



# DESIGN STANDARDS AND CONSTRUCTION DETAILS

*POTABLE WATER*

*RECLAIMED WATER*

*WASTEWATER*



**Gainesville Regional Utilities Water and Wastewater Engineering Department**




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- Appendix B CONTRACTOR RESPONSIBILITIES
- Appendix C TABLE OF HORIZONTAL SEPARATION DISTANCES FOR PARALLEL UTILITIES AND PERPENDICULAR CLEARANCE FROM OTHER OBJECTS
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**Appendix E GUIDE FOR DETERMINATION OF REQUIRED FIRE FLOW – INSURANCE SERVICES OFFICE, 2008**

**Appendix F GRU UTILITY DATA REQUEST FORM**


**Appendix G ACPW UTILITY ACCOMMODATION GUIDE**

**Appendix H JOINT ALACHUA COUNTY UTILITY PERMIT APPLICATION**

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# System Design Standards



Water and Wastewater Engineering Department

## I. INTRODUCTION

On February 17, 1982, the Gainesville Regional Utilities' (GRU) Water & Wastewater Systems Division was granted an exemption from the Florida Department of Environmental Protection (FDEP - formerly known as Florida Department of Environmental Regulation) Wastewater Collection / Transmission and Potable Water Distribution System permitting requirements. The exemption is for all potable water distribution, wastewater gravity, and wastewater force mains that are 10 inches or less in diameter. GRU implements a permitting program similar in nature to the FDEP permitting program. If a new development project requires a potable water distribution, wastewater gravity, or wastewater force main greater than 10 inches in diameter, then an FDEP permit is required for the main exceeding 10 inches in diameter. GRU will coordinate with the owner/developer and the Engineer-of-Record for permit application completion and submittal to FDEP.


## II. CONCEPTUAL DESIGN

### A. Discovery

1. As part of the conceptual review and design of a project, the design engineer may wish to obtain certain "Discovery" information from GRU. The design engineer may request existing Water, Wastewater, and Reclaimed Water (W/WW/RCW) underground utility maps to review existing conditions as depicted on the maps. Current information may be requested by filling out the "GRU Utility Data Request Form" (see **Appendix F**), then emailing it to the appropriate persons, as noted on the form.
2. GRU has compiled an extensive collection of geographic information in the Alachua County and Gainesville, Florida area. While this information is available for developer use, it has been developed for GRU's own internal purposes and is provided without any warranty whatsoever as to its completeness, accuracy or fitness for any specific purpose.
3. In no way does the provision of this information eliminate or diminish the responsibility of the developer to survey the project area, survey existing facilities the project will connect to, or have underground locates performed in the area.
4. It is possible that utilities exist within the project area without GRU knowledge or record. In such cases, it is the responsibility of the developer to ensure that all existing information is properly recorded and displayed in the Permit/Record Drawings. Discovery is only to aid the developer in collecting information.

### B. Utility Project Meeting

1. The design engineer shall request a Utility Project Meeting and meet with the GRU Water and Wastewater Engineering Department to introduce the project and determine utility availability, point of service, and sizing criteria. GRU reserves the right to specify the point of service, the size of the service, the type of service, and the general layout of the internal systems. The Utility Project Meeting shall be held prior to submitting plans to GRU for review.

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**III. FINAL DESIGN & PERMITTING**


**A. REVIEW PROCESS**

1. The project shall be reviewed in accordance with the GRU Plan Review Process. This process is coordinated through the GRU New Services Department and is a multi-step process requiring a Project Meeting, submittal of drawings by the design engineer, followed by review and comments from the GRU review staff. The purpose of the Project Meeting is to provide the design engineer with as much information as possible to facilitate the design process. The design engineer is encouraged to provide GRU with as much information about the proposed project as possible ahead of time by submitting conceptual or preliminary plans electronically. Some of the things GRU Water/Wastewater will be looking for include:

- Backflow prevention – type and location
- Fire flow availability
- Fire hydrant spacing and quantity
- Water meter sizing
- Easements
- Clearances between utilities (pipes, meters, cleanouts, valves) and buildings, (permanent structures), trees, signs, walls, other utilities, etc.
- Backwater valves (in sanitary sewer service)
- Adequate cover over existing utilities (after grade changes) & constructed services
- Approved Materials & Sizes (Pipe, Valves, Fittings for Newly Constructed Services)
- Air conditioning condensate water must not flow to sanitary sewer
- Compliance with FDEP Rules

Depending on the complexity of the project, the process could involve several submittals and review stages. The review process proceeds until the design drawings are acceptable to GRU and all associated forms and permits, necessary to accompany the construction drawings, are completed and approved.

2. The GRU Plan Review Application and Sufficiency Review Checklist (**Appendix A**) shall be completed by the design engineer and shall be submitted with the project drawings for review.
3. Upon GRU approval, the Design Engineer shall submit thirteen (13) signed and sealed copies of the GRU approved design drawings.
4. Separate permit drawings that are required for work within City, County, or State rights-of-way shall conform to the latest edition of the Florida Department of Transportation (FDOT) Utility Accommodation Manual (available at: [http://www.dot.state.fl.us/rddesign/utilities/files/UAM\\_04.htm](http://www.dot.state.fl.us/rddesign/utilities/files/UAM_04.htm)) or the Alachua County Public Works (ACPW) Utility Accommodation Guide (see **Appendix G**), depending on whose jurisdiction the ROW falls under. Any required utility permits from


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the associated jurisdiction(s) shall be provided to GRU prior to issuance of the GRU Utility Construction Permit.

5. Utility Agreement forms (**Appendix D**) shall be completed by the owner/developer and submitted with the project drawings prior to approval of plans by GRU. By using the appropriate attachment(s), this agreement determines ownership of the utilities, cost-sharing in situations that require utilities to be oversized (at GRU’s discretion) (Attachment 1), private ownership of the utility (where applicable) (Attachment 2), reimbursement for the construction of lift station/force-mains (Attachment 3), and reclaimed water reimbursement agreement (Attachment 7).
6. All lift stations require submittal of the over-sizing/cost sharing agreement (Attachment 1) with the Utility Agreement form.
7. The amount of over-sizing required for lift stations or other facilities will be determined by GRU. This determination may require several iterations of the plan review process; following the initial plan review request, GRU will make a preliminary facilities over-sizing decision, and communicate this to the design engineer by providing comments on the plans being returned.
8. The developer’s design engineer shall submit the reclaimed water reimbursement agreement, facilities over-sizing estimate, lift station and force main rebate agreements, FDEP, ACPW, and FDOT (developer joint use) permit applications forms at the time of the second plan review request. If the required forms are not completed and submitted, the plans will be rejected. Please contact GRU Land Rights at (352) 393-1216 to receive copies of blank permit forms.
9. In general, potable water and wastewater stub-outs will be required in new developments, especially if there are developable, undeveloped, or underdeveloped parcels near or adjacent to the planned new development.
10. John Worley, (email: [worleyjw@gru.com](mailto:worleyjw@gru.com), phone: (352) 393-1633) shall be the sole contact for questions related to developer projects.
11. Utility map requests may be accomplished by completing and transmitting the “GRU Utility Data Request Form” in **Appendix F**. Potable Water, Reclaimed Water, Wastewater utility maps, water and force main valve intersection tie sheets shall be researched prior to submitting plans.
12. In the case of a utility encroaching upon or passing through an Alachua County Public Works (ACPW) right-of-way or a Florida Department of Transportation (FDOT) right-of-way, the Developer shall apply for a “Joint Use” permit, using the either the “Joint Alachua County Utility Permit” application (**Appendix H**) or the “State of Florida Department of Transportation Joint Utility Permit” application (**Appendix I**). See “Guidelines for Preparing County/State Permits” (**Appendix J**), also.

**B. GENERAL DESIGN REVIEW REQUIREMENTS**

1. Water distribution, wastewater collection, and reclaimed water systems shall be designed in accordance with GRU standards and specifications, Florida Department of


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Environmental Protection (FDEP) requirements, and all other applicable federal, state and local requirements.


2. All engineering plans shall be submitted to GRU on 24" X 36" (ANSI D) sheets.
3. All engineering plans and drawings must be clear and legible, including the water, wastewater, and reclaimed water configuration (for subdivisions), and the general layout of the project.
4. If, during the review process, changes in the design are made by the engineer (that were not asked for by W/WWE Staff) he/she will address the change by clouding on the plans and providing an explanation for the change in the body of the RAI response.
5. The engineer shall coordinate the location of water, reclaimed water, and wastewater facilities with all other utilities (electric, gas, storm, telephone, cable TV, etc.), along with vegetation management guidelines. Wherever feasible, water mains shall be placed on the opposite side of roads from electric transformers and reclaimed water. Reclaimed water shall be placed on the same side of the road as transformers. The design engineer, surveyor, or developer can call (352) 393-1616 to request that GRU stakeout the existing wastewater service stub-outs to the subject parcel. For location of existing utilities, call Sunshine One Call of Florida at 1-800-432-4770.
6. Questions about utility allocations within rights-of ways and easements can be discussed with the GRU Water/Wastewater review staff.
7. A permit from the FDEP is required for all proposed water and gravity wastewater mains exceeding 10" in diameter. The FDEP permit must be issued prior to GRU releasing the utility construction permit.
8. Reclaimed Water main extensions shall be evaluated for inclusion in the Reclaimed Water Disposal Area, which is detailed in the Kanapaha Water Reclamation Facility (KWRF) FDEP operating permit.
9. The source and route of water supply and fire protection during construction shall be indicated on the plans so that GRU can plan in advance to supply temporary water.
10. Privately maintained water, wastewater, and reclaimed water utilities shall be designed as closely as possible in accordance with GRU standards and shall be inspected by GRU personnel prior to being placed into service. A current maintenance agreement with a private maintenance entity shall be submitted to GRU (see **Appendix D, Attachment 2**).
11. Standard minimum easement widths, centered on the pipeline, are 30' for gravity wastewater, and 20' for water, reclaimed water, and force mains.

**C. CONSTRUCTION DRAWING REQUIREMENTS**

All potable water and/or wastewater utility construction drawings shall include the following basic information:


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1. A Cover Sheet that includes a Project Location Map with nearby and/or adjacent streets labeled, as well as a drawing index that clearly identifies the names and sheet numbers of all drawings under review.
2. The design engineer's name, the project name, and phase to be constructed, must appear on all sheets. Print project name in lower right corner of cover sheet.
3. A legible Utility Master Site Plan, clearly depicting the water and wastewater systems, shall be part of the project drawings. All phases of construction shall be clearly shown. The Utility Master Site Plan shall be at 1" = 40' scale. If the entire project area does not fit on one sheet at these scales, then it shall be printed on multiple sheets, with a key map provided on each sheet indicating the location of the related sheet within the project. When multiple pages are used, a map of the entire project area on a single drawing, with limited labeling, shall be included.
4. Mandatory Plan and Profile Sheets shall be drawn at 1" = 20' or 1" = 30' (preferred) horizontal scale, and 1" = 2' to 1" = 5' vertical scale. Each Plan and Profile Sheet shall display the plan view above the profile view, and each shall depict the same length of utility installation. The plan shall be aligned vertically with the profile. If the entire project area does not fit on one sheet at these scales, then it shall be printed on multiple sheets, with a key map provided on each sheet indicating the location of the related sheet within the project.
5. The Plan and Profile Sheet plan view shall show all water mains, valves, fittings, fire hydrants, services, meters, blow-off assemblies, wastewater mains, manholes, wyes, laterals, cleanouts, reclaimed water mains, storm water lines, electric lines, gas lines, paving, curbs and gutters, right-of-way lines, property lines, and all existing and proposed features.
6. A wastewater structure schedule shall be included on all sheets on which the structure is shown (i.e., the Utility Master Site Plan, Plan and Profile sheets, etc.).
7. The Plan and Profile Sheet profile view shall show the existing and proposed finished grade over proposed and existing gravity wastewater mains. All wastewater gravity lines and wastewater force mains shall be shown in profile view. All stormwater lines in close proximity to depicted wastewater, water, and reclaimed water mains shall also be shown in profile view. All crossings (stormwater, wastewater, reclaimed water, and water mains) and all additional relevant utility information shall be included.
8. A Master Drainage Plan showing the stormwater facilities, including the 100-year floodplain elevation, wetlands, creeks and adjacent floodplains, with elevations, shall be included for review. Wetlands, creeks, ponds, and any other water body shall be clearly delineated.
9. Landscape Plans shall show existing and proposed tree locations and species, and shall include all potable water, reclaimed water, and wastewater utilities, shown clearly, without labeling.
10. Utility Space Allocation Cross-sections for each different roadway section and utility easement shall be included. Wastewater clean-outs, potable and reclaimed water


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meters shall be shown. Proposed trees shall be depicted on the utility allocations, including those within 20 feet of all right-of-way lines.

11. All materials shown on the plans shall be clearly labeled (i.e. pipe, valves, fire hydrants, fire sprinkler lines, water meters, backflow preventers, fittings, manholes, services, and clean outs) with associated elevations, sizes, types, material, slopes, and appurtenances. Materials shall be labeled on each sheet on which the materials are shown.
12. All wastewater design information (pipe sizes, lengths, materials, slopes, manhole top and invert elevations, and cleanout top and invert elevations) shall be shown. All existing wastewater service stub-outs to subject parcels are to be included in the drawings. Presentation of manhole information is recommended to be in a "Sanitary Sewer Structures Schedule" format, but in any case, must be shown on all sheets where manhole is drawn.
13. Elevations (manhole and cleanout tops and inverts) and pipe sizes of all existing wastewater facilities that cross and/or are adjacent to the property.
14. The design drawings shall indicate any required grease, oil, sand, or lint separators and/or other pre-treatment systems required as part of the wastewater system.
15. All existing and proposed utility easements shall be shown with dimensions.
16. All utility easements and property lines shall be clearly labeled.
17. Existing and proposed site contour elevations shall be shown at minimum 2-foot intervals.
18. Building minimum finished floor elevations.
19. Lot numbers and street names. If 'official' street names are not available for initial plan submittals, include temporary street designations. Revise subsequent submittals when official street name labels are available.
20. Connections to existing utilities. Locate, show, and label existing utilities that cross or are adjacent to the property or project construction area.
21. Utility Construction Notes shall be provided in the drawing set as follows (note: show **all** notes, in the following order):
  - a. *Provide a statement identifying any associated utility permits that are required by City, County, FDOT, FDEP, or other agency.*
  - b. The utility plan and plat shows all Public Utility Easements (PUE's) in a metes and bounds format. Upon GRU's approval of plans for developments not being platted, Owner may choose to grant the metes and bounds easements as shown, or a blanket easement over the entire property, provided facilities are installed within the prescribed distances as shown on the utility plans and in accordance with the Utility Separation Requirements Table in Appendix C of the GRU W/WW/RCW Design Standards.


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- c. All construction materials and methods for potable water, wastewater, and reclaimed water systems shall be in conformance with GRU's most recent Potable Water, Wastewater, & Reclaimed Water System Design Standards, and Approved Materials Manual.
- d. Potable Water and Wastewater mains shall maintain a minimum 10 feet horizontal and 1.5 foot vertical separation.
- e. A minimum horizontal separation of 10 feet for potable water mains, wastewater force mains, and reclaimed water mains, and 15 feet for gravity wastewater mains shall be provided and maintained from, buildings, transformers, and all permanent structures. Service laterals require 5 feet less clearance for each of the utilities; note that water service laterals shall be installed within 3" sleeves. Separation to trees is reduced to 7.5' for pressurized mains and services and 10' (minimum) for gravity mains and services. (See **Appendix C of GRU's Design Standards and Construction Details for Potable Water, Wastewater, and Reclaimed Water – Horizontal Separation Distances for Parallel and Perpendicular Clearance from Other Objects Table.**)
- f. Potable water services, requiring a separate water meter, shall be provided to each lot, building or parcel. Effective October 1, 2007, for commercial, multifamily, and institutional developments, the Developer shall be responsible for installing potable water services and Yoke Assembly Package up to and including the meter yoke, box (installed at final grade) and associated appurtenances, for meters 1" and smaller (see **GRU W/WW/RCW Construction Detail W – 8.0**), with a one-year warranty.
- g. 2" valves located in paved areas, including sidewalks, shall be GRU approved cast iron, resilient seat gate valves with standard 2" operating nut, threaded with brass nipple between the valves and tapping saddle or tapped tee.
- h. Water mains 4" in diameter and greater, placed under roadways, shall be cement lined ductile iron pipe (CLDIP) extending 5 feet past the back of curb (3 feet within City of Gainesville limits). Tracer wire installed on PVC water mains shall continue across the CLDIP sections.
- i. 1" or 2" water service crossings located under roadways shall be encased in 3" SCH 40 PVC extending 5' past the back of curb (3 feet inside City of Gainesville limits).
- j. Anchoring tees, couplings, and bends shall be used on all fire hydrant assemblies.
- k. All pressurized main fittings shall be mechanical joint with restrained joint glands; a sufficient length of the pipe connected to the fittings shall be mechanically restrained to provide reaction as specified on the Restrained Joint Standard in the Construction Details (W – 2.8 & 2.9, RCW – 2.8 & 2.9, and WW – 2.4 & 2.5). Calculations for required restraint length must be provided if the specified restraint length, due to soil type or depth of cover, differs from those provided on these details.
- l. All sanitary wastewater service laterals shall be min. 4" diameter PVC (SDR 35) at


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- 1.00% min. slope unless otherwise labeled.
  - m. Wastewater cleanout covers located within pavement and sidewalks shall be rated for traffic load bearing.
  - n. Manholes which are not installed under pavement shall have a rim elevation at least 6" above finished grade, and a 10:1 slope to finished grade.
  - o. Unless otherwise noted on the plans, the finished floor elevations of buildings shall be a minimum of 6" above the lowest upstream manhole top. If this is infeasible, a wastewater service lateral backwater valve is required on the customer side of the cleanout.
  - p. When a potable or reclaimed water main, or a wastewater force main is routed within 10 ft. of an electric transformer, a 20 ft. length of DIP shall be centered on the transformer with mechanical restraint at each end. No fittings or valves shall occur within 10 ft. of the nearest edge of the transformer. A minimum clearance of 3' shall be maintained between the main and the transformer.
22. Typical cross sections for all roadways shall be included.
23. Road crossing details shall be provided. The crossing details shall show all existing and proposed utilities to scale including surveyed elevations and field locations, as follows:
- a. Water, wastewater, and reclaimed water main pipe and casing – location, length, material, diameter, casing thickness, minimum depth of cover under pavement and swale
  - b. Tap, valve, valve box at existing water main, fittings. A note should be included at each tap location stating: "Tap and valve by GRU. Contractor shall be responsible for M.O.T, excavation, connection to tap and valve, and restoration. Coordinate with GRU Water/Wastewater Inspector 7 days in advance."
  - c. Existing utilities – type, diameter, horizontal and vertical location
  - d. Bore pit & receiving pit – size & location dimensioned
  - e. ROW and PUE lines – both sides of roadway
  - f. Approved Casing Spacers – (by text - not required graphically), quantity and spacing
  - g. Pipe restraint within the casing – by text, indicate Fast-Grip or Field-Lock gaskets compatible with brand of pipe installed for DIP water main; Certa-Lok or Diamond-Lok DR-18 green PVC for wastewater (or equal at GRU discretion).
  - h. Vertical clearance between water/sewer main/casing & nearest existing utility
  - i. Pavement & sidewalk – existing & proposed

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- j. Existing and proposed grade at ground surface
  - k. Profile grid lines - labeled w/ elevations and stations
  - l. Horizontal & vertical scale
24. Building footprints, decorative masonry walls, fences, signs, berms, and landscaped buffer areas shall be shown and labeled on the plans.
  25. A minimum 5 feet wide PUE may be required along a right-of-way to accommodate existing or proposed utilities. Additional PUE's may be required to ensure adequate separation for utilities.
  26. Indicate the source of irrigation water and provide appropriate/adequate backflow prevention (BFP) for public water supply in accordance with Section V. G. Backflow Prevention.
  27. All plan sheets shall be to scale with the scale clearly noted on each drawing.
  28. All plan sheets shall have an arrow indicating the direction north (pointing up or to the right).
  29. Where a water or wastewater pipe must cross under another utility, the angle of crossing shall be a minimum of 45 degrees.
  30. To facilitate incorporation of the facilities' data shown on the Construction Drawings into GRU's Geographic Information System (GIS), and to provide information that will allow GRU to perform locates for buried facilities, a Boundary/Topographic Survey shall be provided that contains the following information:
    - a. Horizontal Coordinates
      - i. Construction Drawings shall be referenced to at least three points on the drawing that have noted horizontal coordinate information. These three points may be either existing control, new control, or parcel corners. As long as the drawing has a 1:1 relationship with these three points, the remainder of the drawing can be in a project coordinate system.
      - ii. The coordinate system for all record drawings shall be Florida State Plane Coordinates, NAD 83 Zone North US Survey feet.
    - b. Vertical Coordinates
      - i. All elevations provided shall be referenced to the NAVD 88 datum with elevations given in US Survey feet.
    - c. Survey Information
      - i. Surveyor Name

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- ii. Survey Company
- iii. Date Surveyed
- iv. Control Reference Used (Control ID, Type, Coordinate Datum)
- v. Control Type (PK nail, Brass Marker, etc)

This information will then be available for other parties developing within the area at future dates.

**IV. RECORD DRAWINGS**

**A. GENERAL REQUIREMENTS**

1. The Developer shall be required to submit Record Drawings to GRU upon completion of construction.
2. The details of GRU's Record Drawings policy are outlined below. The policy makes numerous references to a party designated as the "Developer". The term "Developer" is intended to refer to the property owner who is responsible for the construction of the project and the required potable water, reclaimed water, and wastewater system improvements.
3. The Developer may utilize other parties or designated agents such as contractors, architects, surveyors, or engineers to perform the duties and responsibilities outlined in this Policy. However, the failure of a third party to comply with this policy and its obligations shall not relieve the Developer of his responsibilities and shall not imply or impose any obligations upon GRU.
4. During construction of the project, the contractor shall be responsible for keeping accurate track of any GRU approved field construction revisions to the design depicted on the approved GRU Construction Drawings, which are included in the GRU Utility Construction Permit. These revisions, accurately noted, shall be used to prepare Record Drawings of the completed construction.
5. The Developer shall maintain one set of Record Drawings at the Project Site. On these, all project conditions, locations, configurations, and any other changes or deviations that may vary from the information represented on the original approved Construction Drawings shall be noted, including buried or concealed construction and utility features that are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Construction Drawings. Drawings shall also note the location of any other buried infrastructure such as landscape irrigation, onsite drainage, lighting, etc., as well as any surface building obstacles such as ponds, fences, walls, rocks, etc. Record drawings shall be supplemented by any detailed sketches as necessary or directed to fully indicate the facilities as actually constructed.

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6. These master Record Drawings shall be maintained up-to-date during the progress of the Project. Red ink shall be used for alterations and notes. Notes shall identify relevant changes by number and date.
7. Record Drawings shall be accessible to GRU personnel at all times during the construction period.
8. The Record Drawings shall be submitted to GRU upon completion of the project.
9. GRU Staff will review completeness, accuracy, and format of submitted Record Drawings. If the Record Drawings are considered unacceptable, they will be returned to the Developer for correction and resubmission.
10. If the corrected Record Drawings have not been resubmitted to GRU after 60 days, GRU will correct the Record Drawings as necessary to conform to this Policy. All costs incurred by GRU to perform such work will be billed to the Developer. GRU may utilize either GRU personnel or outside contractors to complete the Record Drawings. The determination of which party is to perform such work shall be at the sole discretion of GRU.
11. Upon project construction completion, the Developer shall submit one (1) hard copy and one (1) electronic copy containing the information depicted on the Record Drawings. The Record Drawings shall consist of the approved construction drawings revised to include any substantial GRU approved deviations installed during construction.

In cases where approved drawing sheets cannot completely depict the facilities as constructed, the Developer shall add details, sections, elevations, or other similar drawings to illustrate the facilities as constructed. Such drawings shall be to scale with the scale clearly noted on each drawing, and attached to the GRU stamped contractor set (or reproduction), along with any approved revision sheets.

**V. POTABLE WATER DISTRIBUTION SYSTEMS**

**A. GENERAL**

1. The Potable Water Distribution System design shall conform to the following minimum design standards;
  - a. The latest edition of FDEP Rule 62-555 F.A.C.,
  - b. The latest edition of the Great Lakes Upper Mississippi River Board of Engineers Recommended Standards for Water Works (10-State Standards),
  - c. The American Water Works Association (AWWA) and all applicable federal, state and local requirements,

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- d. Additional information may be required as determined by the GRU Water and Wastewater Engineering Department.
- 2. The Developer shall be responsible for the installation of the Potable Water Distribution System, with a one-year warranty.

**B. MATERIAL**

- 1. 4", 6" and 8" diameter potable water mains shall be minimum Class 350, Cement Lined Ductile Iron Pipe (CLDIP) with blue stripes spaced 90 degrees apart on the on the top and sides of pipe or blue C900 PVC. CLDIP is required in all major traffic areas, under all pavement, in easements. and under concrete sidewalks where the edge of sidewalk is coincident with/adjacent to the back of curb of the roadway.
- 2. All 12" and larger water mains shall be CLDIP and require a DEP permit.
- 3. Potable water service crossings shall be 2" PVC, Schedule 40, solvent weld joints with a maximum length of 300 feet (see detail W – 6.1).
- 4. 2" diameter potable water services/crossings located beneath paved roadways or parking areas shall be encased in 3" Schedule 40 PVC or 4" High Density Polyethylene (HDPE) sleeves. HDPE sleeves shall have blue stripes. 1" diameter potable water services/crossings may be allowed at GRU discretion, only when reclaimed water is available for irrigation. Sleeves shall be the same as for 2", to allow for future upgrade (see detail W – 6.1).
- 5. 1" diameter potable water services shall be Polyethylene (PE), SDR-9 and shall serve no more than one ERC or irrigation meter with a maximum length of 75 feet.
- 6. Potable water mains with less than 18" of vertical separation from sanitary wastewater mains shall require one joint (20 Linear Feet (LF)) of CLDIP water main and one joint (20 LF) of wastewater main centered at the point of crossing (see detail W – 10.4). See **Appendix C** for additional information regarding separation distances.
- 7. Potable water mains within bore and jack casings shall be CLDIP restrained joint with GRU approved casing spacers (Cascade Waterworks Mfg. or equal).

**C. INSTALLATION**

- 1. All potable water mains shall be installed with 30" to 36" of cover and if applicable, at the centerline of a standard metes and bounds easement.
- 2. Potable water mains shall not be installed within 3 feet of any parallel underground utility and shall be installed on a separate shelf. Refer to Minimum Horizontal Clearance Table for Utilities (**Appendix C**) for minimum parallel utility spacing.
- 3. When potable water mains are installed under impervious surfaces or pavement, only


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standard hot mix asphalt or cast in place concrete paving may be used within a 6 ft. wide corridor centered on the pipe, or a corridor with a width equal to twice the depth to the bottom of the pipe, whichever is greater.

**D. SERVICES**

Potable water services, requiring a separate water meter, shall be provided to each lot, building or parcel, per Potable Water Detail W – 7.0 or W – 8.0. After inspection and acceptance for O&M by GRU, GRU will insert a lock into each meter ball valve (note: care should be taken that tracer wire is installed up to and around the ball valve) Effective October 1, 2007, for commercial, multifamily, and institutional developments, the Developer shall be responsible for installing potable water services and Yoke Assembly Package up to and including the meter yoke, box (installed at final grade) and associated appurtenances, for meters 1” and smaller (see Detail W – 8.0), with a one-year warranty.


1. Water services shall be limited to two potable 5/8" meters and two 5/8" irrigation meters per 2" service, and/or 2" loop back.
2. Double residential potable water meters shall be installed at property corners wherever possible.
3. Potable water meters shall not be located at property corners containing electric transformers.
4. Potable water meters shall be located away from roadway (8 feet minimum) and adjacent to the right-of-way line.
5. The potable water meter shall be located on the property, lot, or parcel that it is serving.
6. For multi-family and commercial projects, buildings shall be master metered or served by grouped potable water meter gangs with no more than 12 meters per gang.
7. The Contractor will install a privately maintained Backflow Preventer (BFP) downstream of any GRU master meter (refer to Section V.G and details W-10.1, W-10.2, and W10.3).
8. A master BFP is not required in all cases. Determination is at the sole discretion of GRU (refer to Section V.G and details W-10.1, W-10.2, and W10.3).
9. GRU maintains the potable water system up to the individual meter outlet but not including downstream BFPs and meter banks. (For indoor meters, see Indoor Meter Room Section.)
10. For multi-family and commercial projects, every effort shall be made to locate potable water meters in accessible areas, a minimum of 5 feet from buildings (perpendicular to building, facing the street), outside of tree drip lines and paved areas, behind sidewalks, and generally adjacent to parking areas or roadways at a minimum of 8 feet from the edge of pavement or 2 feet back of curb.

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11. For potable water meters 1.5” or greater, the Engineer-of-Record shall submit a detailed water demand estimate, signed and sealed by a Professional Engineer, reflecting Average Daily Flow and Peak Hour Demand calculations, with supporting documentation for review and approval by GRU.

**E. INSIDE METER ROOM**

1. GRU maintenance shall end at the point of service, typically a valve set at the property or right-of-way line. The customer shall own and maintain the pipes, backflow preventers, and any and all attachments to the water meter, including and without limitation, valves, meter yokes/line-setters, gaskets, washers, fittings and other associated appurtenances. GRU shall own and maintain all water meters.
2. Inside Meter Room shall be on the ground floor, on an exterior wall with an exterior door, and as close to GRU’s point of service as practical.
3. All water meters shall be visible for meter reading and readily accessible for operation and maintenance. There shall be no obstruction or storage of materials or equipment preventing access to the meter. No water meter shall be placed above or behind a furnace, water heater, washer, dryer, or other such arrangement limiting access to the meter. In order to ensure un-encumbered access to the water meter, there shall be clear accessible pathway to the water meter(s) (minimum thirty-six (36) inches wide and eighty-four (84) inches high), and there shall be a clear rectangular area providing a minimum of forty (40) inches clearance in front of the meter(s), extending twenty-four (24) inches to either side and above the meters..
4. Water meters shall be mounted horizontally. iPerl meters (5/8” – 1”) shall flow from left to right so the dial is readable.
5. Water meters shall be mounted with a horizontal spacing of twenty-four (24) inches center-to-center, and a vertical spacing of twelve (12) inches center-to-center for 5/8” to 1” and eighteen (18) inches for 1 ½” and above.
6. Maximum mounting height of any meter or valve shall be seventy-two (72) inches above floor level.
7. Meters 1” and less shall not be suspended nor supported by the piping; meter yoke shall provide the structural support for the meter and shall be securely fastened to a support structure such that no movement of the yoke shall occur.
8. Water meters 1” and less shall be installed in a meter yoke with a shut-off valve on each side of the meter yoke, easily accessible, and at such a point that any and all the water may be drained out of the pipes without causing damage to adjacent surroundings or equipment.
9. The floor of the meter room shall be sloped to drain towards the door at between 1/16 and ¼” per foot. The door shall be installed with a minimum ¼” gap to allow water to


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drain to the outside of the Meter Room. Floor shall be broom finished concrete.

10. All meter yokes shall have permanent water-proof unit numbers affixed identifying the unit fed by the meter.
11. The building owner shall be responsible for the prompt repair of leaks in the portion of the system for which they are responsible, as identified in Item 1 above, and shall promptly (within 7 days) report any leaks, damage or malfunction of the meters to GRU Water/Wastewater Dispatch (352-334-2711).
12. See GRU Potable Water Construction Details W-8.5, W-8.6, W-8.7, W-8.7.1, W-8.8, and W-8.9 for layout and installation details.
13. Failure to meet any of these specifications will result in not passing the "Final Meter Inspection". Any and all corrections shall be made at the customer's expense before a re-inspection will occur.

**F. POTABLE WATER MAIN**


1. Potable water mains 4" in diameter shall be limited to 600 linear feet (LF) for dead end mains and 1500 LF for looped mains.
2. Control valves shall be provided on transmission mains with minimum numbers of service connections. Control valves shall be located at 800-foot maximum intervals and at distribution branches. Valve type shall conform to GRU Standard Materials and Specifications.
3. Control valves shall be provided on each branch of potable water main tees (3 valves per tee may be required, at GRU's discretion).
4. Control valves shall be provided at strategic locations to provide flexibility for operation and maintenance of the potable water system in order to allow segments of pipe to be isolated and minimize the number of service disruptions.
5. Control valves shall be provided at a maximum of 500 feet intervals within higher density (four or more dwelling units per acre) residential projects.
6. A perpendicular blow-off assembly / bacteriological sample point shall be provided at the end of all dead end water mains and at a maximum of 1000 LF intervals.
7. At least one perpendicular blow-off assembly shall be provided on potable water main loops, at a maximum of 1000 foot intervals, with main line control valves on both sides of the assembly to allow the water main to be flushed, disinfected, sampled, and isolated in both directions.
8. 2" blow-off assemblies shall be provided on all 4" diameter potable water mains, 3" blow-off assemblies shall be provided on all 6" and 8" diameter potable water mains, and 6" blow-off assemblies shall be provided on all 12" diameter and greater potable water

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mains.

9. 1" sample points shall be provided at the end of all potable water mains, and at 1000 foot maximum intervals, coincident with blow-off assemblies wherever feasible. Sample points shall consist of a smooth, unthreaded hose bibb, to prevent the attachment of a hose.
10. All potable water systems shall be disinfected in accordance with the latest version of the **AWWA Standard – Disinfecting Water Mains (ANSI/AWWA C651-05)**.
  - a. All potable water pipelines shall be disinfected using the Tablet (or granule) Method. Preliminary and final flushing shall be performed at the ends of mains which have been hydrostatically tested.
  - b. During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft intervals. Quantity of granules shall be determined by consulting Table 1 in the **AWWA Standard – Disinfecting Water Mains (ANSI/AWWA C651-05)**. Care shall be taken to prevent the strong chlorine solution in the line being disinfected from flowing back into the line supplying the water.
  - c. Chlorinated water shall be retained in the pipeline for at least 24 hours. After the chlorine-treated water has been retained for the required time, the free chlorine residual at the pipeline extremities and at other representative points shall be at least 25 mg/l. The contractor shall notify GRU of the chlorine test result.
  - d. The disinfection testing procedure shall be repeated if the initial tests fail to produce satisfactory results. Two consecutive satisfactory test results shall be required after any unsatisfactory test.
  - e. During the process of chlorinating the pipelines, all valves and other appurtenances shall be operated while the pipeline is filled with the heavily chlorinated water.
  - f. The contractor shall do final flushing after he has achieved a satisfactory chlorine residual test. After the applicable retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show that the concentration in the water leaving the pipeline is no higher than that generally prevailing in the system or is acceptable for the intended use. If there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to thoroughly neutralize the residual chlorine remaining in the water, at no additional cost.
  - g. Pipe and appurtenances used to connect the newly installed water main shall also be disinfected in accordance with AWWA C651.
  - h. Neutralizing and disposing of chlorinated water shall be in accordance with Appendix "C" of the **AWWA Standard – Disinfecting Water Mains (ANSI/AWWA C651-05)**. It is recommended that chlorinated and flushing water be captured for re-use in flushing gravity wastewater mains.

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- i. The contractor shall schedule collection by GRU of a minimum of 2 sets of samples at least 24 hours apart after completion of final flushing as indicated above. Samples will be taken at locations indicated in the **AWWA Standard – Disinfecting Water Mains (ANSI/AWWA C651-05)** and will be tested for coliform organisms according to the latest edition of the Standard Methods for the Examination of Water and Wastewater. The initial sampling effort will be provided by GRU at no cost to the Contractor.
  - j. Satisfactory bacteriological results will be:
    - i. Absence of total and *E.coli*
  - k. Any detection of *E. coli* will result in the pipe being re-disinfected , re-flushed and will be re-sampled and re-tested. If counts from analysis of the second samples exceed the criteria in the Standard methods, the pipe shall be re-disinfected and will be re-sampled and re-tested until satisfactory results are obtained. The contractor shall be responsible for all repeat bacteriological testing costs.
  - l. The above information is intended only as a guide. The contractor should consult the **AWWA Standard – Disinfecting Water Mains (ANSI/AWWA C651-05)** for complete details on disinfecting water mains.
11. All potable water systems shall be pressure and leak tested in accordance with the latest version of the **AWWA Standard (C600-05: Installation of Ductile-Iron Water Mains and Their Appurtenances, and C605-05: Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water)**.
  12. Control valves shall be located so that associated valve boxes will not conflict with wheel path, parking spaces, curb & gutter, or ADA handicap ramps. Valve boxes are to be located outside of pavement where possible.
  13. Appropriate fittings shall be utilized on pipes 4" in diameter and larger in order to ensure that the potable water main does not vary more than 2 feet from the approved location. Pipe deflection in accordance with PVC and DIP manufacturer specified limitations are permissible.
  14. All fittings, pipe, hydrants, valves, and appurtenances shall be shown and labeled on utility master plan sheets, and plan view of the plan and profile sheets.
  15. All fittings, pipe, hydrants, valves, and appurtenances in contact with drinking water will conform to NSF International Standard 61 as adopted in. Rule 62-555.335, F.A.C.
  16. Mechanical joint restrained fittings, or other restraint method, must be shown and labeled on all fittings larger than 2". Approved restrained connections between pipe joints shall be used for a sufficient length of pipe adjacent to each fitting to provide restraint for all reaction forces. See Reaction Distance Table E.18 (below) for dead-end mains. Reaction blocks or other alternate restraint method will only be approved at the discretion of GRU Water & Wastewater Engineering. In no case shall a reaction block

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be allowed for providing restraint in a location where a future utility installation or excavation could compromise the soil on which the reaction block is bearing. Use wing block/dead man restraint.

- 17. On dead end mains, a main line control valve must be installed beyond the last service.
- 18. On dead-end mains 4" and larger, provided as a stub-out for future connection, the pipe must be extended past the last valve a minimum distance to provide reaction, or mechanically restrained. Following is a summary of the minimum distances:

**Table E.18:**

**Dead End Reaction Distance**

<u>Pipe Size</u>	<u>DIP Reaction Distance</u>
4"	60 LF
6"	60 LF
8"	75 LF
12"	104 LF

*Note: Because PVC pipe spigots are not "homed" all the way into the bell end of the next pipe segment, soil friction cannot provide the necessary reaction. Therefore, mechanical restraint must be provided for the stub-out when using PVC pipe.*


- 19. A blue Electronic Marker System (EMS) marker/locater ball shall be placed directly above the end of water stub-outs for future connection. Marker balls shall be installed with 18" – 24" of cover.
- 20. Buried 2" valves shall be a GRU approved cast iron, resilient seat gate valve with standard 2" operating nut, threaded with brass nipple on one side and MIP x PVC brass compression coupling (see detail W-7.1. This requirement shall be noted on the utility plan.

**G. FIRE PROTECTION**

- 1. Fire hydrants shall be installed in accordance with the City of Gainesville and Alachua County Fire Safety Code.
- 2. The engineer shall provide signed and sealed fire flow demand calculations in accordance with City of Gainesville Fire Protection standards using the Guide for Determination of Required Fire Flow published by the Insurance Services Office (ISO), 2008 Edition and/or the Florida Fire Prevention Code (see **Appendix E**). Fire sprinkler demand (if required) shall be provided by the engineer with the plan review application.

For non-sprinklered buildings, fire flow requirements shall be determined based on peak domestic demand plus the greater of ISO demand or the Florida Fire Prevention Code demand (at hydrants).

For sprinklered buildings with a signed and sealed fire protection design, fire flow requirements shall be based on the greater of peak domestic demand plus the Florida

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Fire Prevention Code demand or peak domestic demand plus fire sprinkler line demand.


For sprinklered buildings without a signed and sealed fire protection design, fire flow requirements shall be based on the peak domestic demand plus the Florida Fire Prevention Code demand.

3. The number of fire hydrants required for a project will be determined based on the fire flow demand calculations. One hydrant will be required for each 1000 gpm of demand, with at least one hydrant located within 500 feet of the most remote point of the building, as the fire truck drives. The remaining hydrants shall be located within 1000 feet of the most remote point of the building, as the fire truck drives.
4. Potable water distribution systems shall be designed for a minimum hydraulic capacity of 1500 gpm at 20 psig within 500 feet of the most remote point of the building, as the fire truck drives.
5. Fire hydrants within commercial and multi-family residential projects shall be served with a minimum 8 inch diameter water main (Note: in redevelopment or infill areas, the diameter may be reduced to 6 inch if approved by GRU Strategic Planning). In all cases, fire hydrants shall be served with no less than a 6 inch diameter water main.
6. Following is a summary of maximum pipe line lengths for potable water mains supporting fire hydrants at given flows based upon a static pressure of 40 psig and a residual pressure of 20 psig.

Maximum Total Line Length (feet)								
Line Size (inches)	Flow (gpm)	Flow (gpm)	Flow (gpm)	Flow (gpm)	Flow (gpm)	Flow (gpm)	Flow (gpm)	Flow (gpm)
	1500	2000	2500	3000	3500	4000	4500	5000
6" Dead End	250	0	0	0	0	0	0	0
6" Looped	1,800	1,000	700	0	0	0	0	0
8" Dead End	1,000	600	400	300	0	0	0	0
8" Looped	7,600	4,600	3,000	2,000	1,600	1,200	1,000	800
12" Dead End	7,500	4,400	2,900	2,000	1,500	1,200	900	800
12" Looped	54,000	31,000	20,000	15,000	11,000	8,600	7,000	5,800

(Table based on Hazen-Williams formula)

7. Fire hydrants shall be located in easily visible and accessible locations. Fire hydrants shall be located at entrances and intersections whenever possible.
8. Fire hydrants shall be located at property corners just inside the right-of-way. Fire hydrants shall not be located at the same corners as water meters or electric transformers.
9. Fire hydrants shall have a minimum clearance of 4 feet from the edge of pavement or back of curb and 2 feet from the edge of sidewalk.
10. Fire hydrants shall be oriented with the largest (4.5") nozzle directed towards the street


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or parking area.

11. There shall be no obstructions (fences, landscaping, signs, etc.) within 5 feet of each hydrant. There shall be no trees or permanent structures within 10 feet of any hydrant.
12. Fire hydrants shall be connected to water mains using anchoring tees. Fire hydrant assemblies shall utilize anchoring couplings and bends.
13. Fire lines shall be designed and installed by a certified fire line contractor. GRU maintenance shall end at the valve.

**H. BACKFLOW PREVENTION**

1. Backflow prevention shall be provided in accordance with the GRU Manual of Cross Connection Control. If there are any conflicts between the Design Standards and the GRU Manual of Cross Connection Control, the GRU Manual of Cross Connection Control will take precedence.
2. If an auxiliary water source (water from a source other than the GRU potable water system) is proposed or provided for irrigation or other purposes, an approved Reduced Pressure Zone (RPZ) backflow prevention assembly must be installed on the potable water service downstream of GRU’s point of service, typically the water meter.
3. An approved RPZ backflow prevention assembly must be installed on all potable water services connected to all non-residential uses downstream of GRU’s point of service, typically the water meter.
4. Any metered GRU potable water service connection for irrigation purposes must be equipped with an approved backflow preventer assembly downstream of GRU’s point of service, typically the water meter.
5. Any dedicated fire line must be equipped with an approved double check backflow preventer assembly. For fire lines serving fire suppression systems containing antifreeze protection, foaming agent injection systems, or other chemical additives an RPZ backflow prevention assembly is required.
6. Backflow preventers shall be installed as close as possible to GRU’s point of service, typically within 10 feet.
7. All backflow prevention assemblies must be installed and tested by a certified backflow tester at the time GRU installs the potable water meter. A copy of the completed test shall be submitted to GRU’s Water & Wastewater Engineering Dept., P.O. Box 147117, MS-A-122. Gainesville, FL 32614-7117. Backflow test report forms are available from GRU upon request.
8. The entity responsible for the cost of the water meter installation is responsible for furnishing, installing, protection from freezing, protection from vandalism, performing annual testing, and maintaining the backflow preventer assemblies. The freeze

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protection system shall not impede access to test ports, valves, or name plate, and shall not trap moisture against the backflow preventer (to avoid corrosion). If the freeze protection method is insulation, the insulation should be protected with a hard shell that is easily removable, waterproof, and protects the insulation from deterioration.

9.



This...


or this (hard, removable shell)...

not this.

10. In situations in which GRU installs the backflow device, the customer will be required to sign an agreement accepting ownership and responsibility for the perpetual maintenance of the device.

**I. TEMPORARY WATER SUPPLY DURING CONSTRUCTION**

1. Temporary water supply is water that is supplied for construction purposes prior to the installation of the permanent water supply system.
2. There are several ways GRU can supply temporary water to job sites. Prior to plan submittal the developer's engineer should indicate on the utility drawings how construction water will be provided. The selected alternative depends upon field conditions such as the availability of existing water mains and fire hydrant locations.
3. The contractor should contact Gainesville Regional Utilities, New Services Department at (352) 393-1644 if there are any questions, to make application, and pay for temporary construction water meters.
4. The estimated lead times to obtain temporary water are based on existing conditions at the project site. Typical lead times are as follows:
  - a. If an existing fire hydrant is available, allow three (3) working days after payment is made for installation of fire hydrant meter.
  - b. If there is not an available fire hydrant but there is an available water main, allow ten (10) working days after payment is made (note: installation of backflow preventer will be required).
  - c. If there is not a fire hydrant or water main available, the contractor may install the

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water main up to and including the first, on-site fire hydrant. Installation of a perpendicular blowoff assembly (see detail W – 3.7) will also be required immediately downstream of the fire hydrant. The contractor should coordinate the construction with GRU's Utility Inspector and must pass the pressure and bacteriological tests before a temporary construction meter can be installed. Allow three (3) working days after an acceptable inspection and payment of fees.

- d. If the above three options are not feasible because of water main extension timing and on-site construction, then the contractor may have to arrange to transport water to the site by tanker truck.
- 5. The payment for temporary water supply includes a non-refundable meter installation charge and a deposit, which will be applied against the final bill, assuming the safe return of the meter. Water used through such a temporary meter shall be paid at the prevailing general water service rate. This type of temporary connection shall be allowed for a maximum time period of 60 days, but may be extended at the discretion of GRU W/WW Engineering.

## VI. RECLAIMED WATER SYSTEMS

### A. GENERAL

- 1. Reclaimed Water Distribution system designs shall conform to the following minimum design standards and the requirements of FDEP Rule 62-610 F.A.C. and all applicable Federal, State and Local requirements. Additional information may also be required as determined by the GRU Water and Wastewater Engineering Department. Where reclaimed water is used, potable water service(s) must include backflow prevention in accordance with the Backflow Prevention section of these GRU standards.
- 2. The Developer shall be responsible for the installation of the Reclaimed Water Distribution System, with a one-year warranty. The installation sequence shall be as follows:
  - a. Service lateral shall be installed per Potable Water Detail RCW – 7.0 or RCW – 7.1.
  - b. After inspection and acceptance for O&M by GRU, GRU will insert a plug lock into each 1" gate valve and Contractor shall backfill (note: care should be taken that tracer wire is installed up to and around the tee).
  - c. When Developer is ready to install the meter, GRU shall remove the plug lock and provide the meter assembly.
  - d. The Developer's Contractor shall install the meter assembly. The excavation shall remain open until inspection By GRU


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**B. MATERIAL**

1. Reclaimed water mains 12 inches and larger in diameter shall be ductile iron (DIP), Class 250 or 350, cement lined with purple stripes spaced 90 degrees apart on the top and sides of the pipe, or purple PVC, DR18, C900.
2. Reclaimed water mains located within dedicated public rights-of-way (more than 3' outside of pavement), or under privately maintained paved drives/ parking areas in apartment complexes may be either PVC or cement lined DIP, as determined by GRU Water & Wastewater Engineering.
3. Reclaimed water mains located beneath City, County, and State roadways shall be cement lined DIP extending to 5 feet outside of pavement unless installed within a steel casing, per Bore and Jack Standards, Section VIII.
4. 2" reclaimed water services and crossings shall be pantone purple 522C PVC, Schedule 40, solvent weld joints with a maximum length of 300 feet.
5. 1" reclaimed water services shall be pantone purple 522C Polyethylene (PE), SDR-9 or purple PVC Schedule 40, solvent weld and shall serve no more than one irrigation meter with a maximum length of 75 feet.
6. 1" and 2" reclaimed water services/crossings located beneath paved roadways or parking areas shall be encased in a purple 3" Schedule 40 PVC sleeve. HDPE sleeves shall be 4" with purple stripes.
7. Reclaimed water mains with less than 18 inches of vertical separation from sanitary wastewater mains shall require one joint (20 LF) of reclaimed water main and one joint (20 LF) of wastewater main centered at the point of crossing.
8. Reclaimed water mains within jack and bored casings shall be installed with approved casing spacers as described in Jack and Bore Construction Standards. All pipe joints within the casing shall be restrained.

**C. INSTALLATION**

1. All reclaimed water mains shall be installed with a minimum 36 inches of cover at the centerline of a standard metes and bounds easement, if applicable.
2. Reclaimed water mains shall be installed with a minimum 3 feet horizontal clearance (center to center) from other parallel underground utilities, except potable water mains. For typical sizes, reclaimed water mains shall be installed with a minimum horizontal clearance of 4-feet center-to-center from water mains, and in all cases maintain a minimum of 36 inches outside-to-outside of pipe from all potable water mains. Refer to Minimum Horizontal Clearance Table (**Appendix C**) for Utilities for minimum parallel utility spacing.

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3. When reclaimed water mains are installed under impervious surfaces or pavement, only standard hot mix asphalt or cast in place concrete paving may be used within a 6 ft. wide corridor centered on the pipe, or a corridor with a width equal to twice the depth to the bottom of the pipe, whichever is greater.

**D. RECLAIMED WATER SERVICES**


1. Reclaimed water services shall be provided to each lot, building, or parcel that requires a separate reclaimed water account.
2. Reclaimed water services shall be limited to one 5/8" meter per 1" service, and two 5/8" reclaimed water meters per 2" service, and 20 equivalent residential irrigation connections per 4" dead end reclaimed water main.
3. Double residential reclaimed water meters shall be installed at property corners wherever possible. Where space is not available at a property corner, the reclaimed water service may terminate 5 feet offset from the sanitary wastewater cleanout at the center of the lot.
4. Reclaimed water meters shall not be located at property corners containing electric transformers or water meters.
5. Reclaimed water meters should be shown and installed away from road, behind and adjacent to the right-of-way line.
6. The reclaimed water meter should be located on the property, lot, or parcel that it is serving.
7. For multi-family and commercial projects, every effort shall be made to locate reclaimed water meters in accessible areas, outside of paved areas, a minimum of 5 feet from buildings, behind sidewalks, and generally adjacent to parking areas or roadways a minimum of 2 feet from edge of pavement.
8. For reclaimed water meters 1.5" or greater, the engineer shall submit a detailed reclaimed water demand estimate with the Average Daily Flow and Peak Hour Demand indicated with supporting documentation for review and approval by GRU.

**E. RECLAIMED WATER MAIN**

1. 4" reclaimed water mains shall be limited to 600 LF for dead end mains and 1500 LF for looped mains.
2. Control valves shall be provided on transmission mains with limited numbers of service connections at 2500-foot maximum intervals and at distribution branches. Air relief valves shall be provided at each high point on transmission mains not designed with reclaimed water services located at the high point.

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3. Control valves shall be provided on all branches except the supply side of all reclaimed water main tees.
4. Control valves shall be provided at strategic locations to provide flexibility for operation and maintenance of the reclaimed water system to allow sections of pipe to be isolated minimizing the number of customers out of service.
5. Control valves shall be provided at a maximum of 500 feet intervals within high density residential projects, or as required by GRU Water & Wastewater Engineering.
6. A perpendicular blow-off assembly shall be provided at the end of all reclaimed water mains sufficient to flush all sand and debris from all mains. A control valve shall be located a minimum of 60 LF upstream of each blow-off assembly, unless mechanical restraint is installed on the last 60' of main.
7. 2" blow-off assemblies shall be provided on all 4" diameter reclaimed water mains, 3" blow-off assemblies shall be provided on all 6" and 8" diameter reclaimed water mains, and 6" blow-off assemblies shall be provided on all 12" and larger diameter reclaimed water mains.
8. Control valves shall be located so that associated valve boxes will not conflict with vehicle wheel path, parking spaces, curb & gutter, and ADA handicap ramps, and should be located outside of pavement where possible.
9. Appropriate fittings should be utilized on pipes 4" in diameter and larger in order to ensure that the reclaimed water main does not vary more than 2 feet from the approved location. Pipe deflection in accordance with PVC and cement lined DIP manufacturer specified limitations are permissible.
10. All fittings, pipe, valves and appurtenances shall be shown and labeled on utility master plan sheets, and on plan view of plan and profile sheets.
11. Mechanical joint restrained fittings, or other restraint method, must be shown and labeled on all fittings larger than 2" in diameter. Approved restrained connections between pipe joints shall be used for a sufficient length of pipe adjacent to each fitting to provide restraint for all reaction forces. See Reaction Distance Table E.13 for dead-end mains. Reaction blocks or other alternate restraint method will only be approved at the discretion of GRU Water & Wastewater Engineering. In no case shall a reaction block be allowed for providing restraint in a location where a future utility installation or landscape excavation could compromise the soil on which the reaction block is bearing.
12. Connections to existing dead-end reclaimed water mains without an existing valve past the last service shall include installation of a main line valve at the connection point.
13. On dead-end mains, 4" diameter and larger, provided as a stub-out for future connection, the pipe must be extended past the last main line control valve a minimum distance of 60 LF to provide reaction, unless mechanical restraint is installed on the last 60' of main. If no valve is installed at this location, an equal length of pipe shall be restrained and the cap/plug at the end of the pipe shall be mechanically restrained.

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Below is a summary of the minimum restraining distances:

Table E.13  
Reaction Distance

Pipe Size	DIP	HDPE Reaction Distance
4"	60 LF	60 LF
6"	60 LF	60 LF
8"	75 LF	75 LF
12"	104 LF	104 LF


*Note: Because PVC pipe spigots are not "homed" all the way into the bell end of the next pipe segment, soil friction cannot provide the necessary reaction. Therefore, mechanical restraint must be provided for the stub-out when using PVC pipe.*

14. A purple Electronic Marker System (EMS) marker/locator ball shall be placed directly above the end of reclaimed water main stub-outs for future connection. Marker balls shall be installed with 18" to 24" of cover.
15. 2" valves shall be a GRU approved cast iron, resilient seat gate valve with standard 2" operating nut, threaded with a brass nipple on one side and MIP x PVC brass compression coupling (see detail W-7.1). This special valve requirement shall be noted on the master utility plan.

## VII. WASTEWATER COLLECTION SYSTEMS

### A. GENERAL

1. On February 17, 1982, the Gainesville Regional Utilities (GRU) Water & Wastewater systems were granted an exemption from the Florida Department of Environmental Protection (FDEP - formerly known as Florida Department of Environmental Regulation) Wastewater Collection / Transmission and Potable Water Distribution System permitting requirements. The exemption is for all potable water distribution, wastewater gravity, and wastewater force mains that are 10 inches or less in diameter. GRU implements a permitting program similar in nature to the FDEP permitting program. If a new development project requires a potable water distribution, wastewater gravity, or wastewater force main greater than 10 inches in diameter, then an FDEP permit is required for the line exceeding 10 inches in diameter. GRU will coordinate with the owner/developer and the design engineer for permit application completion and submittal to FDEP.
2. Wastewater Collection System design shall conform to the following minimum design standards and requirements:
  - a. The latest edition of FDEP Rule 62-604 F.A.C.
  - b. The latest edition of the Great Lakes Upper Mississippi River Board of Engineers Recommended Standards for Wastewater Facilities (10-State Standards).
  - c. The American Water Works Association (AWWA).

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- d. Any additional applicable federal, state and local requirements.
  - e. Additional information may be required as determined by the GRU Water and Wastewater Engineering Department based upon individual project circumstances.
3. The Developer shall be responsible for the installation of the Wastewater Collection System, with a one-year warranty.


**B. GRAVITY COLLECTION SYSTEMS**

1. MATERIAL

- a. Gravity wastewater mains with 14 feet or less cover from finished grade shall be PVC, SDR 35, green in color or green striped.
- b. Gravity wastewater mains between 14 feet and 20 feet of cover from finished grade shall be PVC, SDR 26, green in color or green striped.
- c. Gravity wastewater mains with 20 - 25 feet of cover from finished grade shall be PVC, DR 18, green in color or green striped. PVC transition couplings shall be used to connect DR 18 PVC to SDR 26 PVC unless the transition occurs at a manhole.
- d. Gravity wastewater mains located within easements between lots with less than 6 feet or more than 10 feet of cover from proposed grade shall be PVC, SDR 26.
- e. Gravity wastewater mains located within easements below stormwater retention areas shall be Diamond-lok PVC, DR 18 in a steel casing extending ten feet beyond the outer edges of the berms (see Bore and Jack Standards for casing details).
- f. Gravity wastewater mains within jack and bored steel casings shall be a minimum of DR 18 Certa-Lok or Diamond-Lok PVC restrained joint piping (or GRU approved equal) with approved casing spacers. (See Bore and Jack standards.)

2. INSTALLATION

- a. PVC, SDR 35 and SDR 26 gravity wastewater mains shall have a minimum of 3 feet of cover from proposed grade and be installed at the centerline of a standard metes and bounds easement, if applicable.
- b. Gravity wastewater mains shall be installed with a minimum of 10 feet of clearance from other parallel underground utilities and storm structures.
- c. Gravity wastewater mains shall be installed in the center of roadways when possible. On curved roads the wastewater main and manholes shall be located such that the pipe remains within the limits of the paved area. The number of manholes should be minimized by using only the amount required to keep the pipe within the


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paved area with the manhole covers located in the center of the roadway or the driving lane.


- d. Manhole covers shall be located in the center of roadways or center of the lane, and in all cases located outside of the wheel path. Manhole covers shall not be located in parking spaces or other places where access for GRU maintenance would be blocked or restricted, such as loading zones, bus bays, taxi stands, dumpsters, compactors, outside storage areas or sheds, etc.
- e. Manhole covers shall not be installed within 3 ft. of the flow line of inverted crown roads or within the design high water limits of gutters, swales, or stormwater areas.
- f. Manhole “pans” may be required at GRU discretion.
- g. Manholes located outside of pavement shall have the ring and cover raised to 6 inches above the final grade. The ground around the manhole ring and cover shall be sloped from the top of the rim down to surrounding finished grade at 10:1 slope. The sloped area shall be seeded and mulched or sodded.
- h. Manholes with a depth of 20 feet or more shall be 72” inside diameter.
- i. A 12 foot wide stabilized access road, stabilized to a minimum LBR 30, shall be provided to all manholes located within easements. The access road shall be designed to provide for adequate drainage and to prevent erosion from stormwater runoff. Maximum grade shall be 5% where feasible, but in no case greater than 10%. A Tee-shaped vehicle turn around area shall be provided at the end of all dead end access roads to provide the ability to maneuver a large utility truck in the road. Each leg of the tee shall be minimum 14’ wide and 25’ long measured from the near edge of the adjacent perpendicular road leg. Access roads shall not be dead-end unless it is infeasible to connect to another paved road.
- j. When gravity wastewater mains are installed under impervious surfaces or pavement, only standard hot mix asphalt or cast in place concrete paving may be used within a 6 ft. wide corridor centered on the pipe, or a corridor with a width equal to twice the depth to the bottom of the pipe, whichever is greater.

3. SERVICE LATERALS

- a. Single gravity services shall be provided to the center of each lot, building, or parcel.
- b. Single services shall be minimum 4” diameter PVC, SDR35, green or green striped, and shall be sloped at a minimum of 1.0 %.
- c. A double service (see GRU Design Detail WW-5.1) shall be constructed using two 4” service pipes in the same trench, with 2-foot center-to-center clearance between pipes.
  - i. 4” services shall have cleanouts installed at a minimum of every 75’.

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- ii. Services shall be designed with minimum 36" of cover.
  - iii. Services shall terminate with a cleanout at a minimum of 5' from each building.
  - iv. Cleanouts shall be installed a minimum of every 75' for 4" services and every 100' for 6" services.
- d. For single family residential systems:
- i. Single services shall be installed at the lot centerline and shall be drawn perpendicular to the wastewater main.
  - ii. 4" services shall have cleanouts installed at a minimum of every 75'.
  - iii. Services shall be designed at a depth of 4.5' to 5.0' below finished grade at the GRU cleanout.
  - iv. Services shall be designed with minimum 36" of cover.
- e. For commercial and multi-family systems:
- i. Services shall terminate with a cleanout at a minimum of 5' from each building.
  - ii. Cleanouts shall be installed a minimum of every 75' for 4" services and every 100' for 6" services.
  - iii. GRU maintained services shall serve no more than one dwelling unit.
  - iv. Services that serve more than one apartment or dwelling unit shall be privately maintained. GRU will maintain the main lines and manholes.
  - v. Services shall be designed with minimum 36" of cover.
  - vi. Services shall be designed with 4.5' to 5' of cover at the clean-out unless more depth is needed to provide minimum slope.
  - vii. Cleanouts located in paved surfaces and sidewalks shall be provided with traffic load bearing covers.
- f. Services shall be designed at the minimum slopes of 1.0% for 4" diameter and 0.6% for 6" diameter pipes.
- g. Cleanout invert elevations shall be set such that there is sufficient slope to the gravity main.
- h. Services shall be designed to connect to the gravity main with a wye fitting rotated

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45 degrees up. The invert elevation of the service at the main shall be at or above the crown of the mainline pipe.


- i. Services connecting to manholes shall be designed with an invert a minimum of 0.3 ft. above the invert of the manhole.
- j. Services connecting to manholes shall penetrate completely through the manhole wall and extend 3 to 5 inches beyond the inside of the manhole; a neoprene boot shall seal the penetration and shall be cleanly grouted in.
- k. Service lateral cleanout invert elevations shall be set a minimum of 1.5 ft. below the minimum finished floor elevation of the proposed buildings or lots/parcels under review.
- l. Finished floor elevation shall be a minimum of 0.5' higher than the rim elevation of the lowest upstream manhole. If this is not feasible, a Clean Check extendable backwater valve (or equal) shall be installed just downstream of the sewer clean-out adjacent to the house and the clean-out lid shall be replaced with a Sewer Popper (or equal) relief valve (see Wastewater Construction Detail WW – 5.5).

4. GRAVITY MAIN

- a. Gravity mains shall have a minimum 8 in. inside diameter and shall be installed with uniform alignment and grade between manholes.
- b. Manholes shall be provided at the end of all pipelines, at 400 ft. maximum intervals, at grade changes, and at deviations in alignment.
- c. Gravity mains shall be designed in accordance with the following slopes (ft/100ft):

<u>Pipe Size</u>	<u>Minimum Slope</u>	<u>Maximum Slope</u>
8"	0.40%	4.50%
10"	0.28%	Based on PDF (Peak Daily Flow)
12"	0.22%	Based on PDF

- d. Pipe slopes shall be designed at greater than minimum slopes when possible, and shall be designed to obtain velocities of not less than 2.0 fps minimum and not more than 15 fps maximum at peak daily flow.
- e. Gravity wastewater main stub-outs shall be provided to all developable land parcels in the vicinity of the project and future phases of the project, and shall be in accordance with the wastewater master plan for the collection system service area.
- f. Gravity wastewater main stub-outs shall be extended to the property line or phase line and shall extend a minimum of 10' past the edge of pavement or a distance of 1.5 times the wastewater depth, whichever is greater. Stub-outs shall be marked

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with a 2" to 3" diameter PVC or metal pipe, green in color, extending 3' above grade. A green Electronic Marker System (EMS) marker/locator ball shall be placed directly over the end of wastewater stub-outs for future connection, with 18"-24" of cover.

- g. Terminal manholes may be required on gravity wastewater stub-outs that exceed 40 feet in length for the purposes of inspection and maintenance, at the discretion of GRU Water and Wastewater Engineering.
- h. Services shall not be connected to stub-outs without a terminal manhole.
- i. Outside drop construction is required for mains which enter a manhole at greater than 2.0 feet above the manhole invert. Drop connection must have the lower invert placed 0.1 to 0.3 feet above the invert of the manhole outlet.
- j. Inside drop construction for connections to existing manholes may be permitted at the discretion of GRU Water and Wastewater Engineering.
- k. GRU or privately maintained collection systems serving more than 2 buildings, lots, or parcels shall be designed with a minimum 8" gravity main and standard manholes.
- l. There shall be only 1 gravity main exiting each manhole and no more than 3 total connections, including services and mains, entering each manhole at or near the same elevation. At least 12 inches of precast concrete shall remain between the boots of any two adjacent pipes.
- m. Proposed manholes with force mains discharging into them shall be lined with HDPE or a GRU approved equivalent corrosion resistant liner. Existing wastewater manholes that are to receive force main discharge shall be lined with a GRU approved corrosion resistant liner as specified by GRU.

**C. FORCE MAIN SYSTEMS**

1. MATERIAL

- a. Force mains 4" through 10" in diameter shall be PVC, C900, DR 18. When approved, at GRU's sole discretion, epoxy lined DIP force mains may be used and shall be Protecto 401 lined.
- b. 12" or larger diameter force mains shall be PVC, C905, DR 18.
- c. Force mains within bore and jacked casings shall be PVC, C900/905, DR-18 Diamond-lok restrained joint piping.
- d. Force main fittings shall be Protecto 401 epoxy lined ductile iron (ELDI P401).

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2. INSTALLATION

- a. Force mains shall be installed with minimum 36" of cover at the centerline of a standard 20' wide metes and bounds easement, if applicable. Force mains crossing under roadways or commercial driveways shall be installed within a steel casing.
- b. Force mains shall be designed with 10' horizontal and 1.5' vertical minimum separation from potable water mains and 3' minimum horizontal separation from other underground utilities (see **Appendix C**).
- c. Force mains shall be designed at grades (minimum 0.1% slope) that will reduce the number of high points; force mains shall not be designed or installed level. The depth shall be limited to 6' maximum.
- d. When force mains are installed under impervious surfaces or pavement, only standard hot mix asphalt or cast in place concrete paving may be used within a 6 ft. wide corridor centered on the pipe, or a corridor with a width equal to twice the depth to the bottom of the pipe, whichever is greater.

3. FORCE MAIN

- a. Force mains shall be a minimum of 4" in diameter.
- b. Air release valve (ARV) assemblies shall be provided at all high points and at maximum intervals of 1500 feet along the force main route, at GRU discretion. Air release valves 2" in diameter shall be used on 4" through 8" diameter force mains. 12" through 16" force mains shall be provided with 3" air release valves. Air release valves shall be above ground type wherever feasible, and shall be offset from the force-main connection a minimum of 10' horizontal, away from vehicular traffic, near the ROW line or similar suitable location. Connection of air release valves to force mains shall utilize a 2" or 3" flanged stainless steel ball valve and a stainless steel tapping sleeve (not saddle) connected to the force main. Piping from the ball valve to the ARV shall be SCH 80 PVC using SCH 80 solvent weld fittings and flanges.
- c. Plug valves shall be provided at maximum 2000 foot intervals and on all force main branches at tees and wyes. Plug valves shall be provided in the main immediately upstream of each tee and wye so that the branch may be kept in service while isolating the main upstream.
- d. Tees and 90 degree bends shall not be used on force mains less than 12" in diameter unless absolutely necessary. Wyes shall be utilized at connection points and bends 45 degrees or less shall be used. All fittings shall be shown and labeled. Control valves shall be located so as to not conflict with curb, gutter, wheel path and parking spaces and shall be located outside of pavement where possible.
- e. Mechanical restraint method must be shown and labeled for all fittings and pipe line segments.


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- f. A pipeline integrity test shall be performed by GRU prior to scheduling a force main tap. Connections to existing force mains shall be shown and labeled as "Force Main Connection by GRU, Coordinated with Water/Wastewater Engineering" and shall be completed in the presence of a GRU W/WW Utility Construction Inspector (must give 48 hours of notice). The resulting tap coupon shall be tagged, labeled, and delivered to the GRU W/WW Construction Inspector.
- g. Private force mains shall connect only to a gravity sewer, and shall connect via a lateral at a clean-out at the ROW or PUE line.
- h. Force mains shall be connected at the bottom of the manhole matching the crown of the existing gravity pipe. The flow from the force main shall be directed into the downstream invert of the manhole to reduce the amount of turbulence and H<sub>2</sub>S dissipation. Alternate connections may be allowed at GRU's discretion.
- i. A plug valve or ball valve shall be provided in the force main adjacent to the gravity system connection.
- j. Installation of privately maintained individual WW grinder stations with one pump that primarily serve a single residence/structure requires Building Department permit. The assigned Codes Enforcement inspector inspects installation of the station and force main routed to the GRU connection point is leak tested per Code. GRU will not provide design review or permitting of these components but will continue to provide review and guidance for the connection point in the ROW.

**D. LIFT STATIONS**

1. GENERAL

- a. A project meeting with GRU staff shall be held prior to designing a lift station for GRU review and approval. The design engineer shall define the area of service for the proposed station. Information regarding the proposed project size, type, phases, wastewater quantity generation, and any other information needed for determination of the station size should be provided to GRU at this meeting.
- b. GRU staff will analyze the information provided and will determine the lift station necessity and its service area. GRU will determine if the station will be GRU owned and maintained or privately owned and maintained.
- c. The design engineer will preliminarily design the station, sizing the pumps, wet well and any other components. GRU will provide the design engineer with required information for the preliminary design (back pressure if the station will discharge into an existing force main, proposed discharge point, etc.). Preliminary design will be based on GRU WW Lift Station Design Standards and existing GRU lift stations (provided to the design engineer by GRU). All calculations and supporting documentation shall be submitted to GRU with the preliminary design.
- d. GRU staff will review the preliminary design, and will provide revisions and changes

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to be incorporated in the plans for approval by GRU. GRU will make the final decision regarding pump, wet-well, discharge piping, force main, conduit, conductor, and transformer size.

- e. The changes will be incorporated into the final utility plans by the design engineer and shall be resubmitted for a final check and approval by GRU prior to issuance of the GRU Utility Construction Permit for the lift station.


2. LIFT STATION DESIGN

- a. Lift Station design shall conform to the following minimum design standards and requirements:

1. The latest edition of FDEP Rule 62-604 F.A.C.
2. The latest edition of the Great Lakes Upper Mississippi River Board of Engineers Recommended Standards for Wastewater Facilities (10-State Standards).
3. Any additional applicable federal, state and local requirements.
4. Additional information may be required as determined by the GRU Water and Wastewater Engineering Department based upon individual project circumstances.

3. LIFT STATION SYSTEM DESIGN DRAWINGS


- a. All wastewater lift station system design drawings shall contain additional drawings and information beyond the general requirements as outlined below.
- b. GRU Water and Wastewater Engineering shall provide standard mechanical and electrical drawings in the latest version of AUTOCAD or on 24" x 36" paper to the design engineer after the first plan review iteration.
- c. GRU will design and specify pump size, pumping rate, total dynamic head conditions, wet well size and associated elevations, pump discharge size, force main size, electrical loads, transformer size, electric conduit, conductor size, and associated appurtenances. The engineer will be responsible for depicting this information on the design drawings.
- d. Privately maintained lift station designs shall be signed and sealed by the design engineer and submitted to GRU for review and approval.
- e. The engineer shall prepare a lift station site plan at 1"=10' scale.
- f. The site plan shall include paving, grading and drainage design and details, with existing and proposed one foot elevation contours.

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- g. The site plan shall show all existing and proposed utilities. Lift stations that receive flow from another lift station shall include a GRU approved corrosion resistant wet well liner and a GRU approved stationary generator.
- h. The site plan shall depict the control panel, SCADA tower, electric meter, transformer, primary conduit to the existing power supply, and secondary conduit to the control panel, and conduits to the wet-well.
- i. The site plan shall indicate the wet well and valve pit locations, to scale, with dimensions from the parcel lines.
- j. The lift station parcel or site area shall be depicted with accurate dimensions. The minimum parcel size for a GRU maintained lift station is 50' x 50'.
- k. The driveway and connection details shall be shown and conform to local (City or County) and FDOT requirements.
- l. Connections to an existing or proposed force main and gravity system shall be labeled with pipe size, type, slope, manhole top elevations and invert elevations.
- m. Existing and proposed stormwater facilities, adjacent or nearby the site, shall be shown, and the design high water elevations for the 100-year, 24-hour storm event shall be indicated.
- n. Elevations (manhole tops and inverts) and pipe sizes of all existing wastewater facilities that cross and/or are adjacent to the lift station property shall be depicted. Call 352-393-1616 to request construction stakeout of existing wastewater lateral stub-outs.

4. PUMPS

- a. Pumps shall be Flygt submersible or GRU specified alternate.
- b. Motors shall be submersible, 3 phase, 208 or 460 volt. GRU will specify motor voltage.
- c. Pumps shall be sized to provide adequate pumping capacity for the peak hour flow (PHF), [2.5 times the average daily flow (ADF)], for the proposed development. Pump sizing shall also result in maintaining a minimum 2.5 fps and maximum 10 fps peak scouring velocity in the force main. The ADF shall be based upon 350 gpd per Equivalent Residential Connection (ERC).
- d. The minimum pumping rate shall be based upon the greater of the PHF or the flow necessary to provide a minimum scouring velocity of 2.5 feet per second in the force main.
- e. The lift station wet well, mechanical, and electrical appurtenances shall be designed to accommodate larger pumps for future station upgrades, to provide pumping

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capacity for the entire lift station tributary area, or to meet changes in system conditions.


- f. Flush valve to be installed on one pump.

5. WET WELL, VALVE PIT AND RECEIVING MANHOLE

- a. The wet well shall be a minimum of 6 feet in diameter for pumps up to 10 HP.
- b. The wet well shall be a minimum of 8 feet in diameter for pumps greater than 10 HP.
- c. The wet well shall be sized to provide a minimum of 5 feet of vertical storage from the pump off level to the lead pump on level.
- d. The wet well storage volume shall be sized to provide a maximum of 5 starts per hour per pump.
- e. The wet well shall be limited to one influent line, which connects to the receiving manhole on the lift station site.
- f. A receiving manhole shall be located 15 to 20 feet from the wet well and shall be installed approximately 90 degrees from the wet well and valve pit in the paved drive.
- g. The gravity main connecting the receiving manhole and wet well shall be minimum 8" diameter DR 18 PVC at minimum 1% slope, as specified by GRU. See approved materials for additional information.
- h. A valve pit shall contain the check valves, control valves and emergency pump out connection.
- i. The valve pit shall be a minimum of 4 feet deep. The length, width, and depth shall be determined based upon the discharge piping size and spacing. Minimum inside length and width is 6' x 6'.
- j. Within the valve pit there shall be a minimum 12 inches of clearance between the discharge piping, valves and fittings and internal walls. There shall be a minimum 6 inches of clearance between the pipe flanges and the valve pit bottom.

6. ELECTRICAL CONTROL PANEL AND SERVICE

- a. The lift station control panel shall be supplied by the pump manufacturer or GRU specified alternate.
- b. The design engineer shall coordinate with the GRU Electrical Engineering Dept. or


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the appropriate electric service provider for the location and type of electrical service to be provided.

- c. The primary and secondary electrical conductors and conduit shall be sized to meet load requirements in accordance with the Florida Building Code and the National Electric Code.
- d. The conductors and conduits may be oversized at GRU's discretion to accommodate future pump and panel upgrades.
- e. Pad mounted transformers shall be provided in an accessible location at a minimum of 4 feet from a paved surface. Bollards shall be installed if less than or equal to 8-feet from a paved surface.
- f. The pad-mounted transformer shall be located in the site corner on the same side as the control panel location.
- g. Primary conduits shall be shown from the transformer to the existing point of service, as determined by GRU.
- h. Secondary conduit shall be shown from the transformer to the meter with disconnect, and to the control panel.
- i. The transformer, conduit, meter with disconnect, SCADA tower, and control panel shall be indicated on the site plan.
- j. A detail of the transformer pad shall be included on the site plan in accordance with the latest edition of the GRU Energy Delivery Electrical Design Standards.

7. SITE PLAN, PAVING, GRADING AND DRAINAGE PLAN

- a. The site shall be a minimum of 50' x 50' square, and shall be deeded to the City of Gainesville. The 50' x 50' site shall be cleared of all landscaping. Any landscaping adjacent to the lift station shall be placed outside of the 50' x 50' lift station site area. Any landscaping located within the 50' x 50' site shall be subject to removal.
- b. The paved drive shall be a minimum of 14' wide with a 20' wide area adjacent to the wetwell and valve pit extending 5' beyond the wetwell.
- c. The paved drive shall have a uniform elevation adjacent to the valve pit and wetwell and shall be designed and constructed to slope 1/4 (0.25) inch per foot away from the lift station.
- d. The site shall be graded to provide adequate and uniform sheet flow runoff. Piping, inlets, curbs and concrete swales, as appropriate, shall be utilized to control stormwater and prevent erosion.
- e. A uniformly graded, level area shall be provided around the valve pit, wetwell,

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control panel, transformer, and meter, and shall uniformly slope away from the pavement and structures at 1/4 (0.25) inch per foot.

- f. A uniformly graded, level area shall be provided extending 5' beyond the paved drive and all structures and appurtenances. This area shall be sloped at 1/2 (0.50) inch per foot away from all structures and appurtenances.
- g. At a minimum of 5' beyond the paved drive, structures, and appurtenances, the site shall be sloped at a 4:1 maximum grade to natural ground. Wastewater Public Utility Easements shall be provided, when necessary, to encompass fill extending beyond the pump station site to accomplish the required grading.
- h. The site elevation shall be a minimum of 2 feet above the design high water level for 100-year, 24-hour flood elevation of any adjacent stormwater areas.
- i. The site elevation shall be within 1 foot of the connecting road elevation with allowances made for stormwater runoff. Stormwater erosion and sedimentation control, and retention systems shall be provided outside of the 50' x 50' lift station site and cleared area, in accordance with all local and state jurisdictional agency requirements.
- j. Roadway plan and profiles shall be provided for drives that extend beyond the lift station site. Minimum 14' wide asphalt pavement is required.
- k. Road grades and alignments shall be designed to allow access by large heavy trucks (i.e. semi with 8000 gallon tanker). Maximum grade shall be 5% if feasible, and in no case greater than 10%.
- l. Temporary water service shall be provided to the lift station site until the final system is constructed, accepted and available for service.
- m. The asphalt driveway shall be tee shaped to provide the ability to maneuver a large utility truck in the driveway. Each leg of the tee shall be minimum 14' wide and 25' long measured from the near edge of the adjacent perpendicular driveway leg.
- n. A minimum 25' of driveway length between the access road and any access gate must be provided.
- o. Fencing is required at the discretion of GRU W/WW Engineering. GRU reserves the right to specify the type, height, and material of required fencing.

**VIII. BORE AND JACK DESIGN STANDARDS**

**A. GENERAL**

- 1. These Standards are intended to provide Developers, Engineers, Contractors and Inspectors with information to design, construct, and inspect steel encasement pipe


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installed by bore and jack construction. When specified, the Contractor shall also furnish and / or install carrier pipe within the steel encasement pipe.

2. Engineers, Developers, Contractors, Inspectors, and others involved with bore and jack construction shall perform all work in accordance with these standards. All proposed deviations from these standards shall require written approval from the Gainesville Regional Utilities' Water and Wastewater Engineering Department.
3. Gainesville Regional Utilities Water and Wastewater Engineering Department Project Manager shall be notified forty-eight (48) hours prior to commencing construction. Gainesville Regional Utilities will not accept work performed without proper notification or inspection.
4. A Contractor regularly engaged in this type of work shall perform all work. The Contractor shall provide and pay for all materials, labor, tools, equipment, construction water and power, transportation, maintenance of traffic, and all other services and facilities necessary to execute and deliver a complete and properly functioning project within the time specified by the Contract or Purchase Order.
5. Prior to commencing work, the Contractor shall conduct a survey of the site to document pre-existing conditions and submit a Pre-Existing Conditions Report to Gainesville Regional Utilities.
6. At no time during construction shall the Contractor operate existing water and sanitary sewer facilities (valves, pumps, etc) without on-site approval and assistance from Gainesville Regional Utilities Water and Wastewater System personnel.
7. The Contractor shall design and maintain excavations as required to comply with all applicable Federal (OSHA), State (FDOT, etc.), County, City and / or Gainesville Regional Utilities requirements at all times during construction.
8. The Contractor shall abide by all rules, regulations and requirements of the Owners of the property where the work is being performed, including notification 48 hours prior to start of construction.
9. The Contractor shall provide maintenance of traffic (signal lights, warning signs, flagging, barricades, etc) for safety as required by the authority having jurisdiction over the roadway or railroad involved.
10. Gainesville Regional Utilities Water and Wastewater Engineering Department will obtain necessary permits for construction across the roadway(s) and / or railroad right-of-way(s). For permits associated with private development projects, the Developer's Engineer shall provide to Gainesville Regional Utilities all information (drawings, details, schedule, completed permit application, etc.) necessary for obtaining the permits.

**B. FINAL ACCEPTANCE**

1. Upon completion of the work, all waste materials or other debris caused by or accumulated as a result of the work shall be removed from the site by the Contractor

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and properly disposed of in accordance with all applicable Federal, State, and County regulations. Disposal costs shall be included in the Contractor’s bid price for performing the work.

2. Upon satisfactory completion the work and correction of discrepancies or deficiencies found, the steel encasement pipe will be accepted for operations and maintenance. Final acceptance shall be in writing from the Gainesville Regional Utilities.
3. The Contractor shall warrant the work to be free from defects or failures for a period of one (1) years from the date of acceptance. At the end of the one (1) year warranty period, the system may be inspected for any defects by Gainesville Regional Utilities. Deficiencies found during the one-year warranty period shall be repaired by the Contractor at no expense to Gainesville Regional Utilities.


**C. PRODUCTS**

1. Material delivered to the job site shall be inspected by the Contractor for cracks, flaws, surface abrasions, cracked linings, or other defects. Materials found to be defective during this inspection or during the progress of the work shall be rejected and removed from the job site immediately. All materials delivered to the job site shall conform to this specification and/or Gainesville Regional Utilities Water and Wastewater System Construction Standards and Approved Materials Manual.
2. Pipe delivered to the job site shall be unloaded adjacent to where it is to be installed. Materials shall be loaded and unloaded by lifting hoists or skidding to avoid shock and prevent damage. Materials unloaded by skidding shall not be skipped or rolled against materials already on the ground.

**D. STEEL ENCASEMENT PIPE**

1. The length of the steel encasement pipe shall be as shown on the Construction Drawing. The steel encasement pipe shall have minimum yield strength of 36,000 psi and the following minimum wall thickness:

DIAMETER OF STEEL ENCASEMENT PIPE	MINIMUM WALL THICKNESS OF STEEL ENCASEMENT PIPE	
	RAILROAD CROSSING	ROADWAY CROSSING
4"	0.250"	0.188"
6"	0.250"	0.188"
8"	0.250"	0.188"
10"	0.250"	0.188"
12"	0.250"	0.188"
14"	0.281"	0.250"

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16"	0.281"	0.250"
18"	0.312"	0.250"
20"	0.375"	0.250"
22"	0.375"	0.250"
24"	0.500"	0.250"
30"	0.500"	0.312"
36"	0.562"	0.375"
42"	0.562"	0.500"

2. Encasement pipe for railroad right-of-way crossings shall be steel casing pipe for Cooper E 80 loading and shall conform to the provisions of Part 5, Section B of the American Railroad Engineering Division Specifications for pipe lines conveying flammable and non-flammable substances.

**E. CARRIER PIPE**

1. The carrier pipe shall be lined ductile iron unless otherwise noted on the Construction Drawing. Within the right-of-way limits for railroad crossings, the carrier pipe shall be mechanical joint, proprietary restrained joint, or as otherwise approved by the governing railroad authority. The following is the minimum allowable size of the steel encasement piping for various sizes of carrier pipe:

CARRIER PIPE DIAMETER	MINIMUM DIAMETER OF STEEL ENCASEMENT PIPE	
	PRESSURE PIPE POTABLE WATER OR FORCE MAIN SERVICE	GRAVITY PIPE SANITARY SEWER SERVICE
1"	3"	---
1.5"	4"	---
2"	4"	---
4"	12"	14"
6"	14"	16"
8"	16"	18"
10"	18"	20"
12"	20"	22"
14"	22"	30"
16"	24"	30"
18"	30"	30"
20"	30"	36"
24"	36"	36"
30"	42"	42"

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36"	48"	48"
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**F. CASING SPACERS**


1. Casing spacers shall be installed in accordance with the manufacturer’s written recommendations. One (1) casing spacer shall be installed within two (2) feet of each end of the steel encasement pipe. Casing spacers shall be installed on the carrier pipe at intervals not exceeding 10 feet. Each length of ductile iron carrier pipe shall be supported by a minimum of two (2) casing spacers. Each length of PVC carrier pipe shall be supported by a minimum of three (3) casing spacers.
2. Spacers shall be 8-inches wide minimum, bolt-on style with a two piece solid shell made from T-304 stainless steel, 14 gauge minimum thickness. The shell interior shall be lined with PVC.
3. Bearing surfaces, or runners, shall be made from ultra-high molecular weight polymer (plastic). The runners shall be attached to risers at appropriate positions to properly locate the carrier pipe within the casing and to ease installation.
4. Risers shall be made from T-304 stainless steel, 14 gauge minimum thickness and shall be attached to the shell by MIG welding.
5. Fasteners shall be made from T-304 stainless steel.
6. The minimum number of runners per casing spacer and the runner height shall be as follows:

Carrier Pipe Size	Minimum Number of Runners	Height of Runners
2” – 10”	4	2”
12” – 24”	4	2.5”
30” – 36”	6	2.5”

7. Casing spacers shall be Model CCS manufactured by Cascade Waterworks Manufacturing Company, Inc., Yorkville, IL, or equal.

**G. EXECUTION**

1. Prior to a steel encasement pipe installation by the bore and jack method, the roadway and/or railroad right-of-way shall be inspected for depressions or pavement damage by the Contractor and representatives from Gainesville Regional Utilities and the authority having jurisdiction over the roadway and/or railroad right-of-way. Existing depressions and asphalt damage shall be documented by the Contractor and initialed by the attending representatives in a Pre-Existing Conditions Report. The Contractor shall

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provide copies of the Pre-Existing Conditions Report to Gainesville Regional Utilities and the authority having jurisdiction over the roadway and / or railroad right-of-way.


2. Steel casing material, welding equipment, boring and jacking equipment, flood lights, and emergency equipment shall be on site and in proper working condition prior to commencing the bore and jack operation. The work shall not begin until approval has been obtained from Gainesville Regional Utilities and the authority with jurisdiction over the roadway or railroad right-of-way. Once the bore and jack operation has commenced beneath the roadway or railroad right-of-way, it shall continue without interruption until the crossing is successfully completed. Backup equipment (boring machines, welders, etc.) may be required for major roadways and crossings at GRU discretion.

**H. PROTECTION OF PROPERTY AND OBSTRUCTIONS**

1. Structures and/or facilities located within the work zone influence shall be temporarily supported and/or adequately protected at all times during the progress of the work. Structures disturbed or damaged by the Contractor’s construction activities shall be restored to pre-construction condition at the completion of the work at no additional cost to GRU.
2. The Contractor shall obtain utility locates at Sunshine One Call 1-800-432-4770 prior to commencing construction. The Contractor shall exercise caution to avoid damage to existing underground utilities and facilities (e.g. pipes, cables, conduit, utility poles, structures, etc.). Existing utilities shall be kept in operation by temporary lines, temporary pumps, or other means necessary to provide for continuous uninterrupted operation. The Contractor shall be responsible to install, maintain, and operate all required temporary utility systems during construction and shall remove the temporary utility systems upon completion of the work.

**I. PIT EXCAVATION**

1. The steel encasement pipe shall be installed beneath roadways and/or railroads at the location, depth and grade shown on the Construction Drawing. The steel encasement pipe shall be installed sufficiently in advance of the carrier pipe to permit adjustment of the carrier pipe alignment and grade to fit conditions existing after steel encasement pipe construction.
2. Pavement, curb and gutter, driveway and walkway that must be removed to perform the work shall be removed to neat lines of a sufficient width to allow proper steel encasement pipe installation.
3. The bottom of the boring pit shall not be over-excavated unless job site conditions require. If over-excavation occurs, the Contractor shall backfill the pit with approved, suitable material in lifts not exceeding 6-inch thickness to the elevation necessary to install the steel encasement pipe as required by the Construction Drawing. Each lift of the backfill material shall be compacted to a minimum of 95% of maximum density as determined by AASHTO T99, Method C.


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4. During excavation, if ashes, cinders, refuse or other organic material considered unsuitable is uncovered at the bottom of the bore pit or at subgrade, it shall be removed and backfilled with approved, suitable material. Approved backfill material shall be tamped in 6-inch lifts to provide a uniform and continuous bearing characteristic of that area's soil condition.
5. Where the bottom of the pit at subgrade consists of unsuitable material to such a degree that, in Gainesville Regional Utilities opinion, it cannot be removed and replaced with an approved material to support the bore and jack equipment or the pipe properly, a suitable foundation shall be constructed.
6. Excavated material shall be piled in such a manner that it will not endanger the work, obstruct natural watercourses, sidewalks or driveways. Fire hydrants under pressure, valve pit covers, valve boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible at all times. Storm water collection facilities shall be kept clear or other satisfactory provisions made for proper drainage. All surface materials, which are suitable for reuse in restoring the surface, shall be kept separate from unsuitable excavated material.
7. Excavations must conform to governing Federal or State law, municipal ordinances, OSHA Standards or as may be necessary to protect life, property or the work. When shoring and / or sheeting systems are necessary, they must conform to the shoring/sheeting system manufacturer's written requirements.
8. Water shall not be allowed in the entrance/exit pit at any time during the bore and jack operation. Dewatering equipment (wellpoint systems, gravel and pump, etc.) shall be used to remove the water. Discharge from dewatering equipment shall be screened to remove silt and routed to natural drainage channels, storm drains or storm sewers in conformance with Federal, State, or Local regulations.

**J. BORE AND JACK OPERATION**

1. In the event cover conditions are critical or the encasement pipe will be constructed in close proximity to other underground utilities, Gainesville Regional Utilities may direct the Contractor to install a small, temporary guide pipe across the roadbed along the proposed centerline location of the steel encasement pipe before the steel encasement pipe is installed. Under no circumstances shall anchors or other supports be installed in the roadbed or railroad right-of-way.
2. The maximum permissible encasement pipe variation from the horizontal alignment and vertical grade shown on the Construction Drawing shall be as follows:

APPLICATION	MAXIMUM ACCEPTABLE STEEL ENCASEMENT PIPE VARIATION	
	ALIGNMENT	GRADE
Potable Water Service	1.0 ft	0.5 percent greater and no less than as shown on the Drawings

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Sanitary Sewer Force Main Service	1.0 ft	0.5 percent greater and no less than as shown on the Drawings
Sanitary Sewer Gravity Service	1.0 ft	As shown on the Drawings


- After the installation, the steel encasement pipe shall be cleaned free of debris, soil and other foreign matter. The carrier pipe shall be installed and the ends of the steel encasement pipe shall be plugged with brick and mortar.

**K. BACKFILLING**

- Backfilling material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks, stones, or other material which is considered unsuitable. When imported/select backfill material is not specified on the Construction Drawing, backfilling with the native excavated material may be acceptable provided that the native material is suitable for backfilling and approved by Gainesville Regional Utilities.
- After placement of the pipe the soil shall be consolidated to the spring line of the pipe by hand tamping the soil in place. From the spring line of the pipe to twelve (12) inches above the pipe the soil shall be backfilled by hand and the soil consolidated by hand tamping. After placement and compaction of the embedment material, the balance of the backfill material may be machine placed or as required by the Inspector and shall not contain any large rocks or organic/construction debris.
- Backfill within the limits of the roadway and / or railroad right-of-way may require backfill and compaction in incremental lifts to original grade. The authority having jurisdiction over the roadway and /or railroad right-of-way will designate actual compaction requirements. Density tests indicating satisfactory compaction within the roadway and/or railroad right-of-way shall be required for approval.

**L. SURFACE RESTORATION: PAVING, CURB AND GUTTER, WALKWAY AND GRASSING**

- The roadway or railroad right-of-way must be restored after completion of the work to the satisfaction of the authority having jurisdiction.
- The roadway, including asphaltic concrete, walkways, shoulders, and ditches shall be restored in accordance with the "Florida Department of Transportation, Standard Specifications for Road and Bridge Construction" (latest edition).


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3. No pavement base shall be replaced before the ditch backfill has been inspected and approved. The authority having jurisdiction over the roadway shall provide this inspection and approval. Density tests indicating satisfactory compaction within the roadway shall be required for approval.
4. Curb and gutter shall be replaced with new concrete units poured-in-place and having the same cross section as the original curb removed. Backfill under concrete work shall be thoroughly compacted and the sub-grade approved before any concrete may be placed. The authority having jurisdiction over the roadway will designate actual compaction requirements.
5. Concrete walkways and driveways shall be replaced with concrete of the same cross sectional area as the original walkway or driveway. Backfill under concrete work shall be thoroughly compacted and the sub-grade approved before any concrete may be placed. The authority having jurisdiction over the roadway will designate actual compaction requirements.
6. Depressions resulting from settlement of backfill material shall be refilled with approved, suitable material.
7. At the conclusion of the work, the Contractor shall restore the work area to a condition equal to that prior to construction in regards to topography, grassing, vegetation, structures, signs and utilities. The Contractor shall be responsible for all work, including backfilling, seeding, placing of sod, mulching and complete clean-up of the construction area as required by the authority having jurisdiction over the roadway or railroad right-of-way.

**IX. DIRECTIONAL DRILLING DESIGN STANDARDS**


**A. GENERAL**

1. Scope of Work: The work specified in this section consists of furnishing and installing underground utilities using the horizontal directional drilling (HDD) method of installation. This work shall include all services, equipment, materials, and labor for the complete and proper installation, testing, restoration of underground utilities and environmental protection and restoration. For the supply of potable water during construction, the Contractor shall utilize a GRU fire hydrant meter assembly (meter & backflow device) and pay for all water consumed unless otherwise approved by GRU’s Authorized Project Representative. Un-metered reclaimed water may be utilized for flushing and testing of new reclaimed water mains. Non-metered potable water quantities shall be limited to the maximum extent possible.
2. Quality Assurance: The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper directional drilling installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification or within any associated permit (i.e.: FDEP, FDOT, etc.). Adherence to the specifications contained herein, or the GRU authorized Representative’s approval on any aspect of any directional drilling operation covered by this specification, shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work

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authorized under the Contract. The HDD Contractor shall be responsible for the repair of all damage to private and/or public property (at no additional expense to GRU). Post construction restoration and/or repair work shall meet all local, state, and federal rules and requirements.

3. **Project Schedule and Cooperation:** The project schedule shall be established on the basis of working a normal work schedule including five days per week, single shift, and eight hours per day or four days per week, single shift, ten hours per day. Unless approved otherwise by GRU, normal or general items of work such as bacteriological testing, leakage and pressure testing, density testing and final inspections, shall be scheduled during the normal work schedule. GRU may require the Contractor to perform work outside of the normal work schedule. The Contractor shall provide such work or services at the unit prices shown on the Bid Form.
4. **Warranty:** The Contractor shall supply to GRU one (1) year unconditional warranty. The warranty shall include materials and installation and shall constitute complete replacement and delivery to the site of materials and installation of same to replace defective materials or defective workmanship with new materials/workmanship conforming to the specifications.
5. **Referenced Standards:** The work shall conform to applicable provisions of the GRU Water and Wastewater Standards, and the following standards, latest editions, except as modified herein.
  - a. **American Water Works Associations (AWWA) Standards:**
    - i. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch, for Water Distribution
  - b. **American Society for Testing and Materials (ASTM) Standards:**
    - i. ASTM D618 - Standard Methods of Conditioning Plastics and Electrical Insulating Materials for Testing
    - ii. ASTM D638 - Standard Test Method for Tensile Properties of Plastics
    - iii. ASTM D1238 - Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
    - iv. ASTM D1248 - Standard Specifications for Polyethylene Plastics Molding and Extrusion Materials
    - v. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique
    - vi. ASTM D1598 - Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
    - vii. ASTM D1599 - Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings

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- viii. ASTM D1603 - Standard Test Method for Carbon Black in Olefin Plastics
- ix. ASTM D2122 - Standard Method of Determining Dimensions of Thermoplastics Pipe and Fittings
- x. ASTM D2290 - Standard Test Method for Apparent Tensile Strength or Tubular Plastics and Reinforced Plastics by Split Disk Method
- xi. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
- xii. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
- xiii. ASTM D2839 - Standard Practice for Use of a Melt-Index Strand for Determining Density of Polyethylene
- xiv. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter
- xv. ASTM E3261 - Standard Specification for Butt Heat Fusion Polyethylene Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- xvi. ASTM D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
- xvii. ASTM D4218 - Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
- xviii. ASTM F412 - Standard Terminology Relating to Plastic Piping Systems

**B. PERMITS**

- 1. Permits for all work within the FDOT, City of Gainesville, Alachua County, and Submerged Land of the State of Florida right of way shall be obtained and paid for by GRU. The Contractor shall verify the existence of all permits before commencing any work on the project.

**C. SUBMITTALS**

- 1. Work Plan: Prior to beginning work, the Contractor may be required to submit to the GRU Authorized Representative a work plan detailing the procedure and schedule to be used to execute the project. The work plan should include a description of all equipment to be used, down-hole tools, a list of personnel and their qualifications and experience (including back-up personnel in the event that an individual is unavailable), list of sub-contractors, a schedule of work activity, a safety plan (including MSDS of any potentially hazardous substances to be used), traffic control plan (if applicable), an environmental protection plan and contingency plans for possible problems including a Frac-Out and Surface Spill Contingency Plan (for GRU review). The work plan should be comprehensive, realistic, and based on actual working conditions for the particular project. The work plan should document the thoughtful planning required to successfully


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complete the project. The HDD Contractor shall submit to GRU for review a pre-construction bore-log depicting a plan and profile (horizontal and vertical alignment) of the proposed bore path. The bore-log shall show all existing utility crossings and existing structures.

2. Shop Drawing Submittals: Actual catalog data, brochures and descriptive literature will not be required for items of standard usage which meet the requirements of the GRU Water and Wastewater Approved Materials and Construction Standards Manual. Any specialty item not shown in this manual will require a complete shop drawing submittal for any material which may, in the Engineer's opinion, not be in compliance with the GRU Water and Wastewater Approved Materials and Construction Standards Manual.
3. As-built Project Drawing(s): Submit for GRU's approval the As-built drawings in duplicate to the GRU Representative within five days after completing the pull back. The As-built (24" x 36" sepia and Auto CAD disk of as-built data, 20 horizontal max scale with 2 foot vertical max scale) shall include a plan, profile (data every 25 LF of main, at a minimum), and all information recorded during the progress of the work, including all subsurface anomalies identified by Ground Penetrating Radar or vacuum excavation. The HDD Contractor shall certify in writing the accuracy of all As-built drawings.
4. Notification: For all HDD project construction occurring within the limits of the Alachua County Public Works Department (ACPWD) Rights-of-Way (ROW) the Contractor must strictly comply with the following administrative procedures:
5. Prior to starting any construction work, the Contractor must obtain a copy of the ACPWD Approved ROW Use Permit from GRU W/WW Engineering staff. The HDD Contractor must at all times retain a copy of the Approved Permit at the project site. The Contractor is required to provide GRU W/WW Engineering staff with a "firm" construction start date and time a minimum of 48-hours prior to requesting GRU staff to activate the ACPWD Permit.
6. The HDD Contractor is solely responsible for scheduling a Pre-Bore meeting with the ACPWD Inspector identified on the ACPWD Permit. The Pre-Bore meeting shall occur 24-hours (minimum) prior to beginning the HDD work.
7. Incidents involving failure by the HDD Contractor to strictly comply with the requirements stated within Paragraph 1.8, Notification, will be documented by GRU W/WW Engineering staff. GRU W/WW Engineering staff will consider documented non-compliance with the required Administrative procedures stated herein as part of a process to determine the award of future HDD project work.

**D. SITE PREPARATION**

1. Prior to any alterations to the work-site, the Contractor shall photograph or video tape the entire work area. One copy of which shall be given to GRU Representative and one copy to remain with the Contractor for a period of two (2) years following the completion of the project.

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2. The Contractor shall coordinate utilities locates with Sunshine State One-Call of Florida, Inc., (800/432-4770 or web site www.callsunshine.com). Once the locate service has field marked all utilities, the Contractor shall field verify each utility (including any service laterals, i.e. water, sewer, cable, gas, electric, phone, etc.) and those within each paved area. Verification may be performed by utilizing Ground Penetrating Radar, hand dig, or vacuum excavation. Prior to initiating drilling, the Contractor shall record on the construction drawings both the horizontal and vertical location of all existing utilities located within the project limits.
3. The work site shall be graded and filled to provide a level working area. No alterations beyond what is required for the Contractor's operations are to be made. The Contractor shall confine all activities to designated work areas.
4. Following drilling operations, the Contractor shall de-mobilize equipment and restore the work-site to pre-construction condition. All excavations shall be backfilled and compacted to 95% of the original density (at a minimum).
5. Environmental Protection: Contractor shall place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by the construction drawings and/or, local, state, and federal regulations. Contractor shall place hay bales, or other approved protection measures, to prevent any off-site discharge of silt and sediments from the project area. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations including environmental condition stated in local, state, and federal permits. Fuel may not be stored in bulk containers (greater than 25 gallons) within 200 feet of any water-body or wetland.

**E. PROTECTION OF PROPERTY AND OBSTRUCTIONS**

1. Temporary supports and/or adequate protection and maintenance shall be installed on all underground and surface structures encountered in the progress of the work. The structures that have been disturbed shall be restored upon completion of the work.
2. All underground utilities shall be notified 48 hours prior to beginning construction on an individual project. Any known obstruction shall be shown on the construction drawing (s) provided by the user department for the project. The utmost caution shall be taken during construction operations to avoid damage to existing obstructions (pipe, conduit, utility poles and other structures) whether or not shown on the drawings.
3. GRU shall be responsible for obtaining and the cost associated with all required permits for each project.

**F. PERSONNEL QUALIFICATIONS CERTIFICATION**

1. Directional Drilling: All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. (Each person must have been fully trained for over 1,000 hours on all facets of directional drilling, including, but not limited to machine operations, mud mixing, locating, and material fusion.) A responsible representative who is thoroughly familiar with the equipment and type of work to be

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performed, must be in direct charge and control of the operation at all times. In all cases the supervisor must be continually present at the job site during the actual directional drilling operation. The Contractor shall have a sufficient number of competent workers on the job at all times to insure the directional drill is made in a timely and satisfactory manner.

2. Pipe and Fitting Joining: Heat Fusion Joining: Joints between plain end pipes and pipe fittings shall be made by butt fusion when possible. Electro-fusion welding may also be used to complete when the location is not accessible to butt fusion welding equipment. The on-site welder making the joints (butt fusion or electro-fusion) shall have received specific training from the manufacturer of the fittings and/or pipe being welded and shall have written proof of proper training/certification from the associated manufacturers. Only certified welders who have written training certifications from the fitting and/or pipe manufacturer will be allowed to perform this work. That is, to weld a fitting or electro-fusion coupling in place, the on-site welder (employee) must be trained and certified by the fitting manufacturer. The fusion work shall be accomplished (welding and cool-down/closing times) in accordance with the fitting and pipe manufacturers' recommendations, at a minimum. External and internal beads shall not be removed unless approved by GRU.


**G. MATERIALS**

High Density Polyethylene (HDPE) Pipe and Fittings

1. Materials used for the manufacturer of polyethylene pipe and fittings shall be PE3408 high density polyethylene meeting cell classification 345464C per ASTM D3350; and meeting Type III, Class B or Class C, Category 5, Grade P34 per ASTM D1248; and shall be listed in the name of the pipe and fitting Manufacturer in PPI TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade rating of 1600 psi at 73°F per ASTM D-2837. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.
2. Polyethylene Pipe (4 inch and larger): HDPE Pipe shall conform to AWWA C906, DR-11, Ductile Iron Pipe (DIP) size and NSF 61 Standard (as applicable). Polyethylene pipe shall be manufactured in accordance with ASTM F714, Polyethylene (PE) Plastic Pipe (SDR-PR) based on Controlled Outside Diameter and shall be so marked. Each production lot of pipe shall be tested for (from material or pipe) melt index, density, % carbon, dimensions and either quick burst or ring tensile strength (equipment permitting).
3. Nominal pipe sizes only are indicated on the Construction Drawings and Bid Form. Outside diameter of pipe is generally 1 to 2-inches greater than the nominal pipe diameter.
4. Service Identification: Permanent identification of piping service shall be provided by co-extruding three (minimum) equally spaced color stripes into the pipe outside surface or by solid colored pipe shell. The striping material shall be the same material as the pipe material except for color. The following colors shall be used to identify piping service (pressure service):
  - a. Blue – potable water

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- b. Green – wastewater or force main
  - c. Purple – reclaimed water
  - d. Black – raw water
  - e. Yellow – gas
5. Polyethylene Fittings and Custom Fabrication: Polyethylene fittings and custom fabrications shall be molded or fabricated by the pipe manufacturer’s trained personnel. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe. Fabricated fittings must have the same working pressure as the mating pipe.
  6. Molded Fittings: Molded fittings shall be manufactured in accordance with ASTM D3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, and shall be so marked. Each production lot of molded fittings shall be subjected to the test required under ASTM D3261.
  7. Fabricated Fittings: Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service equivalent to the full service pressure rating of the mating pipe. Directional fittings 16-inch and larger such as elbows, tees, crosses, etc., shall have a plain end inlet for butt fusion and flanged directional outlets.
  8. Electro-fusion Branch Saddles: Shall meet AWWA C-906, outlet shall comply with ASTM-D3261, and shall be specifically manufactured for HDPE pipe. This saddle may be utilized for wet-tap applications. These electro-fusion fittings shall be designed and manufactured in accordance with ASTM Specifications F-1055 for use with HDPE (DIPS) pipe.
  9. Polyethylene Flange Adapters: Flange adapter shall be made with sufficient throughbore length to be clamped in a butt fusion joining machine without the use of a stubend holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves to provide gasketless sealing, or to restrain the gasket against blow-out. Adapters for 24-inch and smaller utilize an MJ adapter (see below).
  10. Back-up Rings and Flange Bolts: Flange adapters shall be fitted with lap joint flanges pressure rated equal to or greater than the mating pipe. Convuluted style backup rings are required. The lap joint flange bore shall be chamfered to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 2 or higher.
  11. Manufacturer’s Quality Control: The pipe and fitting manufacturer shall have an established quality control program responsible for inspecting incoming and outgoing materials. Incoming polyethylene materials shall be inspected for density, melt flow rated, and contamination. The cell classification properties of the material shall be certified by the supplier, and verified by Manufacturer’s Quality Control Program.
  12. Polyethylene Mechanical Joint (MJ) Adapters: Mechanical connections of HDPE pipe (4-inch through 24-inch diameter) to Ductile Iron or PVC piping, mechanical joint fittings, or valves shall be through a self-restraining, fusible mechanical joint adapter with or without an integral, internal stainless steel insert. Mechanical joint adapter shall be of the same SDR rating as the pipe. A separate, loose stainless steel type insert will only


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be allowed for pipe sizes 4-inch through 16-inches. Provide the mechanical joint adapter, including but not limited to longer tee bolts or all thread rods with nuts at the mechanical joint bell.

13. Electro-fusion Couplings: Polyethylene pipe and fittings may be joined using approved electro-fusion couplings. Fittings shall be PE3408 HDPE, Cell Class 345464C as determined by ASTM D3350-99. Electro-fusion fittings shall conform to manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe. All electro-fusion fittings shall be suitable for use as pressure conduit per AWWA C906, and have nominal burst value of 3.5 times the working pressure of the fitting. To minimize “toe-in” problems when installing an electro-fusion coupling larger than 12-inch size, the Contractor shall remove 12-inches (minimum) from all associated “factory ends” and use a re-rounding clamp on the associated pipe. The Contractor shall mark pipe insertion depth prior to assembly and construction in accordance with manufacturer’s instructions.
14. Polyethylene service line tubing shall conform to GRU’s Water and Wastewater Approved Standard Materials and Construction Manual.
15. Drilling Fluids: drilling fluids shall be as determined appropriate by the HDD Contractor.
16. Delivery, Storage, and Handling of Materials
  - a. Inspect materials delivered to the site for damage. All materials found during inspection or during the progress of work to have cracks, flaws, cracked linings, or other defects shall be rejected and shall be removed from the job site immediately.
  - b. Unload and store opposite or near the place where the work will proceed with minimum handling. Store material under cover out of direct sunlight. Do not store directly on the ground. Keep all materials free of dirt and debris.
  - c. Contractor is responsible for obtaining, transporting, and sorting any fluids, including water, to the work site.
  - d. Disposal of fluids is the responsibility of the Contractor. Disposal of fluids shall be done in a manner that is in compliance with all permits and applicable federal, state, or local environmental regulations. The bentonite drilling slurry may be recycled for reuse in the hole opening operation, or shall be hauled by the Contractor to an approved location or landfill for proper disposal. Contractor shall thoroughly clean entire area of any fluid residue upon completion of pipe installation, and replace any and all existing landscaping plants and sod damaged, discolored or stained by drilling fluids.

**H. EQUIPMENT REQUIREMENTS**

1. General
  - a. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing, delivery, and recovery system of sufficient capacity to successfully complete the drill, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be re-used, a guidance system to accurately guide boring operations, a vacuum truck of

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sufficient capacity to handle the drilling fluid volume, trained and competent personnel to operate the system. All equipment shall be in good, and safe, operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of the project.

2. Drilling System


- a. Drilling Rig: The directional drilling machine shall consist of a power system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The power system shall be self contained with sufficient pressure and volume to power drilling operations. The drilling equipment hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. The rig shall be grounded during drilling and pull-back operations. There shall be a system to detect electrical current from the drilling string and an audible alarm which automatically sounds when an electrical current is detected.
- b. Drill Head: The drill head shall provide the necessary cutting surfaces and fluid jets.
- c. Drill Pipe: Shall be constructed of high quality 4130 seamless tubing, grade D or better.

3. Guidance System

- a. Magnetic Guidance System (MGS) or proven gyroscopic system shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at all depths up to eighty feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate to +/-2% of the vertical depth of the borehole at sensing position at depths up to one hundred feet and accurate within 1.5 meters horizontally.
- b. The Guidance System shall be of a proven type and shall be operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies on the surface of the drill path and shall consider such influences in the operation of the guidance system if using a magnetic system.
- c. Bore Tracking and Monitoring: At all times during the pilot bore the Contractor shall provide and maintain a bore tracking system that is capable of accurately locating the position of the drill head in the x, y, and z axes. The Contractor shall record these data at least once per drill pipe length or every twenty-five (25) feet, whichever is more frequent.
- d. Downhole and Surface Grid Tracking System: Contractor shall monitor and record x, y, and z coordinates relative to an established surface survey bench mark. The data shall be continuously monitored and recorded at least once per drill pipe-length or at twenty-five (25) feet, whichever is more frequent.

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- e. Deviations between the recorded and design bore path shall be calculated and reported on the daily log. If the deviations exceed plus or minus 5 feet (horizontal or vertical deviation) from the design path, such occurrences shall be reported immediately to GRU. The Contractor shall undertake all necessary measures to correct deviations and return to design line and grade.
4. Drilling Fluid Pressures and Flow Rates: Drilling fluid pressures and flow rates shall be continuously monitored and recorded by the Contractor. The pressures shall be monitored at the pump. These measurements shall be made during pilot bore drilling, reaming, and pullback operations.
5. Drilling Fluid (Mud) System
- a. Mixing System: A self-contained, closed drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid. Mixing system shall continually agitate the drilling fluid during operations.
  - b. Drilling Fluids: Drilling fluids shall be composed of clean water, appropriate additives and clay. Water shall be from an authorized source with a minimum pH of 6.0. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No potentially hazardous material may be used in drilling fluid.
  - c. Delivery System: The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and conveyed to the drilling fluid recycling system. A berm, minimum of 12" high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid cycling system to prevent spills into the surrounding environment. Pumps and/or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage and recycling facilities.
  - d. Drilling Fluid Recycling System: The drilling fluid recycling system shall separate sand, dirt and other solids from the drilling fluid to render the drilling fluid reusable. Spoils separated from the drilling fluid will be stockpiled for later use or disposal.
  - e. Control of Drilling Fluids: The Contractor shall follow all requirements of the Frac-Out and Surface Spill Contingency Plan as submitted and approved and shall control operational pressures, drilling mud weights, drilling speeds, and any other operational factors required to avoid hydro fracture fluid losses to formations, and control drilling fluid spillage. This includes any spillages or returns at entry and exit locations or at any intermediate point. All inadvertent returns or spills shall be promptly contained and cleaned up. The Contractor shall maintain on-site mobile spill removal equipment during all drilling, pre-reaming, reaming and pullback operations and shall be capable of quickly removing spills. The Contractor shall immediately notify GRU of any inadvertent returns or spills and immediately contain and clean up the return or spill.

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6. Other Equipment

- a. Pipe Rollers: Pipe rollers, if utilized, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. A sufficient number of rollers shall be used to prevent excess sagging of pipe.
- b. Pipe Rammers: Hydraulic or pneumatic pipe rammers may only be used if necessary and with the approval of GRU’s Authorized Project Representative.
- c. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those defined above in the preceding sections shall not be used unless approved by GRU’s Authorized Project Representative prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the projects.

**I. DRILLING PROCEDURES**

1. Drill Path


- a. Prior to drilling Contractor shall utilize all verified location information to determine drill pathway. Marked up construction drawings shall be on site at all times, and referenced during the drill operation.

2. Guidance System


- a. Contractor shall provide and maintain instrumentation necessary to accurately locate the pilot hole (both horizontal and vertical displacements), measure pilot string torsional and axial pressure and measure drilling fluid discharge rate and pressure. The GRU Authorized Project Representative shall have access to instrumentation and readings at all times during operation.

3. Pilot Hole

- a. The pilot hole shall be drilled along the path shown on the Construction Drawings. Unless approved otherwise by GRU, the pilot hole tolerances shall be as follows:
- b. Elevation: As shown on the drawings.
- c. Alignment: ±5 feet and within 3 feet of right-of-way or easement boundary.
- d. Curve Radius: The pilot hole radius shall be no less than 80% of the maximum bending radius as recommended by the pipe manufacturer of the pipe being installed. In no case shall the bending radius be less than 30 pipe diameters, unless approved otherwise by GRU.

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- e. Entry Point Location: The exact pilot hole entry point shall be within ±5 feet of the location shown on the drawings or as directed by the GRU Representative in the field.
  - f. Exit Point Location: The exit point location shall be within ±5 feet of the location shown on the drawings or as directed by the GRU Representative in the field.
  - g. Limitations on Depth: If not noted on the drawings, 6-inch HDPE pipe and smaller shall be installed with a minimum depth of 3 feet and 8-inch HDPE pipe thru 12-inch pipe shall be installed with a depth of 3 to 6 feet unless it is required to install the pipe deeper due to utility conflicts. HDPE pipe larger than 12-inch shall be specifically designed by the engineer and approved by GRU. Where utilities cross under FDOT roads, the depth of cover shall comply with the applicable FDOT permit.
  - h. Water Main and Non-Water Main Separation Requirements: The minimum separation requirements between HDPE water main and a non-water main shall be shown on the construction drawings or in accordance with the Florida Department of Environmental Protection requirements.
4. Pull Back
- a. After successfully reaming the bore hole to the required diameter, Contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel and reamer to compact bore hole walls. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations Contractor will not apply more than the maximum safe pipe pull pressure at any time. Maximum allowable tensile force imposed on the pull section shall be equal to 80% of the pipe manufacturer's safe pull (or tensile) strength and as follows:
  - b. Torsional stress shall be minimized by using a swivel to connect a pull section to the reaming assembly.
  - c. The pullback section of the pipeline shall be supported during pullback operations so that it moves freely and the pipe is not damaged.
  - d. External pressure shall be minimized during installation of the pullback section in the reamed hole. Damaged pipe resulting from external pressure shall be replaced at no cost to GRU.
  - e. Buoyancy modification shall be at the discretion of the Contractor and shall be approved by the GRU Authorized Project Representative. The Contractor shall be responsible for any damage to the pullback section resulting from such modifications.
  - f. In the event that pipe becomes stuck, Contractor will cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, Contractor will notify the GRU Representative. The GRU Authorized Project Representative and Contractor will discuss options and then work will proceed accordingly


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**J. PIPE ASSEMBLY**

1. Pipe shall be welded/fused together in one length, if project site space permits, pipe may be placed on pipe rollers before pulling into bore hole to minimize damage to the pipe. For pipes 16-inch and larger, a re-rounding clamp tool shall be utilized during the electro-fusion process to ensure pipe roundness. For pipe sizes larger than 12-inch, mechanical scrapers (per the fitting manufacturer’s recommendation) shall be utilized during the electro-fusion work. It is critical that all original oxidized pipe surfaces be removed in order for fusion to take place. The scraping process requires that approximately 0.10” of the outer “skin” be removed in order to penetrate the oxidation and contamination barrier.
2. Acceptability of Damaged Pipe: Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out and discarded.
3. Butt Fusion Testing: When requested by a GRU inspector, butt fusion testing will be performed. The test fusion shall be allowed to cool completely, and then fusion test straps shall be cut out. The test strap shall be 12” (min) or 30 times the wall thickness in length with the fusion in the center and 1” (min) or 1.5 times the wall thickness in width. Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new test fusion shall be made, cooled completely and tested.
4. Mechanical Joining: Polyethylene pipe and fittings may be joined together or to the materials by means of flanged connections (flange adapters, electrofused couplings, and back-up rings) or mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material. Mechanical couplings shall be fully pressure rated and fully thrust restrained such that when installed in accordance with manufacturer’s recommendations, a longitudinal load applied to the mechanical coupling will cause the pipe to yield before the mechanical coupling disjoins. External joint restraints shall not be used in lieu of fully restrained mechanical couplings.
5. Mechanical Joint and Flange Installation: Mechanical joints and flange connections shall be installed in accordance with the Manufacturer’s recommended procedure. Flange faces shall be centered and aligned to each other before assembling and tightened bolts. In no case shall the flange bolts be used to draw the flanges into alignment. Bolts shall be lubricated, and flat washers shall be fitted under the flange nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be 100 ft-lbs or less as recommended by the Manufacturer.

**K. TESTING**

1. Disinfection Tests
  - a. All water pipe and fittings shall be thoroughly disinfected prior to being placed in service. Disinfection shall follow the applicable provisions of the procedure

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established for the disinfection of water mains as set forth in AWWA – Standard C651 entitled “AWWA Standard for Disinfecting Water Mains” and shall be in accordance with Section 350. Bacteriological testing on the water main shall be scheduled and completed by GRU. GRU will collect the water samples and be responsible for completing the water sample analysis (lab testing).


2. Temporary blow-offs shall be installed for the purpose of cleaning the water main. Blow-offs installed on water mains up to and including 16-inches shall be the next smaller size, in diameter, than the water main being tested. Temporary blow-off shall be removed and plugged after the main is cleared. The GRU Representative shall be present prior to and during the operation of blow-offs. The main shall be flushed prior to disinfection.
3. The new water main shall be connected to the existing water main at one point only for flushing purposes (no looping). The new main MUST have a blow off on the end as required previously. After the new main is thoroughly flushed, the open end shall be sealed and restrained and the main shall be thoroughly disinfected. Any time the new line is reopened (to repair defective joints or pipe, defective fitting or valve) the complete disinfection process shall be repeated.
4. Pressure and Leakage Tests
  - a. Perform tests in accordance with GRU’s Water and Wastewater Approved Design Standards Manual.

**L. LOCATE WIRE**

1. Locate wire shall be provided on all installations. For HDD projects, locate wire shall be as specified within GRU’s Water and Wastewater Standard Materials Manual AWG copper-clad carbon steel with 30 mils (min) insulation.

**M. RECORD KEEPING AND AS-BUILTS**

1. Contractor shall maintain a daily project log of drilling operations and a Magnetic Guidance System (MGS) log with a copy given to GRU’s authorized project representative at the completion of the project.
2. The MGS data shall be recorded per accepted industry standard practice during the actual directional drilling operation. The Contractor shall furnish “as-built” plan and profile drawing based on these recordings showing the actual horizontal and vertical location of the new utility installation, and all existing utility facilities found during the installation. The MGS data shall be certified accurate by the Contractor to the capability of the MGS System.
3. “As-built” drawings shall be completed and certified by a Florida registered professional surveyor at Contractors sole expense in a format acceptable to GRU’s authorized project representative.

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**N. ROCK REMOVAL**


1. Payment for installing piping under the rock removal unit price shall be on a linear foot basis on the actual number of linear feet of rock removed. The unit price shall cover the cost for all materials, labor, and equipment required to complete the bore through the rock. A minimum of three (3) continuous linear feet of rock is required before a rock removal adder may be requested by the Contractor. The Contractor is responsible for notifying GRU when at least three (3) continuous linear feet of rock is encountered and may resume work only when authorization from GRU is given to continue work under this provision.

**O. THRUST-RESTRAINED PVC PIPE AND FITTINGS**

1. DESCRIPTION OF WORK.
  - a. Furnish all labor, materials and equipment required to install potable water main or reclaimed water main, and sanitary sewer force main pipe using the horizontal directional drilling method of installation, all in accordance with the requirements of the Contract Documents. The pipe size, type and length shall be as specified on the purchase order and as shown on the Drawings. Work shall include and not be limited to proper installation, testing, restoration of underground utilities and environmental protection and restoration.
  - b. The directional drill shall be accomplished by first drilling a pilot hole to design standards, and then enlarging the pilot hole no larger than 1.5 times larger than the outer diameter of the Certa-Lok C900 / RJ coupling to accommodate the pull back of the pipe through the enlarged hole.
  - c. Any soil borings required to properly define subsurface soil conditions shall be provided by the Horizontal Directional Drilling Contractor at no additional cost to GRU.

**P. GENERAL PIPE DESCRIPTION**

1. This specification covers thrust-restrained Poly-Vinyl Chloride (PVC) pipe, in nominal sizes 4”–12” with cast iron outside diameters. Pipe shall be suitable for use as pressure-rated potable water mains or reclaimed water mains, as well as in sanitary sewer force main applications.
2. Products delivered under this specification shall be manufactured only from water distribution pipe and couplings conforming to AWWA C900. The restrained joint pipe shall also meet all short term pressure test requirements AWWA C900. Pipe, couplings, and all locking splines components used thereon shall be completely non-metallic to eliminate corrosion problems.
3. Pipe and couplings shall be made from unplasticized PVC compounds having a minimum cell classification of 12454-B, as defined in ASTM D1784. The compound shall qualify for a Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4 Degrees F, in accordance with the requirements of ASTM D2837.

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4. Nominal outside diameters and wall thicknesses of thrust-restrained pipe shall conform to the requirements of AWWA C900. Thrust-restrained pipe shall be furnished in sizes 4", 6", 8", 10", and 12", Class 150 and Class 200. Pipe shall be furnished in standard lengths of 20 feet. Dimensions of the pipe thrust restraint grooves shall be in accordance with manufacturer's specifications.

**Q. JOINTS**


1. The pipe shall be joined using non-metallic couplings which, together, have been designed as an integral system for maximum reliability and interchangeability. High-strength flexible thermoplastic splines shall be inserted into mating precision-machined grooves in the pipe and coupling to provide full 360 degree restraint with evenly distributed loading.
2. Couplings shall be designed for use at the rated pressure of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F477. Joints shall be designed to meet the leakage test requirements of ASTM D3139.

**R. MARKING**

1. Pipe shall be legibly and permanently marked in ink with the following information.
  - a. Manufacturer and Trade Name
  - b. Nominal Size & DR Rating/Pressure Class
  - c. Hydrostatic Proof Test Pressure
  - d. (NSF-61)
  - e. Manufacturing Date Code
  - f. Pipe and couplings shall also bear the mark of the certifying agency(s) that have tested and approved the product for use in fire protection applications.

**S. POLYVINYL CHLORIDE (PVC) PIPE**

1. The pipe material to be used shall meet AWWA C900 standards for Polyvinyl Chloride pressure pipe and fittings with a dimension ratio DR18 or DR14. The pipe shall be designated as Certa-Lok C900/RJ as manufactured by Certain Teed Corporation, no substitutes.
2. The pipe shall be joined using a separate PVC coupling with beveled edges, built in sealing gaskets and restraining grooves. The restraining splines shall be square and made from Nylon 101.
3. Exposed splines shall be cut flush from coupling to reduce soil drag.

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4. Couplings shall be beveled on each edge to minimize soil friction.
5. Contractor shall adhere to the pipe manufacturer’s most current calculations regarding tensile load limitations for trenchless application (see chart below).

Size (inches)	SDR	Class (psi)	Pipe O.D. (inches)	Coupling O.D. (inches)	Maximum Pull-In Force Tightest Bending (lbs)	Maximum Pull-In Force Straight Pull (No Bending) (lbs)
4	18	150	4.800	5.964	6,700	8,200
6	18	150	6.900	8.366	9,000	12,800
8	18	150	9.050	10.947	18,000	25,200
10	18	150	11.100	13.361	25,600	35,200
12	18	150	13.200	15.836	26,440	41,100

6. Contractor shall adhere to the pipe manufacturers most current calculations regarding radius of curvature for Certa-Lok C900/RJ pipe used for trenchless application. This calculation of each bore shall be part of the required submittal prior to work (see chart below).


Pipe Diameter (inches)	Min. Radius of Curvature (feet)	Offset per 20' Length (inches)	Deflection per 20' Length (degrees)
4	100	23	11.5
6	150	16	7.6
8	200	12	5.7
10	250	9	4.6
12	300	8	3.8

**T. APPROVALS**

1. Restrained joint pipe products shall be tested and approved by an independent third-party laboratory for continuous use at rated pressure. Copies of Agency approval reports or product listing shall be provided to GRU’s authorized project representative. Products intended for contact with potable water shall be evaluated, tested, and certified for conformance with NSF Standard 61 by an acceptable certifying organization.

**U. QUALITY CONTROL**

1. Every pipe and machined coupling shall pass AWWA C900 hydrostatic proof test requirements (4X rated pressure for 5 seconds).

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2. As defined in AWWA C900, pipe and couplings shall be homogeneous throughout and free from voids, cracks, inclusions, and other defects, and shall be as uniform as commercially practicable in color, density, and other physical characteristics.

**V. DIRECTIONAL DRILLING EQUIPMENT REQUIREMENTS**

1. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pull back the pipe, a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the installation, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused (if required), a magnetic guidance system (MGS) or walk over system to accurately guide boring operations, a vacuum truck of sufficient capacity to handle the drilling fluid volume, and trained / competent personnel to operate the system. All equipment shall be in well maintained, safe working condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.
2. The directional drilling machine shall consist of a hydraulically powered system to rotate and push hollow drilling pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the installation. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. There shall be a system to detect electrical current from the drill string and an audible alarm which automatically sounds when a electrical current is detected.
3. The drill head shall be steerable by changing its rotation and shall provide necessary cutting surfaces and drilling fluid jets.
4. Mud Motors (if required) shall be of adequate power to turn the required drilling tools.

**W. GUIDANCE SYSTEM**

1. An electronic walkover tracking system or a Magnetic Guidance System (MGS) probe or proven gyroscopic probe and interface shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at all depths up to fifty feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate and calibrated to manufacturer’s specifications of the vertical depth of the borehole at sensing position at depths up to fifty feet and accurate to 2-feet horizontally.
2. The Contractor shall supply all components and materials to install, operate, and maintain the guidance system.
3. The guidance System shall be of a proven type, and shall be set up and operated by personnel trained and experienced with the system. The operator shall be aware of any

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geo-magnetic anomalies and shall consider such influences in the operation of the guidance system.

**X. OTHER EQUIPMENT**


1. Pipe rollers shall be used for pipe assembly during final product pull back.
2. Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by GRU prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated with out undue stoppage and maintain line and grade within the tolerances prescribed by the particular conditions of the project.

**Y. DIRECTIONAL DRILLING OPERATION**

1. Contractor shall provide all material, equipment, and facilities required for directional drilling. Proper alignment and elevation of the bore hole shall be consistently maintained throughout the directional drilling operation. The method used to complete the directional drill shall conform to the requirements of all applicable permits. Copies of all permits shall be supplied to the Contractor by the Owner.
2. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If Contractor is using a magnetic guidance system, drill path will be surveyed for any surface geo-magnetic variations or anomalies.
3. Contractor shall place silt fence between all drilling operations and any drainage, well-fields, wetland, waterway or other area designated for such protection necessary by documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other close space measures. Contractor shall adhere to all applicable environmental regulations. Fuel may not be stored in bulk containers within 200 feet of any water body or wetland.
4. Readings shall be recorded after advancement of each successive drill pipe, (no more than 10') and the readings plotted on a scaled drawing of 1" = 2', both vertical and horizontal. Access to all recorded readings and plan and profile information shall be made available to GRU, or its representative, at all times. At no time shall the deflection radius of the drill pipe exceed the deflection limits of the carrier pipe as specified herein.
5. A complete list of all drilling fluid additives and mixtures to be used in the directional operation will be submitted to GRU along with their respective Material Safety Data Sheets. All drilling fluids and loose cuttings shall be contained in pits or holding tanks for recycling or disposal. No fluids shall be allowed to enter any unapproved areas or natural waterways. Upon completion of the directional drill close space project, the drilling mud and cuttings shall be disposed of by the Contractor at an approved dumpsite.

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6. The pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100-feet. In the event that pilot does deviate from the bore path more than 5-feet of depth in 100-feet, Contractor will notify GRU and GRU may require Contractor to pull-back and re-drill from the location along bore path before the deviation. In the event that a drilling fluid fracture, inadvertent returns, or returns loss occurs during pilot hole drilling operations, Contractor shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a Marsh funnel and wait another 30 minutes. If mud fracture or returns loss continues, Contractor will discuss additional options with the GRU engineer and work will then proceed accordingly.
7. Upon completion of pilot hole phase of the operation, a complete set of “as-built” records shall be submitted in duplicate to the Owner. These records shall include copies of the plan and profile drawing, as well as directional survey reports as recorded during the drilling operation.
8. Upon approval of the pilot hole location the hole opening or enlarging phase of the installation shall begin. The bore hole diameter shall be increased to accommodate the pullback operation of the required size of PVC pipe. The type of hole opener or back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. The reamer type shall be at the Contractor’s discretion with the final hole opening being a maximum of 1.5 times larger than the outside diameter of the Certa-Lok C900 / Restrained Joint Coupling to be installed in the bore hole.
9. The open bore hole may be stabilized by means of bentonite drilling slurry pumped through the inside diameter of the drill rod and through openings in the reamer. The drilling slurry must be in a homogenous / flowable state serving as an agent to carry the loose cuttings to the surface through the annulus of the borehole. The volume of bentonite mud required for each pullback shall be calculated based on soil conditions, largest diameter of the pipe couplings, capacity of the bentonite mud pump, and the speed of pullback as recommended by the bentonite drilling fluid manufacture. The bentonite slurry is to be contained at the exit or entry side of the directional bore in pits or holding tanks. The slurry may be recycled at this time for reuse in the hole opening operation, or shall be hauled by the Contractor to an approved dumpsite for proper disposal.
10. The PVC pipe shall be joined together according to manufacturer’s specifications. The gaskets and the ends of pipe must be inspected and cleaned with a wet cloth prior to each joint assembly so they are free of any dirt or sand. The ends of pipe must be free of any chips, scratches, or scrapes before pipe is assembled. A pulling eye will be attached to the Certa-Lok C900/RJ pulling head on the lead stick of pipe which in turn will be attached to a swivel on the end of the drill pipe. Tracer wire conforming to GRU W/WW approved materials manual shall be attached to the pulling eye and the crown of PVC pipe with duct tape @ 24” O.C. and a minimum of two full wraps around the pipe. This will allow for a straight, smooth pull of the product pipe as it enters and passes through the borehole toward the drill rig and original entrance hole of the directional bore. The product pipe will be elevated to the approximate angle of entry and supported by means of a side boom with roller arm, or similar equipment, to allow for the “free stress: situation as the pipe is pulled into the exit hole toward the drill rig. The product

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pullback phase of the directional operation shall be carried out in a continuous manner until the pipe reaches the original sentry side of the bore.

**Z. PIPE HANDLING**

1. Care shall be taken during transportation of the pipe such that it will not be cut, kinked or otherwise damaged.
2. Ropes, fabrics or rubber protected slings and straps shall be used when handling pipes. Chains, cables or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped into rocky or unprepared ground.
3. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the Certa-Lok C900 / RJ pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.
4. The handling of the joint pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Slings for handling the pipeline shall not be positioned at pipe joints. Sections of the pipes with deep cuts and gouges shall be removed and the ends of the pipeline rejoined.

**AA. PIPE TESTING**

1. Carrier pipe cleaning and flushing are to be performed by the Contractor at no additional cost to the owner.
2. Carrier pipe shall be pressure tested by the Contractor after pullback. The average hydraulic test pressure shall be maintained at 150 psi for two hours. The test pump and water supply shall be arranged to allow accurate measurements of the water required to maintain the test pressure. Any piping material showing seepage or the slightest leakage shall be replaced as directed by the Owner at no additional expense to the Owner.
3. The manufacturer’s recommendations on pipe stretch allowances, bend radius and tensile strength, allowable make-up water, and duration of test pressure shall be observed.
4. All carrier pipe installed by the Contractor shall be pressure tested end to end.
5. All service lines installed by the Contractor on the new main shall also be tested in addition to the new main at no additional cost to GRU.

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