

## TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
<b>1.0</b>	<b>INTRODUCTION</b>	
1.1	PURPOSE OF MANUAL	1 - 1
1.2	ORGANIZATIONS, AUTHORITY, AND RESPONSIBILITIES	1 - 1
1.2.1	Greenville Utilities Commission	1 - 1
1.2.2	City of Greenville	1 - 2
1.2.3	County of Pitt	1 - 2
1.3	DEFINITIONS AND ABBREVIATIONS	1 - 3
1.3.1	Definitions	1 - 3
1.3.1.1	General Definitions	1 - 3
1.3.1.2	Pipe Backfill Zones	1 - 4
1.3.2	Abbreviations	1 - 5
1.3.3	Standards	1 - 6
<b>2.0</b>	<b>CONCEPTUAL PHASE</b>	
2.1	GENERAL	2 - 1
2.2	INITIAL CONFERENCE	2 - 1
2.3	PRE-APPLICATION PACKAGE	2 - 2
2.3.1	Conceptual Plans	2 - 2
2.3.2	Design	2 - 2
2.3.3	Estimated Time Schedule	2 - 2
2.3.4	Projected Cost Estimate	2 - 2
2.4	REQUIRED FEES AND CHARGES	2 - 3
2.5	REQUIREMENTS FOR PLANNING BOARD APPROVAL	2 - 3
<b>3.0</b>	<b>DESIGN CONSIDERATIONS FOR WATER SYSTEM EXTENSIONS</b>	
3.1	GENERAL	3 - 1
3.2	LOCATION AND ALIGNMENT	3 - 1
3.2.1	Depth of Cover	3 - 1
3.2.2	Relationship of Mains to Property Lines, Rights-of-Way and Structures	3 - 1
3.2.3	Relationship of Water Mains to Sanitary Sewers	3 - 2
3.2.4	Relationship of Water Mains to Storm Sewers	3 - 3
3.2.5	Location Under Paved Areas	3 - 3
3.2.6	Location of Fire Hydrants	3 - 4
3.2.7	Location of Gate Valves	3 - 5
3.2.8	Location of Air Release Valves	3 - 6
3.2.9	Location of Services	3 - 6
3.2.10	Location of Blow-Offs and Dead End Hydrants	3 - 7
3.2.11	Location of Backflow Prevention Devices	3 - 8
3.3	SIZING OF WATER MAINS	3 - 8
3.3.1	General	3 - 8
3.3.2	Pressure Requirements	3 - 9
3.3.3	Fire Hydrants	3 - 9
3.3.4	Private Mains	3 - 9
3.3.5	Minimum Fire Flows	3 - 9
3.3.5.1	General	3 - 9
3.3.5.2	Fire Flow Conditions	3 - 10
3.3.5.3	Fire Flow Requirements for Buildings	3 - 10
3.3.5.4	Non-Residential Areas	3 - 11
3.4	INSTALLATION OF WATER MAIN AND APPURTENANCES	3 - 11
3.4.1	General	3 - 11
3.4.2	Construction Safety	3 - 11
3.4.3	Replacement of Damaged Facilities and Structures	3 - 12
3.4.4	Connection to Commission Owned Facilities	3 - 12
3.4.5	Salvage of Commission Owned Facilities	3 - 12
3.4.6	Water Main Construction and Excavation	3 - 12
3.4.7	Backfilling	3 - 17

**TABLE OF CONTENTS CONTINUED**

<u>Section</u>	<u>Title</u>	<u>Page</u>
3.4.8	Termination of Water Mains	3 - 18
3.4.9	Installation of Services	3 - 18
3.4.10	Setting of Valves and Valve Boxes	3 - 19
3.4.11	Setting of Fittings	3 - 20
3.4.12	Installation of Air Release Valves and Blow-Offs	3 - 20
3.4.13	Installation of Backflow Prevention Devices	3 - 20
3.4.14	Setting of Fire Hydrants	3 - 21
3.4.15	Roadway, Street and Railway Crossings	3 - 21
<b>3.5</b>	<b>CLEANING AND TESTING OF WATER SYSTEM EXTENSIONS</b>	<b>3 - 22</b>
3.5.1	General	3 - 22
3.5.2	Test Sequence	3 - 22
3.5.3	Pretest Inspection	3 - 23
3.5.4	Cleaning of the Main	3 - 23
3.5.4.1	Cleaning of Water Mains Smaller Than 4" In Diameter	3 - 23
3.5.4.2	Cleaning of Water Mains 4" and Larger In Diameter	3 - 23
3.5.5	Hydrostatic Test	3 - 24
3.5.6	Chlorination	3 - 25
3.5.7	Bacteriological Testing	3 - 26
<b>3.6</b>	<b>TEMPORARY WATER SERVICE</b>	<b>3 - 28</b>
<b>4.0</b>	<b>DESIGN CONSIDERATIONS FOR WASTEWATER SYSTEM EXTENSIONS</b>	
<b>4.1</b>	<b>GENERAL</b>	<b>4 - 1</b>
4.1.1	Private Sewers	4 - 1
<b>4.2</b>	<b>LOCATION AND ALIGNMENT</b>	<b>4 - 1</b>
4.2.1	Depth of Cover	4 - 1
4.2.2	Relationship of Mains to Property Lines and Rights-of-Way	4 - 2
4.2.3	Relationship of Sanitary Sewers to Water Mains and Wells	4 - 2
4.2.4	Relationship of Sanitary Sewers to Structures and Pipes	4 - 2
4.2.5	Relationship of Sanitary Sewers to Impoundments and Creeks	4 - 3
4.2.6	Manhole Location and Grade	4 - 3
4.2.7	Location of Sewer Services	4 - 4
4.2.8	Location of Force Main Appurtenances	4 - 5
<b>4.3</b>	<b>SIZING AND DESIGN OF SANITARY SEWERS AND APPURTENANCES</b>	<b>4 - 6</b>
4.3.1	Sizing of Gravity Sewers	4 - 6
4.3.1.8	Construction Tolerances/Acceptance of Sewer Lines	4 - 8
4.3.1.9	Construction Tolerances/Manholes	4 - 9
4.3.2	Sizing of Wastewater Force Mains	4 - 9
4.3.3	Sizing of Wastewater Pumps and Wet Wells	4 - 9
4.3.4	Gravity Flows Versus Pump Stations	4 - 10
<b>4.4</b>	<b>INSTALLATION OF SANITARY SEWERS AND APPURTENANCES</b>	<b>4 - 11</b>
4.4.1	General	4 - 11
4.4.2	Replacement of Damaged Facilities and Structures	4 - 11
4.4.3	Connection of New Sewers to Existing Facilities	4 - 11
4.4.4	Salvage of Commission Owned Facilities	4 - 12
4.4.5	Sewer Construction and Excavation	4 - 12
4.4.6	Backfilling	4 - 14
4.4.7	Installation of Manholes and Wet Wells	4 - 15
4.4.8	Installation of Services	4 - 16
4.4.9	Installation of Air Release Valves for Force Mains	4 - 17
4.4.10	Pump Installation and Site Work	4 - 17
4.4.11	Roadway, Street and Railway Crossings	4 - 18
<b>4.5</b>	<b>TESTING OF SEWER SYSTEM EXTENSIONS</b>	<b>4 - 18</b>
4.5.1	General	4 - 18
4.5.2	Test Sequence	4 - 18
4.5.3	Visual Inspection of Gravity Sewers	4 - 19
4.5.4	Leakage Testing for Gravity Sewers	4 - 19
4.5.4.1	Air Test	4 - 19
4.5.4.2	Infiltration Test	4 - 21
4.5.4.3	Exfiltration Test	4 - 21

**TABLE OF CONTENTS CONTINUED**

<b>Section</b>	<b>Title</b>	<b>Page</b>
4.5.4.4	Deflection Testing of Gravity Sewers (PVC SDR35)	4 - 21
4.5.4.5	Manhole Testing	4 - 23
4.5.5	Testing and Cleaning of Force Mains	4 - 24
4.5.6	Testing and Start-Up of Pumps	4 - 24
<b>5.0 SUBMITTALS FOR WATER AND WASTEWATER SYSTEM EXTENSIONS</b>		
<b>5.1</b>	<b>GENERAL</b>	<b>5 - 1</b>
<b>5.2</b>	<b>ENGINEERING DESIGN CALCULATIONS</b>	<b>5 - 1</b>
5.2.1	Water Design Calculations	5 - 1
5.2.1.1	Minimum Pressure Requirements	5 - 1
5.2.1.2	Minimum Fire Flow	5 - 2
5.2.2	Sewer Design Calculations	5 - 2
5.2.2.1	Gravity Sewers	5 - 2
5.2.2.2	Pump Station Capacity and Force Mains	5 - 2
<b>5.3</b>	<b>CONTRACT DOCUMENTS</b>	<b>5 - 3</b>
5.3.1	General	5 - 3
5.3.2	General Requirements for Drawings	5 - 3
5.3.3	General Requirements for Specifications	5 - 5
5.3.4	Required Permits for Construction	5 - 5
5.3.4.1	Water System Extensions	5 - 5
5.3.4.2	Wastewater System Extensions	5 - 6
5.3.4.3	NCDOT Encroachment Agreements	5 - 6
5.3.4.4	Erosion and Sedimentation Control Plan	5 - 6
5.3.4.5	Railway Encroachment Agreements	5 - 6
5.3.4.6	Indemnification and Hold Harmless Agreement	5 - 7
<b>5.4</b>	<b>REQUIRED COPIES OF CONTRACT DOCUMENTS</b>	<b>5 - 7</b>
<b>5.5</b>	<b>SHOP DRAWINGS</b>	<b>5 - 8</b>
<b>5.6</b>	<b>SURVEY DATA</b>	<b>5 - 8</b>
5.6.1	General	5 - 8
5.6.2	Vertical Control	5 - 8
<b>5.7</b>	<b>EASEMENTS AND RIGHTS-OF-WAY</b>	<b>5 - 8</b>
5.7.1	Recorded Final Plat	5 - 8
5.7.2	Standard Easement Form	5 - 9
<b>6.0 GUIDELINES FOR THE CONSTRUCTION PHASE OF WATER AND WASTEWATER SYSTEM EXTENSIONS</b>		
<b>6.1</b>	<b>GENERAL</b>	<b>6 - 1</b>
<b>6.2</b>	<b>PRECONSTRUCTION CONFERENCE</b>	<b>6 - 1</b>
<b>6.3</b>	<b>UTILITIES LOCATION SERVICES</b>	<b>6 - 1</b>
<b>6.4</b>	<b>NORMAL WORK HOURS</b>	<b>6 - 1</b>
<b>6.5</b>	<b>OPERATION OF EXISTING FACILITIES</b>	<b>6 - 2</b>
<b>6.6</b>	<b>QUALITY CONTROL</b>	<b>6 - 2</b>
6.6.1	General	6 - 2
6.6.2	Materials Testing	6 - 3
6.6.3	Inspection Services	6 - 3
6.6.4	Construction Staking	6 - 3
<b>6.7</b>	<b>PROJECT CLOSE-OUT</b>	<b>6 - 4</b>
6.7.1	Pre-Final Inspection	6 - 4
6.7.2	Final Inspection	6 - 4
6.7.3	As-Built Drawings	6 - 5
<b>6.8</b>	<b>CONTRACTOR'S AND DEVELOPER'S BILL OF SALE</b>	<b>6 - 8</b>
<b>6.9</b>	<b>SATISFACTORY COMPLETION</b>	<b>6 - 8</b>

TABLE OF CONTENTS CONTINUED

<u>Section</u>	<u>Title</u>	<u>Page</u>
6.10	WARRANTY	6 - 8
7.0	MATERIAL SPECIFICATIONS FOR WATER SYSTEM EXTENSIONS	
7.1	GENERAL	7 - 1
7.2	WATER MAIN AND FITTINGS	7 - 1
7.2.6	Restraint Devices	7 - 3
7.3	MAIN VALVES AND BOXES	7 - 4
7.3.1	General	7 - 4
7.3.2	Gate Valves	7 - 4
7.3.3	Butterfly Valves	7 - 5
7.3.4	Valve Boxes	7 - 6
7.4	HYDRANTS	7 - 7
7.4.1	Fire Hydrants	7 - 7
7.4.2	Hydrants for Blow-Offs	7 - 7
7.5	WATER SERVICE MATERIALS	7 - 8
7.5.1	Materials for ¾" and 1" Services	7 - 8
7.5.2	Materials for 1 ½" and 2" Services	7 - 9
7.5.3	Materials for Services Larger Than 2"	7 - 10
7.6	BACKFLOW PREVENTION ASSEMBLIES	7 - 10
7.7	TAPPING SLEEVES	7 - 10
7.7.1	Tapping Valves	7 - 10
7.8	AIR RELIEF VALVES	7 - 11
7.8.1	Manual Air Release Valves	7 - 11
7.8.2	Automatic Air Release Valves	7 - 11
7.9	STEEL ENCASEMENT PIPE	7 - 11
8.0	MATERIAL SPECIFICATIONS FOR WASTEWATER SYSTEM EXTENSIONS	
8.1	GENERAL	8 - 1
8.2	GRAVITY SEWER PIPE AND FITTINGS	8 - 1
8.2.1	ABS Composite Pipe	8 - 1
8.2.2	Ductile Iron Pipe	8 - 1
8.2.3	Vitrified Clay Pipe	8 - 2
8.2.4	Polyvinyl Chloride (PVC) Pipe 8"-15"	8 - 2
8.2.5	Polyvinyl Chloride (PVC) Pipe 18"-24"	8 - 2
8.2.6	PVC Composite Pipe	8 - 3
8.2.7	Sewer Service Pipe	8 - 3
8.2.8	Service Fittings	8 - 3
8.2.9	Manhole Vent Piping	8 - 4
8.2.10	Transition Couplings For Gravity Sewers	8 - 4
8.3	STEEL ENCASEMENT PIPE	8 - 4
8.4	MANHOLES	8 - 5
8.5	FORCE MAIN PIPE AND APPURTENANCES	8 - 7
8.5.2	Force Main Valves	8 - 7
8.5.3	Check Valves	8 - 8
8.5.4	Air Relief Valves	8 - 8
8.6	WASTEWATER PUMP STATIONS	8 - 9
8.6.6	Pumps	8 - 10
8.6.7	Pump Construction	8 - 10
8.6.8	Cable	8 - 11
8.6.9	Motor	8 - 11
8.6.10	Shaft	8 - 11
8.6.11	Seals	8 - 12
8.6.12	Bearings	8 - 12
8.6.13	Impeller	8 - 12
8.6.14	Volute	8 - 13
8.6.15	Wearing Ring	8 - 13
8.6.16	Power Cord	8 - 13

TABLE OF CONTENTS CONTINUED

<u>Section</u>	<u>Title</u>	<u>Page</u>
8.6.17	Guide Bars	8 - 13
8.6.18	Controls	8 - 13
8.6.19	Liquid Level Sensors	8 - 14
8.6.20	Piping and Valves	8 - 15
8.6.21	Access Hatches	8 - 15
8.6.21.1	Safety Net	8 - 15
8.6.22	Screening Basket	8 - 15
8.6.23	Emergency Transfer Switch	8 - 16
8.6.24	Odor Control	8 - 16

## A P P E N D I C E S

- A RESIDENTIAL PEAK USER DEMAND
- B FIRE FLOW REQUIREMENTS & FIRE HYDRANT DISTRIBUTION
- C SAMPLE "NONDISCHARGE PERMIT" APPLICATION
- D SAMPLE DIVISION OF HEALTH SERVICES APPLICATION  
For: Approval of Plans and Specifications For  
Water Supply Systems
- E SAMPLE EASEMENT DOCUMENTS
- F BILL OF SALE
- G SAMPLE INDEMNIFICATION AND HOLD HARMLESS AGREEMENT
- H CLEANING AND TESTING PRIVATE FIRE SERVICE
- I STANDARD DETAILS