.57 INSTALLATION OF PIPE AND FITTINGS

- A. Pipe laying shall not begin until all stake out and cut sheets have been approved.
- 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 bottom, or when, in the opinion of the Engineer, the trench or weather conditions are unsuitable for proper installation.
- E. In laying pipe, special care shall be taken to insure 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.

2.58 MANHOLE AND INLET STEPS

- A. Manhole and inlet steps shall be made of (3) 80-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. Manhole and inlet steps shall be cast-in-place during manufacture of precast reinforced concrete risers and eccentric top section or embedded during construction of brick manholes. Embedment length shall be suitable for minimum five (5") inch thick, precast reinforced concrete riser walls or eight (8") inch thick brick manhole walls.
- C. Manhole and inlet steps shall be OSHA approved and as manufactured by M.A.

Industries, Inc., Peachtree City, Georgia, ICM, Inc., Jacksonville, Arkansas or equal.

- D. Manhole steps shall be spaced twelve (12") inches apart. The maximum spacing from top of manhole to the first step shall not exceed sixteen (16") inches.

2.59 DETECTION TAPE

Pipeline detectable warning tape shall be installed continuously above all underground utilities including water mains and service lines, or other utility which may be installed or distributed as part of this project. Detectable tape of the color and label required by the particular utility shall be installed in 2 places, 12 inches above the pipe and 12 inches below the ground surface or as recommended by the tape manufacturer. Detectable tape shall be minimum of 2" wide and be imprinted with the words "Warning! Underground (Utility Type) Below." Continuously along the tape. Provide tape colors to utilities as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

2.60 STONE FOR EROSION CONTROL

Stone for channels and ditches shall be in accordance with Maryland Department of Transportation Standard Specification Section 901, paragraph 901.03 for Class I Rip Rap.

STREET PAVEMENT

2.61 GENERAL

- A. The Developer shall employ a qualified Contractor to furnish all materials, labor, and equipment necessary to construct streets as detailed.

2.62 STREET SUBGRADE

- A. Contractor shall obtain approval of the Engineer prior to placing stone base over subgrade (shown as subgrade line on typical street section on the drawings). Contractor shall proof-roll subgrade, in the presence of the Engineer, with a loaded tandem dump truck or a pneumatic rubber tire roller which shall be of the size, type and weight that will reveal any soft, yielding or spongy area.
- B. Where deemed necessary by the Engineer the Contractor shall remove all subgrade soils where pumping occurs. Extent of excavation is to be determined by the Engineer at the time of proof-rolling and excavation.
- C. Replacement material shall be in accordance with Section 2 of this specification. If the amount of stockpiled recycled pavement is not sufficient in quantity to meet construction requirements use select borrow conforming to Maryland Department of Transportation, from off-site source for refill below subgrade line.
- D. Replacement material shall be placed in maximum 8" loose lifts and compacted to 95% of maximum dry density as determined by ASTM D1557, at or near optimum moisture content.
- E. When directed by the Engineer, Contractor shall retain the services of an independent testing laboratory to perform soil testing on all subgrade, embankment, select backfill and base course materials. Contractor shall schedule personnel to perform compaction tests at the rate of one test for every 200 linear feet of paving, alternating lanes for each layer of compacted material. Test results shall be submitted in duplicate direct by the testing agency, to the Engineer. The cost of all soil testing and retesting of non-passing areas shall be paid by the Developer.

2.63 SUBBASE COURSE

- A. Street subbase course shall be graded aggregate, meeting the requirements of Maryland Department of Highways and Transportation Standard Specification Section 501 and Aggregate Section 901, Tables 901A and 901B.
- B. Gradation results of the subbase material shall be submitted to the Engineer for approval, prior to delivery to the job site.
- C. Compaction testing on the subbase course material shall be performed in accordance with Section 2.08 Paragraphs c. through e. of these specifications.

- D. Subbase materials shall be thoroughly compacted and final graded prior to placement of asphalt pavement. Work shall be performed per Maryland Department of Highway and Transportation Standard Specification Section 501.03. The Contractor shall pay for density testing performed on subbase material. Testing shall be done during the early stage of compaction to allow adjustment in moisture content and compaction equipment.

2.64 BITUMINOUS CONCRETE PAVEMENT

- A. Hot mix, hot laid bituminous concrete pavement shall be manufactured in accordance with Maryland Department of Transportation Standard Specification, Section 904 and shall be installed by the Contractor in accordance with Maryland Department of Transportation Standard Specification, Section 504, paragraphs 504.01 through 504.03.15. Thickness of lifts and pavement type shall be as noted on the plans. Wedge all existing low areas with bituminous concrete to assure a level finished surface on overlay work.
- B. Existing pavement to be resurfaced shall be swept for removal of dust, debris, and loose or foreign materials. All existing pavement surfaces shall receive a tack coat at a rate of 0.025 gallons per square yard prior to placement of bituminous concrete.
- C. Catch basin inlets, curbing, and all other site features shall be protected prior to application of pavement materials.
- D. Bituminous mix certifications and certified material tonnage tickets shall be submitted to the Engineer upon request.
- E. Pavement equipment utilized shall be capable of applying a minimum of a 12-foot width in one pass.

SURFACE RESTORATION

2.65 GENERAL

- A. The Contractor shall restore all surfaces damaged by his operations to the widths and extent detailed in the plans or specified herein. This restoration encompasses any damage to any existing off-site natural or man-made features to include; asphalt, curb and gutter, sidewalk or grassed areas and any features thereon, whether public or private.
- B. Surface restoration in streets and roads maintained by the Maryland State Highway Administration shall be accomplished in accordance with applicable utility construction permits as obtained by the Owner.
- C. Various conditions and types of surface restoration are detailed in the Appendix. Materials and construction methods shall be in accordance with these specifications and the Maryland Department of Transportation Standard Specifications for Construction & Materials dated 2001 and all subsequent amendments.
- D. Existing pavement to be trimmed to secure a straight clean edge for repaving. Saw cut bituminous pavement as shown on the drawings and as directed to obtain a clean pavement edge.
- E. Surface course and concrete sections shall be lifted out, not broken out.
- F. No staggered or irregular longitudinal trench repair widths shall be allowed in each block of work. Repairs shall be of a uniform width and in a straight line.
- G. Pavement restoration width shall be as shown in the details unless otherwise approved in writing by the Engineer. Should the Contractor damage or disturb larger areas without being authorized to do so by the Engineer, he shall replace the additional area at his cost.
- H. Minimum pavement restoration width is four (4') feet including edge of roads. Actual width shall be as detailed or noted on the plans. Payment is limited to these widths. Should the Contractor damage or disturb larger areas, he shall replace the additional area at his cost.
- I. Undermined areas shall be grout filled or cut back.
- J. All necessary adjustments to existing utilities shall be made prior to paving operations and shall be repeated if there is any damage due to rolling and compacting operations. Structures and utilities in areas to be paved shall be set so that the top slab and/or frame and cover are 1/8" to 3/8" below final pavement surface grade.
- K. Manhole or catch basin adjustments can be made with manhole adjustment rings,

brick courses or mortar layers. Valve boxes shall be screw adjusted; expansion section will not be allowed.

- L. 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.
- M. All trenches have to be cut back by one (1') foot on each side.
- N. Skewed patches will not be permitted, they have to be boxed square.
- O. The final surface shall match 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/pr sidewalks. No depressions or other misalignment shall obstruct, trap or otherwise misdirect the flow of surface water drainage.
- P. Where longitudinal trenches or multiple crosstrenches are installed in a travel lane, the entire lane shall be milled 1½" for the affected area and overlay with bituminous concrete 1 ½" thick after compaction.
- Q. All Town streets shall be cleaned up on a daily basis during construction. No debris or sediment shall be allowed to be left in the road.

2.66 TEMPORARY REPAVING IN PUBLIC STREETS

- A. The Contractor shall furnish, place and compact 2 inches of cold patch as temporary pavement surface over all backfill areas created for pipeline and structure installation located in roadways. 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 Maryland Department of Transportation exercises jurisdiction, all pavement restoration shall be done in accordance with the permit requirements of the State Highway Administration.
- D. A six (6) inch layer of crusher run shall be placed at the end of every workday on all utility trenched in areas not subject to complete street repavement such as gravel parking lots, drives, crusher run alleys and walkways.
- E. Metal laying may be used at the end point of the utility laying operation and must be used to protect the integrity of concrete patches.

2.67 MAINTENANCE OF REFILLED EXCAVATIONS

- A. The Contractor shall maintain, at his own expense, all refilled excavations and surfacing in proper condition as specified herein. All depressions appearing in the refilled excavation, stabilized base and temporary paving shall be properly refilled. If the Contractor fails to make repairs within 48 hours after receipt of written notice from the Engineer, the Town may refill said depressions and the cost thereof shall be deducted from any monies due 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 assessed to the Developer.
- 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.

2.68 GRADED AGGREGATE BASE COURSE

- A. Graded aggregate base course shall be spread on prepared and compacted refilled excavation to the compacted depth shown on the drawing details.
- B. Materials and methods on construction shall meet the provisions of Section 501 of referenced standard specifications.

2.69 GRADING

- A. Grading shall be the limit defined. Regrade and remove excess materials on existing street shoulders to permit positive drainage of stormwater from the roadway.
- B. The Contractor shall dispose of all excess materials removed.

2.70 BITUMINOUS CONCRETE PAVEMENT

- A. Hot mix, hot laid bituminous concrete shall consist of placing bituminous concrete base and or wearing courses on a prepared base to the minimum compacted thickness shown on the drawings.
- B. Materials and methods of construction shall meet the provisions of Section 504 of the referenced standard specification. All thicknesses detailed shall be compacted thicknesses.

2.71 BITUMINOUS CONCRETE DRIVEWAY AND PARKING AREAS

Bituminous driveways and parking areas disturbed through the Contractor's construction operations shall be restored as stated in Section – Concrete Sidewalks, Curb and Gutter.

CONCRETE SIDEWALKS, CURB AND GUTTER

2.72 GENERAL

- A. Contractor shall provide all labor, materials, and appurtenances for construction of concrete sidewalk, curb, and gutter where indicated on the drawings as specified.
- B. Restoration of existing concrete sidewalks, curb and gutter shall be as stated in Section 8.08 of these Specifications.

2.73 METHODS AND MATERIALS

- A. All materials and construction methods shall be in accordance with the Maryland Department of Transportation Standard Specifications dated 2001 and all subsequent amendments. Concrete curb shall be constructed per Section 602, paragraphs 602.01 through 602.04.02. Concrete sidewalks shall be constructed per Section 603, paragraphs 603.01 through 603.04.02.
- B. Minimum ultimate compressive strength of concrete shall be 3000 pounds per square inch (psi) at the end of 28 days per Maryland State Highway Administration Standard Section 902 for Mix No. 2. 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 50 cubic yards or fraction per day of concrete placed as curb 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 test, plus 7-day and 28-day compression tests. Test results shall be submitted, in duplicate, direct by the testing agency, to the Engineer. The cost of all concrete testing shall be paid by the Developer.
- D. Sidewalks and curbs 100 feet or change in direction shall include 1/2-inch expansion joints after each 20 linear feet. Score intermediate dummy joints at 5 linear feet on center on sidewalks. Install 1/4-inch expansion joints between all curb and sidewalk placed. Joints to conform with Maryland SHA Specification, Section 911.02.

2.74 SUBBASE

- A. Base for concrete curbing shall be select borrow as detailed on the plans. Compact subgrade to at least 95% (percent) of maximum density as determined by ASTM D1557 at or near optimum moisture.
- B. Where subgrade is unsuitable, the Contractor shall excavate below subgrade and install crusher run as required to stabilize prior to placing curb.

2.75 RECONSTRUCTION OF PRIVATE DRIVEWAYS

Saw cut existing driveways if sections are acceptable for re-use. Prior to replacement of driveways, the Contractor, Engineer and Town shall review field conditions and determine the extent of removal and replacement. Upon completion of utility construction, the Contractor shall reconstruct private driveways in kind except as follows:

A. Concrete Driveways

1. Concrete driveways shall be replaced and reconstructed upon a properly prepared, graded and compacted subgrade and in compliance with MD-SHA requirements.
2. Driveway shall be placed over suitable compacted subgrade and 4" of graded aggregate base.
3. Driveways shall be constructed to a minimum thickness of 6-inches and shall be reinforced with 6-inch by 6-inch wire mesh of 10-10 gauge if materials removed were reinforced before.
4. 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.

B. Bituminous Concrete Driveways

1. Bituminous driveways and parking areas disturbed through the Contractor's construction operations shall be restored by a minimum of 3-inches of hot mix bituminous concrete pavement placed in a single lift onto a base course consisting of 4-inches of properly prepared and compacted crushed stone or quarry waste. Commercial and residential entrances on State maintained streets shall be in accordance with the plan details. Match existing thickness where condition exceeds minimum restoration.
2. The hot-mix bituminous concrete surface shall conform to the Maryland SHA requirements and shall be constructed in accordance with the applicable Articles of the specifications.
3. Driveway shall be placed over suitable compacted subgrade and 4" of graded aggregate base.

2.76 CONCRETE CURBS, GUTTERS AND SIDEWALKS

A. General

1. The Contractor shall permanently repair or relay all curbs, gutters, sidewalks and driveways in kind that have been removed, broken, or otherwise injured in executing any of the work under the contract or injured by settlement of any backfilled excavation at any time prior to termination of the contract and guarantee period.

2. Curb, gutter and sidewalk removed or damaged during construction shall be replaced in accordance with State of Maryland Department of Transportation Standards. Install handicap ramps and any other required handicap accessibility features at all reconstructed pedestrian facilities in accordance with ADA requirements.
3. All concrete shall be according to Maryland D.O.T. Standard Specifications Section 902. Concrete strength shall be in accordance with Section 2.73 (B) of these Standards.

B. Curb and/or Gutter

1. Concrete curbs, normal and depressed, shall be replaced in kind and in accordance with Maryland D.O.T. Standard Specifications Section 602 and shall match the existing line, grade and thickness of adjacent curb and gutter.
2. Curbs shall be depressed at all existing and proposed driveway locations in accordance with Maryland State Standard Details, including proper preparation of subgrade and proper placing and spacing of joints and joint materials.
3. Partial replacement, when so directed, shall extend to the nearest existing joint in each direction.

C. Sidewalks

1. Concrete sidewalks shall be replaced in kind and as required, in accordance with Section 603 of the Maryland D.O.T. Standard Specifications. Handicapped ramps shall be installed as directed.
2. Sidewalks in areas not subjected to vehicular loading shall have a minimum thickness of 4 inches placed upon a properly prepared, graded and compacted subgrade. Sidewalk subgrade shall consist of 4" select fill compacted to 95% of ASTM D1557.
3. Sidewalks in vehicular loading areas shall be a minimum thickness of 6 inches reinforced with 6-inch by 6-inch wire mesh of 10-10 gauge. Sidewalk subgrade shall consist of 4" graded aggregate base compacted to 95% of ASTM D1557.
4. Replacement of partial sections of concrete sidewalk, where so directed, shall be extended to the nearest existing joint in each direction.
5. Sidewalks shall be replaced to a width equal to that existing prior start of construction and such width shall be maintained throughout the entire length of the block. In no instance shall the constructed width be less than 4 feet.
6. A broom finish shall be applied perpendicular to the direction of traffic.

TOPSOIL, SEEDING AND MULCHING

2.77 GENERAL

The Contractor shall furnish all labor, materials and equipment required for finish grading, topsoiling, and seeding as noted on the plans.

2.78 TOPSOILING AND FINISH GRADING

- A. Topsoil all areas of earthwork on the project or as noted on the plans in accordance with Maryland DOT Specification, Section 701, and 704.
- B. Prior to topsoiling and finish grading operations, all rough graded areas shall be corrected, mounds and ridges shall be cut off, gullies and depressions filled, and other necessary repairs performed to enable all surfaces to be brought to the grades shown on the drawings, and/or specified herein, in an even and properly compacted condition.
- C. Topsoil shall be placed at a depth of a minimum of 4 inches. Topsoil after subsequent operation shall be raked smooth and rolled lightly. After spreading of topsoil, all large stiff clods, hard lumps, large rocks, roots, stumps, litter or other foreign matter shall be raked up and removed from the topsoil area and disposed of by the Contractor.

2.79 SEEDING AND MULCHING

- A. Seeding and mulching shall be by hydro-seed operation in accordance with Maryland SHA Specification, Section 705.

END OF SECTION

STANDARD DETAILS

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- 4.01 BUTTRESS DETAIL - HORIZONTAL BENDS
- 4.02 BUTTRESS DETAIL - TEES, WYES, AND PLUGS
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- 6.11 DUPLEX SUBMERSIBLE GRINDER PUMP STATION
- 6.13 AT-GRADE SUCTION LIFT PUMP STATION (CROSS SECTION VIEW)
- 6.14 AT-GRADE SUCTION LIFT PUMP STATION (ALTERNATE SECTION VIEW)
- 7.01 PRECAST WR INLET DETAIL
- 7.02 PRECAST SINGLE WR INLET DETAIL
- 7.03 PRECAST WRM INLET DETAIL
- 7.11 INLET FRAME & GRATE DETAIL #1
- 7.12 INLET FRAME & GRATE DETAIL #2
- 7.13 CURB & GUTTER TRANSITION AT INLETS
- 8.01 PAVEMENT RESTORATION DETAIL FOR TOWN STREETS
- 8.11 TYPICAL SECTION DETAIL – MAJOR COLLECTOR STREET
- 8.12 TYPICAL SECTION DETAIL – MINOR COLLECTOR STREET
- 8.13 UTILITY LOCATION PLAN
- 8.14 TYPICAL SECTION DETAIL – MAJOR COLLECTOR STREET WITH BIKE PATHS
- 8.15 TYPICAL SECTION DETAIL – MINOR COLLECTOR ST. W/ ON-STREET PARKING
- 10.01 CURB & GUTTER DETAIL
- 10.02 SIDEWALK DETAIL
- 10.03 SIDEWALK RAMPS TYPE “A”
- 10.04 SIDEWALK RAMPS TYPE “B”
- 10.05 SIDEWALK RAMPS TYPE “C”
- 10.06 SIDEWALK RAMPS TYPE “D”
- 10.07 DETECTABLE WARNING SURFACES
- 10.08 SIDEWALK PASSING ZONES
- 10.09 CROSSWALK DETAIL
- 10.12 CONCRETE VALLEY GUTTER