HAMILTON COUNTY REGIONAL UTILITY DISTRICT
HAMILTON COUNTY, INDIANA

STANDARDS FOR THE DESIGN AND CONSTRUCTION OF WATER MAINS, SANITARY SEWERS, AND RELATED APPURTENANCES

OCTOBER 2024

HAMILTON COUNTY REGIONAL UTILITY DISTRICT, INDIANA AUTHORITIES

Hamilton County Regional Utility District Trustees

County Commissioners

County Council

County Highway

County Surveyor

General Manager

HAMILTON COUNTY REGIONAL UTILITY DISTRICT

STANDARDS FOR THE DESIGN AND CONSTRUCTION OF WATER MAINS, SANITARY SEWERS, AND RELATED APPURTENANCES

Appendix A – Standard Forms for Sanitary Sewer and Water Main Service

Appendix B – Standard Details

SECTION 1

INTRODUCTION

1.01 General

1. The Hamilton County Regional Utility District (the District) is responsible for the operation and maintenance of all public water and sanitary sewer facilities within the limits of the District.

2. The purpose of these Standards for the Design and Construction of Water Mains, Sanitary Sewers, and Related Appurtenances (the Standards) is to establish a minimum criteria for design and workmanship. These Standards shall have jurisdiction over the entire water and sanitary sewer systems and appurtenances including the points of connection with building services.

3. All water and sanitary facilities, whether public or private, shall be designed and constructed in accordance with these Standards as well as all applicable State and Federal regulations and requirements.

4. It shall be the Property Owner/Contractor responsibility to comply with all requirements of the District and other authorities having jurisdiction on work if such authority imposes greater requirements. Furthermore, the Property Owner shall be responsible for procuring all necessary permits and licenses, pay all charges and fees for acquiring and recording all easements, and giving all notices necessary and incidental to the work.

5. The Property Owner/Contractor shall be responsible for obtaining all permits which relate to the design and construction of the completed facilities. Permits obtained by the Property Owner/ Contractor include, but are not limited to, permits from the following:

   a. Indiana Department of Environmental Management
   b. Indiana Department of Natural Resources
   c. U.S. Army Corps of Engineers
   d. Indiana Construction Stormwater General Permit

e. Applicable County Permits

6. Additional standards that may be applicable to the design and construction are as follows:

   a. Hamilton County Stormwater Technical Standards Manual (Stormwater Management and Erosion and Sediment Control)
   b. Hamilton County Permit Manual For County Roads (For Work Within Hamilton County Road Right of Way)
   c. Hamilton County Standards For Construction of Road Improvements
   d. Standard Detail Drawings for Drain Design, Hamilton County Surveyor's Office

7. Addenda and/or revisions to these Standards may be issued periodically and will be distributed and made available to the public. Users shall be responsible to keep apprised of any changes and revisions to these Standards.

8. Any conflicts between these Standards and any applicable State laws shall be superseded by such law. If any conflict arises between these Standards and applicable County Ordinances, these Standards shall prevail. These Standards are approved and adopted by the Hamilton County Regional Utility District.

SECTION 2

CHECKLISTS

Hamilton County Regional Utility District

SANITARY SEWER
PROCEDURES FOR CONSTRUCTION (CHECK LIST)

Date Received/ Requested	Date Appr./ Sent	
		PROJECT NO.:_____
		PROJECT NAME:_____
_____	_____	1. Initial Coordination meeting including Developer, Planning Administrator (PA), and District's Engineer.
_____	_____	2. Developer submits preliminary plans of proposed development with estimated capacity demand to the PA for preliminary review and response, and Application for Sewer Service.
_____	_____	3. Developer submits three (3) sets of construction plans and the completed Contract Form for Sewer Service to the PA.
_____	_____	4. PA will forward construction plans to the District's Engineer for review and report to the District Council on the Sewer Service request.
_____	_____	5. District's Engineer will review the plans for completeness, conformance with the District's standards, and evaluate whether the existing collection system can accommodate the sewage generated by this project. The District's Engineer will identify necessary changes in the plans.
_____	_____	6. The District's Engineer will submit review letter which will recommend (not recommend) approval of the plans for construction to the PA.
_____	_____	7. After payment of required fees, the Sewer Service Agreement is executed by the District and Developer and recorded by the District.
_____	_____	8. Developer transmits Bond and insurance certificate.
_____	_____	9. Developer receives construction authorization from the PA.

Date Received/ Requested	Date Appr./ Sent	
_____	_____	10. Developer notifies PA two (2) weeks in advance that project is ready for construction.
		PROJECT NO.:_____
		PROJECT NAME:_____
_____	_____	11. The Developer begins construction by notifying the PA at least 24 hours in advance of beginning work.
_____	_____	12. Following installation of the sewers, the Developer conducts air tests, mandrel tests, manhole tests, and CCTV inspection of the new sewers.
_____	_____	13. The Developer submits two (2) sets of proposed record drawings (prints) (and any easements required but not already included in approved plat) to the PA for review.
_____	_____	14. The District's Engineer prepares a punch list for the project.
_____	_____	15. The Developer completes punch list items.
_____	_____	16. The District's Engineer reinspects the project.
_____	_____	17. The Developer submits two (2) sets of prints and an electronic version (in a format acceptable to the District) of the approved record drawings for the District's files, along with CCTV videos.
_____	_____	18. Developer submits Maintenance Bond to the PA.
_____	_____	19. The District's Engineer recommends approval for acceptance for maintenance to the District.
_____	_____	20. All easements (if not already included in approved plat) are accepted by the District, then recorded by the Developer.
_____	_____	21. Developer submits required documentation for dedication or transfer of sewer system to PA for District's approval. After payment of any remaining fees and reimbursable expenses, the District approves the sewer system for acceptance.

Hamilton County Regional Utility District

Water Service/Main Extension
PROCEDURES FOR CONSTRUCTION (CHECK LIST)

Date Received/ Requested	Date Appr./ Sent	
		PROJECT NO.:_____
		PROJECT NAME:_____
_____	_____	1. Initial Coordination meeting including Developer, Planning Administrator (PA), and District's Engineer.
_____	_____	2. Developer submits preliminary plans of proposed development with estimated capacity demand to the PA for preliminary review and response, and Application for Water Service/ Water Main Extension.
_____	_____	3. Developer submits three (3) sets of construction plans and the completed Contract Form for Water Service/Water Main Extension to the PA.
_____	_____	4. PA will forward construction plans to the District's Engineer for review and report to the District on the Sewer Service request.
_____	_____	5. District's Engineer will review the plans for completeness, conformance with the District's standards, and evaluate whether the existing distribution system can accommodate the water demand generated by this project. The District's Engineer will identify necessary changes in the plans.
_____	_____	6. The District's Engineer will submit the review letter which will recommend (not recommend) approval of the plans for construction to the PA.
_____	_____	7. After payment of required fees, the Water Service/Main Extension Agreement is executed by the District and Developer and recorded by the District.
_____	_____	8. Developer transmits Bond and insurance certificate.
_____	_____	9. Developer receives construction authorization from the PA.

Date Received/ Requested	Date Appr./ Sent	
		10. Developer notifies PA two (2) weeks in advance that project is ready for construction.

PROJECT NO.: _____

PROJECT NAME: _____

		11. The Developer begins construction by notifying the PA at least 24 hours in advance of beginning work.
		12. Following installation of the Water Service/Main Extension, the Developer, with District representatives' oversight, conducts pressure tests, tracer wire continuity tests, bacteriological tests, and confirms construction conformance along with appropriate documentation of the new services and/or mains.
		13. The Developer's Engineer submits two (2) sets of proposed record drawings (prints) (and any easements required but not already included in approved plat) to the PA for review.
		14. The District's Engineer prepares a punch list for the project.
		15. The Developer completes punch list items.
		16. The District's Engineer reinspects the project.
		17. The Developer submits two (2) sets of prints and an electronic version (in a format acceptable to the District) of the approved record drawings for the District's files, along with the Asset Management Form.
		18. Developer submits Maintenance Bond to the PA.
		19. The District's Engineer recommends approval for acceptance for maintenance to the District.
		20. All easements (if not already included in approved plat) are accepted by the District, then recorded by the Developer.

_____	_____	21. Developer submits required documentation for dedication or transfer of main extension system to PA for District's approval. After payment of any remaining fees and reimbursable expenses, the District approves the main extension system for acceptance.

HAMILTON COUNTY REGIONAL UTILITY DISTRICT
SANITARY PLAN & SPECIFICATION REVIEW CHECKLIST

NAME OF PROJECT:_____

PROJECT NO:_____

DESIGN ENGINEER:_____

I. Completeness and Conformance With District Standards

A. Manholes & Cleanouts
1. Manhole Numbers, Rim & Invert Elevations ..... ____
2. Manhole/Cleanout Materials & Construction ..... ____
3. Spaced Max of 400' Apart ..... ____
4. Standard Manhole: 5' Deep or Greater ..... ____
5. Shallow, flat top, Manholes: Less than 5' ..... ____
6. Drop Manhole: 2' Drop of Greater ..... ____
7. Manholes at Finish Grade ..... ____
8. Details Complete ..... ____
9. Specs Complete ..... ____

B. Gravity Sewer Pipe
1. Pipe Numbers, Lengths, Sizes (8" Min.), and Slopes ..... ____
2. All Sewer Lines Planned and Profiles ..... ____
3. Depth: 3' Min. to Top of Pipe ..... ____
4. Pipe Materials ..... ____
5. Pipe Bedding & Backfill Materials & Construction ..... ____
6. Depth Restrictions ..... ____
7. Details Complete ..... ____
8. Specs Complete ..... ____

C. Laterals & Wyes
1. Wyes Connected to Sewer, Not Manholes ..... ____
2. Basement Connection Requirements (See Specs) ..... ____
3. Pipe Size: 6” Min. ..... ____

1% _____
8. Details Complete ..... ____

D. Force Main
1. Pipe and Fitting Material ..... ____
2. Valve Types & Materials ..... ____
3. Pipe Size: 4-Inch Min ..... ____
4. Depth: 5’ Min. to Top of Pipe ..... ____
5. Pipe Bedding & Backfill Materials & Construction ..... ____
7. Details Complete ..... ____
8. Air/Vacuum Release Stations ..... ____

E. Pump Stations
1. Wet Well Size: Min. 15 Minute Detention Time _____
2. Pump Capacity: Min. 100 GPM _____
3. Pump Able to Pass 3-inch Sphere _____
4. Double Mechanical Seals _____
5. Piping Inside Station: D.I. Class 250 _____
6. NEMA 4X Stainless Steel Enclosure for Controls _____
7. Control Panel Setback from Classified Area _____
8. Service Entrance Size and Coordination _____
9. Generator Size and Fuel _____
10. VFDs and Associated Requirements _____
11. Pump Control and Monitoring Devices _____
12. Panelboards _____
13. Lighting Requirements _____
14. Instrumentation and Load Lists (Taking Future into Account) _____
15. Wet Well Junction Boxes _____
16. Access Road & Fencing _____
17. Specs Complete _____
18. Details Complete _____

F Connections To Existing Sewers
1. Details of Connections _____
2. Existing Sewer Sizes & Materials Indicated _____
3. Compare Existing Sewers to District Sewer Map _____
4. Connection to Existing Sewer Made Using New Manhole Over Line _____

G. Other Utility Conflicts
1. Plan shows locations of all other utilities _____
2. Horizontal Separation of 10' Min. to Water Lines _____
3. Vertical Separation of 18" to Water Lines _____
4. Horizontal & Vertical Separation Between Other Utilities _____

H. Miscellaneous
1. Easement Widths: 15' wide-force mains; 20' wide <15' deep; 25' wide – 15-22' deep; 30' wide >22' deep _____
2. Engineer's Seals & Signature _____
3. Page Numbers, Set Complete _____
4. Specs Complete _____
5. North Arrow on Each Sheet _____
6. Benchmark Indicated on Plans _____
7. Scale Indicated on Plans _____
8. Roads Labeled _____
9. Contours Labeled _____
10. Buildings Existing and Proposed Shown _____
11. Existing & Final Grade Shown on Profiles _____
12. Check Additional Notes, Details, Spec. Sections _____

II. Calculations

A. Design Flow
1. 100 Gallons Per Capita Per Day or 310 Per House Per Day ____
2. Use 327 IAC 3-6-11 For Flow Determination ____

III. Cost Estimate

PLAN REVIEW DATE:
LETTERS SENT:
PLANS RESUBMITTED:
APPROVAL DATE:

Hamilton County Regional Utility District
Submersible Sanitary Lift Station
Final Inspection Checklist

Date:_____ Location:_____

Lift Station ID:_____ KW Meter Number:_____

Pump Manufacturer:_____ Pump Supplier:_____

Pump Model:_____ Serial number:_____

Voltage:_____ Phase:_____

Hertz:_____ Horsepower:_____

Control Panel model:_____ Control Panel Supplier:_____

Contractor:_____ Engineer:_____

I. ELECTRIC

A. Is the Power System 3 phase 480/277V with neutral? □ Yes □ No

B. Voltage readings
   1. Between phases: L1, L2_____ L1, L3_____ L2, L3_____
   2. L-G _____
   3. L-N _____

C. Is the service entrance 200A or 400A? □ 200A □ 400A

D. Does the service entrance meet the requirements set forth in NFPA 70/NEC 2008 Edition (hereby referenced as just "NEC") Article 230 and 250? □ Yes □ No

E. Generator
   1. Fuel Source □ Natural Gas □ Diesel
   2. Rating _____kW _____kVA

F. Are wet well junction boxes installed per detail E-3 and in compliance with the NEC? □ Yes □ No

G. Are motor starters or VFDs being used? □ Starters □ VFDs

H. Have all circuits and their components (overcurrent protection device, wire, wiring method, conduit and disconnecting means) been checked and verified for compliance with the NEC? □ Yes □ No

Remarks: _____

II. PUMP AND MOTOR CONTROLS

A. Breaker switches operate property:

480V

1.	Pump # 1	□	Yes	□ No
2.	Pump # 2	□	Yes	□ No
3.	Lighting Panel Transformer	□	Yes	□ No
4.	(Future) Odor Control	□	Yes	□ No

120/240V

1.	Lighting Panel	□	Yes	□ No
	a. Site Lighting	□	Yes	□ No
	b. SPD	□	Yes	□ No
	c. Generator Accessories	□	Yes	□ No
	d. Mag Meter (Tier 2 only)	□	Yes	□ No
	e. Receptacle(s)	□	Yes	□ No
	f. A/C (I.A.)	□	Yes	□ No
2.	Control Panel			
	a. UPS	□	Yes	□ No
	b. 24V Power Supply	□	Yes	□ No
	c. Heater	□	Yes	□ No
	d. Receptacle	□	Yes	□ No

B. Hand-Off-Automatic switches:

1.	Pump #1 Hand position operates	□	Yes	□ No
2.	Pump #2 Hand position operates	□	Yes	□ No
4.	Pump #1 Auto position operates	□	Yes	□ No
5.	Pump #2 Auto position operates	□	Yes	□ No
7.	Do the floats sequence all pumps with relation to lead, lag and alternation:	□	Yes	□ No
8.	Does the level sensor sequence all pumps with relation to lead, lag and alternation:	□	Yes	□ No

C. Amperage:

1.	Name Plate Rating (amps) Pump #1 Motor	□	Yes	□	No
2.	Amps pulled by Pump #1 Motor	□	Yes	□	No
3.	Name Plate Rating (amps) Pump #2 Motor	□	Yes	□	No
4.	Amps pulled by Pump #2 Motor	□	Yes	□	No

D. Seal Failure/Heat Sensor (If the response for any of the pumps is no, mark no):

1.	Seal failure wires connected properly to seal failure circuit	□	Yes	□	No
2.	Test seal failure circuit OK?	□	Yes	□	No
3.	Heat sensor wires connected properly to heat sensor circuit	□	Yes	□	No
4.	Test heat sensor circuit OK?	□	Yes	□	No

E. Control Components:

1.	Verify all electrical components are locally available	□	Yes	□	No
2.	Pump Control Device				
	a. Pump disable with HOA in off or pump fault	□	Yes	□	No
	b. All pump disable from phase monitor	□	Yes	□	No
	c. Pump #1 Run	□	Yes	□	No
	d. Pump #2 Run	□	Yes	□	No
	e. Wet Well Level	□	Yes	□	No
	f. Flow (Tier 2 only)	□	Yes	□	No
	g. Pump #1 Speed Setpoint (I.A.)	□	Yes	□	No
	h. Pump #1 Speed Feedback (I.A.)	□	Yes	□	No
	i. Pump #2 Speed Setpoint (I.A.)	□	Yes	□	No
	i. Pump #2 Speed Feedback (I.A.)	□	Yes	□	No
3.	HMI programmed and working	□	Yes	□	No

F. Alarms:

1.	High water alarm light and horn activate with test button	□	Yes	□	No
2.	Horn silences with silence button.	□	Yes	□	No
3.	High water alarm light and horn activate with float.	□	Yes	□	No
4.	Pump #1 Fail	□	Yes	□	No
5.	Pump #2 Fail	□	Yes	□	No
6.	Generator Running	□	Yes	□	No
7.	Generator Fail	□	Yes	□	No
8.	Generator Leak Detected	□	Yes	□	No
9.	Generator Low Fuel	□	Yes	□	No
10.	ATS Emergency	□	Yes	□	No

11. ATS Fail □ Yes □ No

G. Float and Level Control Settings:

1. Lead pump kicks on at Elv. _____from wet well bottom
2. Lead pump kicks off at Elv._____from wet well bottom
3. Lag pump kicks on at Elv._____from wet well bottom
4. Lag pump kicks off at Elv._____from wet well bottom
5. Back up pump kicks on at Elv._____from wet well bottom
6. Back up pump kicks off at Elv._____from wet well bottom
7. Height of influent sewer above floor of wet well_____
8. Height of high water alarm above floor of wet well_____
9. Top of basin Elev._____
10. Total basin depth_____

Remarks: _____

III. PUMPS AND MOTORS

A. Operation:

1. Are pumps running quietly?
   a. Pump # 1 □ Yes □ No
   b. Pump # 2 □ Yes □ No
   c. Pump # 3 □ Yes □ No
2. Are motors running quietly?
   a. Pump #1 □ Yes □ No
   b. Pump # 2 □ Yes □ No
   c. Pump # 3 □ Yes □ No
3. Is excessive vibration noted:
   a. Pump #1 □ Yes □ No
   b. Pump # 2 □ Yes □ No
   c. Pump #3 □ Yes □ No

B. Installation

1. Are guide rails exactly vertical (plumb)? □ Yes □ No
2. Is base elbow installed level? □ Yes □ No

Remarks: _____

IV. REMOTE MONITOR PANEL

A. Verify start-up procedure completed properly and put "On-Line" with the Wastewater Plant by remote monitor panel suppler. □ Yes □ No

V. VALVES

A. Check valves:
1. Do clappers swing freely? □ Yes □ No
2. Does packing leak? □ Yes □ No

B. Plug valves:
1. Do valves open and close freely? □ Yes □ No
2. Does packing leak? □ Yes □ No
3. During operation, are all valves completely open? □ Yes □ No

Remarks: _____

VI. PUMP STATION TESTING

A. Draw Down Test

Diameter of wet well _____
(5'-0" = 150 gal/ft 6'-0"-212 gal/ft 7'-0"-288 gal/ft 8'-0"-376 gal/ft)

	Time	Depth	Vo. Per Unit Depth	Total Vol.	Pump Capacity
Pump # 1 On					
Pump # 1 Off					
Pump # 2 On					
Pump # 2 Off					
Pump # 3 On					
Pump # 3 Off					
Pump # 4 On					
Pump # 4 Off					
Pump #1,2 On					
Pump #1,2 Off					
Pump #1,3 On					
Pump #1,3 Off					
Pump #2,3 On					
Pump #2,3 Off					
Pump #1, 4 On					
Pump #1, 4 Off					
Pump # 2,4 On					
Pump # 2,4 Off					
Pump #3,4 On					
Pump #3, 4 Off					

B. Pressure Test
1. No Pumps Running – Static Back Pressure: _____
2. Pump No. 1 Operating – Pressure: _____
3. Pump No. 2 Operating – Pressure: _____
4. Pump No. 3 Operating – Pressure: _____
5. Pump Nos. 1 & 2 Running – Pressure: _____
6. Pump Nos. 2 & 3 Running – Pressure: _____
7. Pump Nos. 1 & 3 Running – Pressure: _____

Remarks: _____

VII. EQUIPMENT

A. Service Entrance Disconnect

B. ATS

C. Generator

D. Motors

E. Pump Circuit Breakers

F. Starters or VFDs

G. Control Panel

H. Alternator

I. H-O-A Switches

J. Plug Valves

K. Check Valves

L. Pressure Gauge

M. Transducer

N. Floats

O. Other

Remarks: _____

_____

_____

_____

I CERTIFY THIS REPORT IS ACCURATE

_____
Start-up date/time

_____
Start-up Coordinator

_____
Factory Representative

_____
Wastewater Utility Operator

_____
Wastewater Utility Representative

_____
Engineer

_____
Contractor

HAMILTON COUNTY REGIONAL UTILITY DISTRICT
Water Service/Main Extension
PLAN & SPECIFICATION REVIEW CHECKLIST

NAME OF PROJECT: _____

PROJECT NO: _____

DESIGN ENGINEER: _____

I. Completeness and Conformance With District Standards

A. Mains

1. Pipe Material Shown ..... ____
2. Pipe Size Shown ..... ____
3. Depth at least 54" ..... ____
4. Valves Spaced According to Standards and Design Dictates ..... ____
5. Hydrants Spaced Accordingly, Storz Connection, Color noted ..... ____
6. Private Hydrants Called out if present, Color Correct ..... ____
7. Air Relief shown where needed ..... ____
8. Chlorination Plan Shows Taps, Blow-offs, Phases ..... ____
9. Separation Distances with other Utilities shown and comply ..... ____
10. Separation Distances with Buildings shown and comply ..... ____
11. Services Shown, Locations Appropriate ..... ____
12. Fire Protection Services Shown ..... ____
8. Flushing points/equipment provided where needed ..... ____
8. Layout includes appropriate looping/redundancy ..... ____
9. Standard Details Complete ..... ____
10. Specs Complete ..... ____

B. Miscellaneous

1. Easements Shown ..... ____
2. Engineer's Seals & Signature ..... ____
3. Page Numbers, Set Complete ..... ____
4. Vicinity Map Shows Site in Larger Area ..... ____
5. North Arrow on Each Sheet ..... ____
6. Benchmark Indicated on Plans ..... ____
7. Scale Indicated on Plans ..... ____
8. Roads Labeled ..... ____
9. Contours Labeled ..... ____
10. Buildings Existing and Proposed Shown ..... ____
11. Existing & Final Grade Shown on Profiles ..... ____
12. Legal Drains and other Water Courses Shown ..... ____
13. Areas of Potential Ground Contamination Shown ..... ____
14. Check Additional Notes, Details, Spec. Sections ..... ____

15. Any Up-sizing needed for District Purposes (Agreement Needed)..... ____
16.. Any Tees or Valves needed for Future connectivity..... ____

II. Calculations

Design Flow
1. Consumption ____
2. Needed Fire Flow ____
3. Pressure at High and Low Point of Development ____

III. Cost Estimate ____

PLAN REVIEW DATE:
LETTERS SENT:
PLANS RESUBMITTED:
APPROVAL DATE:

Hamilton County Regional Utility District
Water Main/Service Installation
Walkthrough Checklist

Project Name: _____
Project Number: _____
Date: _____
Contractor: _____
Inspectors: _____;
_____
_____;
_____

- □ Copy of Record Drawings available
- □ Valve Box Lids free of obstructions, not covered by Asphalt, Concrete, soil or sod, flush with grade, not modified.
- □ Valve operator visible and free of soil or construction materials, receives key, turns easily, number of turns corresponds to size, is in correct position. (Mark turns on Drawings, note deficiencies on Punch List)
- □ Tracing wire in each Valve Box or Stop Box as required, wire comes up through top of split box

Hydrants:

- □ Paint is proper color and no exposed metal is shown
- □ Storz connection and hose nozzles operate smoothly (apply food grade grease to hose nozzles and leave hand tight)
- □ Bury line is at grade
- □ Hydrant opens easily and flows (protect ground when flowing hydrant, flow water until free of air and or rusty colored water.
- □ Barrel drains when Hydrant is closed. (Avoid overly compressing gasket when closing)

Air Relief Valve:

- □ Valve Pit opens and is free of obstructions
- □ Stop valve to air relief is accessible to key and open
- □ Air Relief Vent pointing down and has mesh over opening

Services

- □ Curb stop box is accessible, at grade and key fits on stop valve
- □ Stop Valve in correct position (on/off)

- □ Meter Lid unobstructed and flush with grade, Setter at specified depth,
- □ Commercial/Industrial Services unobstructed and at specified grade, lids function as intended, valves operate, meter installed in correct flow orientation, bypass valves closed
- □ Automatic Flush Valves, at grade, shut-off valve open, timer programmed, drain functions properly
- □ Other: _____

Signature of Contract Representative _____ Date: _____

SECTION 3

ABBREVIATIONS AND DEFINITIONS

SECTION 3

ABBREVIATIONS AND DEFINITIONS

3.01 Abbreviations and Definitions

Construction work, alterations, repairs, mechanical installations and appliances connected therewith shall comply with the State Building rules and regulations of the Indiana Department of Fire and Building Services, Indiana Department of Environmental Management, local municipal ordinances and other statutory provisions pertaining to this class of work; such rules, regulations and ordinances are to be considered part of these Specifications.

Wherever in these Standards the following terms, abbreviations, or definitions are used, the intent and meaning shall be interpreted as follows:

A. Abbreviations

AAR	Association of American Railroads
AASHTO	American Association of State and Highway and Transportation Officials
A-E	Architect/Engineer
AGA	American Gas Association
AIA	American Institute of Architects
ANSI	American National Standards Institute
ARA	American Railway Association
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Material
AWPA	American Wood-Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
CTR	Contractor
ETL	Electrical Testing Laboratory
Fed.Spec.	Federal Specifications
FHWA	Federal Highway Administration, Department of Transportation
FM	Associated Factory Mutual Laboratories

FSS	Federal Specifications and Standards, General Services Administration
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
INDOT	Indiana Department of Transportation
IPCEA	Insulated Power Cable Engineers Association
ISPC	Indiana State Plumbing Code
NAVFAC	U.S. Naval Facilities Engineering Command
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
ONR	Owner
OSHA	Occupational Safety and Health Act of 1970
SAE	Society of Automotive Engineers
S-CTR	Sub-Contractor
SPECS	Specifications
SSPC	Steel Structures Painting Council
UL	Underwriter's Laboratories, Inc.
WWPA	Western Wood Producers

B. Definitions

Acceptance: The formal written acceptance by the District of water and sanitary infrastructure which has been completed in all respects in accordance with the approved Plans, Specifications, and these Standards including any previously approved modifications thereof.

Backfill: Earth and/or other material used to replace material removed from trenches during construction which is above the pipe bedding.

Bedding: That portion of the trench backfill which encases the sewer or water pipe to a minimum depth above and below the bell/barrel of the pipe for the purpose of properly supporting the pipe.

Block: The Property abutting on one side of a street between two nearest intersecting streets, railroad right-of-ways, or natural barriers.

Building Sewer (lateral): The conduit for transporting waste discharged from the building to the public sewer commencing three (3) feet outside the building walls and ending at the wye or tee fitting at the connection to the public sewer.

Contractor: Any Contractor who meets the District's requirements and is licensed to enter into contracts for and to perform the work of installing water and sanitary infrastructure.

Construction Plans: The professionally-certified drawings showing the specific location and design of water and sanitary infrastructure to be installed in accordance with these Standards.

County: The County of Hamilton, State of Indiana

Cul-de-Sac: A local street with only one outlet that terminates in a vehicular turnaround and having an appropriate convenient reversal of terminal for the safe and traffic movement.

District – The Hamilton County Regional Utility District

District Engineer: The certified professional engineer or firm appointed by the District to furnish engineering assistance in the administration of these Standards.

Drop Manhole: A manhole having a vertical drop pipe connecting the inlet pipe to the elevation of the outlet pipe. The vertical drop pipe shall normally be located immediately outside the manhole.

Easement: Areas along the line of public water and sanitary infrastructure outside of rights-of-way dedicated to the District granting rights along the line of the public water and sanitary infrastructure. Easements shall be exclusively for public water and sanitary infrastructure and no other utilities may be constructed or encroach upon these easements except with the written authorization by the District.

Property Owner Engineer: The Engineer for the property owner whom must be an engineer properly licensed and registered in the State of Indiana.

Excavation: Removal by any means whatsoever of soil, rock, minerals, mineral substances or organic substances other than vegetation, from water or land on or beneath the land surface thereof, whether exposed or submerged.

Existing Grade or Elevation: The vertical location of the ground surface prior to excavating or filling.

Flood Elevation: The maximum level of high waters for a flood of given return period and rainfall duration.

Flood Hazard Area: Any floodplain, floodway, floodway fringe, or any combination thereof, which is subject to inundation by the regulatory flood, or any floodplain as delineated by Zone A on the current Flood Hazard Boundary Map of the Federal Emergency Management Agency.

Floodplain: The area adjoining the river or stream which has been or may be covered by floodwaters. It consists of both the floodway and floodway fringe.

Flood Protection Grade: An elevation which is a specific distance above the regulatory flood elevation as established by agencies having jurisdiction.

Floodway Fringe: That portion of the floodplain lying outside the floodway which is inundated by the regulatory flood.

GIS: Geographical Information System, a graphical database for presentation of information on maps and for managing assets and information contained in the database.

Infiltration/Inflow: The total quantity of water from both infiltration and inflow without distinguishing the source.

Inspector: A direct employee or representative of the District assigned to make detailed observations of any or all portions of the work and materials. The inspector has full authority to reject materials and/or any portion of the work not supplied and installed in accordance with these Standards.

Lift Station: Any arrangement of pumps, valves and controls that lift and/or convey wastewater to a higher elevation.

Maintenance Guarantee: Any security that may be required and accepted by the District to assure that necessary improvements will function as required for a specific period of time.

Manhole: A sanitary sewer structure, through which a person may enter to gain access to a storm or sanitary sewer or other enclosed structure.

Non-Residential Subdivision: A subdivision whose intended use is other than residential, such as commercial or industrial

Other Specifications and Materials: Wherever in these Standards other specifications or regulations are mentioned, it shall be understood that the materials and methods mentioned therewith shall conform to all requirements of the latest revision of the specifications so mentioned.

Property Owner: Any individual, partnership, firm, corporation or other entity who, as property owner, is initiating the work.

Developer: Any individual, partnership, firm, corporation or other entity having interest, whether legal or equitable, sole or partial, in any premise or tract, lot or parcel of land which is or may be in the future developed or subdivided. This includes any engineers and/or contractors hired by the Developer to perform the work of installing water and sanitary infrastructure.

Record Drawings (As-Builts): Plans certified, signed and dated by a professional engineer registered in the State of Indiana, indicating that the Plans have been reviewed and revised, if necessary, to accurately show all as-built construction and installation details including, but not limited to, key elevations, locations, and distances.

Right-of-Way: All land or interest therein which by deed, conveyance, agreement, easement or otherwise legally accepted method is reserved for or dedicated to the use of the general public.

Sewer: A pipe or conduit for carrying wastewater (sanitary sewer).

Specification: A detailed instruction that designates the quality and quantity of materials and workmanship expected in the construction of the infrastructure.

Standards: The Standards for the Design and Construction of Water Mains, Sanitary Sewers, and Related Infrastructure for the Hamilton County Regional Utility District as contained herein and all subsequent additions, deletions, or revisions.

Structure: Anything constructed or erected, the use of which requires permanent location on the ground or attached to something having a permanent location on the ground.

Ten State Standards (Sewage Works): Recommended Standards for Sewage Works, latest edition, developed by the Committee of the Great Lakes – Upper Mississippi River Board of State Sanitary Engineers.

Ten State Standards (Water Works): Recommended Standards for Water Works, latest edition, Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers.

Uniform Plumbing Code: The Uniform Plumbing Code adopted by the International Association of Plumbing and Mechanical Officials, current edition.

Watercourse: Any natural or manmade drainage way having a defined channel and banks and into which storm water runoff or floodwaters flow either regularly or intermittently.

Work: All the work to be done, in accordance with the approved Plans, Specifications, these Standards and permit conditions.

SECTION 4

TO BE PROVIDED FOR FUTURE APPROVAL

SECTION 5

GENERAL DESIGN STANDARDS FOR SANITARY SEWERS

SECTION 5

GENERAL DESIGN STANDARDS FOR SANITARY SEWERS

5.01 General

The District shall issue final approval for the installation of all sanitary sewer facilities. All facilities shall be designed and installed in accordance with these Standards as well as applicable State and Federal regulations.

5.02 Sanitary Sewer Design Criteria

A. General

1. All sanitary sewers shall be designed and constructed in accordance with IDEM and Recommended Standards for Wastewater Facilities (Ten States Standards).

2. All sanitary sewers shall be designed to carry the estimated flow from the area ultimately contributing to the respective service area of the sanitary sewer. The required capacity shall be established by the District Engineer or at the District's option by means of a study conducted by the Property Owner/Contractor or his authorized representative engineer. This study shall verify the capacity of downstream sewers to handle the proposed additional flow and the proposed connection point.

B. Residential Flows

1. Flows shall be determined per the requirements of 327 IAC 3-6-11, or current Indiana code.

C. Commercial/Institutional Flows

1. Flows shall be determined per the requirements of 327 IAC 3-6-11, or current Indiana code.

D. Industrial Flows

1. For those industries which do not have any process wastewater discharge, flows shall be calculated as stated above in "Commercial/ Institutional Flows". For industries which will have a process discharge, the Property Owner shall submit detailed flow estimates for each process, duration and frequency.

2. Peak capacity shall be determined by multiplying the average discharge by a factor determined by the Property Owner/Contractor and approved by the District Engineer.

E. Additional Capacity

1. Sanitary sewer design capacity must include an allowance to carry unavoidable amounts of additional flows in addition to the peak sanitary flows. Collector and trunk sewers shall be designed to include an allowance of 200 gallons per day per inch diameter mile of pipe.

F. Pipe Capacities

1. Collector sewers shall be classified as any sewer ranging between 8-inches and 12-inches in diameter. Peak design flow capacities shall be based upon the sewer flowing full without surcharge.

2. Trunk or interceptor sewers shall be classified as any sewer 15-inches in diameter and larger.

3. Peak design flow capacities for trunk or interceptor sewers shall be based on sewers flowing full, without surcharge, using the design population density and appropriate land use determined by the District, and shall include an allowance for additional flows which will be reviewed on a case-by-case basis and is subject to the approval of the District.

G. Pipe Diameter

1. The required diameter of gravity sewers shall be determined by Manning's formula using a roughness coefficient, "n", of 0.013 or required by the latest Ten States Standards.

2. The minimum pipe diameter for gravity sanitary sewers shall be 8-inches.

H. Minimum Slopes and Velocities

1. All sanitary collector, trunk and interceptor sewers shall be designed and constructed to provide a minimum velocity when flowing full of 2 feet per second. The slope of the pipe shall be such that these minimum velocity requirements are achieved. The minimum acceptable slopes for the design and construction of the sanitary sewers are as follows:

Pipe Size (Inches)	Minimum Slope (ft. per 100 ft., %)
8	0.45
10	0.33
12	0.26
15	0.19
18	0.16

I. Minimum Depth

1. In general, sewers shall be sufficiently deep to receive sewage from the first floor of all places served by the sewers. No below ground floors may be directed connected via a gravity sewer to the collector sewer unless the floor is 1-foot above the rim of the upstream manhole. The sanitary sewers shall have a minimum cover of 4.5-feet unless waived by the District. Sewers crossing waterways shall meet the requirements of 327 IAC 3-6-10, or current Indiana code. For regulated drains, the crossing shall meet the current County Surveyor's Office Standard Detail Drawings. The developer shall construct the sanitary sewer at reasonable depths to avoid interference with other utilities or drainage structures.

J. Building Sewers (Laterals)

1. Building sewers shall conform to the latest edition of the Uniform Plumbing Code, these Standards, and District Ordinances. No more than one (1) building will be permitted to connect to a building sewer. Sewers with more than one (1) connection must be constructed as a sanitary sewer in a dedicated easement with a minimum sewer diameter of 8-inches with manholes.

2. The building sewer shall connect to the public sewer at a mainline fitting. In situations where this requirement may not be possible, the District may allow for connection of the lateral directly to a manhole structure providing the connection occurs at the manhole invert. Under these circumstances, the manhole base shall be pre-formed with a gasketed connection for the lateral line. The invert of the manhole shall also have a formed benchwall at the flow line to accept the lateral sewer connection. Laterals from two separate buildings may be installed parallel in the same trench but shall be a minimum of 4 feet apart and a minimum of 2 feet off the property line.

3. All single-family and multi-family housing, commercial, institutional, and industrial facilities will require a minimum of 6-inch diameter laterals (unless design flows require a larger lateral). Building sewers shall have a 6-inch wye cleanout located within 3-feet of the building's exterior wall and extended to grade. The cleanout shall be fitted with a threaded lid and shall be constructed such that it is located below the floor level serviced by the gravity sewer to serve as a relief point in the event the municipal sanitary sewer backs up. Industrial buildings shall have a suitable control manhole for observation, sampling, and measurement of the waste stream located prior to the connection to the sanitary sewer, as required by the District.

4. Cleanouts installed under concrete or asphalt paving shall be made accessible by yard boxes or extended flush with paving with approved materials and be adequately protected.

5. Building sewers installed for future connections shall be terminated at the right-of-way or easement and plugged to ensure 100% water tightness. A 5/8-inch steel rod shall be installed so that it is flush

with finished grade. The location shall be recorded by GPS, and the coordinates shall be supplied to the District.

6. All new building sewers shall be provided with tracer wire and location tape from the mainline sewer connection to the edge of right-of-way or easement as described in Sections 6 and 8.

7. If approved by the District, a service may be cut into an existing public sewer using a saddle connection and connected to the District's tracer wire/tape if existing.

K. Manholes

1. Manholes shall be installed at the end of each line. Cleanouts will not be acceptable. Manholes shall also be installed at all changes in grade, size, materials, or alignment, and at all sewer intersections. The interval between manholes shall not be greater than 400-feet.

2. The minimum inside diameter of manholes shall be 48-inches.

3. Flow channels shall be shaped and formed in each manhole to provide a smooth transition of flow from all inlets to the outlet. The bench wall shall be formed to the crown of the inlet and outlet pipes to form a "U" as shown in the Standard Details included in this manual.

2. At changes in sewer alignment and/or sizes, the energy gradient elevation shall not increase. This shall be accomplished by keeping the "0.8 diameter" of the crown elevation continuous where possible for changes in sewer sizes.

3. Manholes proposed to be installed in unpaved areas shall be designed and constructed such that the top of the casting is flush with the finished grade to prevent ponding of water over the casting. Positive drainage away from the manhole shall be provided.

4. Manholes receiving discharge from force mains in which the discharge is more than 12-inches above the manhole invert shall have a force main external drop connection (Detail SS-7). New and

existing manholes which have force main discharge lines shall have a full depth internal coating to prevent corrosion. Internal coating shall be Mainstay Composite Liner by Madewall Products Corporation or approved equal. Epoxy liners shall be required for new structures and composite cementitious and epoxy liners shall be required for existing structures. Manhole frame seal shall be provided: Madewell 806 flexible epoxy or approved equal.

L. Outside Drop Connections

1. Outside drop pipe connections shall only be permitted and approved by the District on a case-by-case basis.

2. In areas where future residential, commercial, institutional, and/or industrial growth can occur, the District shall determine which new manholes 15-feet deep or deeper shall be equipped with outside drop connections of a size and at an elevation to be determined by the District at the time of design to allow for future connections at these points. The drops shall extend from the base to within 10-feet of the final graded surface elevation.

5.03 Lift Station and Force Main Design Criteria

A. General

1. All lift stations shall be designed and constructed in accordance with IDEM and Ten States Standards. All design criteria and calculations shall be submitted to the District for approval.

2. No lift station shall be approved for a project unless a 50-year life cycle analysis is submitted to the District to demonstrate that it will be more cost effective in lieu of constructing a deeper gravity sewer.

B. Pump Sizing Criteria

1. Lift Station pumps shall be provided to accommodate peak hourly flow with the largest pump out of service. A minimum of two (2) pumps shall be provided at each lift station.

C. Force Main Sizing Criteria

1. Force mains shall be designed to maintain a minimum of 2 feet per second in order to avoid solids deposition in the pipe. Minimum force main size shall be 4-inches in diameter unless specifically authorized by the District.

2. Force mains shall have a minimum of 4.5 feet of cover.

D. Lift Station Design

1. All lift stations shall be wet well/valve vault design utilizing submersible pumps in the wet well with a separate valve vault. Meter vaults shall be required for lift stations with a capacity of 350 gpm or greater. Provisions for draining the valve vault (and meter vault if applicable) into the wet well shall be made.

2. Permanent back-up power shall be provided at each lift station unless approved by the District. Provisions shall be made for connection to the District's portable generators at all lift stations in the event of a power failure.

E. Wet Well Sizing Criteria

1. The wet well storage below the lowest inlet shall be a minimum of 5 feet and shall also meet the following criteria:

   a. OFF level to be set at the pump manufacturer's recommended level but no less than 1 foot from the bottom of the wet well.

   b. The distance between the OFF level and the lead pump ON level shall be set to provide storage capacity in gallons equal to:

$$\frac{15 \times \text{Rated Pump GPM}}{4}$$

   (i.e. 15 minute cycle minimum)

   c. The lag pump ON level shall be set a minimum of 6-inches above the lead pump ON level.

d. The high water alarm shall be set a minimum of 6-inches above the lag pump ON level.

e. All level settings shall be set a minimum of 6-inches below the lowest invert.

F. Lift Station Capacity

1. All lift stations will be designed with a minimum capacity of 100 gpm to meet IDEM's requirement of maintaining 2 fps in force mains.

G. Wet Well Lining

1. Lift station wet wells shall receive an internal protective coating for the full depth of the structure. Internal coating shall be Mainstay Epoxy Liner by Madewall Products Corporation, Dura-Plate Epoxy Liner by the Sherwin-Williams Company, or equal.

5.04 Low Pressure Systems Design Criteria

A. General

1. All low pressure systems shall be designed and constructed in accordance with IDEM and Ten States Standards. All design criteria and calculations shall be submitted to the District for approval.

2. No low pressure systems shall be approved for a project unless a 50-year life cycle analysis is submitted to the District to demonstrate that it will be more cost effective in lieu of constructing a deeper gravity sewer.

3. The District will only be responsible for the operation and maintenance of the common low pressure sewer force main and the portion of the lateral from the common low pressure sewer to, and including, the shutoff valve and lateral kit that is to be installed at the R/W or easement line.

4. Only one (1) home (1 EDU) shall be connected to a simplex grinder pump station. For large volume users (Structure greater than 5 EDU's), a duplex grinder pump station shall be required.

B. Low Pressure Sewer System Criteria

1. Grinder Station pumps shall be E-One DH071 or Zoeller 815 Shark. Grinder pump stations

2. Low pressure system grinder pumps shall be submersible, grinder pump capable of handling material commonly found in sanitary sewage collection systems, such as plastics, rags, grit, wood, etc. The pump must be capable of operating at zero or negative heads without damage to the pump.

3. The grinder pump basins shall be constructed of fiberglass reinforced polyester resin. The basin walls must withstand the pressure exerted by saturated soil loading at the maximum bury depth. The saturated soil weight is assumed to be 120 lbs per cubic foot. The basin wall and bottom shall withstand 150% of the anticipated maximum pressure exerted on the basin. All station components must function normally when exposed to these loadings. The basin must Nationally Recognized Testing Laboratory (NRTL) approved to U.L. 1951. All materials exposed to the wastewater shall have inherent corrosion protection, i.e., painted cast iron, fiberglass, stainless steel, PVC.

4. Each basin shall be a minimum of 96-inches deep to provide sufficient storage capacity in the tank. Each basin shall be equipped with a 300 Series Stainless Steel guide rail system to facilitate removal of the pump from ground level.

5. All discharge piping within the basin shall be constructed of 300 Series Stainless Steel and terminate outside the bulkhead with a stainless steel, 1-1/4” female NPT fitting.

6. The pump discharge piping shall be equipped with a factory installed, gravity-operated integral check valve. Working parts of the check valve shall be made of 300 Series Stainless Steel, PVC, or a fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. The valve operation shall provide maximum seating capability, even at a very low back pressure.

7. The pump discharge shall also be equipped with a factory installed, true union, manual ball valve. Balls valves shall be full-ported, constructed of PVC, with a minimum rated pressure of 150 psi. The shut off valve must be replaceable without excavating the basin exterior.

C. Low Pressure Sewer Force Main Criteria

1. Low pressure system pipe size shall be per the pump manufacturers' recommendations with a minimum size of two (2) inches for the common force main and one and one-quarter (1-1/4) inches between the grinder pump and the common force main. The Developer shall assure adequate cleansing velocities in the common force main.
2. Pipe material shall be HDPE, and shall conform to force main requirements in Sections 6, 8, and 10 for materials, installation, and testing.
3. A 1-1/4-inch stainless steel lateral kit shall be supplied at the easement or right-of-way line. The lateral kit shall be owned and operated by the District.

5.05 Easements

All sanitary sewer lines not installed in public rights-of-way shall be protected by dedicated Sanitary Sewer Easements. Lift stations shall be installed in dedicated fee simple parcels.

The minimum sewer easements shall be 20-feet wide for force mains; 25-feet wide for sanitary sewers up to 15-feet deep; 35-feet wide for sanitary sewers between 15-feet deep and 22-feet deep; and 40-feet wide for sewers greater than 22-feet deep.

All sewers shall be centered in the easement unless a water main is also present. In that case, a minimum of 10-feet separation must be maintained between the water line and the sewer line, and additional easement widths may be required as determined by the District.

A minimum 50-foot by 50-foot fee simple parcel shall be provided for all submersible lift stations. Parcel shall be dedicated to the District.

Existing (and proposed, if applicable) Hamilton County Regulated Drain easement limits shall be shown on plans.

The easements shall be exclusively under the discretion and control of the District. Ingress and egress shall be available to the District's crew at all times. No utility companies are allowed to use the easements for installation of their utility lines without the expressed written permission of the District. All plans sheets shall clearly identify the easement and the location of all other proposed utilities. The horizontal and vertical plans shall identify all utilities proposed to cross the easement.

5.06 Drafting Standards

All drawing sheets and specifications are to be certified and dated by a professional engineer of the State of Indiana.

Include all detail sheets and specification sheets as applicable.

Electronic copies (.pdf) and hard copies of the design drawings shall be provided. Hard copies shall be printed in 22-inch by 34-inch format and scaled.

The scale for plan and profile sheets shall not exceed 1"=30' Horizontal and 1"=5' Vertical.

SECTION 5A

GENERAL DESIGN STANDARDS FOR WATER DISTRIBUTION SYSTEMS

SECTION 5A

GENERAL DESIGN STANDARDS FOR WATER DISTRIBUTION SYSTEMS

5A.01 General

Water main design for Hamilton County Regional Utility District (the District) shall meet the requirements of Indiana Administrative Code (IAC), 327-IAC-8, American Water Works Association (AWWA) Standards and accepted practice, Recommended Standards for Water Works, Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, commonly referred to as 10 States Standards, and the design standards specified and approved by the District.

5A.02 Water Main Design Criteria

A. Pressures

1. Normal working pressure should be approximately 60 to 80 psi (139 to 184 feet of elevation) at the base of the tank.

2. Pressures over 80 psi will require private services to install pressure reducing valves (PRVs) to protect private plumbing.

3. Minimum working pressure should be 35 psi.

4. Pressure during fire fighting or other maximum flows shall not drop below 20 psi (46 feet of elevation).

B. Water Mains

1. All materials including pipe, fittings, valves, hydrants, services, etc. shall meet the requirements of ASTM, AWWA, and ANSI/NSF. See District Approved Construction Materials list for specific materials.

2. Permeation considerations in areas that have ground or groundwater contamination by organic compounds shall require use of non-permeable components (ductile iron main, viton gaskets, type k copper service line).

3. Diameter: Pipe shall be sized according to the flow requirements of the development and future needs considering needed fire flow. Minimum size of main providing fire protection is 6-inch diameter. Mains shall be sized to keep projected velocity of flow in mains less than 7 feet per second during required fire flow conditions. Planned water use shall at minimum account for demand estimates provided in 327 IAC 8. Hydrant flow testing coordinated with the District personnel shall also be performed to determine residual pressures for available capacity and demand calculations. New water main extensions shall be certified by a registered engineer that they will maintain required minimum pressures at design flow.

Flow		**Velocity in pipe of diameter x inches (ft/s)**			
gpm	**cfs**	**6**	**8**	**12**	**16**
500	1.11	5.7	3.2	1.4	0.8
1,000	2.23	11.4	6.4	2.8	1.6
1,500	3.34		9.6	4.3	2.4
2,000	4.46		12.8	5.7	3.2
2,500	5.57			7.1	4.0
3,000	6.68			8.5	4.8
3,500	7.80			9.9	5.6

4. Dead end mains shall be minimized by providing looped designs whenever practical. Dead end mains shall be equipped with a hydrant for flushing.

5. Valves shall be located at the following intervals:
   a. Rural areas not expecting future development: 1320 feet or less;
   b. Developed Areas: 600 feet or less;
   c. Commercial Areas: 500 feet or less.

6. Valves shall be gate valves on mains less than 12-inches diameter and butterfly valves on mains 12-inches and larger.

7. Hydrants shall be located at the following intervals:
   a. Residential/Commercial: 600 feet or less
   b. Industrial: 350 feet or less

   Hydrants shall be dry barrel hydrants with 5 ¼ -inch pumper nozzle and two 2 ½ -inch nozzles. Hydrant leads shall be 6-inch diameter and have an isolation valve. Hydrants to be owned and maintained by the District shall be painted ***Yellow***.

8. Private fire hydrants shall e painted ***Red.*** All paint shall be factory applied finishes.

9. Hydrant leads shall be 6-inch fully restrained ductile iron pipe or anchor couplings. Leads shall have an isolation valve. Foster adaptors shall not be used between isolation valve and hydrant to allow for ease of valve key use.

10. Hydrants shall be installed at high points in water mains where air can accumulate.

C. Installation of Water Mains

1. Section 8A provides Installation requirements for water mains.

D. Cross-Connections

1. Cross-connections shall be forbidden. Water service shall not be approved for a building also having well water. Appropriate devices shall be used to prevent cross-connection of any potential contamination source to the potable water supply. Prevention of cross-connections may be achieved by an Air Gap, Reduced Pressure Principle Backflow Preventer, Double Check Valve, or Pressure type Vacuum Breaker as allowed in state regulations.

2. The following customer facilities are designated cross connection hazards per 327 IAC 8-10-4(c) , or current Indiana code, and require either an air gap or reduced pressure principle backflow preventer:

   a. Aircraft and missile manufacturing plants.

   b. Automotive plants, including those plants that manufacture motorcycles, automobiles, trucks, recreational vehicles, and construction and agricultural equipment.

   c. Beverage bottling plants, including dairies and breweries.

   d. Canneries, packing houses, and reduction plants.

   e. Car washes.

   f. Chemical, biological, and radiological laboratories, including those in high schools, trade schools, colleges, universities, and research institutions.

   g. Hospitals, clinics, medical buildings, autopsy facilities, morgues, other medical facilities, and mortuaries.

   h. Metal and plastic manufacturing, fabricating, cleaning, plating, and processing facilities.

   i. Plants manufacturing paper and paper products.

   j. Plants manufacturing, refining, compounding, or processing fertilizer, film, herbicides, natural or synthetic rubber, pesticides, petroleum or petroleum products, pharmaceuticals, radiological materials, or any chemical that could be a contaminant to the public water supply.

k. Commercial facilities that use herbicides, pesticides, fertilizers, or any chemical that could be a contaminant to the public water supply.

l. Plants processing, blending, or refining animal, vegetable, or mineral oils.

m. Commercial laundries and dye works, excluding coin-operated laundromats.

n. Sewage, storm water, and industrial waste treatment plants and pumping stations.

o. Waterfront facilities, including piers, docks, marinas, and shipyards.

p. Industrial facilities that recycle water.

q. Restricted or classified facilities (federal government defense or military installations), or other facilities closed to the supplier of water or to the commissioner.

3. In addition, a fire sprinkler system with chemical additives shall have either the air gap or reduced pressure principle backflow preventer

4. A service line with only a fire sprinkler system and no chemical additions can use an air gap, reduced pressure principle backflow preventer or double check valve.

5. Lawn irrigation systems shall use either an air gap, reduced pressure principle backflow preventer or pressure type vacuum breaker.

6. Air gaps shall require annual inspection, all other cross-connection prevention devices shall be tested annually. Inspection and testing shall be the responsibility of the building owner and shall be performed by a certified cross-connection control device inspector. Results shall be submitted to the District annually.

E. Services

1. Water services shall consist of residential, irrigation, commercial, industrial, fire sprinkler and wholesale classifications. Service line materials shall consist of materials from the District *Approved Construction Materials* list. Installation shall be performed consistent with Detail Drawings and plumbing code. Service taps shall be at least 2 feet away from valves and fittings. Taps for testing shall also be at least 2 feet away from valves and fittings. Meters shall not be located in traffic areas. Meters shall be in outdoor pits or vaults, on private property. Meters shall use appropriate cross-connection measures. Meters will be issued for individual addresses. Meters shall remain the property of the District. Service ownership and maintenance responsibility shall be the District owned from main to curb stop. Property Owner will own and maintain the service from the curb stop to the structure, including meter pit, lid, setter and piping. Agreeing to water service includes right-of-entry for the District to perform work on meter and meter reading equipment.

2. Residential services are ¾" or 1" piping with a 5/8" meter. Residential Services shall be installed and inspected prior to issuance of a meter.

3. Irrigation meters shall be ¾" or 1" piping with a 5/8" meter and shall be installed and inspected prior to issuance of a meter.

4. Commercial meters shall be 1 ½", 2", 3", 4", or 6". Meters smaller than 3" shall be in a meter pit. Meters 3" and larger shall be in a vault. By-pass lines if used shall remain closed.

5. Industrial meters shall be 2", 3", 4" or 6". Industrial meters shall be in vaults with exception of 2" meters that can be in a meter pit. By-pass lines if used shall remain closed.

6. Fire sprinkler services shall have appropriate backflow prevention and shall be owned by the property owner from the valve at the main.

7. Wholesale meters shall be 3", 4" or 6". Wholesale meters shall be in vaults. By-pass lines if used shall remain closed.

F. Water Main Layout

1. Mains shall be in dedicated easements in new subdivisions or where protections are needed outside of right-of-way. Cross fittings shall be avoided. Mains shall be located at least 20 feet from any building, including overhanging projections or basements projecting beyond the building façade. Deflection of pipe shall only be made in the allowable deflection of joints and fittings according to the manufacturer's guidelines.

2. Provisions shall be made to loop mains for redundancy as well as for connection to future development. Mains shall be extended across the full frontage of lots and developments. Mains shall wrap cul-de-sacs so that each cul-de-sac lot has a short service and does not lie beneath pavement. Mains can be reduced in size in the cul-de-sac if the reduced size meets required flows, residual pressure requirements, and fire protection is within 300 feet of the furthest structure in the cul-de-sac. Developments with greater fire protection need may require shorter distances.

5A.03 Easements

A. Easements

1. All water main lines and storage tanks not installed in public rights-of-way shall be protected by dedicated Water Main Easements.

2. The minimum water main easements shall be 20-feet wide.

3. All water mains shall be centered in the easement unless a sanitary sewer or sanitary force main is also present. In that case, a minimum of 10-feet separation must be maintained between the water line and

the sewer line, and additional easement widths may be required as determined by the District.

4. Hamilton County Regulated Drain easement limits shall be shown on all plans.

5. All easements shall be exclusively under the discretion and control of the District. Ingress and egress shall be available to the District's crew at all times. No utility companies are allowed to use the easements for installation of their utility lines without the expressed written permission of the District. All plan sheets shall clearly identify the easement and the location of all other proposed utilities. The horizontal and vertical plans shall identify all utilities proposed to cross the easement.

5A.04 Drafting Standards

A. All Plan and Profile Sheets:

Are to be certified and dated by a professional engineer of the State of Indiana.

Shall include all detail sheets and specification sheets as applicable.

Electronic copies (.pdf) and hard copies of the design drawings shall be provided. Hard copies shall be printed in 24-inch by 36-inch format and scaled.

The scale for plan and profile sheets shall not exceed 1"=30' Horizontal and 1"=5' Vertical..

SECTION 6

MATERIALS FOR SANITARY SEWERS

SECTION 6

MATERIALS FOR SANITARY SEWERS

6.01 General

This section provides a description of the materials acceptable for the construction of sanitary sewer facilities including low pressure systems. Use of other materials which are not specified herein shall only be permitted with the written approval by the District.

6.02 Gravity Sanitary Sewer

A. General

1. The following materials are acceptable for gravity sanitary sewers:

   a. Polyvinyl Chloride (PVC) Pipe

   b. Ductile Iron Pipe (DIP)

2. Joints shall be bell and spigot type with elastomeric seals per ASTM D3212, with gaskets conforming to ASTM F-477.

3. All pipe shall be required to withstand testing requirements as described in other Sections of these Standards.

B. Sanitary Sewer Pipe Materials

1. PVC Pipe

   a. All gravity sewer pipe shall be solid-wall Polyvinyl Chloride (PVC):

      i. For pipe sizes 15 inches and less which are less than 15 feet deep, provide SDR-35 PVC conforming to ASTM D3034.

      ii. For pipe sizes 15 inches and less which are 15 feet deep or deeper, provide SDR-26 PVC conforming to ASTM D3034.

iii. For pipe sizes 18 to 48 inches which are less than 15 feet deep provide PVC conforming to ASTM F679, PS 46.

iv. For pipe sizes 18 to 48 inches which are 15 feet deep or deeper, provide PVC conforming to ASTM F679, PS 115.

v. For pipe sizes 12 inches and less which are within 10 feet of water main or 50 feet of a water well, regardless of depth, provide SDR-21 PVC conforming to ASTM D3034.

vi. For pipe sizes greater than 12 inches which are within 10 feet of a water main or 50 feet of a water well, regardless of depth, provide PVC conforming to AWWA C900-16, CSA B137.3 ASTM D1784 Cell Class 12454 DR 14 or DR 18.

b. Mechanical Plugs shall be wedge type plugs with rubber "O" rings to provide an air tight fitting.

2. Ductile Iron Pipe

a. Pipe shall be ductile iron gravity sewer pipe conforming to ANSI/AWWA A21.51/C15 and ASTM A-746. Pressure Class shall be 350 psi. Pipe and fittings shall comply with ANSI/AWWA A21.51/C151 and ANSI/AWWA A21.10/C110. Provide pipes, fittings and adapters with interior cement mortar lining and external bituminous seal coat meeting the requirements of ANSI/AWWA A21.4/C104.

b. Joints shall be either push-on or mechanical. Supply pipe with push-on type joints conforming to ANSI A21.11/AWWA C111. Supply fittings with push-on or mechanical joints rated for minimum of 150 psi working pressure.

c. Provide polyethylene encasement conforming to ANSI A21.5/AWWA C105 for ductile pipe and fittings consisting of three (3) layers of co-extruded linear low-density polyethylene, fused into a single thickness of not less than 8 mils. Encasement shall be V-Bio Enhanced Polyethylene Encasement as manufactured by U.S. Pipe, or approved equal.

6.03 Sanitary Sewer Force Mains

A. General

1. The following materials are acceptable for sanitary sewer force mains:
   a. Polyvinyl Chloride (PVC) Pipe
   b. High Density Polyethylene (HDPE) Pipe
   c. Ductile Iron (DI) Pipe

B. Force Main Materials

1. Polyvinyl Chloride (PVC) Force Main

   a. Pipe shall conform to ANSI/ASTM D 2241 and have SDR 21. Pipe materials shall conform to ASTM D 1784, Type 1, Grade 1, 2,000 psi design stress. Pipe joints shall be single gasket bell and spigot type, the bells being formed integrally with the pipe.

   b. Fittings shall be mechanical joint iron or ductile iron conforming to ANSI A21.10/AWWA C 110 and ANSI A21.11/AWWA C 111. Restrained joints shall be used at fittings instead of mechanical joints and thrust blocking.

2. High Density Polyethylene (HDPE) Force Main

   a. Pipe shall be manufactured from extra high molecular weight, high density polyethylene, PE 4710 resin meeting the material properties of ASTM D3350, cell classification 445574E with green stripes for sanitary.

   b. Pipe shall be iron pipe size (IPS) meeting requirements of ASTM D3035 and ASTM F714.

   c. Minimum pressure class shall be 200 psi and minimum thickness of DR 11.

   d. Piping joints other than those shown as mechanically connected shall be butt-fusion bonded in accordance with ASTM F2620.

e. Qualification records certifying that bonders and bonding operators employed to complete fusion bonding are qualified shall be submitted prior to commencement of fusion bonding work.

f. Fusion bonding equipment shall be in proper operating condition. Equipment heater performance shall be tested and certified prior to use for fusion bonding. Bonders and bonding operators shall be qualified for the specific bonding equipment utilized in the fusion bonding work.

g. The joining method shall be performed in strict accordance with the pipe manufacturer's requirements. The butt fusion equipment used in the jointing procedure shall be capable of meeting all conditions required by the pipe manufacturer, including temperature, alignment and fusion pressure. Heat fusion joining shall be 100% efficient offering a joint weld strength at least equal to the tensile strength of the pipe. Each butt fusion joint shall be logged electronically by the butt fusion unit, for quality control, by such equipment as The Data Logger manufactured by McElroy Manufacturing, Inc. Logged fusion joints shall be stored in the Data Logger unit, such that it can be downloaded and printed weekly for submittal to the District.

3. Ductile Iron (DI) Force Main

a. Pipe shall be centrifugally cast in metal or sand-lined molds and shall conform to AWWA C151. Minimum pressure class shall be

i. 350 PSI rated water working pressure for 12-inch diameter and smaller pipe

ii. 250 PSI rated water working pressure for 14-inch diameter and larger pipe

b. Each length of pipe shall be marked to show manufacturer’s name or trademark, pipe pressure class, and year of manufacture.

c. Buried pipe joints shall be push-on type and conforming to AWWA C111 and restrained. Exposed joints shall be flanged. Buried fittings shall be mechanical joint and exposed fittings

shall be flanged. Mechanical joint ductile iron fittings shall conform to AWWA C153 and AWWA C110. Restrained joints shall be used in lieu of thrust blocking.

C. Fittings and Joint Restraints

1. Ductile Iron Fittings

a. Buried

i. Provide mechanical joint ductile iron fittings conforming to AWWA C153 and AWWA C110. Use restrained joints instead of thrust blocking.

ii. Gaskets: conforming to AWWA C111.

b. Exposed

i. Flanged gaskets shall conform to ANSI/AWWA C110, full face rubber or other material approved by the engineer and must have minimum 1/8-inch thickness

ii. Nuts and bolts shall conform to ANSI/AWWA C110 and be stainless steel.

c. Conform to AWWA C153 and AWWA C110.

2. High Density Polyethylene (HDPE) Fittings

a. Fittings shall be manufactured in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabrication from HDPE pipe listed in this specification. Fittings shall be manufactured by the same manufacturer as the pipe to which fusion bonding is intended, using identical materials. Fittings shall be manufactured to meet the same pressure rating as the pipe with an included 2:1 safety factor. The pipe DR (Dimension Ratio) shall be used to determine the fitting pressure rating requirements. Fitting shall be manufactured in facilities designed for that purpose. Field-fabricated fitting shall not be allowed.

b. HDPE tapping tees for low pressure sewer systems shall be butt fusion or heat fusion types manufactured from PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4 and shall meet the specifications of ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

c. Branch Saddle Reducing Tees shall be used to connect Air Release Valves to the force mains. Saddles shall be main line size by 4" with 4" flange adapter and back-up ring, and 4" x 2" NPT companion flange.

d. Flange Backup Rings and Gaskets: Conform to AWWA C207; Class D with bolting dimensions conforming to ASTM B16.5. Fusion-bonded epoxy applied to all exterior and interior exposed surfaces with a minimum dry film thickness of 4 mil. Flange gaskets shall be synthetic red rubber (SBR) hardness (Shore A) 80 +/- 5, ring or full face, 1/8-inch thick and conform to ASTM D1330 grades I and II. Asbestos gaskets are not allowed. Bolts and Nuts shall be stainless steel.

e. Pipe fitting markings shall be in accordance with ASTM D3261 requirements and include at a minimum manufacturer's name or trademark, size, and ASTM standard, and as space allows material designation and date of manufacture.

f. HDPE mechanical joint adapters shall be required when making connections to mechanical joint fittings and when connecting to dissimilar pipe materials.

g. Fusion requirements shall be same as for force main pipe.

3. Joint Restraints

a. Pipe Restraints

i. For DI pipe: Series 1700 Megalug Restraint Harness by EBAA Iron for DI pipe, Flex-Ring Joint System by American Ductile Iron Pipe, JCM 620 Sur-Grip Bell Joint Restrainer, Grip Ring Series 600 Pipe Restraining System manufactured by ROMAC Industries, Inc., Ford Meter Box Uni-Flange Series 1390 Joint Restrainer, or approved equal.

ii. For PVC pipe: Series 6500 Bell restraint Harness by EBAA Iron, JCM 620 Sur-Grip Bell Joint Restrainer for IPS PVC pipe, Grip Ring Series 600 Pipe Restraining System manufactured by ROMAC Industries, Inc., or approved equal.

b. Fitting Restraints

i. Series 1100 Megalug by EBAA Iron, JCM 610 Sur-Grip Restrainer by JCM, Ford Meter Box Uni-Flange Series 1400 Restrainer, or approved equal

D. Locator Tape and Wire

1. Locator wire for force mains shall be 12 gauge AWG solid core copper wire. Splices and branch connecting shall be made with 12 AWG splice kits suitable for underground installation. Seal connections with epoxy contained in splice kit and wrap with waterproof tape.

2. Marking tape shall be metallic type tape such as Terra Tape Detectable as manufactured by Reef Industries, Inc., or approved equal. Tape shall be marked with “Caution Sewer Line Buried Below”.

E. Combination (Air Release and Air/Vacuum) Air Valves

1. The design of sanitary sewer force mains shall eliminate the need for combination air valves by eliminating high points. If high points cannot be eliminated, a combination air valve shall be installed at each point.
2. Air release valves shall be provided a minimum of every 2,000 linear feet.

3. Combination air valves and air release valves shall be properly sized for each application. Each valve shall be installed in a precast concrete structure.

4. Sewage air release valves and combination air valves shall have stainless steel body and cover with a N.P.T. inlet and N.P.T. outlet, properly sized per each application, and having stainless steel float

and float guide. Valves shall be as manufactured by A.R.I. or approved equal and shall be a minimum 2-inches.

5. Start-up/checkout services shall be provided for each combination air valve installed by a qualified manufacturer's representative to check the completed installation, place the air release/combination air valves in service and check the operation, and instruct the District's personnel in the operation and maintenance procedures. The purpose of these services is to demonstrate to the District's satisfaction that the air release/combination air valves have been properly selected and installed and will satisfactorily perform the functions for which they are intended. Provide one (1) pdf and (1) bound copy of Operation and Maintenance (O&M) manual for each type of valve installed.

6.04 Building Sewers / Service Laterals

A. Materials and Fittings

1. Building sewers or services less than 15 feet depth shall be SDR 35, bell and spigot type PVC pipe. Building sewers or services 15 feet depth and greater shall be SDR 26, bell and spigot type PVC pipe Joints shall be gasket push-on, compression type conforming to ASTM D3212. Gaskets shall conform to ASTM F477. Factory made wye connections shall be provided at the connection with the municipal sewer line and shall be made in such a manner as will provide strength and watertightness at least equal to the class of the adjacent main line pipe to which they are jointed and shall conform to all other requirements specified for pipe corresponding class and internal diameter. Joints shall be of the same type as used on the adjoining pipe.
2. as used on the adjoining pipe.

B. Saddle Connections

1. Where allowed, saddle connections to facilitate lateral connections to the existing sanitary sewer shall conform to ASTM D3034. Fabricated branches for wyes and tees shall be securely attached to

the wall of the pipe in a watertight manner and shall be flush with the inside surface of the pipe.

C. Cleanout

1. Where required on a service lateral, a cleanout shall be provided (6" diameter minimum) made of the same material as the main line pipe. Said cleanout shall include a watertight, detachable lid and conform to the Service Connection Detail.

D. Tracer Wire and Location Tape

1. Tracer wire and location tape shall be installed for building sewers from the mainline sewer to the edge of right-of-way or easement. Refer to Section 6.03.C for material requirements.

6.05 Sanitary Sewer Manholes / Wet Wells and Valve Vaults

A. Precast Manholes

1. Manholes shall be precast concrete manhole risers with 48-inch precast concrete base and shall meet the requirements of ASTM C-478. Precast concrete manhole shall have cone of eccentric cone type and meet the requirements of ASTM C-478. Manhole risers shall be minimum 48-inches I.D. Eccentric cone sections shall have a 24-inch opening.

2. Joints for manhole sections shall have a flexible butyl rubber joint gasket conforming to ASTM C-443.

3. Manhole benchwalls shall be precast or constructed using a concrete mixture with a low cure time and the ability to be troweled to a smooth finish. Concrete mix shall have minimum 28-day compressive strength of 4,000 psi. Sumps are not permitted in manhole structures.

B. Adjusting Rings

1. Where one (1) solid riser or barrel section cannot be used, final adjustments in elevation of the frame and cover shall only be accomplished by the use of precast concrete adjusting rings conforming to ASTM C-478.

2. Rings shall be of a nominal thickness of not less than 4-inches. No more than 12-inches total of adjusting rings shall be allowed for adjustment of the manhole frame and cover to the required elevation.

C. Sewer Pipe to Manhole Connections

1. Pipe penetration holes shall be either pre-formed by manufacturer or cleanly core drilled in the field. Provide neoprene molded boot (Kor N Seal by National Pollution Control Systems, Inc.) or resilient seal (A Lok) at each pipe to manhole connection.

D. Castings

1. Manhole frames and lids shall have machined horizontal and vertical bearing surfaces. Watertight frames and lids for sanitary sewers shall have a grooved rubber gasket with concealed pick holes.

2. Manhole frames shall be Neenah R-1772-C or EJIW 1022Z1, or approved equal.

3. Manhole covers shall be Neenah R-1772-C, EJIW 1020AGS, or approved equal.

4. Bolt down lids frames and covers shall be provided on manholes located in flood plains or areas susceptible to flooding or ponding water and shall be EJIW 1022Z1PT or approved equal.

5. Sanitary manhole covers shall have the words “SANITARY SEWER” in 2-inch raised letters.

E. Extrudable Preformed Gasket Material

A nominal ½-inch size butyl rubber base gasket material, conforming to AASHTO M-198 and Federal Specification SS-S-210A, shall be used for adjusting ring grooves; between adjusting ring and cone; between cone and casting, and between adjusting ring and casting. The gasket material shall be as manufactured by Hamilton Kent-Seal.

SECTION 6A

APPROVED CONSTRUCTION MATERIALS FOR WATER MAINS AND SERVICES

SECTION 6A

APPROVED CONSTRUCTION MATERIALS FOR WATER MAINS AND SERVICES

6A.01 General

This section provides a description of the materials acceptable for the construction of water distribution facilities. Use of other materials which are not specified herein shall only be permitted with the written approval by the District. All materials shall conform to AWWA standards and have NSF 61 approval.

6A.02 Water Main Materials

A. Water Main

All Water Main shall meet AWWA and NSF 61 requirements.

1. Ductile Iron (DI) Pipe

   a. Pressure Class 350 for 12” and smaller, Pressure Class 250 for larger than 12”.

   b. Pipe shall be centrifugally cast in metal or sand-lined molds and conforming to AWWA C151.

   c. Standard joint: Provide push-on type joints and gaskets conforming to AWWA C111. Mark each length of pipe with manufacturer's name or trademark, pipe class, and year of manufacture.

   d. Restrained joint pipe: boltless restrained type not requiring the use of special tools for disassembly. Pipe shall be TR Flex.

e. Coatings: cement mortar interior lining as specified in AWWA C104 and a bituminous exterior coating as specified in AWWA C151.

f. Acceptable Manufacturers (standard joint):

   i. McWane Ductile - Tyton joint
   ii. US Pipe & Foundry Co. – Tyton joint
   iii. American Cast Iron Pipe Company – Fastite joint

g. Acceptable Manufacturers (restrained joint)

   i. McWane Ductile – TR Flex joint
   ii. US Pipe & Foundry Co. – TR Flex joint

2. Polyvinyl Chloride (PVC) Pipe C900 or C905 (Ductile Iron O.D.)

a. Provide PVC pipe conforming to AWWA C900 or C905 as applicable and having Dimension Ratio of DR 18.

b. Pipe materials: conform to ASTM D1784, Class 12454-A or Class 12454-B virgin compounds with hydrostatic design basis of 4,000 psi.

c. Standard pipe joint and gasket: conforming to ASTM D3139 for joints; single gasket bell and spigot type, the bells being formed integrally with the pipe; bell consisting of a factory-installed solid cross section elastomeric gasket which meets the requirements of ASTM F477.

d. Restrained joint pipe: Provide Certa-Lok PVC. Pipe joints shall utilize non-metallic couplings with high-strength, flexible thermoplastic locking splines that insert into mating, precision machined grooves in the pipe and coupling to provide full 360 degrees restraint.

e. Approved Manufacturers:

i. JM Eagle

ii. National Pipe and Plastics

iii. North American Pipe Corporation

iv. Restrained joint: CertainTeed Corporation Certa-lok

3. High Density Polyethylene (HDPE)

a. Pipe shall be manufactured from extra high molecular weight, high density polyethylene, PE 4710 resin meeting the material properties of ASTM D3350, cell classification 445574E with green stripes for sanitary.

b. Pipe shall be ductile iron pipe size (DIPS) meeting requirements of AWWA C906, ASTM D3035 and ASTM F714.

c. Minimum pressure class shall be 200 psi and minimum thickness of DR 11.

d. Piping joints other than those shown as mechanically connected shall be butt-fusion bonded in accordance with ASTM F2620.

e. Qualification records certifying that bonders and bonding operators employed to complete fusion bonding are qualified shall be submitted prior to commencement of fusion bonding work.

f. Fusion bonding equipment shall be in proper operating condition. Equipment heater performance shall be tested and certified prior to use for fusion bonding. Bonders and bonding operators shall be qualified for the specific bonding equipment utilized in the fusion bonding work.

g. The joining method shall be performed in strict accordance with the pipe manufacturer's requirements. The butt fusion equipment used in the jointing procedure shall be capable of meeting all conditions required by the pipe manufacturer, including temperature, alignment and fusion pressure. Heat fusion joining shall be 100% efficient offering a joint weld strength at least equal to the tensile strength of the pipe. Each butt fusion joint shall be logged electronically by the butt fusion unit, for quality control, by such equipment as The Data Logger manufactured by McElroy Manufacturing, Inc. Logged fusion joints shall be stored in the Data Logger unit, such that it can be downloaded and printed weekly for submittal to the District.

h. Deflection: Do not deflect pipe on a radius of less than 50 times the pipe diameter or less than the manufacturer's instruction. If an HDPE fitting, flange or mechanical joint is present within the length of pipe to be deflected, do not deflect on a radius of less than 100 times the pipe diameter.

i. Pipe markings: blue shell or blue permanent striping and AWWA specification stamp embedment or permanent blue-line print clearly and continuously marked longitudinally along the outside pipe wall.

j. Acceptable manufacturers:

   i. JM Eagle
   ii. ISCO
   iii. Approved equal

B. Fittings, mechanical joint (for use with DI and PVC pipe)

1. Provide mechanical joint ductile iron fittings conforming to AWWA C153 and AWWA C110. Use restrained joints instead of thrust blocking. Gaskets shall conform to AWWA C111.

2. Provide standard thickness cement mortar lining as specified in AWWA C104 and a bituminous seal outside coating as specified in AWWA C151.

3. Furnish high strength, heat-treated cast-iron nuts and bolts which conform to AWWA C111. Nuts shall be hexagon and bolts shall be tee head.

C. Fittings, HDPE (for use with HDPE pipe)

1. Fittings material: manufactured from high density, extra high molecular weight polyethylene which conforms to PE Standard Code PE 4710. Fittings shall have a minimum cell classification of 445574C per the requirements of ASTM D3350.

2. Manufactured per the requirements of ASTM D3261; injection molded

3. Fitting markings: blue shell or permanent blue striping and the AWWA pipe specification stamp embedment or permanent blue-line print clearly and continuously marked longitudinally along the outside pipe wall.

4. Mechanical joint adapters

   a. Use polyethylene mechanical joint adaptors when making connections to mechanical joint fittings and when connecting to dissimilar pipe materials such as PVC or ductile iron.

   b. Connect polyethylene adaptor to mechanical joint fitting using a mechanical joint gland and gasket and in accordance with the specifications regarding mechanical joint ductile iron fittings. Meg-A-Lugs and Field-Lok gaskets are not allowed for use with polyethylene mechanical joint adaptors.

   c. Provide “Harvey” style polyethylene mechanical joint adaptors that include a stainless steel stiffener inserted into the inside of

the mechanical seal end of the adaptor to provide additional axial strength and prevent pipe diameter reduction at the seal.

d. Provide mechanical joint adaptors as a kit complete with gasket, mechanical gland, bolts, and nuts per this section.

5. Flange Backup Rings and Gaskets

a. Provide flange backup rings conforming to AWWA C207; Class D with bolting dimensions conforming to ASTM B16.5.

b. Flange backup ring coating: fusion-bonded epoxy applied to all exterior and interior exposed surfaces with a minimum dry film thickness of 4 mil.

c. Flange gaskets: synthetic red rubber (SBR) hardness (Shore A) 80 +/- 5, ring or full face, 1/8-inch thick and conform to ASTM D1330 grades I and II. Asbestos gaskets are not allowed.

d. Bolts and Nuts: Flange to flange connection bolts shall be carbon steel, ASTM A307 grade B for Class D flanges. Nuts shall conform to ASTM A194 grade 2H. Furnish bolts and nuts having regular unfinished hexagonal dimensions in accordance with ASTM B18.2.1 for wrench head bolts and nuts and wrench openings. Minimum bolt lengths shall be the sum of the mating flange maximum thicknesses, the gasket, and the depth of nut plus 1/8 inch minimum before torquing.

D. Mechanical Joint Fitting Restraints

1. Restraints for mechanical joints shall be constructed of ASTM A536 Ductile Iron with a minimum 2 to 1 Safety Factor. The mechanical joint follower gland shall be incorporated into the restraint.

2. Provide with torque limiting twist-off nuts.

3. Acceptable manufacturers:

   a. Series 1100 Megalug by EBAA Iron,

   b. JCM 610 Sur-Grip Restrainer,

   c. Ford Meter Box Uni-Flange Series 1400 (DI) or 1500 (PVC C900) Restrainer

   d. Approved equal

E. Pipe Joint Restraints

1. For ductile iron pipe

   a. Boltless restrained joint pipe: required for pipe within casing or suspended from bridge. Pipe shall be TR Flex boltless restrained joint pipe by McWane Ductile or U.S. Pipe and Foundry Company:

   b. Restraint harness for push-on joint pipe: Comply with AWWA C151/ANSI A21.51 and AWWA C150/ ANSI A21.50 standards. Harness shall be constructed of ASTM A536 Ductile Iron with a minimum 2 to 1 Safety Factor. Connecting tie rods that join the two rings shall be made of low alloy steel that conforms to ANSI/AWWA C111/A21.11. Acceptable products:

      i. For new joints:
         - Series 1700 Megalug Restraint Harness by EBAA Iron for DI pipe (4- to 48-inch diameter)
         - Ford Meter Box Uni-Flange Series 1390 Joint Restrainer for DI pipe (black body) (4- to 16-inch diameter)
         - JCM 620 Sur-Grip Bell Joint Restrainer (4- to 12-inch diameter)

- Approved Equal

ii. For existing joints:

- Series 1100HD or 1100 SD Split Megalug Restraint Harness by EBAA Iron

- Ford Meter Box Uni-Flange Series 1390 Joint Restrainer for DI pipe (black body) (4- to 16-inch diameter)

- Grip Ring Series 600 Pipe Restraining System manufactured by ROMAC Industries, Inc. for DI pipe (4- to 12-inch diameter)

c. Restraint gaskets: shall not be used for connections to valves or fittings. Field Lok 350 Gaskets by U.S. Pipe & Foundry Company or McWane Ductile (4- to 24-inch diameter):

2. For PVC pipe

a. Restrained joint pipe: required for pipe within casing or horizontally directionally drilled. Pipe shall be CertainTeed Corporation Certa-lok

b. Restraint harness for new bell and spigot pipe: Comply with AWWA C151/ANSI A21.51 and AWWA C150/ ANSI A21.50 standards. Harness shall be constructed of ASTM A536 Ductile Iron with a minimum 2 to 1 Safety Factor. Connecting tie rods that join the two rings shall be made of low alloy steel that conforms to ANSI/AWWA C111/A21.11. Acceptable products:

i. Series 1500/1600 Bell Restraint Harness by EBAA Iron for C900 PVC pipe (4- to 12-inch diameter)

ii. Series 2800 Megalug Restraint Harness by EBAA Iron for C905 PVC pipe (14- to 48-inch diameter)

iii. JCM 620 Sur-Grip Bell Joint Restrainer for DI or C900 PVC pipe (4- to 12-inch diameter)

iv. JCM 621 Sur-Grip Bell Joint Restrainer by JCM for C905 PVC pipe (14- to 30-inch diameter)

v. Ford Meter Box Uni-Flange Series 1390 Joint Restrainer for C900 or C905 PVC pipe (black body) (4- to 36-inch diameter)

F. Polyethylene Encasement for DI

1. Provide polyethylene encasement for all ductile iron pipe and fittings conforming to ANSI/AWWA C105/A21.5.

2. Encasement shall consist of three (3) layers of co-extruded linear low-density polyethylene, fused into a single thickness of not less than 8 mils. The inside surface of the wrap to be in contact with the pipe exterior shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

3. Acceptable products:

   a. U.S. Pipe V-BIO Enhanced Polyethylene Encasement

   b. Approved equal

G. Tracer Wire and Detectable Warning Tape

1. Tracer Wire

   a. Install tracer wire with all PVC and HDPE pipe.

   b. Provide solid 12-gauge AWG copper wire, Copperhead or approved equal.

c. Supply 3M Direct Bury splice kits (KIK 3M) consisting of tubes prefilled with silicone electrical insulating gel or approved equal.

d. On pipe installed by horizontal directional drilling, pull 2 strands of tracer wire with pipe. Provide Copperhead Direct Burial 12 AWG solid, steel core hard drawn extra high strength.

2. Detectable Warning Tape

a. For HDPE and PVC pipe, provide metallic type tape such as Terra Tape Detectable as manufactured by Reef Industries, Inc. or approved equal

b. For DI pipe, provide non-detectable tape such as Terra Tape Non-Detectable Standard Tape, as manufactured by Reef Industries, Inc. or approved equal.

c. Supply blue location material marked with "Caution Water Line Buried Below".

H. Valves (Open Counterclockwise, Left)

1. Gate Valves, 4” – 14”: Resilient seated with mechanical joint ends conforming to AWWA C509 or AWWA C515. Valves shall be Iron body with bronze stem nuts, glands, and bushings: non-rising stem type with O-ring packing Valves shall open counterclockwise (left) and have a 2-inch operating nut.

a. Mueller Company

b. American Flow Control

2. Butterfly Valves, 16” and Larger: Resilient seated with mechanical joint ends and conforming to AWWA C501. Iron body, bronze retainer, stainless steel shaft type with O-ring packing. Provide valves with an underground external operator. Valves shall open counterclockwise (left) and have a 2-inch operating nut.

    a. Mueller

    c. Pratt/Milliken Groundhog

3. Tapping Valves:

    a. Shall meet all requirements of gate valves in these Standards.

    b. Supply valve gates, gate rings and body-seat rings which are oversized to permit entry and exit of tapping machine cutters.

    c. Valve end connecting to tapping sleeve shall have a flange for bolting to the sleeve. The flange shall have a tongue which fits a recess in the tapping sleeve.

    d. Valve end connecting to plain end of water main pipe or adapter shall be mechanical joint.

4. Insertion Valve

    a. Use of insertion valves requires special permission by District. Acceptable products:

        i. Mueller Permaseal, 4-inch – 12-inch

I. Hydrant Assemblies (Open Counterclockwise, Left)

1. Hydrants shall be dry barrel, compression shutoff, traffic model hydrants conforming to AWWA C502 with 5-1/4-inch main valve opening, 6-inch mechanical joint inlets, two 2-1/2-inch hose

nozzles, and one 4-1/2-inch pumper nozzle with integral 5-inch Storz connection.

2. Provide each hydrant with a 2-component exterior grade full gloss polyurethane exterior enamel topcoat. Touch-up painting for field repairs shall be in accordance with Manufacturer's instructions Hydrants to be owned and maintained by the District shall have be painted yellow. Private fire hydrants shall be painted red.

3. Provide 6-inch gate valve meeting these Standards as auxiliary valve for each hydrant.

4. Acceptable products:

   a. American Flow Control Darling B-84-B-5

   b. Mueller Centurion 250 A-423

J. Air Relief Valves and Vaults

1. Air relief valves shall be by A.R.I.
2. Vaults shall be precast concrete.

K. Tapping Sleeves, Full SS with SS Bolts and Nuts

1. JCM

2. Romac

3. Smith Blair

L. Repair Clamps/Bands, Full SS with SS Bolts and Nuts

1. JCM

2. Ford Meter Box

3. Romac

4. Smith Blair

M. Valve Boxes

1. Provide all buried valves with adjustable 5-inch diameter valve boxes with a minimum thickness of 3/16 inch, constructed so that the removable cover will not be thrown out by travel over it.

2. Provide cast iron, extension type valve boxes with slide or screw type adjustment to permit movement of the top section without transmitting forces onto the valve body.

3. The valve box shall rest on the valve bonnet and be centered over the valve, and the top of the section shall be approximately on line with nut at top of valve stem. The entire assembly shall be plumb.

4. Covers for valve boxes on water service valves shall be marked "WATER".

5. If the valve is 6’ deep or greater, a valve nut extension shall be installed to bring the operating nut to a depth 4’ below finished grade.

6. Acceptable products:

    a. Sigma VB260 series

    b. East Jordan Iron Works 8550 Series

    c. Tyler Union 6850 Series with Water HD Drop Lid

    d. Approved Equal

7. Centering device shall be Box Loks or Posi Caps

6A.03 Service Materials

A. Service Saddle:

Provide saddles for C900 PVC manufactured and tested in accordance with AWWA C800. For service connections to an HDPE water main provide electrofusion service saddles. Do not mechanically attach.

1. Mueller Series S-13000 (hinged)

2. Or approved equal.

B. Corporation and Curb Stop, NL, Ball Style, 360 deg. turn

Provide corporation stops manufactured and tested in accordance with AWWA C800.

1. Mueller Series 300 Ball Type Corporation Valves (300 psi rating)

2. Ford Meter Box

C. Stop Box

Tyler Union 6500 Series

D. Residential Service Line

Polyethylene, rated to match the class of water main where installed and conforming to ASTM D2737 and AWWA C901. Use stiffener inserts at fittings and connections

E. Meter Box and Cover

1. Provide 18-inch diameter, 30-inch depth meter box by FRATCO or approved equal.

2. Provide 18-inch cast iron meter box cover with Locking Lid Residential Meter Lid and Frame (With hole for Remote Meter Reading). Model No. H10816 as manufactured by Mueller Company or approved equal. Supply 1-1/32-inch pentagon bolts for meter cover.

F. Coppersetter

Provide 5/8-inch by 3/4-inch coppersetter. Provide Catalog No. B-2474-2A as manufactured by Mueller Company or approved equal. Supply compression inlet and outlet fittings and dual check valve.

G. Meter

Neptune T-10 5/8”x3/4” water meter will be provided and set by District for residential connections.

H. Dual Check Valve u

Provide angle meter valves, bronze body, acetal plastic dual poppet assemblies with rubber gasket and stainless steel springs for each new service. Provide Model No. H14245 as manufactured by Mueller Company or approved equal.

I. Commercial Meter (1.5 to 2 inch, domestic)

1. Neptune Mach10 water meter will be provided and set by District for commercial domestic connections.

2. 36” Corrugated PVC Pit

3. 36” Cast Iron Lid and Frame with Hole for Remote Meter Reading

4. Copper Meter Setter with Angle Ball Valve and Dual Check Valve by Mueller Company or approved equal

J. Commercial Meters (>2 inch)

1. Neptune Mach10 water meter will be provided by District for commercial connections. Meter will be installed by Customer.

2. Meter shall be provided in a precast concrete vault. For services that also have a fire protection service, the meter stall be included in a combined vault with the fire protection meter.

3. Backflow prevention approved by the Indiana Department Of Environmental Management is required for commercial services.

K. Fire Protection Lines

1. Fire protection lines require double check valve backflow prevention assembly located in a vault per the standard details. shall be a model approved by the Indiana Department Of Environmental Management, with flanged OS&Y gate valve on inlet and outlet sides. Vault and contents will be constructed, owned and maintained by Customer, and Customer shall provide the District with access into the vault.

2. Fire protection lines require fire meter vault per the Standard Details. Neptune Mach10 water meter will be provided by District for commercial connections. Vault and contents will be constructed, owned and maintained by Customer with the exception of the meter, which will provided, owned, and maintained by the District. Customer will install the meter. Customer shall provide the District with access into the meter vault.

3. All risers entering building (fire line and domestic) shall be NSF approve steel or iron with welded connection flanges. No galvanized piping material or uni flange shall be allowed.

4. Post Indicator Valves for fire lines shall be on the same side of the street as the building.

5. If fire pump is provided, pump shall be provided with suction control valve or cut-off valve with a 20-psi minimum setpoint.

SECTION 7

SANITARY SEWER LIFT STATIONS

SECTION 7

SANITARY SEWER LIFT STATIONS

7.01 General

This section pertains to the requirement for sanitary sewer lift stations and low pressure system designed and constructed by a Property Owner / Contractor. The District shall review and approve the use of any lift station or low pressure system. The Property Owner must show that it is not physically possible or economically feasible to provide gravity service into a public sewer.

7.02 General Requirements

All of the mechanical and control equipment shall be an integral package supplied by the pump manufacturer with local representation so as to provide undivided responsibility.

The Contractor shall submit to the District for review a one (1) PDF of shop drawings (and up to two (2) sets of hardcopies if requested), detailed specifications, pump warranty and performance characteristics for all of the equipment and fixtures to be furnished and installed. The shop drawings and equipment data shall be submitted with a cover letter and Contractor's stamp of approval, indicating he has reviewed, checked and approved the data submitted. The District will review the submittal and render a decision in writing as to the acceptability of the equipment.

The Contractor shall provide the services of a factory service technician to inspect the installation and alignment of all equipment and materials provided under this section. Upon completion of the installation and alignment, the service technician shall certify to the District, in writing, that the equipment furnished has been installed and aligned in accordance with all requirements, recommendations, and advisory instructions of the equipment manufacturer.

After the installation and alignment is complete, the factory service technician shall operate the equipment for such a period as to assure the proper functioning of the same. All auxiliary equipment shall be operated to demonstrate that it is

functioning properly. Any adjustments deemed necessary to place the equipment in proper operating condition will be made. Such adjustments shall be made at the Contractor's expense. The Lift Station Inspection Form included in Section 2 shall be completed, and the drawdown pump tests shall be performed, and the results submitted to the District using the forms included in this Manual.

The pump supplier shall have full-time service personnel and repair facilities at his place of business to be eligible as a pump supplier to the District.

The Contractor shall supply the services of a factory service technician for one (1) day in addition to the time described above to provide on-site instruction to the Owner's personnel in operation, routine maintenance, and "trouble shooting" for each piece of equipment furnished under this section.

The manufacturer shall provide one (1) PDF and one (1) bound copy of a manual fully explaining the operation, routine maintenance and "trouble shooting" for all the equipment provided in this Section. The manual shall include copies of all approved shop drawings with all required revisions. This manual must be submitted to the District for approval prior to acceptance of the lift station.

Any exceptions to this Standard or associated approved Plans shall be submitted in writing and clearly stated. The exceptions must be approved by the District prior to proceeding with the work.

All components of the lift station that are exposed to weather shall be constructed of material that is resistant to corrosion and will not require surface protection throughout the expected life of the lift station. In general, these materials are stainless steel, aluminum, fiberglass reinforced polyester (FRP) and ultraviolet stabilized PVC.

All exposed valves and piping coming in contact with sewage or within the wet wells and vaults shall be coated as follows:

1. Prime Coat:

   Sherwin Williams: Sher-Glass FF,1 coat, 8.0-20.0 mils DFT
   Tnemec: Omnithane Series, 1 coat, 2.5-3.5 mils DFT

2. Finish Coat:

   Sherwin Williams: Sher-Glass FF, 1 coat, 9.5-20.0 mils DFT
   Tnemec: Perma-Glaze 435, 1 coat, 15-20 mils DFT

3. Minimum of 2 coats and a minimum total finished DMT of 17.5

Inlet piping shall be located such that the sewage discharging into the wet well does not fall directly onto one or both of the submersible pumps. Inlets shall be provided with stainless steel baffle.

7.03 Operating Conditions

Prior to installation, the Contractor shall submit the following information for each pump to the District for review and approval. Preference for high efficiency pumps will be considered.

1. Pump capacity in gallons per minute
2. Total dynamic head (TDH) and Operating RPM
3. Motor Horsepower
4. Motor RPM
5. Motor voltage, phase, and cycle
6. Make and model number of the pump
7. Pump curves for the pumps to be provided.

7.04 Products

Provide a submersible pump station(s) as shown in the Standard Details including concrete structures, pumps, pump base elbow, rail system, hatches, piping, valves, electrical service, control panel and station controls, and other appurtenances. All work shall comply with the National Electric Code (NEC) for Class I, Division 1, Groups C and D, T4 location.

All pumping units shall meet the requirements of Hydraulic Institute (HI) standards. The pumps provided shall be approved by the District and shall be provided by a District-approved local supplier.

Lift Station Submersible non-clog pumps shall be Xylem/Flygt, NP models.

7.05 Pump Design

Furnish and install submersible non-clog wastewater pumps. The pumps shall have the ability to pass a 3-inch diameter spherical solid. The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well.

The pumps shall be supplied with mating cast iron discharge connections. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact or gasket. Sealing of the discharge interface with a diaphragm or O-ring is not acceptable. No portion of the pump shall bear directly on the sump floor.

Pumps shall be equipped with submersible cable (SUBCAB) suitable for submersible pump applications of length necessary from each pump to its respective local control panel. The power cable shall be sized according to NEC and ICEA standards and meet with P-MSHA approval.

7.06 Pump Construction and Components

A. Pump Construction

1. Major pump components shall be gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel.

2. All metal surfaces coming into contact with sewage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

3. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings shall be the result of controlled

compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

4. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease, or other devices shall be used.

5. Pump and motor shaft shall be the same unit. The pump shaft shall be an extension of the motor shaft. Couplings are not acceptable. The pump shaft shall be AISI type 431 stainless steel.

B. Impeller

1. The impeller shall be of Hard-Iron™ (ASTM A-532 (Alloy III A) 25% chrome cast iron), dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge, and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater.

2. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt, and shall be coated with alkyd resin primer.

3. On pumps 10 Hp and under, the impeller shall be capable of momentarily moving axially upwards a distance of 15mm/0.6-in. to allow larger debris to pass through and immediately return to normal operating position.

C. Volute Bottom/Insert Ring

1. The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller.

Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of Hard-Iron™ (ASTM A-532 (Alloy III A) 25% chrome cast iron) and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

D. Bearings

1. The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two-row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.

E. Mechanical Seal

1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate.
4. The lower primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide ring.

5. The upper secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring.

6. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing.

7. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub is not

acceptable. No system requiring a differential to offset pressure and to effect sealing shall be used.

8. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load. Seal lubricant shall be FDA approved, non-toxic.

F. Cooling System

1. On 10 Hp or smaller, motor shall be sufficiently cooled by the surrounding environment or pumped media. No water jacket will be required.

2. On 12 Hp and larger, each unit shall be provided with an integral motor cooling system. A stainless steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

G. Submersible Electric Motor

1. The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type. The stator windings shall be insulated with moisture resistant Class H insulation rated from 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H

monomer free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter-duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing.

2. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of up to 20 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum.

3. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with the supplemental to external motor overload protection and shall be connected to the control panel.

4. The junction chamber containing the terminal board shall be hermetically sealed from the motor by an elastomer compression seal.

5. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board.

6. The motor and pump shall be designed and assembled by the same manufacturer.

7. The combined service factor (combined effect of voltage, frequency, and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%.

8. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C.

9. A performance chart shall be provided showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

10. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box

without the need of splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet. Power cable shall include all control conductors as required for the thermal switches and moisture sensing probes. Provide stainless steel cable holder capable of supporting all the cables provided for the pumps.

11. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

H. Cable Entry Seal

1. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal.

2. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems are not acceptable.

I. Protection

1. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125ºC (260ºF), stop the motor, and activate the alarm.

   A leakage sensor shall be available to detect water in the inspection chamber. When activated, the Float Leakage Sensor will send an alarm to both the local indicator and the remote monitoring device.

2. The thermal switches and Float Leakage Sensor shall be connected to a MiniCAS monitoring unit.

J. Stainless Steel Nameplates

1. Nameplates shall be attached to the pump and drive motor giving the manufacturer's model and serial number, rated capacity, head, speed, and all other pertinent data. The nameplates shall be stainless steel.

7.07 Concrete Wet Well and Vaults

The Contractor shall furnish and install a monolithic concrete or precast manhole type wet well. The pumps and all other related equipment shall be installed and/or mounted as described herein or as ordered by the manufacturer(s). Epoxy line the wet well per Section 5.02.K.

A concrete valve vault shall be furnished and installed to house the valves and appurtenances.

A concrete meter vault shall be furnished and installed to house the magnetic flow meter and appurtenances for lift stations with a capacity of 350 gpm and larger.

When required, A concrete combination air valve vault shall be furnished and installed to house a combination air valve.

Precast manhole sections shall conform to the requirements as set forth in ASTM Specification C478. Wet well and valve vault shall be constructed in the same manner as described in Section 5 of these Standards.

7.08 Piping and Valves

A. Wet Well and Vault Piping

1. Piping in the wet well through the last vault to the connection to the force main shall be ductile iron. Ductile iron pipe shall meet the requirements of ANSI A21.51/AWWA C151 and shall designed and

manufactured for a working pressure of 150 psi plus 100 psi surge and a safety factor of 2. Minimum pressure class shall be 150.

2. Gaskets for flange joints on exposed pipe shall meet ANSI/AWWA C110, full face rubber or other material approved by the engineer and must have minimum 1/8-inch thickness. Nuts and bolts shall conform to ANSI/AWWA C110 and be zinc-coated alloy steel.

3. Pipe joints for buried piping shall be push-on type. Joints shall meet the requirements of Section 6. Joints shall be restrained with restraints per Section 6.03 C.

4. Fittings shall be ductile iron. Fittings shall meet the requirements of Section 6. Design and manufacture fittings for a pressure rating of 150 psi. Buried fittings shall have restrained mechanical or push-on joints; exposed fittings shall be flanged. Joints shall meet the requirements of ANSI/AWWA A21.1/C111. Retrained joints are required at fitting locations per 6.03 C.

B. Plug Valves

1. Eccentric Plug Valves for wastewater service shall be non-lubricated with a resilient sealing surface. Valves shall have screwed, flanged or mechanical joint ends conforming to ANSI/AWWA C110 requirements. Port areas shall be at least 80% of full pipe area. Valves shall have permanently lubricated stainless steel slave-type bearings, or other lubricated type bearings, in the upper and lower stem journals. Valve seats shall be corrosion resistant, having a high nickel content.

2. Bonnet shaft seals shall be capable of being replaced while line and valve remain in service, thereby eliminating the need to take lift stations out of service. All exposed nuts, bolts, springs and washers shall be stainless steel. Means of actuation shall be by operating nut with a hand lever. Provide one lever for each valve vault.

3. The valves shall be capable of providing drop-tight shutoff with flow in either direction up to the valve's rated operating pressure. Flanged valves shall be faced and drilled to ANSI B.16.1, Class 125

standard. Flanges of valves through 12 inches shall have face-to-face dimensions of ANSI/AWWA standard gate valves.

4. The plug face material shall be nitrile-butadiene, Neoprene or as approved by the District.

5. Each actuator or operator shall be capable of seating and unseating the valve and have a maximum torque 50 foot-pounds on operating nuts.

6. Valves shall be DeZurik, Series 100; Val-Matic, Cam-Centric, or equal.

C. Check Valves

1. Check valves shall be outside lever weight style, all iron body, bronze mounted, full opening swing type. Valve clapper shall swing completely clear of the waterway when valve is fully open, permitting a full flow through the valve equal to the nominal pipe diameter. Comply with AWWA Standard C508 latest revision.

2. Check valves shall be rated at 175 psi water working pressure, 350 psi hydrostatic test. Seat tightness at rated working pressure shall be in accordance with values shown in AWWA Standard C500 for gate valves and conform to AWWA C508.

3. Flanged ends, 125 lb ANSI.

4. All cast iron shall conform to ASTM-A-126 Class B. Discs shall be cast iron, rubber faced. Hinge pins shall be 18-8 Stainless Steel rotating bronze plugs. Bolts shall be electro-zinc plated steel with hex heads and hex nuts in accordance with ASTM A-307 and A-563, respectively.

5. Check valves shall be constructed to permit top entry for complete removal of internal components without removing the valve from the line. Glands shall be O-rings. Bosses shall be provided on check valves that may be tapped for draining or used for by-pass.

6. The inside and outside of all valves, together with the working parts, except bronze and machined surfaces, shall be coated in accordance with AWWA standards.

7. Marking shall be in accordance with AWWA C508 and shall include size, working pressure, and cast arrow to indicate direction of flow, name of manufacturer, and year of manufacture.

8. Check valves shall be suitable for sewage and sludge service and be manufactured by DeZurik/APCO, Valmatic, or approved equal.

7.09 Accessories

A. Slide Rail System

1. A slide rail system shall be provided for easy removal of the pumps for inspection and service. The system shall not require a man to enter the wet well to remove the pump and motor assembly.

2. Two (2) guide rails of 2-inch stainless steel pipe shall be provided for each pump. The guide rails shall be positioned and supported by the pump mounting base. The guide rails shall be aligned vertically and supported at the top by attachment to the access hatch frame with a stainless steel upper guide rail mounting bracket.

3. One (1) intermediate stainless steel guide rail support is required for every 10-feet of guide rail length.

4. The pumps are equipped with sliding brackets or rail guides. To insure easy removal of the pumps, the rail guides attached to each pump shall not encircle the rails.

5. A stainless steel lifting cable of adequate length for the basin depth shall be provided for each pump.

6. The rails and the rail guides shall function to allow the complete weight of the pumping unit to be lifted on dead center without binding and stressing he pump housing. The rail system shall function to automatically align the pumping unit to the discharge

connection by a simple downward movement of the pump. No twisting or angle approach will be considered acceptable.

B. Access Hatches and Accessories

1. Frames shall be ¼-inch extruded aluminum with built-in neoprene cushion and with strap anchors bolted to the exterior. Cover leaf shall be ¼-inch aluminum reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot. All stainless steel bolts and hardware shall be used. The cover shall open to 90-degrees and lock automatically in that position. A vinyl grip handle shall be provided to release and close the cover with one hand. Covers shall be built to withstand a live load of 300 pounds per square foot, and equipped with a snap lock and removable handle. When closed, the covers shall not protrude above the operating surface in which they are installed. Factory finish shall be aluminum lacquer. Surface contacting concrete shall have bituminous coating. Covers shall be diamond pattern plate. Aluminum covers shall be Bilco, Halliday, or equal.

2. When flush mounted covers are furnished, two (2) wrenches shall be provided for opening the covers. The valve vault cover shall be watertight with a drain system.

3. Fall protection grating shall be provided on each access hatch and meet OSHA 29 CFR 1926.502(c) requirements for access hatches. Aluminum grating shall be designed to withstand a minimum live load of 300 psf. The aluminum safety grate shall be made of 6061-T6 aluminum with a minimum ultimate strength of 38,000 psi and a minimum yield strength of 35,000 psi, per ASTM B221. Aluminum grate openings shall allow visual inspection of the pit once the access hatch is open without entering the confined space. The opening arm shall also be equipped with a controlled confined space entry locking device that will prevent unauthorized entry to the confined space. Welding shall be in accordance with ANSI/AWS D1.2-90 Structural Welding Code for Aluminum. Provide grating assemblies with hardware made out of Type 316 stainless steel, including mounting brackets, hinges, torsion rod, padlock loop, and fasteners. Each aluminum grate shall be provided with a permanent hinge system which will lock the grate in the 90-degree

position once opened. Safety-yellow or safety-orange powder coat paint finish. Provide torsion rod lift assistance for ease of operation and an aluminum hold open arm with a stainless steel handle that automatically locks the panel in the fully open 90 degree position. Each grate shall have an opening arm with a red vinyl grip handle, which will allow the opening of the grate, while providing the grade as a barrier between the operator and the pit. Provide a release handle to close the grating panel. Design of the system must assure fall through protection is in place after the door has been closed, thereby protecting the next operator.

4. Provide telescoping safety post for each vault access ladder, designed in compliance with OSHA 1910.23 for fixed ladders, to extend 42 inches above the access level. Manufacture posts from high-strength, square aluminum tubing. Fabricate the post to mount directly to the top two rungs (square or round) of a fixed ladder. Design post to support a minimum 200 pound load. Provide a pull up loop at the upper end of the post to facilitate raising the post. Provide post that locks automatically when fully extended and has a release lever that disengages the post so that it can be returned to its lowered position. Provide post with a stainless steel constant force balancing spring mechanism so raising and lowering of the post is a smooth, easy, controlled operations. Mounting hardware shall be zinc plated steel or Type 316 stainless steel, whichever is recommended by the manufacturer as most suitable for use with the specific safety post and ladder materials given the potential difference of the materials.

C. Portable Hoist Socket

1. A surface-mounted socket compatible with the District's existing portable hoist (davit crane) shall be provided and anchored into the top of the concrete slab over the wet well for removal of the pumps, as shown on the Standard Detail. Any additional reinforcing and appurtenances required to install the socket assembly shall be provided by the manufacturer or Contractor.

D. Cable Holder

1. A stainless steel cable and chain holder shall be mounted inside the hatch opening of the top slab of the wet well to support the pump power and control cables and lifting cable.

E. Spare Parts and Special Tools

1. Furnish one set of all special tools necessary for normal operation, maintenance and calibration of the equipment specified in this Section.

2. Provide padlocks and keys for all access hatches and control panels. All padlocks shall be manufactured to be opened by the District's master key.

3. Provide manufacturer's recommended spare parts for each unit. As a minimum, a spare O-Ring Kit package shall be supplied with each pump.

7.10 Control Panel

The Control Panel shall be assembled with the components listed below:

a. Control Panel Enclosure
    i. Saginaw Control & Engineering
    ii. Model SCE-60XEL6118SSLP
        1. Size may vary

b. Circuit Breakers
    i. Allen-Bradley 1489-M Circuit Breakers

c. Surge Protection Device
    i. Eaton Bussman Series UL Type 1

d. Surge Arrestors
    i. Eaton Bussman Series UL Type 4

e. DIN rail mounted duplex receptacles
    i. Allen-Bradley 1492 DIN Rail Receptacles

f. Surge Protective Devices
    i. Emerson Islatrol IE120

g. Uninterruptible Power Supply
    i. APC Smart-UPS SRT 1000VA Sinewave Tower
        1. SRT1000XLA

h. DIN Rail Mounted Ethernet Switch
    i. Moxa EDS managed Ethernet Switches
        1. EDS-G516E

i. 24VDC Power Supply & Redundancy
    i. Phoenix Contact Trio
        1. 2903148 24VDC Power Supply – 5A

j. Control Panel Heater
    i. Saginaw Control & Engineering
        1. SCE-HF4001B

k. Electronic Totalizers
    i. Redington Model 722

l. Isolation Barriers
    i. PR Electronics 5202B Pulse Isolator
    ii. PR Electronics 5104B Ex Repeater / Power Supply

m. Industrial Ethernet Switch
    i. Pohenix Contact FL SWITCH 1005N
        1. Model Number 1085039

n. Alarm Light
    i. Federal Signal Corporation
        1. StreamLine Low Profile Strobe Light
        2. Model LP3

o. Alarm Horn
    i. Federal Signal Corporation
        1. Vibratone Horn, Model 350TR

p. Control Panel Internal Lighting
    i. Pentair LED Light Kit
        1. LEDA1S35

The Contractor shall install the Control Panel as indicated on the Standard Details. All equipment shall be mounted in a NEMA 4X stainless steel enclosure, manufactured by Saginaw Control & Engineering, Enviroline Series Two-Door Enclosures for Flange-Mounted Disconnects. Coordinate with power utility to determine available power. Standard service shall be 480/277 volt 3 phase, 4 wire, 200A or 400A service. Control power shall be 120 volts supplied from an accessory circuit breaker mounted inside the control panel. Control power transformer shall be sized to supply any single-phase loads in the panel. A hasp and staple shall be provided for padlocking.

Control Panels shall be designed to include industrial grade equipment typical for lift station applications. Circuit Breakers mounted internal to the control panel shall be Allen-Bradley 1489-M Circuit Breakers affixed to 35mm DIN rail fastened to the control panel backplane.

A. If Pump Motors are Less than 20HP:

1. Individual magnetic motor starters shall be used as the motor power device. They shall be combination type complete with motor circuit protectors (MCP's). Starters shall be rated 480 VAC, 3-pole, sized for the intended load unless otherwise indicated. In no case shall a starter smaller than a NEMA Size 1 be used and in no cases shall IEC contactors be used. Each starter shall be furnished with a minimum of two spare auxiliary contacts.

2. Furnish and install manual reset overload relays in each phase sized in accordance with the NEC. Provide cover mounted overload reset button with metal (not plastic) shaft and pilot devices as indicated and required. Starters shall be provided with all coils and controls for 120 VAC operation, unless otherwise indicated on the Drawings.

3. Ambient compensated, thermal, bi-metallic type overload relays shall be furnished and installed providing Class 20 operation. Overload relays shall be equipped with one additional normally open (NO) and normally closed (NC) isolated contact for use as specified herein or indicated on the Standard Details. Solid state overload relays shall only be furnished and installed if specifically accepted by the District. The Contractor shall furnish and install correctly sized overload heaters based on the rating of the motor installed.

4. Time-delay relays shall be included with the motor starting circuit to prevent the pumps from starting simultaneously. Restart times shall be adjustable from 0-60 seconds.

5. Unless otherwise indicated, the pilot devices shall be mounted on the covers of the respective enclosures. Pushbuttons, selector switches, and pilot lights shall be 30.5 mm, heavy-duty, oil tight type with provisions to maintain the NEMA ratings of starter enclosures. Legend plates indicating switch positions shall be provided for each pilot device. Pilot lights shall be LED type.

6. All control wiring shall be No. 14 AWG (minimum) labeled at each end in accordance with the wiring numbers shown on the accepted shop drawings. Power wiring shall be sized to suit the maximum horsepower rating of unit; No. 12 AWG (minimum). Wiring shall be type MTW rated for 105ºC.

7. Each motor starter coil shall be equipped with a surge-suppression device for protection of the solid state equipment (e.g. programmable logic controller) wired as part of the control circuit.

8. Where specified in these Standards, indicated on the Standard Details, or as required, interposing relays shall be furnished for the motor control circuits. Coil voltage shall be as specified, indicated on the Standard Details, or as required. The contact ratings of the relays shall be coordinated with the burden of the motor starter coil. If the burden or other electrical requirements exceed the contact rating of general purpose, plug-in relays, machine tool type relays with adequate contact ratings shall be provided.

9. Individual magnetic motor starters shall be NEMA sized and as manufactured by ABB/General Electric Company.

B. If Pump Motors are 20HP or Greater:

1. Variable frequency drives (VFDs) shall be used as the motor power device. VFD's shall be from one manufacturer who shall also manufacture the enclosure and major equipment components. The manufacturer shall have a minimum of five years' experience in the manufacture of similar units and shall have a general distribution to the electrical trade. Subcontracting of wiring will not be acceptable.

2. Motor control circuits shall be wired in accordance with the requirements specified herein or indicated on the Standard Details. Where not indicated, the control circuits shall be standard three-wire "start-stop" and the Contractor shall furnish wiring accordingly.

3. Control panel manufacturer shall be responsible for the successful application and operation of the entire drive and control system serving the motor and driven equipment. This includes the responsibility for obtaining all load, torque, speed and performance requirements from the respective sources and integrating these into a variable frequency drive system that fulfills the requirements of this section.

4. Variable Frequency drives shall be ABB ACQ580-31 ULH type. No "or equals" will be accepted.

Panel heaters and corrosion inhibitors shall be furnished for condensation and corrosion control inside the panel. Panel heaters shall be of the forced air types, provided with integral thermostat control.

Pump Control Panels fitted with VFDs shall be provided with a properly sized cooling AC unit. Cooling unit should be powered from a dedicated HACR 30A 2P 240V breaker in the lighting panel as shown on the drawings. The cooling unit shall be mounted per manufacturer instructions. Include report of heat calculations with submittal.

Provide a 120VAC uninterruptible power supply (UPS) with integral TVSS to condition incoming power and ride-through utility power interruptions. UPS shall

power, HMI, PLC, and all 120VAC and 24VDC components for a minimum of 15 minutes.

A three-pole main circuit breaker shall be provided. Operator handles shall be mounted through the inner door. The circuit breaker shall be as manufactured by Square D or equal.

Each pump shall have a hand-off-auto selector switch mounted on the inner swing-out panel. The run lights, seal failure lights, elapsed time meters, and flow meter indication of instantaneous and totalized flow shall also be mounted on the inner swing-out panel. All switches and lights shall be corrosion resistant and be of the 30.5 MM Type, as manufactured by Eaton Cutler-Hammer, Square D, or equal.

A seal failure relay shall be installed to monitor the seals in the pumps. It shall be as required by the pump manufacturer. Upon failure, the relay shall energize an alarm indicator light and not shut the pump off. The pump shall also have over-temp protection in the windings of the motor. These shall be wired to shut the pump off and be automatic reset. The over-temp protection shall be wired into the level controller to automatically switch over to the stand-by pump.

There shall be a termination strip with box type connectors to make all power and control connections for the pumps, floats and level transmitter. All terminals shall be marked for easy identification. A ground busbar shall be provided also.

These units shall be type and size with the number of poles and accessories as indicated on the Standard Details or as required for the application if not otherwise indicated.

Provide accessory circuit breakers for 120VAC and 24VDC control wiring and devices within the control panel. Circuit breakers shall be used to isolate and protect circuits both prior to and after the UPS. Power supplies shall be sized to meet the requirements of the control circuit involved as well as generator single phase loads.

Provide individual circuit breakers for the following devices, at a minimum, that are external to the control panel or otherwise not backed up by the UPS.

Lighting Panel Transformer– 2P, 25A, 480V
Panel Heater – HACR sized to meet NEC criteria

Future Odor Control – 3P, 15A, 480V
Spare – 3P, 20A, 480V

The level transmitter, float switches and seal fail relay cables shall be operated off an intrinsically safe relay within the panel.

Provide 3-Phase Monitoring Relay.

Provide two (2) 24VDC LED Panel Lights that activate upon opening of the Control Panel.

7.11 Level/Pump Control System

The pump control device shall be able to control up to two (2) pumps to perform liquid level control. It shall provide lag pump delays and high level alarm.

The pump control device shall be UL listed as Industrial Control Equipment, UL 508.

The pump control device must have at least 18 discrete inputs. The inputs must be optically isolated, transient protected and be programmable for the following functions:

1. Pump disable with HOA in off, or pump fault
2. All pump disable – for connection to phase monitor
3. Four (4) float switch backup control for low level cutoff, lead and lag pump run, and high-high level alarm.
4. ATS Normal
5. ATS Emergency
6. ATS Fail
7. Generator Running
8. Generator Fail
9. Generator Low Fuel
10. Generator Leak Detected

The pump control device must have at least 3 discrete outputs. The outputs must be optically isolated, transient protected and be programmable for the following functions:

1. Pump Run (2)
2. High Level Alarm

The pump control device must have at least 2 analog inputs (For lift stations with VFDs, the pump control device shall have at least 4 analog inputs). The inputs must be optically isolated, transient protected and be programmable for the following functions:

1. Wet Well Level (4-20mA)
2. Flow (4-20mA)
3. Pump 1 Speed Feedback (4-20mA) (for stations with VFDs)
4. Pump 2 Speed Feedback (4-20mA) (for stations with VFDs)

For lift stations with VFDs, the pump control device must have at least 2 analog outputs The outputs must be optically isolated, transient protected and be programmable for the following functions:

1. Pump 1 Speed Setpoint (4-20mA)
2. Pump 2 Speed Setpoint (4-20mA)

Status of the discrete inputs must also be viewable from the front of the pump control device. Menu selectable first-on/first-off or first-on/last-off alternation sequences must be available. Menu selectable alternation by external time clock must also be available.

An Industrial Unmanaged Ethernet switch shall be provided for connectivity to all ethernet devices within the control panel and connection to the remote monitoring device.

The pump control device shall be as manufactured by Allen Bradley, CompactLogix 5370 Series, model 1769-L24ER-QBFC1B and associated expansion IO cards.

The pump control interface shall be an Allen Bradley, PanelView Plus 7, 10” color touchscreen HMI.

The following signals not hardwired to the controller shall be monitored by the Lift Station Control System:

1. Pump Run Time (2)

Include the following:

1. Include a minimum 1-year full warranty.
2. Startup of system

Remote Monitoring Device shall be a cellular modem for communications to District's SCADA system:

1. Modem: 4RF Aprisa LTE Cellular Router, no substitutes.
2. Cellular Antenna: Laird/TE Connectivity, Model TRA6927M
3. Install inside of Lift Station control panel.
4. SIM card for modems provided outside of contract.
5. Configuration and setup to be provided by the District's approved SCADA Control System Programmer. Contact the District for further information.

7.12 Operation of System

There are three levels within the wet well for normal operation of the system. The first level is for low level alarm and shut off. The next level is for starting the lead pump and stopping the pumps. When the level reaches the lead pump "on" level, the lead pump shall start and continue to run until the "off" level is reached. When the level reaches the lag pump "on" level, the lag pump shall start and continue to run until the "off" level is reached. The two pumps shall alternate on each on/off cycle.

The fourth level is to alert the Operator that the wet well is at a high-water level and shall activate the alarm system.

All levels shall be as indicated on the approved Plan Drawings at startup of the system and shall be adjusted during the manufacturer's start up assistance.

7.13 Electrical Components

Electrical power provided to Lift Stations shall be 480V, 3PH, 60HZ, 200A or 400A. Utility equipment and requirements shall be coordinated with the electrical utility and is the responsibility of the Contractor.

All electrical equipment shall be installed as per the NEC and local codes at a minimum in addition to the specifications herein.

A. Conduit

1. Provide schedule 40 PVC for utility service lateral and riser only. Include a GRS elbow and stub where the conduit turns up at the meter base location. Install the conduit a minimum of 36” below grade with detectable warning tape 12” below grade.

2. Provide rigid aluminum conduit for all above grade installations except for where conduits make contact with concrete. PVC coated rigid conduit shall be used at all concrete penetrations. Stub out of concrete 18” and then a coupling can be used to transition to the appropriate conduit for the environment.

3. Include link type seals where conduits enter the wet well. Link Seal model #S-316 or equal.

B. Wire

1. Power conductors shall be type THWN-THHN: For dry and wet locations; max dry location operating temperature 90 Deg. C. Insulation shall be flame-retardant, moisture-resistant and heat-resistant thermoplastic; outer covering shall be nylon jacket. All conductors shall be copper.

2. Wiring from the load side of any VFDs shall be Belden shielded VFD cable with 100% rated ground. Conductors shall be sized to match the application.

3. Cables between the wet well junction boxes and the wet well shall be provided by the equipment manufacturer.

4. All terminals shall be rated for copper conductors. Dual rated lugs shall be acceptable.

5. Provide a solidly grounded service ground electrode system. Include an equipment grounding conductor for all circuits.

C. Electrical Identification

1. Provide engraved nameplates for all major devices and equipment. Include detailed instructions on the connection and transferring over to a portable generator. Identify and label all conductors with Brady style labels.

D. Supporting Devices

1. All exposed supporting members to be made of aluminum. All hardware to be stainless steel. Neoprene washers to be provided between dissimilar metals. Provide bituminous coating anywhere aluminum may come in contact with concrete.

E. Disconnect Switches

1. All lift station disconnect switches shall be NEMA 4X 304 Stainless Steel manufactured by ABB or approved equal. A spare set of fuses shall be supplied for each fused switch provided.

F. Panelboards

1. All lift station panelboards shall be NEMA 4X 304 Stainless Steel as manufactured by ABB or approved equal. Spare breakers shall be provided so that there are no empty spaces within panelboard. All bussing shall be tin plated copper. Each panelboard shall be provided with a Current Guard CG3-060 or equal SPD.

G. Backup Power

1. Generator shall be provided. Generator shall operate on diesel fuel with a 24-hour sub-base fuel tank. Generators shall be sized to fit the application and provided with an appropriately sized OCPD.

Generator enclosures shall be sound attenuated and sandstone in color (not green). All Generators will be manufactured by Cummins. No “or equals” will be accepted.

2. Automatic Transfer Switches shall be open transition in a NEMA 4X 304 Stainless Steel enclosure. Automatic Transfer Switches shall be 3-pole, with solid neutral. All Automatic Transfer Switches shall be manufactured by ASCO (300 Series). No “or equals” will be accepted.

7.14 Instrumentation

A. For All Lift Stations:

1. Submersible level (pressure) sensors shall consist of a pressure-sensing probe assembly with a depth cable molded directly to the probe body. Sensing probe housing shall be fabricated of titanium or 316 stainless steel. The depth support cable shall be polyurethane and shall contain a Kevlar strength member, a vent tube, and conductors for electrical power and signal. The sensor shall contain an encapsulated pressure sensing element which is electrically and physically isolated from the media via a ceramic or titanium isolation diaphragm. The pressure sensing connection shall be protected from damage by a removable acetal nose cone or equivalent guard. Each submersible level transducer shall be provided with a NEMA 4X termination/junction box and aneroid bellows to prevent moisture from entering the vent tube.

2. Sensor specifications shall be as follows:

a.	Sensor Rating:	NEMA 6 (IP68), loop-powered
b.	Output Signal:	4-20 mA, 2-wire design
c.	Accuracy:	+ 0.25%, F.S. (full scale)
d.	Long Term Stability:	+ 0.1% F.S./year
e.	Zero Offset and Span Setting:	+ 0.25% F.S., max.
f.	Operating Temperature:	-20 to +60 degrees C
g.	Compensated Temperature:	-2 to +30 degrees C
h.	Overpressure Limits:	At least 2x full scale range
i.	Cable Length:	As required

3. The manufacturer of this instrument shall be Evoqua Water Technologies A1000I. The unit shall be installed as shown on the Details, and according to the manufacturers' recommendations.

4. Float switches acting as a backup level control method shall be Anchor Scientific Roto-Float Type S, Normally Open, direct acting, micro-switch type connected to a factory installed 50 foot cable or as required to reach the desired elevation. The float shall be either pipe-mounted, or suspended by its cable by means of a weight kit, as indicated in the equipment data. The floats shall be non-mercury type and be manufactured of high impact styrene. The floats shall be fixed to 3/16" SS aircraft cable attached to a 25 pound concrete weight by PVC cable ties to allow removal of one float without affecting the other floats. The switch contacts shall be normally open or normally closed as indicated in the equipment data. The switch contacts shall be rated 6 amperes, non-inductive at 120 Volts AC. The cable shall be two fine-stranded AWG #18 conductors in heavy-duty type SJO-W Neoprene jacketing. Standard length of the cables shall be 50 feet. The switch shall make and break over a 1-inch level change.

7.15 Station Warranty

The overall station warranty shall be one (1) year from the date of acceptance per District maintenance bond requirements. Included under the warranty shall be all concrete structures, pumps valves, piping, controls, electrical equipments, and all other appurtenances listed within the Standards and necessary for the operation of the lift station. The pumps shall be provided with a 5-year prorated warranty from the pump manufacturer.

SECTION 8

INSTALLATION AND CONSTRUCTION

OF SANITARY SEWERS

SECTION 8

INSTALLATION AND CONSTRUCTION

OF SANITARY SEWERS

8.01 General

This section shall provide general, minimum requirements for the installation and construction for Hamilton County Regional Utility District (the District) sanitary sewer projects.

8.02 Excavation

A. Dewatering and Control of Surface Water

1. Where groundwater is encountered, the Contractor shall make every effort necessary to secure a dry trench bottom before laying pipe. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hoses, piping, well points, etc. necessary to depress and maintain the groundwater level below the base of the excavation.

2. The Contractor shall keep the site free of surface water at all times and shall install drainage ditches, dikes, pumps and perform other work necessary to divert or remove rainfall and other accumulation of surface water from excavations. The diversion and removal of surface and/or groundwater shall be performed in a manner which will prevent the accumulation of water within the construction area.

3. Under no circumstances shall surface water and/or groundwater be discharged, disposed of, or allowed to flow into the District's Sanitary Sewer System.

B. Site Preparation

1. Before any excavation is started, adequate protection shall be provided for all lawns, trees, landscape work, shrubs, fences,

hydrants, sidewalks, and other objects that are to remain in place. Such protection shall be maintained for as long as necessary to prevent damage from the Contractor operation.

2. Moveable items such as mailboxes and roadway signs may be temporarily relocated during construction. Place moveable items in their original location immediately after backfilling is complete. Moveable items damaged during construction shall be replaced with new items at the Contractor's expense.

3. Strip topsoil and vegetation from the excavated areas. Clean topsoil may be stockpiled for re-use as the upper 6-inches of the area to be seeded. Do not intermix grass, weeds, roots, brush, and stones larger than 1-inch with stockpiled topsoil. Dispose of root contaminated topsoil.

4. Clear and remove logs, stumps, brush, vegetation, rubbish and other perishable matter from the job site. Do not remove or damage trees that do not interfere with the work. Completely remove trees including stumps and roots that are required to be removed. Replace trees removed unnecessarily and properly treat damaged trees that can be saved.

5. Remove existing pavement and walks from the excavated areas. Remove asphaltic and concrete materials from the job site as these materials are excavated. Use methods to remove pavement and walks that will assure the breaking or cutting along straight and vertical lines. Remove walks completely where excavation is along the length of a walk. Remove walks completely where excavation is along the length of a walk. Remove walks to existing joints where excavation crosses walks. The width of pavement to be removed shall not exceed the width of the trench by more than 12-inches on each side of the trench.

C. Excavating

1. Excavated materials suitable and necessary for backfilling shall be stored in a neat pile adjacent to the excavation in a manner so as to interfere as little as possible with traffic. Such materials shall not be

placed with sufficient height or proximity to excavation so as to endanger such openings due to earth slides or cave-ins.

2. Excavated material not suitable for backfilling and excess suitable material shall be removed from the job site and disposed of in a spoil area secured by the Contractor.

3. Provide and maintain adequate dewatering equipment to remove and dispose of surface and ground water entering excavations. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation.

D. Trenching

1. Excavate trenches to a depth and width as required by the pipe manufacturer for proper installation of the pipe and appurtenances. Excavations below the required grade shall be filled with compacted bedding material.

2. The trench width for concrete box sections shall be only as wide as is necessary to facilitate proper compaction of backfill material, provided the adjacent embankment material is structurally adequate to provide the necessary side support. Verification of sufficient bearing strength of underlying soil foundation material, based upon manufacturer's recommendations, shall be required for all reinforced concrete box section installations.

3. Trenches shall be made as narrow as possible and to the straight lines shown on Plans. Sides of trenches shall be kept as near vertical as possible and shall be properly sheeted and/or braced, if required. The width of the trench shall provide a clearance of not less than 8-inches no more than 10-inches on each side of the pipe.

4. Provide a continuous, uniform bearing support for the pipe on solid undisturbed soil or compact granular fill with trench dished to provide circumferential support to the lower third of each pipe. Dig out holes to receive pipe bells.

5. Rock excavation encountered in the trench and soft material which, in the opinion of the District is incapable of providing adequate bearing to support the pipe, shall be removed to a depth of 4-inches below the required elevation and filled with compacted granular fill material.

6. Do not open more than 50-feet of trench in advance of the installed pipe, unless otherwise directed or permitted by the District. Excavate the trench within 6-inches of full depth for a distance of at least 30-feet in advance of the pipe installation, unless otherwise directed or permitted.

7. Maintain one lane of traffic at all streets and service drives during construction. Streets and drives may be closed and traffic detoured if permission is obtained by the Contractor from the State, City, County, or Local Business having jurisdiction.

8. Any sewer, gas, water, or other pipes or conduits crossing the trench shall be supported without damage and without interrupting service. The manner of supporting such pipes or conduits shall be subject to the approval of the District and/or the inspector of the utility involved.

9. The Contractor shall provide adequate sheeting and bracing in open cut trenches to protect life, property and the work.

10. All sheeting, planking, timbering, shoring, bracing, and bridging shall be placed, renewed and maintained, and shall not be removed until sufficient backfill has been placed to protect the pipe.

11. Where rock is encountered during trenching operations, the Contractor may remove the rock by mechanical means. The use of a rock trencher which produces excavated material commensurate to “granular backfill” is preferred. Materials suitable for granular backfill excavated by a rock trencher may be used as bedding for pipe in areas of rock excavation.

12. No farm fences shall be cut when gates are available within a reasonable distance to move equipment from one field to another.

E. Trenchless Installation

1. Submittals include

   a. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
   b. Certified copies of reports of factory tests specified in this Section and required by the referenced standards
   c. Plans and details describing materials and methods proposed by the Contractor for use in special crossings
   d. Documentation of experience requirements

2. Quality Assurance

   a. Demonstrate experience and expertise in horizontal bore installation methods by providing a list of 6 references for whom similar Work has been performed prior to commencing any Work. Include a name and telephone number for each contact.
   b. Provide documentation showing successful completion of at least 10,000 linear feet of horizontal bore installation of piping or obtain the services of an experienced horizontal bore subcontractor meeting the experience requirements of this section to supervise the installation prior to commencing any Work. Conventional trenching is not considered applicable experience.
   c. Adequately train all supervisory personnel and ensure they have at least 4 years of experience in pipe installation by horizontal bore. Submit the names and resumes of all supervisory field personnel for review by the District prior to commencing any Work.
   d. Perform all horizontal bore Work in accordance with laws, permits, requirements and regulations of the authority having jurisdiction of the rights-of-way.
   e. A permit will be obtained for the proposed boring(s) under US 31. The traffic maintenance plan and boring pit locations shown in the Drawings are in accordance with that permit. No deviation will be allowed without the approval of the INDOT Permit inspector. All work needs to meet the INDOT permit requirements.
   f. Give notification to the applicable agency or officials prior to the start of the Work and do not start the Work until all arrangements are completed and permission to start Work is given by the INDOT District Highway Engineer.

g. The District or jurisdictional officials shall review, and modify if necessary, the scheduling of construction activities within the right-of-way in order to prevent interruption to traffic. The Contractor shall include the cost for such procedures in his Bid and shall not be entitled to any change in contract amount on account of such procedures.
h. Complete Work in a careful, workmanlike manner to the satisfaction of the jurisdictional officials and the District.

3. Trenchless Materials

a. Carrier Pipes

1) See Section 6, Materials for Sanitary Sewers.

4. Steel Pipe Casing

a. Welded steel pipe, new and unused, in accordance with ASTM A139 Grade B for “Electric Fusion of Welded Steel Pipe” with a minimum yield of 35,000 psi.
b. The inside diameter shall be at least 6 inches greater than the largest bell diameter of the carrier pipe.
c. The casing pipe and joints shall be capable of withstanding the loads of traffic, pavement, subgrade and other dead loads.
d. The casing pipe and joints shall be constructed to prevent leakage of any matter from the casing or carrier pipe throughout its entire length including the ends of the casing pipe.
e. The minimum wall thickness of the casing pipe shall be as shown in the following table:

Diameter of Casing	Minimum Wall Thickness (Inches) Under Highway	Under Railroad
Under 14"	0.250	0.188
14" to 16"	0.250	0.219
18"	0.250	0.250
20"	0.375	0.281
22"	0.375	0.312
24"	0.375	0.344
26"	0.375	0.375
28" to 30"	0.500	0.406
32"	0.500	0.438
34" to 36"	0.500	0.469
38" to 42"	0.500	0.500

f. The exterior walls of casing shall be coated with protective coal tar or bitumastic material, after the welding of each joint has been completed.
g. When casing is installed without benefit of a protective coating and the casing is not cathodically protected, the wall thickness shown above shall be increased to the nearest standard size, which is a minimum of 0.063 inch greater than the thickness shown except for diameter under 12-3/4 inches.
h. The diameter, gauge, ASTM specification and manufacturer's name must be marked on the exterior of each pipe length.
i. Install casing pipe spacers to provide uniform support throughout the entire length of the casing. Casing pipe spacers shall have stainless steel bands and risers, plastic liner and runners as manufactured by Cascade Waterworks Manufacturing Company or approved equal.

4. Installation of Casing and Carrier Pipes

a. Excavate the boring pit providing a minimum clearance of 5 feet from the edge of the road right-of-way avoiding interruption to traffic.
b. Support existing, and replace damaged, structures or utilities encountered to the satisfaction of the District. Maintain pits during casing and carrier pipe installation.
c. Bore or jack the casing pipe into place to satisfactory alignment and grade for its entire length.

d. After casing is installed, push successive lengths of carrier pipe through to the length indicated on the Drawings or Submittals. Make connections to the water and force main.
e. The material of carrier pipe and type of pipe joint fittings shall be as specified in other Sections for the type of pipe, whether water main, gravity sanitary sewer, storm sewer, force main, or electrical conduit. Employ suitable methods to maintain tight joints to the satisfaction of the District representative.
f. Block up the ends of the casing pipe to prevent the entrance of foreign material but do not tightly seal. Grouting of the void space between the casing and the water force main is not required.
g. Backfilling shall be as specified. Remove excess excavated material and debris from the site.
h. Each end of the casing pipe shall be referenced to a minimum of two (2) permanent reference points for Record Drawing purposes.

5. Directional Drilling Procedure

a. Prior to any alterations to the Work site, video tape the entire Work area, including entry and exit points. Provide one copy of the video to the District and keep one copy for a period of 1 year following the completion of the project.
b. Grade or fill the Work site as indicated on the drawings, within the right-of-way, to provide a level working area. Make no alterations beyond what is required for operations. Confine all activities to the designated Work areas and construction limits.
c. Accurately survey the entire drill path and place entry and exit stakes in the appropriate locations within the areas indicated on the Drawings. If using a magnetic guidance system, survey the drill path for any surface geo-magnetic variations or anomalies.
d. Place environmental protection necessary to contain any hydraulic or drilling fluid spills, including berms, liners, turbidity curtains, and other erosion control measures. Adhere to all environmental regulations. Do not store fuel and oil in bulk containers within 200 feet of any waterbody or wetland.
e. Place pipe resting on paved or hardened surfaces (i.e., sidewalks, asphalt, concrete, gravel, etc.) on pipe rollers before being pulled into the drill hole, with rollers spaced close enough to prevent excessive sagging and dragging of the pipe on rough surfaces which could scar the pipe.

f. Calibrate the directional drilling head locator at the start of the day and at each new directional drilling operation. Keep a daily calibration log for the District's review.
g. Ensure the directional drilling operator has full control of the direction of the drilling tool at all times. Abandon and fill shallow, misdirected, or other unsuccessful drills at the direction of the District and at Contractor's expense.
h. The maximum drill angle shall be 15 degrees measured perpendicular to grade to the design depth elevation.
i. Drill a pilot hole on the drill path with no deviations greater than 5 percent of depth over a length of 100 feet. In the event the pilot hole does deviate from the drill path more than 5 percent of depth in 100 feet, notify the District. The District may require pull back and re-drill from the location along the drill path before the deviation.
j. In the event of a drilling fluid fracture, inadvertent returns, or returns loss occurs during pilot hole drilling operations, cease drilling. Wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a March funnel, and then wait another 30 minutes. If mud fracture or returns loss continues, cease operations, and notify the District. The District and Contractor will discuss additional options and Work will proceed accordingly.
k. Upon successful completion of the pilot hole, ream the drill hole to a minimum of 25 percent greater than the outside diameter of the pipe using appropriate tools. Do not attempt to ream, at one time, more than the drilling equipment and mud system are designed to safely handle.
l. After successfully reaming the drill hole to the required diameter, pull the pipe through the drill hole. In front of the pipe will be a swiveling mandrel. Once pull-back operations have commenced, operations must continue without interruption until the pipe is completely pulled into the drill hole. Do not apply more than the maximum safe pipe pull pressure at any time during pull-back operations.
m. Pull back 2 strands of tracer wire with the pipe.
n. Tracer wire shall be Copperhead Direct Burial #12 AWG, solid steel core, hard drawn, extra-high strength, horizontal directional drill tracer wire with:

    1) 1150 pound average tensile break load,
    2) 45 mil high molecular weight-high density yellow polyethylene jacket complying with ASTM D1248, and
    3) 30 volt rating.
    4) Include the tracer wire in the cost of the pipe.

o. In the event the pipe becomes stuck during pull-back, cease pulling operations to allow any potential hydro-lock to subside and then commence pulling operations. If the pipe remains stuck, notify the District. The District and the Contractor will discuss options and then Work will proceed accordingly.
p. At drill pits and directional drilling entrances and exits to the surface, use a backhoe or equivalent to gradually return the bore depth to the prescribed depth.
q. Upon completion of drilling and pipe installation, remove spoils from starting and termination pits. Backfill and compact drill pits and directional drilling entrances and exits to the surface. Restore pits to their original condition.

6. Field Quality Control
   a. Maintain a daily calibration log of the directional drilling head locator, or bore operator. Provide completed forms or computer-generated output to the District representative daily for checking line and grade of the drill or bore operation.
   b. Dig test/pressure relief holes (potholes) every 25 feet along the bore route to confirm alignment and grade, and to relieve subsurface pressure.
   c. Install to avoid high points.
   d. Replace sections of pipe that do not meet the above requirements at no additional cost to the District. If the new pipe installed does not meet the above requirements, either grout and abandon the pipe in place, or remove the pipe and fill the void as directed by the District at no additional cost to the District.
   e. Pressure test the installed force main as specified.
   f. Pressure test the installed water main and disinfect as specified.

8.03 Bedding and Backfill

A. General

All trenches or excavations shall be backfilled to the original surface of the ground or such other grades as required or directed. In general the backfilling shall be carried along as speedily as possible in order to avoid open excavations.

B. Bedding and Backfill Materials

1. Bedding and Backfill material classes referenced within this section shall be defined as follows:

   Class I — INDOT No. 8 Crushed Stone

   Class II — Coarse sands and gravel-sand mixtures (meets INDOT Standard Specification 904 for structure backfill with maximum particle size)

2. Flowable fill, if required, shall be per INDOT requirements.

C. Backfill of Trench Excavations for Pipes and Conduits

1. Bedding and Backfill materials samples shall be submitted to the District prior to start of construction.

D. Bedding

1. Plastic (PVC, HDPE) Pipe

   a. Plastic pipe conduits (PVC and HDPE) shall be provided with No. 8 crushed stone or approved Class I granular bedding material shovel sliced or otherwise carefully placed and “walked” or hand tamped into place from 4- to 8-inches (based in the diameter of the pipe) below the pipe barrel, to a minimum of 12-inches above the crown of the pipe.

   b. Bedding and initial backfill material shall be hand placed around the haunch and sides of the plastic pipe, to ensure proper compaction filling of all voids.

   c. Bedding shall be placed in 6-inch to 8-inch balanced lifts.

2. Ductile Iron Pipe (DI)

   a. Ductile Iron Pipe (DI) conduits shall be provided with Class I granular bedding material. Class I material shall be shovel sliced or otherwise carefully placed and “walked” or hand

tamped into place from 3- to 6-inches (based upon pipe diameter) below the pipe barrel, to 1/6th the outside pipe diameter (Bc).

E. Backfill Around Pipe

1. Do not backfill trenches until all piping and utilities have been inspected and until the piping system, as installed, conforms to the requirements as detailed in these Standards and are approved by the District.

2. Backfill all trenches within State Highway Right-of-Way in accordance with Indiana Department of Transportation Specifications. Backfill trenches in Hamilton County rights-of-way in accordance with the requirements of Hamilton County Highway Department.

3. Initial backfill material shall be hand placed around the haunch and sides of pipe to ensure proper compaction filling of all voids. Initial backfill shall be placed in 6-inch to 8-inch balanced lifts.

4. Backfill trenches for mainline sewers under existing paved roads, curbs, and gutters with flowable fill. Backfill trenches for mainline sewers under future roads, curbs, and gutters with compacted granular backfill. Prepare upper portion of the trench accordingly for surface restoration or pavement replacement.

5. Compacted Class I or Class II granular fill shall be used for backfilling trenches in the following areas: (1) for mainline sewers, laterals, and force mains under paved roads, driveways and alleys (paved or unpaved), curbs, and gutters to 5 feet from the edge of pavement or backside of curb; and for mainline sewers, laterals, and force mains not under paved roads but within 5 feet of the edge of pavement. Place backfill in 8-inch layers and compact to 95% Standard Proctor Density. Prepare upper portion of the trench for surface restoration or pavement replacement.

6. Backfill trenches under sidewalks greater than 5-feet from roadways with suitable excavated material placed in 8-inch layers and compacted to 95% Standard Proctor Density.

7. Backfill trenches in areas not requiring flowable or granular fill with suitable excavated material compacted to produce an adequate foundation for seeding. The top 4-inches of backfill shall not contain stones or other objects larger than 1-inch in maximum dimension. Mound backfill above the finished grade to allow for settlement. Place 6-inches of clean topsoil over the area to be seeded. Grade area to be restored settlement and immediately before restoration.

8. Maintain backfilled trenches in a smooth and uniform condition until paving or seeding operations are completed. Contractor shall refill and restore to the original grade any settlement in the backfill which takes place within the 1-year warranty period at no additional cost to the District.

9. For all areas requiring compacted granular backfill to meet 95% Standard Proctor Density, perform compaction tests in accordance with the standard specifications of the Indiana Department of Transportation. The Contractor shall be responsible for payment of all compaction tests.

8.04 Installation of Sewers

A. General

1. The Contractor shall provide all tools, labor and equipment necessary for the safe and expeditious installation of all sanitary sewers, manholes, and appurtenances.

2. Inspect sewer pipe, manhole sections and appurtenances prior to installation and promptly remove damaged or unsuitable materials with new and unused materials.

B. Installation of Sewers

1. Sewer pipe shall be laid uniformly to line and grade so that the finished sewer will present a uniform bore.

2. The Contractor, at his own expense, shall set line and grade by means of laser beam and target for alignment and grade.

3. Sewer pipe shall be laid progressively upgrade with bell upstream in a manner to form close, concentric joints with smooth bottom inverts.

4. After the joint is made, sufficient bedding material shall be placed along each side of the pipe to prevent conditions that might tend to move the pipe off line or grade.

5. Installed piping systems shall be temporarily plugged at the end of each day's work, or other interruption of progress on a given line. Plugging shall be installed in a manner satisfactory to the District, and it shall be adequate to prevent entry of animals into the pipe or the entrance or insertion of deleterious materials.

6. A mechanical plug shall be installed at the end of all sewer stubs for future sewer extensions.

8.05 Installation of Force Mains

A. General

1. The Contractor shall provide all tools, labor and equipment necessary for the safe and expeditious installation of all force mains and appurtenances.

2. Inspect force main pipe and appurtenances prior to installation and promptly remove damaged or unsuitable materials with new and unused materials.

3. The Contractor installing a low pressure system must provide proof that they have been certified by the low pressure system's manufacturer or supplier to install the proposed system.

B. Installation of Force Mains

1. Force mains shall be laid uniformly to line and grade so that the finished sewer will present a uniform bore. The Contractor, at his

own expense, shall set force main alignment and grade for all sewers.

2. HDPE force mains shall be butt fusion bonded at grade level and lowered into the trench using nylon slings to avoid damage to the pipe. Chains or cable type chokers must be avoided when lifting used sections of pipe.

3. Sewer pipe shall be laid progressively upgrade with bell upstream in a manner to form close, concentric joints with smooth bottom inverts.

4. After the joint is made, sufficient bedding material shall be placed along each side of the pipe to prevent conditions that might tend to move the pipe off line or grade.

5. Installed piping systems shall be temporarily plugged at the end of each day's work, or other interruption of progress on a given line. Plugging shall be installed in a manner satisfactory to the District, and it shall be adequate to prevent entry of animals into the pipe or the entrance or insertion of deleterious materials.

6. Bedding of Class I materials shall be provided from 4-inches below the pipe to 12-inches above the crown of the pipe. After the main is installed, sufficient bedding material shall be placed along each side of the pipe to prevent conditions that might tend to move the pipe off line or grade.

7. Locate tape shall be installed above all force mains within 2-feet of the finished grade. Tracer wire shall be installed above force mains near the top of the pipe. It is the responsibility of the Contractor to protect these markers and to verify that all force mains have been properly marked.

8.06 Structure Installation

1. Manhole excavation shall be kept free from water during construction. Space excavated below the depth required for the

manhole base shall be refilled with compacted sand or crushed stone at the Contractor's expense.

2. Manhole benchwalls shall have troughs equal to at least the diameter of the incoming and exiting sewers with the benchwall having a minimum ½ inch per foot slope from the manhole wall/benchwall interface to the top of the trough.

3. Precast concrete risers and adjusting rings shall be used in such combination that the top of the eccentric cone section, when installed, will be at a proper elevation for the manhole frame. Concrete adjusting rings shall be allowed up to a maximum of 12-inches height adjustment. Manholes needing more than 12-inches adjustment shall have a concrete riser section installed to the proper elevation.

4. Manhole frames shall be brought to grade, centered and embedded in a mastic bonding course. Manhole frames shall be bolted or anchored through adjusting rings and into the cone section of the manhole using stainless steel all-thread or expansion bolts.

5. Precast concrete risers and cone sections shall be installed so that the axis of the manhole is vertical. Gaskets for the riser joints shall be installed in accordance with the manufacturer's recommendations. Manhole joints shall be sealed on the outside per the sanitary details.

6. Unless otherwise indicated, castings for manholes shall be set at finish grade level. This Contractor shall be responsible for adjusting the casting to the satisfaction of the District at the Contractor's expense.

7. The Contractor shall remove all debris and excess soil from the manholes after construction and prior to flushing the sewer pipes, to the satisfaction of the District.

8.07 Pavement Installation

Pavements shall be installed per the Hamilton County Standards for Construction of Road Improvements.

8.08 Installation of Building Sewers (Laterals)

A. General

1. Laterals shall be installed at a normal slope of ¼-inch per foot. Minimum slope shall be 1/8-inch per foot. A mechanical plug shall be installed at the end of each lateral. It shall be the responsibility of the Contractor to install the lateral at a depth sufficient to allow each customer to connect to the end of the lateral.

2. A piece of steel rebar shall be installed at the end of each sewer lateral for marking. It shall be the responsibility of the Contractor to protect these markers and to verify that all laterals have been properly marked.

B. Connection to Sanitary Sewers

1. Connections to new sanitary sewers shall be made only at the manufactured fitting. Connections to existing sanitary sewers shall be made at existing manufactured fittings, as shown on the approved record drawings. In the event that no manufactured fitting exists in an existing sanitary sewer, and if approved by the District, a service connection may be made using a saddle connection.

C. Connections to Sanitary Manholes

1. Connections of building sewers to sanitary manholes shall not be made without prior approval of the District. Building sewers shall connect to the manhole, when approved, at the manhole invert. Under these circumstances, the manhole base shall be pre-formed with a gasketed connection for the lateral line. The invert shall also be formed at the flow line to accept the lateral sewer connection. No inside drop connections shall be allowed without the prior written approval of the District.

D. Bedding and Backfill

1. Bedding and Backfill shall be required per the specifications for PVC flexible pipe included in these Standards.

E. Laying of PVC Sanitary Lateral

1. The point of commencement for laying of the sanitary lateral pipe shall be at the connection to the sanitary sewer and shall be laid with the bell end pointing upgrade.

2. Whenever a sanitary lateral needs to cross under street pavement to get to the building to be served, an additional 6-inch cleanout shall be installed at the edge of the right-of-way, on the building private property.

3. Tracer wire and location tape shall be installed from the connection to the mainline sewer to the edge of the right-of-way or easement.

Section 8A

Installation and Construction of Water Mains

Section 8A

Installation and Construction of Water Mains

8A.01 General

A. Trench Safety

1. Contractor is responsible for using means and methods to ensure safe trenches and excavations following OSHA Standards for Construction from 29 CFR 1926.

2. Contractor is responsible for providing warnings and barricades to secure the site perimeter.

3. Water mains in general shall be installed using manufacturer's recommendations and following AWWA Standards, 10 States Standards, IDEM Regulations, District Standards and District Approved Plans, Details and Specifications.

4. Permits for construction shall be obtained prior to starting work including approval from the District for technical aspects of plans, approval from agencies controlling rights-of-way, soil and erosion control, construction in waterways, etc.

5. Excavation, bedding and backfill requirements of Section 8 Installation and Construction of Sanitary Sewers shall be followed for water mains.

8A.02 Excavation

A. Dewatering and Control of Surface Water

1. Where groundwater is encountered, the Contractor shall make every effort necessary to secure a dry trench bottom before laying pipe. The Contractor shall provide, install and operate sufficient trenches,

sumps, pumps, hoses, piping, well points, etc. necessary to depress and maintain the groundwater level below the base of the excavation.

2. The Contractor shall keep the site free of surface water at all times and shall install drainage ditches, dikes, pumps and perform other work necessary to divert or remove rainfall and other accumulation of surface water from excavations. The diversion and removal of surface and/or groundwater shall be performed in a manner which will prevent the accumulation of water within the construction area.

3. Under no circumstances shall surface water and/or groundwater be discharged, disposed of, or allowed to flow into the District's Sanitary Sewer System.

B. Site Preparation

1. Before any excavation is started, adequate protection shall be provided for all lawns, trees, landscape work, shrubs, fences, hydrants, sidewalks, and other objects that are to remain in place. Such protection shall be maintained for as long as necessary to prevent damage from the Contractor operation.

2. Moveable items such as mailboxes and roadway signs may be temporarily relocated during construction. Place moveable items in their original location immediately after backfilling is complete. Moveable items damaged during construction shall be replaced with new items at the Contractor's expense.

3. Strip topsoil and vegetation from the excavated areas. Clean topsoil may be stockpiled for re-use as the upper 6-inches of the area to be seeded. Do not intermix grass, weeds, roots, brush, and stones larger than 1-inch with stockpiled topsoil. Dispose of root contaminated topsoil.

4. Clear and remove logs, stumps, brush, vegetation, rubbish and other perishable matter from the job site. Do not remove or damage trees

that do not interfere with the work. Completely remove trees including stumps and roots that are required to be removed. Replace trees removed unnecessarily and properly treat damaged trees that can be saved.

5. Remove existing pavement and walks from the excavated areas. Remove asphaltic and concrete materials from the job site as these materials are excavated. Use methods to remove pavement and walks that will assure the breaking or cutting along straight and vertical lines. Remove walks completely where excavation is along the length of a walk. Remove walks completely where excavation is along the length of a walk. Remove walks to existing joints where excavation crosses walks. The width of pavement to be removed shall not exceed the width of the trench by more than 12-inches on each side of the trench.

C. Excavating

1. Excavated materials suitable and necessary for backfilling shall be stored in a neat pile adjacent to the excavation in a manner so as to interfere as little as possible with traffic. Such materials shall not be placed with sufficient height or proximity to excavation so as to endanger such openings due to earth slides or cave-ins.

2. Excavated material not suitable for backfilling and excess suitable material shall be removed from the job site and disposed of in a spoil area secured by the Contractor.

3. Provide and maintain adequate dewatering equipment to remove and dispose of surface and ground water entering excavations. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation.

D. Trenching

1. Excavate trenches to a depth and width as required by the pipe manufacturer for proper installation of the pipe and appurtenances. Excavations below the required grade shall be filled with compacted bedding material.

2. The trench width for concrete box sections shall be only as wide as is necessary to facilitate proper compaction of backfill material, provided the adjacent embankment material is structurally adequate to provide the necessary side support. Verification of sufficient bearing strength of underlying soil foundation material, based upon manufacturer's recommendations, shall be required for all reinforced concrete box section installations.

3. Trenches shall be made as narrow as possible and to the straight lines shown on Plans. Sides of trenches shall be kept as near vertical as possible and shall be properly sheeted and/or braced, if required. The width of the trench shall provide a clearance of not less than 8-inches no more than 10-inches on each side of the pipe.

4. Provide a continuous, uniform bearing support for the pipe on solid undisturbed soil or compact granular fill with trench dished to provide circumferential support to the lower third of each pipe. Dig out holes to receive pipe bells.

5. Rock excavation encountered in the trench and soft material which, in the opinion of the District is incapable of providing adequate bearing to support the pipe, shall be removed to a depth of 4-inches below the required elevation and filled with compacted granular fill material.

6. Do not open more than 50-feet of trench in advance of the installed pipe, unless otherwise directed or permitted by the District. Excavate the trench within 6-inches of full depth for a distance of at least 30-

feet in advance of the pipe installation, unless otherwise directed or permitted.

7. Maintain one lane of traffic at all streets and service drives during construction. Streets and drives may be closed and traffic detoured if permission is obtained by the Contractor from the State, City, County, or Local Business having jurisdiction.

8. Any sewer, gas, water, or other pipes or conduits crossing the trench shall be supported without damage and without interrupting service. The manner of supporting such pipes or conduits shall be subject to the approval of the District and/or the inspector of the utility involved.

9. The Contractor shall provide adequate sheeting and bracing in open cut trenches to protect life, property and the work.

10. All sheeting, planking, timbering, shoring, bracing, and bridging shall be placed, renewed and maintained, and shall not be removed until sufficient backfill has been placed to protect the pipe.

11. Where rock is encountered during trenching operations, the Contractor may remove the rock by mechanical means. The use of a rock trencher which produces excavated material commensurate to “granular backfill” is preferred. Materials suitable for granular backfill excavated by a rock trencher may be used as bedding for pipe in areas of rock excavation.

12. No farm fences shall be cut when gates are available within a reasonable distance to move equipment from one field to another.

E. Trenchless Installation

1. Submittals include

   a. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.

   b. Certified copies of reports of factory tests specified in this Section and required by the referenced standards

   c. Plans and details describing materials and methods proposed by the Contractor for use in special crossings

   d. Documentation of experience requirements

2. Quality Assurance

   a. Demonstrate experience and expertise in horizontal bore installation methods by providing a list of 6 references for whom similar Work has been performed prior to commencing any Work. Include a name and telephone number for each contact.

   b. Provide documentation showing successful completion of at least 10,000 linear feet of horizontal bore installation of piping or obtain the services of an experienced horizontal bore subcontractor meeting the experience requirements of this section to supervise the installation prior to commencing any Work. Conventional trenching is not considered applicable experience.

   c. Adequately train all supervisory personnel and ensure they have at least 4 years of experience in pipe installation by horizontal bore. Submit the names and resumes of all supervisory field personnel for review by the District prior to commencing any Work.

   d. Perform all horizontal bore Work in accordance with laws, permits, requirements and regulations of the authority having jurisdiction of the rights-of-way.

   e. A permit will be obtained for the proposed boring(s) under US 31. The traffic maintenance plan and boring pit locations shown in the

Drawings are in accordance with that permit. No deviation will be allowed without the approval of the INDOT Permit inspector. All work needs to meet the INDOT permit requirements.

f. Give notification to the applicable agency or officials prior to the start of the Work and do not start the Work until all arrangements are completed and permission to start Work is given by the INDOT District Highway Engineer.

g. The District or jurisdictional officials shall review, and modify if necessary, the scheduling of construction activities within the right-of-way in order to prevent interruption to traffic. The Contractor shall include the cost for such procedures in his Bid and shall not be entitled to any change in contract amount on account of such procedures.

h. Complete Work in a careful, workmanlike manner to the satisfaction of the jurisdictional officials and the District.

3. Trenchless Materials

a. Carrier Pipes

1) See Section 6A, Materials for Water Mains.

4. Steel Pipe Casing

a. Welded steel pipe, new and unused, in accordance with ASTM A139 Grade B for “Electric Fusion of Welded Steel Pipe” with a minimum yield of 35,000 psi.

b. The inside diameter shall be at least 6 inches greater than the largest bell diameter of the carrier pipe.

c. The casing pipe and joints shall be capable of withstanding the loads of traffic, pavement, subgrade and other dead loads.

d. The casing pipe and joints shall be constructed to prevent leakage of any matter from the casing or carrier pipe throughout its entire length including the ends of the casing pipe.

e. The minimum wall thickness of the casing pipe shall be as shown in the following table:

Diameter of Casing	Minimum Wall Thickness (Inches) Under Highway	Under Railroad
Under 14"	0.250	0.188
14" to 16"	0.250	0.219
18"	0.250	0.250
20"	0.375	0.281
22"	0.375	0.312
24"	0.375	0.344
26"	0.375	0.375
28" to 30"	0.500	0.406
32"	0.500	0.438
34" to 36"	0.500	0.469
38" to 42"	0.500	0.500

f. The exterior walls of casing shall be coated with protective coal tar or bitumastic material, after the welding of each joint has been completed.

g. When casing is installed without benefit of a protective coating and the casing is not cathodically protected, the wall thickness shown above shall be increased to the nearest standard size, which is a minimum of 0.063 inch greater than the thickness shown except for diameter under 12-3/4 inches.

h. The diameter, gauge, ASTM specification and manufacturer's name must be marked on the exterior of each pipe length.

i. Install casing pipe spacers to provide uniform support throughout the entire length of the casing. Casing pipe spacers shall have stainless

steel bands and risers, plastic liner and runners as manufactured by Cascade Waterworks Manufacturing Company or approved equal.

4. Installation of Casing and Carrier Pipes

   a. Excavate the boring pit providing a minimum clearance of 5 feet from the edge of the road right-of-way avoiding interruption to traffic.

   b. Support existing, and replace damaged, structures or utilities encountered to the satisfaction of the District. Maintain pits during casing and carrier pipe installation.

   c. Bore or jack the casing pipe into place to satisfactory alignment and grade for its entire length.

   d. After casing is installed, push successive lengths of carrier pipe through to the length indicated on the Drawings or Submittals. Make connections to the water and force main.

   e. The material of carrier pipe and type of pipe joint fittings shall be as specified in other Sections for the type of pipe, whether water main, gravity sanitary sewer, storm sewer, force main, or electrical conduit. Employ suitable methods to maintain tight joints to the satisfaction of the District representative.

   f. Block up the ends of the casing pipe to prevent the entrance of foreign material but do not tightly seal. Grouting of the void space between the casing and the water force main is not required.

   g. Backfilling shall be as specified. Remove excess excavated material and debris from the site.

   h. Each end of the casing pipe shall be referenced to a minimum of two (2) permanent reference points for Record Drawing purposes.

5. Directional Drilling Procedure

   a. Prior to any alterations to the Work site, video tape the entire Work area, including entry and exit points. Provide one copy of the video to the District and keep one copy for a period of 1 year following the completion of the project.

   b. Grade or fill the Work site as indicated on the drawings, within the right-of-way, to provide a level working area. Make no alterations beyond what is required for operations. Confine all activities to the designated Work areas and construction limits.

   c. Accurately survey the entire drill path and place entry and exit stakes in the appropriate locations within the areas indicated on the Drawings. If using a magnetic guidance system, survey the drill path for any surface geo-magnetic variations or anomalies.

   d. Place environmental protection necessary to contain any hydraulic or drilling fluid spills, including berms, liners, turbidity curtains, and other erosion control measures. Adhere to all environmental regulations. Do not store fuel and oil in bulk containers within 200 feet of any waterbody or wetland.

   e. Place pipe resting on paved or hardened surfaces (i.e., sidewalks, asphalt, concrete, gravel, etc.) on pipe rollers before being pulled into the drill hole, with rollers spaced close enough to prevent excessive sagging and dragging of the pipe on rough surfaces which could scar the pipe.

   f. Calibrate the directional drilling head locator at the start of the day and at each new directional drilling operation. Keep a daily calibration log for the District's review.

   g. Ensure the directional drilling operator has full control of the direction of the drilling tool at all times. Abandon and fill shallow, misdirected, or other unsuccessful drills at the direction of the District and at Contractor's expense.

   h. The maximum drill angle shall be 15 degrees measured perpendicular to grade to the design depth elevation.

i. Drill a pilot hole on the drill path with no deviations greater than 5 percent of depth over a length of 100 feet. In the event the pilot hole does deviate from the drill path more than 5 percent of depth in 100 feet, notify the District. The District may require pull back and re-drill from the location along the drill path before the deviation.

j. In the event of a drilling fluid fracture, inadvertent returns, or returns loss occurs during pilot hole drilling operations, cease drilling. Wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a March funnel, and then wait another 30 minutes. If mud fracture or returns loss continues, cease operations, and notify the District. The District and Contractor will discuss additional options and Work will proceed accordingly.

k. Upon successful completion of the pilot hole, ream the drill hole to a minimum of 25 percent greater than the outside diameter of the pipe using appropriate tools. Do not attempt to ream, at one time, more than the drilling equipment and mud system are designed to safely handle.

l. After successfully reaming the drill hole to the required diameter, pull the pipe through the drill hole. In front of the pipe will be a swiveling mandrel. Once pull-back operations have commenced, operations must continue without interruption until the pipe is completely pulled into the drill hole. Do not apply more than the maximum safe pipe pull pressure at any time during pull-back operations.

m. Pull back 2 strands of tracer wire with the pipe.

n. Tracer wire shall be Copperhead Direct Burial #12 AWG, solid steel core, hard drawn, extra-high strength, horizontal directional drill tracer wire with:

   1) 1150 pound average tensile break load,

   2) 45 mil high molecular weight-high density yellow polyethylene jacket complying with ASTM D1248, and

   3) 30 volt rating.

   4) Include the tracer wire in the cost of the pipe.

o. In the event the pipe becomes stuck during pull-back, cease pulling operations to allow any potential hydro-lock to subside and then commence pulling operations. If the pipe remains stuck, notify the District. The District and the Contractor will discuss options and then Work will proceed accordingly.

p. At drill pits and directional drilling entrances and exits to the surface, use a backhoe or equivalent to gradually return the bore depth to the prescribed depth.

q. Upon completion of drilling and pipe installation, remove spoils from starting and termination pits. Backfill and compact drill pits and directional drilling entrances and exits to the surface. Restore pits to their original condition.

6. Field Quality Control

a. Maintain a daily calibration log of the directional drilling head locator, or bore operator. Provide completed forms or computer-generated output to the District representative daily for checking line and grade of the drill or bore operation.

b. Dig test/pressure relief holes (potholes) every 25 feet along the bore route to confirm alignment and grade, and to relieve subsurface pressure.

c. Install to avoid high points.

d. Replace sections of pipe that do not meet the above requirements at no additional cost to the District. If the new pipe installed does not meet the above requirements, either grout and abandon the pipe in place, or remove the pipe and fill the void as directed by the District at no additional cost to the District.

e. Pressure test the installed force main as specified.

f. Pressure test the installed water main and disinfect as specified.

8A.03 Bedding and Backfill

A. General

All trenches or excavations shall be backfilled to the original surface of the ground or such other grades as required or directed. In general the backfilling shall be carried along as speedily as possible in order to avoid open excavations.

B. Bedding and Backfill Materials

1. Bedding and Backfill material classes referenced within this section shall be defined as follows:

Class I	INDOT No. 8 Crushed Stone
Class II	Coarse sands and gravel-sand mixtures (meets INDOT Standard Specification 904 for structure backfill with maximum particle size)

2. Flowable fill, if required, shall be per INDOT requirements.

C. Backfill of Trench Excavations for Pipes and Conduits

1. Bedding and Backfill materials samples shall be submitted to the District prior to start of construction.

D. Bedding

1. Plastic (PVC, HDPE) Pipe

a. Plastic pipe conduits (PVC and HDPE) shall be provided with No. 8 crushed stone or approved Class I granular bedding material shovel sliced or otherwise carefully placed and "walked" or hand tamped into place from 4- to 8-inches (based in the diameter of the pipe) below the pipe barrel, to a minimum of 12-inches above the crown of the pipe.

b. Bedding and initial backfill material shall be hand placed around the haunch and sides of the plastic pipe, to ensure proper compaction filling of all voids.

c. Bedding shall be placed in 6-inch to 8-inch balanced lifts.

2. Ductile Iron Pipe (DI)

a. Ductile Iron Pipe (DI) conduits shall be provided with Class I granular bedding material. Class I material shall be shovel sliced or otherwise carefully placed and "walked" or hand tamped into place from 3- to 6-inches (based upon pipe diameter) below the pipe barrel, to 1/6th the outside pipe diameter (Bc).

E. Backfill Around Pipe

1. Do not backfill trenches until all piping and utilities have been inspected and until the piping system, as installed, conforms to the requirements as detailed in these Standards and are approved by the District.

2. Backfill all trenches within State Highway Right-of-Way in accordance with Indiana Department of Transportation Specifications. Backfill trenches in Hamilton County rights-of-way in accordance with the requirements of Hamilton County Highway Department.

3. Initial backfill material shall be hand placed around the haunch and sides of pipe to ensure proper compaction filling of all voids. Initial backfill shall be placed in 6-inch to 8-inch balanced lifts.

4. Backfill trenches for mainline sewers under existing paved roads, curbs, and gutters with flowable fill. Backfill trenches for mainline sewers under future roads, curbs, and gutters with compacted granular backfill. Prepare upper portion of the trench accordingly for surface restoration or pavement replacement.

5. Compacted Class I or Class II granular fill shall be used for backfilling trenches in the following areas: (1) for mainline sewers, laterals, and force mains under paved roads, driveways and alleys (paved or unpaved), curbs, and gutters to 5 feet from the edge of pavement or backside of curb; and for mainline sewers, laterals, and force mains not under paved roads but within 5 feet of the edge of pavement. Place backfill in 8-inch layers and compact to 95% Standard Proctor Density. Prepare upper portion of the trench for surface restoration or pavement replacement.

6. Backfill trenches under sidewalks greater than 5-feet from roadways with suitable excavated material placed in 8-inch layers and compacted to 95% Standard Proctor Density.

7. Backfill trenches in areas not requiring flowable or granular fill with suitable excavated material compacted to produce an adequate foundation for seeding. The top 4-inches of backfill shall not contain stones or other objects larger than 1-inch in maximum dimension. Mound backfill above the finished grade to allow for settlement. Place 6-inches of clean topsoil over the area to be seeded. Grade area to be restored settlement and immediately before restoration.

8. Maintain backfilled trenches in a smooth and uniform condition until paving or seeding operations are completed. Contractor shall refill and restore to the original grade any settlement in the backfill which takes place within the 1-year warranty period at no additional cost to the District.

9. For all areas requiring compacted granular backfill to meet 95% Standard Proctor Density, perform compaction tests in accordance with the standard specifications of the Indiana Department of Transportation. The Contractor shall be responsible for payment of all compaction tests.

8A.04 Installation of Water Mains

A. Installation and Materials

1. The Contractor shall provide all tools, labor and equipment necessary for the safe and expeditious installation of all water mains and appurtenances.

2. Material shall be AWWA and NSF rated in accordance with approved plans.

3. Inspect pipe and appurtenances prior to installation and promptly remove damaged or unsuitable materials with new and unused materials.

4. Protect stored materials from contamination and degradation.

5. The District only allows Ductile Iron Pipe, C-900 PVC Slip Joint Pipe, C-900 Restrained Joint PVC Pipe, and HDPE pipe of the pressure ratings and dimension ratios specified in the technical specifications.

B. Contamination Prevention Requirements

1. During Installation, water main shall be protected from contamination using care during construction to keep foreign material out of pipe.

2. Plugs designed to seal open pipe ends shall be used when work is not actively being performed (i.e., during breaks and at the end of a work day). Plugs shall be secured so that they will not be dislodged by sudden weather events.

C. Tracer wire

1. Tracer wire shall be placed with the PVC and HDPE pipe as installed. Warning tape, blue in color, shall be placed 12 to 18 inches above all installed pipe.

D. Record Drawings

1. Record Drawings of the water main installation are required for acceptance of water main for maintenance by the District. Record drawings require actions during installation. Coordinate locations for fittings and appurtenances shall be either recorded as installed, or markers shall be brought to the surface and identified for recording coordinates at the end of the job.

E. Cover

1. Cover shall be a minimum of 54-inches above the top of pipe to the ground surface per 327 IAC 8.

F. Restraint

1. All tees, bends, plugs, caps, and hydrants shall be restrained with mechanical joint restraints per plans, details and specifications.

2. HDPE fusible pipe shall be restrained further with concrete collars as shown on the plans and details because of its thermal expansion characteristics.

G. Prevention of Pipe Stress Cracking

1. Fittings or valves closer than 2 feet apart shall be connected using anchor couplings or foster adapters if back-to-back.

2. Services or test ports shall not be placed within 2 feet of any fitting or valve.

H. Water use

1. Water use during all testing phases of water main installation shall be tracked using a water meter provided by the District, and reported to the District for water loss accounting purposes.

I. Corrosion Protection:

1. Ductile Iron mains shall be encapsulated in polyethylene encasement wrap.

J. Separation from other Utilities:

1. Separation distances are all referenced from outside of one Utility to the other.

2. Water mains shall be a minimum of 10 feet from sanitary or storm sewers.

3. Water mains shall be a minimum of 8 feet from sanitary or storm structures (i.e., manholes, inlets, area drains, etc.).

4. Water mains shall be a minimum of 18-inches above or below utilities they cross.

5. At crossings with sanitary or storm sewers, one full length of ductile iron water main pipe shall be used to keep joints as far from the crossing as possible.

6. Mains shall be placed at least 5 feet from other Utilities.

7. Any deviation of any separation distances shall obtain permission from the Utility as well as from the regulatory agencies.

K. Surface water crossings:

1. Generally, surface water courses being crossed will require 5 feet of minimum cover below the bottom of the creek or ditch crossing.

2. Hamilton County Surveyor requires 10 feet of cover below the bottom of Legal Drains.

3. Water courses greater than 15 foot in width also require valves on either side of the water course outside the flood plain and taps on either side of the valve closest to the supply source for testing.

L. PVC Slip Joints

1. PVC Slip Joint Pipe has specified bell insertion distances (homing distance). Over-homing of PVC Pipe reduces the ability of the PVC main to expand and can lead to cracked bells. PVC pipe shall be manually homed to ensure proper installation. If mechanical means are used, approved bell stops shall be installed at each joint.

M. Temporary Blow-offs and Chlorination Taps

1. Temporary Blow-offs and chlorination taps used for flushing, disinfection and sampling mains shall be placed in locations isolated from traffic.

2. Sample points shall be able to be reached by testing personnel in a safe manner. Creating safe access for testing may require backfill of the area or plating.

3. Signage and/or locking of valves to prevent tampering or possible exposure to highly chlorinated water during sampling is recommended.

N. Services:

1. Services of the type and size shown on the plans shall be installed after pressure testing, leak testing and bacteriological testing of the main have been approved and documentation provided.

2. Residential Services shall be made with an approved service saddle on PVC and DI pipe. Electrofusion saddles approved by the District shall be used for HDPE pipe. Direct taps on DI mains shall have at least 3 full thread engagement per AWWA and ANSI Standards. Direct taps shall require District approval on Plans.

3. Commercial and industrial services shall have an approved service saddle if 2-inch or smaller with a corresponding property line curb stop. Larger services shall use a Tee fitting of a size to match the meter with a valve anchored to the tee.

O. Changes in Material Type

1. Fittings of the appropriate size shall be used to make transitions from one type of material to another.

8A.05 Restoration

A. Pavement

1. Follow pavement restoration requirements of Section 8.07 from Installation and Construction of Sanitary Sewers.

B. Non-Paved Surfaces

1. Restore non-paved surfaces to generally match existing conditions or as instructed by plans and specifications.

SECTION 9

EROSION CONTROL

Refer to Hamilton County Stormwater Management Technical Standards Manual Chapter 600 for erosion control measures to prevent stormwater pollution.

SECTION 10

INSPECTION, TESTING AND ACCEPTANCE OF SANITARY SEWERS

SECTION 10

INSPECTION, TESTING AND ACCEPTANCE OF SANITARY SEWERS

10.01 General

This section describes the minimum requirements and general procedures for the inspection, testing and acceptance of systems dedicated to the Hamilton County Regional Utility District (the District).

10.02 Inspection

The Developer shall test all manholes, gravity sewers, laterals, low pressure and force mains installed. New gravity sewers shall also have a closed-circuit television (CCTV) inspection performed.

All necessary equipment and instrumentation required for proper completion of the flushing and testing of the manholes and piping systems shall be provided by the Contractor. Source and quality of water, test procedures, and disposal of water shall be approved by the District.

District personnel or District's Representative will inspect construction activities.

All tests shall be made in the presence of the District or the District's representative. Preliminary tests made by the Contractor without being observed by the District or the District's representative will not be accepted. Notify the District at least 48 hours before any work is to be inspected or tested.

All defects in piping systems shall be repaired and/or replaced and retested until they are found to be acceptable to the District. Repairs shall be made to the standard of quality specified for the entire system.

Sections of the system may be tested separately, but any defect which may develop in a section previously tested and accepted shall be promptly corrected and retested.

All manholes and piping systems shall be tested in accordance with these test methods in addition to any test required by the Indiana Department of Environment Management, State or Local plumbing codes and/or building authorities.

10.03 Gravity Sewer Testing

A. General

1. After backfill has been placed, the Contractor shall visually inspect all gravity flow lines to check alignment and grade. All obstructions shall be removed. Any sewer in which the direct light of a lamp cannot be viewed in either direction between adjacent manholes shall be considered unsatisfactory and shall be repaired by the Contractor immediately.

2. Unless otherwise directed by the District, all underground sewer system piping for gravity flow shall be subjected to an air test rather than an infiltration or exfiltration tests, however, infiltration and exfiltration test methods may be requested by the District during construction. When leakage occurs in excess of the specified limits, defective pipe or joints shall be located and repaired. The Contractor shall remove and reconstruct, along with retesting, as much of the original work as necessary to obtain a sewer test within the allowable leakage limits.

B. Air Tests

1. Air tests shall be per ASTM F1417, standard test method for installation acceptance of plastic gravity sewer lines using low pressure air, latest revision. The sewer line to be tested shall be tested in increments between manholes. The line shall be sealed at each end. The seal at one end shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice at one end of the line. The air supply line shall contain an on/off gas valve and a pressure gauge having a range of 0 to 5 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of ±0.04 psi.

2. The pipe line under test shall be pressurized to 4 psig. The line shall be allowed to stabilize between 4 psig and 3.5 psig for a period of no less than 5 minutes. If necessary, air shall be added to the line to maintain the pressure above 3.5 psig. After the stabilization period, the gas valve shall be closed. When the line pressure drops to 3.5 psig, commence timing with a stop watch. The stop watch shall be allowed to run until such time as the line pressure drops to 2.5 psig. If the test time is greater than the allowable time for 1.0 psig pressure drop, the test section will have passed the pressure test.

3. Allowable times are shown in the following table.

Minimum Specified Time Required for a 1.0 psig Pressure Drop
quired for a 1.0 psig Pressure Drop
For Size and Length of Pipe Indicated, Q=0.0015

Pipe Dia.	Min. Time	Length for Min. Time	Time for Longer Length	Specification Time for Length (L) Shown, minutes							
(in)	(min: s)	(ft)	(sec)	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.864 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	189	3.418 L	11:20	11:20	11:20	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.574 L	22:47	34:11	45:34	56:58	66:22	79:45	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:16	89:02	106:50	124:38	142:26	160:15
33	21:10	72	26.852 L	43:06	64:38	86:10	107:48	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

4. If the time lapse is greater than that specified, the section undergoing tests shall have passed. If the time is less than that specified, the line has not passed the test and the Contractor shall be required to make all repairs and retests. If the pipe line to be tested is beneath the ground water level, the test pressure shall be increased 0.433 psi for each foot the ground water level is above the crown of the pipe.

5. The Contractor shall furnish all equipment and personnel required to make all tests including pipe stoppers, air compressor, air storage tank, pressure regulating valves, pressure gauges, stopwatch, etc. The Contractor shall take all precautions necessary, including blocking of stoppers or plugs, to protect the safety of property and personnel.

C. Infiltration Tests

1. When the groundwater level is 4-feet or more above the top of the sewer, the infiltration test will consist of sealing off a length of sewer and measuring the depth of flow over a measuring weir, or by pumping the infiltrated water into containers for measurement. Tests shall be conducted for a minimum of 4-hours. Infiltration leakage shall not exceed 200 gallons per 24 hours per inch diameter, per mile of sewer.

D. Exfiltration Tests

1. When the groundwater level is below a point 4-feet above the top of the pipe, the exfiltration test shall consist of isolating the particular section and filling the water to a point 4-feet above the ground water level in the upper manhole and allowing it to stand not less than 4-hours. The section shall then be refilled with water up to the original point and after 2 hours the drop in water surface shall be measured. The computed leakage shall not exceed 200 gallons per inch diameter, per 24 hours, per mile of sewer.

E. Deflection Tests

1. Deflection tests shall be performed on <u>all</u> flexible pipes after the final backfill has been in place at least 30 days. No pipe shall exceed a vertical deflection of 5%. Deflection testing shall be performed using a mandrel pulled by hand.

2. Ductile iron pipe is considered non-flexible and will not require a deflection test.

10.04 Gravity Sewer CCTV Inspection

1. After new gravity sanitary sewers have been completed and all sewers have passed the required testing (including mandrel test), new segments shall be internally inspect, via CCTV, by the Developer. These inspections shall be recorded on digital media, or other approved electronic storage methods including a narrative noting:

    a. Date and time of day;

    b. Sewer segment number “from manhole to manhole”;

    c. Locations of service connections (laterals) into sewer;

2. If detected, the location of obstructions, structural defects, leakage or evidence thereof, and other abnormalities with respect to the sewer condition and distance in feet from the upstream manhole centerline.

3. The video shall visually display date, pipe section number (manhole number) and distance from upstream manhole (accuracy of 2 feet±). Where an obstruction is encountered and a reverse set up is required, the distance shall be written and verbally noted on the video as to from which manhole measurements are being made. Video case shall display the same information as indicated above plus date and crew ID number. Videos of all sections shall be provided to the District along with the respective television inspection field logs. TV field logs shall legibly show the location of each point of significance in relation to an identified manhole, including private service connections (laterals).

4. Video shall be a continuous image of not less than ninety percent (90%) of the internal pipe surface at all times. Maximum acceptable speed of camera through sewer shall be thirty (30) feet per minute. Lighting system shall be adequate for quality pictures. A reflection in front of the camera may be required to enhance lighting.

5. If any obstruction in the sewer segment prohibits the passage of the television camera, Contractor shall inspect the remainder of the

sewer segments by making a reverse set up at the next down stream manhole.

6. All obstructions in the sewer segment that prohibit passage of the television camera shall be immediately reported to the District by Contractor referencing location and nature of the obstruction.

7. The video camera shall be equipped with remote control devices to adjust the light intensity and a minimum one thousand (1,000) feet of continuous cable shall be provided. The camera shall be able to transmit a continuous image to the television monitor as it is being pulled through the sewer segments.

8. Developer shall submit digital CCTV inspection videos and field logs to the District within 60 days of completion of the sanitary infrastructure, and prior to acceptance of the sewers. Deviations in grade of the sanitary sewer, including sags, may require removal and replace of the sanitary sewers in question.

10.05 Force Main Testing

A. General

1. All sewage force mains and low pressure systems shall pass a hydrostatic pressure test as specified. All buried piping with slip-type or mechanical joints shall pass a leakage test. No leakage is allowed in exposed piping or buried piping with flanged, threaded, welded or mechanical joints.

2. Tests for exposed piping shall be made before covering and insulation is placed and prior to concealment within the building or lift station construction.

3. The pressure and leakage tests for buried piping shall be made after all jointing operations and backfilling are completed, and concrete reaction blocks and restraints have cured at least 14 days. Piping tested before backfill is in place shall be retested after compacted backfill is placed.

4. Sections of piping between valves, and other short sections of line may be isolated for testing. If shorter sections are tested, test plugs or bulkheads required at the ends of the test section shall be furnished and installed by the Contractor, together with all anchors, braces, and other devices required to withstand the hydrostatic pressure without imposing any thrust on the pipe line. The Contractor shall be solely responsibly for any damage which may result from the failure of test plugs or supports.

B. Hydrostatic Tests

1. Piping systems shall be slowly filled with water and all air expelled from the pipe. Care shall be taken that all air valves are installed and open in the section being filled, and that the rate of filling does not exceed the venting capacity of the air valves. After the section of line to be tested has been filled with water, the specified test pressure shall be applied and maintained for a minimum period of 2 hours and for such additional period as necessary for the District to complete the inspection of the line under test. If defects are noted, repairs shall be made and the test repeated until all parts of the line withstand the test pressure. Hydrostatic test pressures shall be 150% of the design pressure, but not less than 100 psi. Test duration shall be 2 hours.

2. For HDPE pipe, testing must be performed in accordance with ASTM F2164. Piping systems shall be slowly filled with water and all air expelled from the pipe. Care shall be taken that all air valves are installed and open in the section being filled, and that the rate of filling does not exceed the venting capacity of the air valves. After the section of line to be tested has been filled with water, the specified test pressure of 1.5 times the design pressure or 150 psi shall be applied and maintained for a period of 4 hours. Add make-up water as necessary to maintain maximum test pressure for 4 hours. Reduce test pressure by 10psi and monitor pressure for 1 hour. Do not increase pressure or add make-up water. If no visual leakage is observed and pressure during test phase remains steady (within 5% of test phase pressure) for the 1 hour test phase period, a passing test is indicated. If retesting is necessary, correct any faults or leaks in the test section and wait at least 8 hours before repressurizing.

C. Leakage Test

1. After the specified hydrostatic test has been completed, the line shall be subjected to leakage test under a hydrostatic pressure the same as the pressure specified for the hydrostatic test. The pressure shall be maintained within a maximum variation of 5% during the entire leakage test. Leakage measurements shall not be started until a constant test pressure has been established. The line leakage shall be measured by means of a water meter installed on the supply side of the pressure pump, or method as approved by the District.

2. The tested section will not be accepted if it has a leakage rate in excess of that rate determined by the formula:

$$L=\frac{0.000135 \times N \times D \times P}{2}$$

where:

L = Maximum permissible leakage rate, in gallons per hour, throughout the entire length of line being tested

N = Number of gasketed joints (2 for each flexible coupling joint) in the line under the test

D = Nominal internal diameter (in inches) of the pipe

P = The actual pressure in psig on all joints in the tested portion of the line. This actual pressure shall be determined by finding the difference between the average elevation of all tested pipes joints and the elevation of the pressure gauge and adding the difference in elevation head to the required pressure.

Where the leakage rate exceeds the permissible maximum, the Contractor shall locate and repair leaking joints to the extent required to reduce the total leakage to the required amount.

3. All leaks discovered within 1-year from the date of final acceptance of the work by the District shall be located, repaired, and retested by the Contractor, regardless of the total line leakage rate.

10.06 Manhole Vacuum Testing

Manholes shall be air tested in accordance with ASTM C1244, “Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test”.

The equipment required to conduct a vacuum test on manholes includes inflatable pipe plugs, test head, vacuum pump, flexible air hose and a vacuum gage. The test equipment shall be capable of drawing a vacuum of 10-inches Hg. The equipment shall be designed specifically for the purpose of testing manholes and shall be as manufactured by P.A. Glazier, Inc., Worchester, Massachusetts, 10002 or as approved by the District.

The procedure for conducting an air test on manholes shall be in accordance with the following procedure:

1. Each manhole shall be tested immediately after assembly and prior to setting the casting or backfilling around the structure.

2. All lift holes shall be plugged with non-shrink grout.

3. All pipes entering the manhole shall be securely plugged and adequately braced against the inside of the manhole to prevent being drawn out of the pipe.

4. The test head shall be placed on the inside of the cone section and sealed with an inflatable seal.

5. A vacuum of 10-inches of mercury (Hg) shall be drawn before the vacuum pump is shut off. With the valves closed, the time shall be measure for the vacuum to drop to 9-inches. The manhole shall pass if the time is greater than the following:

Depth	Diameter 48”	60”	72”
	Time in seconds		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97

10.07 Dedication and Acceptance Procedures

A. Dedication

1. The District shall review the applicable requirements and make a determination as to whether the work has been completed in conformance with the District’s requirements.

B. Acceptance of Facilities

1. The District will assume responsibility of the sanitary sewer when construction is fully completed in accordance with the plans and specifications and when all requirements in these Design and Construction Standards are met.

2. Sanitary sewer connection approvals will not be issued until the facilities are accepted by the District.

SECTION 10A

INSPECTION, TESTING, AND ACCEPTANCE

OF WATER MAINS

SECTION 10A

INSPECTION, TESTING, AND ACCEPTANCE OF WATER MAINS

10A.01 General

This section describes the minimum requirements for inspection, testing and acceptance of water mains dedicated to the District.

10A.02 Inspection of Water Mains

Prior to construction, all materials proposed for use on the water main shall be submitted to the District for approval. Throughout the project, any deviation in materials from those submitted shall be approved by the District prior to use.

During construction, only District employees shall open or close any water mains owned by the District.

Taps for new main extensions shall be witnessed by District personnel, including pressure tests for the tapping sleeve and recovery of the tapping coupon. Tapping coupons shall be provided to the District for analysis.

District personnel or District's Representative will inspect construction activities.

The Developer shall be responsible for testing all mains installed.

All necessary equipment and instrumentation required for proper completion of the flushing and testing shall be provided by the Contractor. Source and quality of water, test procedures, and disposal of water shall be approved by the District.

Dechlorination of water flushed is required.

All tests shall be done in the presence of the District or its representative. Preliminary tests done by the Contractor without being observed by the

District or District's Representative will not be accepted. Notify the District at least 48 hours before any work is to be inspected or tested.

Requests for bacteriological testing shall be made on a District approved form.

All defects in piping systems shall be repaired and/or replaced and retested until they are found to be acceptable by the District. Repairs shall be made to the standard of quality specified for the entire system.

Sections of the system may be tested separately, but any defect which may develop in a section previously tested and accepted shall be promptly corrected and retested.

After water main is completely installed, a walkthrough inspection shall be performed with the Contractor and District personnel to create a final punchlist. Walkthrough inspection shall consist of:

- Turning valves to ensure keys fit on valves, valves are in proper position (either open or closed), valves turn as expected, and have the expected number of turns.
- Inspecting hydrants to ensure hydrant is at bury line, hydrant valve opens and closes as expected, hydrant drains as expected, nozzle caps and storz connection open and close as expected, paint is correct color and not chipped during installation
- Inspecting services to ensure shutoff valves are accessible with key and open/close as expected, meter pit and lid are acceptable, meter setter is at specified depth and successful reading is collected.
- Other appurtenances, air relief valves, blow-offs, automatic flushing devices, etc.

Any punchlist items shall be corrected, repaired, or replaced prior to request for acceptance by the District of maintenance responsibility.

10A.03 Water Main Testing

A. Hydrostatic Pressure Testing

1. Tapping Sleeve

   a. A passing 15-minute hydrostatic pressure test at 150 psi with no pressure drop allowable of the installed tapping sleeve prior to the tap being made is required to be performed, witnessed and recorded on a District approved form.

2. Water Main

   a. Water mains require a hydrostatic two-hour test at 150 psi or 1-1/2 times the working pressure at the point of testing, whichever is greater, but shall not exceed 150 psi at the lowest point in elevation of the system being tested. Hydrostatic in accordance with AWWA C600 for Ductile Iron pipe or AWWA C605 for PVC pipe. Piping systems shall be slowly filled with water and all air expelled from the pipe. Care shall be taken that all air valves are installed and open in the section being filled, and that the rate of filling does not exceed the venting capacity of the air valves. Allow the pipeline to stabilize at the test pressure before conducting the hydrostatic test. If pressure drops in 2 hours, the leak testing procedures and formulas from the technical specifications shall be used to determine if the main passes the hydrostatic testing. Hydrostatic testing shall be performed, witnessed and recorded on a District approved form. Passing results shall be obtained prior to disinfection.

   b. HDPE pipe pressure testing procedures shall be per ASTM F2164 and contain an allowance for expansion of HDPE pipe under pressure that will be accounted for in determining a passing hydrostatic test. The HDPE main shall be pressurized to 150 psi and maintained at test pressure for 4 hours prior to the hydrostatic test to allow for initial expansion. Add make-up water as necessary to maintain maximum test pressure for 4 hours. Passing results shall be obtained prior to disinfection.

B. Leak testing

1. Leak testing shall be performed on new mains and the District shall approve the results prior to disinfection.

   a. Ductile Iron leak testing consists of measuring the gallons of water needed to return the pressure from the hydrostatic test back to 150 psi, then comparing to the allowable leakage rate for the length, size, and time of testing based on the rates in the table below.

Table 10A-1 – Allowable Leakage for Ductile Iron Pipe per 1000 ft. of Pipeline* - gph

Average Test Pressure	Nominal Pipe Diameter – in.																	
psi	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60	64
450	0.43	0.57	0.86	1.15	1.43	1.72	2.01	2.29	2.58	2.87	3.44	4.30	5.16	6.02	6.88	7.74	8.60	9.17
400	0.41	0.54	0.81	1.08	1.35	1.62	1.89	2.16	2.43	2.70	3.24	4.05	4.86	5.68	6.49	7.30	8.11	8.65
350	0.38	0.51	0.76	1.01	1.26	1.52	1.77	2.02	2.28	2.53	3.03	3.79	4.55	5.31	6.07	6.83	7.58	8.09
300	0.35	0.47	0.70	0.94	1.17	1.40	1.64	1.87	2.11	2.34	2.81	3.51	4.21	4.92	5.62	6.32	7.02	7.49
275	0.34	0.45	0.67	0.90	1.12	1.34	1.57	1.79	2.02	2.24	2.69	3.36	4.03	4.71	5.38	6.05	6.72	7.17
250	0.32	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85	4.49	5.13	5.77	6.41	6.84
225	0.30	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04	3.65	4.26	4.86	5.47	6.08	6.49
200	0.29	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87	3.44	4.01	4.59	5.16	5.73	6.12
175	0.27	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68	3.22	3.75	4.29	4.83	5.36	5.72
150	0.25	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48	2.98	3.48	3.97	4.47	4.97	5.30
125	0.23	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27	2.72	3.17	3.63	4.08	4.53	4.83
100	0.20	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03	2.43	2.84	3.24	3.65	4.05	4.32

*If the pipeline under test contains sections of various diameters, the testing allowance will be the sum of the testing allowance for each size.

Table 10A-2 – Allowable Leakage for PVC Plastic Pipe with Elastomeric Joints – gph

(Allowable Leakage per 1,000 Ft. or 50 Joints)*

Average Test Pressure	Nominal Pipe Diameter – in.											
psi	4	6	8	10	12	14	16	18	20	24	30	36
300	0.47	0.70	0.94	1.17	1.40	1.64	1.87	2.11	2.34	2.81	3.51	4.21
275	0.45	0.67	0.90	1.12	1.34	1.57	1.79	2.02	2.24	2.69	3.36	4.03
250	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85
225	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04	3.65
200	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87	3.44
175	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68	3.22
150	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48	2.98
125	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27	2.72
100	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03	2.43
75	0.23	0.35	0.47	0.59	0.70	0.82	0.94	1.05	1.17	1.40	1.76	2.11
50	0.19	0.29	0.38	0.48	0.57	0.67	0.76	0.86	0.96	1.15	1.43	1.72

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

c. PVC C-900, leak testing consists of measuring the gallons of water needed to return the pressure from the hydrostatic test back to 150 psi, then comparing to the allowable leakage rate for the length, size, and time of testing based on the rates in the table below.

Table 10A-3 – Allowance for Expansion of HDPE Pipe Under Pressure* for Ambient Conditions

Nominal Pipe Size	Allowance for Expansion (U.S. Gal per 100 Ft. of Pipe)		
	1-Hour Test	**2-Hour Test**	**3-Hour Test**
Inch	Gallon	Gallon	Gallon
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.00	1.50
10	0.75	1.30	2.10
12	1.10	2.30	3.40
14	1.40	2.80	4.20
16	1.70	3.30	5.00
18	2.20	4.30	6.50
20	2.80	5.50	8.00
22	3.50	7.00	10.50
24	4.50	8.90	13.30
28	5.50	11.10	16.80
32	7.00	14.30	21.50
36	9.00	18.00	27.00

*These allowances only apply to the test phase and not the initial expansion phase. In addition, they assume that the pipe is being tested for a system design pressure equal to the pipe's pressure class. If the pipe is being tested to a lower system design pressure, the above allowances should be reduced by the ratio of the system design pressure to the pipe's pressure class.

d. HDPE, testing consists of measuring the gallons of water needed to return the pressure from the hydrostatic test back to 150 psi, then comparing to the allowance for expansion rate for the length, size, and time of testing based on the rates in the table above.

C. Flushing

1. New main shall be flushed at a velocity of at least 2.5 feet per second to remove air and contaminants that may have entered the main during construction until the flushing water runs clear. Initial filling shall be done slowly to prevent water hammer. In larger mains or at times outside normal working hours, the District shall be informed of the plans to be able to protect overall system pressure.

Required flow for Flushing Water Mains Prior to Disinfection

Nominal Pipe Diameter (in)	Flow (gpm)		
	DI	**C-900 PVC**	**HDPE**
3	70	-	50
4	110	110	80
6	250	230	180
8	450	400	300
10	690	600	460
12	980	840	650
14	1,330	1,130	780
16	1,730	1,470	1,020
18	2,180	1,840	1,290
20	2,680	2,260	1,600
24	3,840	3,220	2,300

D. Disinfection

1. Quality Control Submittals
   Prior to starting any disinfection Work, furnish for the District's review a detailed outline of the proposed sequence of operation, disinfection method to be used, manner of filling and flushing units, source and quality of water to be used, and disposal of heavily chlorinated water.

2. New Mains, Valves, Fittings and Appurtenances
   New mains, valves, fittings and appurtenances shall be flushed and disinfected according to the methods in AWWA Standard C651. Samples shall be collected with District supervision and lab results indicating absence of bacteria shall be obtained prior to activation of the new main as part of the District's distribution system. Connection of new main to existing system after chlorination and passing bacteriological testing, if necessary, shall be accomplished by swabbing connecting pipe and fittings with 5% bleach (hypochlorite solution), making connection and observing water tightness of connection prior to backfill. Connecting pipe and fittings shall not be longer than 20 feet in total length. Portions of new and existing mains that lose pressure below 20 psi during connection shall be placed on a precautionary boil advisory until bacteriological testing of water in the depressurized area shows absence of bacteria. Services shall be connected to the new main only after documentation of passing test results.

   2. Disinfection of Service Lines and Accessories

      a. Perform in accordance with the Indiana Plumbing Code.

      b. Flush the piping with clean, potable water until only potable water appears at the points of outlet.

      c. Disinfect the system according to one of the following procedures:

         i. Fill the system with a water – chlorine solution containing at least 50 mg/L of free chlorine. Retain the

heavily chlorinated water in the system for at least 24 hours.

ii. Fill the system with a water – chlorine solution containing at least 300 mg/L of free chlorine. Retain the heavily chlorinated water in the system for at least 3 hours.

d. Following disinfection, flush the system with clean, potable water until the chlorine in the water coming from the system does not exceed the chlorine residual in the flushing water.

e. Verification of disinfection for service lines is not required.

3. Verification of Disinfection

a. After application of disinfection is complete, perform final flushing of heavily chlorinated water, unless specified otherwise.

b. Before the system or structure is placed in service, obtain 2 successive water samples 24 hours apart and have them tested for bacteriological analysis by a State-approved laboratory. Samples shall be drawn in accordance with the State's procedure.

c. If samples do not prove satisfactory, the system or tank structure shall be re-chlorinated and re-sampled until 2 successive water samples taken 24 hours apart have tested satisfactory.

d. Assume the expense of taking and testing additional samples until satisfactory samples are obtained.

e. Assume the expense of all water for subsequent fillings of the pipelines, tanks, and appurtenances.

4. Disposal of Waste

a. Properly dispose of all heavily chlorinated water by neutralization and in accordance with the regulations of the

local health department, Indiana Department of Environmental Management, and AWWA standards.

b. Dispose of heavily chlorinated water as required by AWWA C651.

E. Tracer wire Continuity

1. Tracer wire continuity check shall be done as part of the main testing and acceptance for maintenance process. Repair or replace all tracer wire found not to be continuous after testing

10A.04 Dedication and Acceptance Procedures

A. Dedication

1. The Developer shall request formal acceptance of water mains and appurtenances after mains have been constructed, tested, and any punchlist items have been addressed.

2. The District shall review the applicable requirements and make a determination as to whether the work has been completed in conformance with the District's requirements.

B. Acceptance of Facilities

1. The District will assume responsibility of the water distribution system when construction is fully completed in accordance with the plans and specifications and when all requirements in these Design and Construction Standards are met.

2. Records of Test Results are provided.

3. Record Drawings and Geodatabase files are provided.

4. Asset Management Form is received.

5. Maintenance Bond(s) and Agreement in place.

6. Meters for new services will not be issued until mains have passed hydrostatic, bacteriological, and tracer wire testing.

SECTION 11

TO BE PROVIDED FOR FUTURE APPROVAL

Appendix A

STANDARD FORMS FOR SANITARY SEWER AND WATER MAIN SERVICE

APPENDIX A

TO BE PROVIDED FOR FUTURE APPROVAL

Appendix B

STANDARD DETAILS